

EUROMAP 87	OPC UA interfaces for plastics and rubber machinery - Particle Foam Machines
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**EUROMAP 87 (Release Candidate 1.0.0) is identical with
OPC 40087 (Release Candidate 1.0.0) and VDMA 40087:2025-01**

Contents

	Page
Forewords.....	12
1 Scope	13
2 Normative references	13
3 Terms, definitions and conventions	14
3.1 Overview	14
3.2 Conventions used in this document.....	14
3.3 Abbreviations	14
4 General information to OPC UA interfaces for plastics and rubber machinery and OPC UA	14
5 Use cases	14
6 OPC 40087 Information Model Overview.....	15
7 ParticleFoamMachineType	16
7.1 ParticleFoamMachineType definition	16
7.2 Identification and MachineryBuildingBlocks	17
7.3 MachineCharacteristics	17
7.4 MachineMesStatus	18
7.5 ErrorHandling.....	18
7.6 ProcessMonitoring	18
7.7 Users	18
7.8 Maintenance	18
7.9 Jobs.....	18
7.9.1 Types, methods and events for cyclic jobs	18
7.10 ProductionDatasetManagement.....	18
7.11 SupportedLogbookEvents	19
8 MachineCharacteristicsType	19
8.1 MachineCharacteristicsType definition.....	19
8.2 IntegratedHandlingSystem	20
8.3 TimeZoneOffset	20
8.4 SetMachineTime	21
8.5 MachineMESConfiguration	21
8.6 MaximumWorkingPressure	21
8.7 BlockMachineCharacteristicsType	22
8.7.1 BlockMachineCharacteristicsType definition.....	22
8.7.2 BlockXDimension	22
8.7.3 BlockYDimension	22
8.7.4 BlockZDimension	22

- 8.8 ShapeMachineCharacteristicsType23**
- 8.8.1 ShapeMachineCharacteristicsType definition23
- 8.8.2 ClampingSurfaceXDimension24
- 8.8.3 ClampingSurfaceYDimension24
- 8.8.4 Stroke.....24
- 8.8.5 SteamChamberDepth24
- 8.8.6 MouldingProcessSource24
- 8.8.7 CoresPneumaticMovableSide25
- 8.8.8 CoresPneumaticFixedSide25
- 8.8.9 CoresElectricMovableSide25
- 8.8.10 CoresElectricFixedSide25
- 8.8.11 CoresHydraulicMovableSide25
- 8.8.12 CoresHydraulicFixedSide25
- 8.8.13 EjectorsPassive25
- 8.8.14 EjectorsActive.....25
- 8.8.15 TotalNumberOfInjectionConnections25
- 8.8.16 FillingHopper25
- 9 ErrorHandlingType26**
- 9.1 ErrorHandlingType definition26
- 9.2 HighestActiveAlarmSeverity26
- 9.3 ActiveErrors26
- 9.4 ResetAllErrors26
- 9.5 ResetErrorById27
- 10 ProcessMonitoringType.....28**
- 10.1 ProcessMonitoringType definition28
- 10.2 ActiveProcessStep29
- 10.3 StartOfActiveCycle29
- 10.4 StartOfActiveProcessStep.....30
- 10.5 LastCycleTimes30
- 10.6 ReleaseOfCycle30
- 10.7 ReleaseInterval30
- 10.8 Tempering30
- 10.9 Supply.....30
- 10.10 FoamMonitoring30
- 10.11 MaterialConditions30
- 10.12 MaterialConsumptions.....30
- 10.13 RfMonitoring30
- 10.14 Silos30
- 10.15 FillingMonitoring30

10.16	Distances	30
10.17	MouldMonitoring	31
10.18	Drives	31
11	TemperingType	31
11.1	TemperingType definition	31
11.2	ExternalSourceActive	31
11.3	StartTime	31
11.4	StopTime	31
11.5	Temperature	31
12	SupplyType	32
12.1	SupplyType definition	32
12.2	SteamSupply	33
12.3	WaterSupply	33
12.4	CompressedAirSupply	33
12.5	VacuumSupply	33
12.6	ElectricitySupply	33
13	SteamSupplyType	33
13.1	SteamSupplyType definition	33
13.2	CurrentSteamingType	33
13.3	StartOfCurrentSteamingType	34
13.4	SteamMeasuringPoints	34
14	SteamMeasuringPointsType	34
14.1	SteamMeasuringPointsType definition	34
14.2	SteamMeasuringPoint	34
15	WaterSupplyType	34
15.1	WaterSupplyType definition	34
15.2	WaterMeasuringPoint	35
16	AirSupplyType	35
16.1	AirSupplyType definition	35
16.2	AirMeasuringPoint	35
17	VacuumSupplyType	35
17.1	VacuumSupplyType definition	35
17.2	VacuumMeasuringPoint	36
18	SupplyMeasuringType	36
18.1	SupplyMeasuringType definition	36
18.2	SupplyPressure	36
18.3	SupplyTemperature	36
18.4	SupplyInputFlowRate	36
18.5	SupplyVolume	36

19	ElectricitySupplyType	37
19.1	ElectricitySupplyType definition.....	37
19.2	ElectricityMeasuringPoint	37
20	ElectricityMeasuringType	37
20.1	ElectricityMeasuringType definition.....	37
20.2	Voltage.....	37
20.3	Current.....	38
20.4	PowerFactor	38
20.5	Frequency	38
20.6	Power	38
21	FoamMonitoringType	39
21.1	FoamMonitoringType definition.....	39
21.2	FoamPressure.....	39
21.3	FoamTemperature	39
22	MaterialConditionsType	40
22.1	MaterialConditionsType definition	40
22.2	MaterialCondition	40
23	MaterialConditionType	40
23.1	MaterialConditionType definition	40
23.1.1	Temperature	41
23.1.2	Humidity	41
23.1.3	Density.....	41
23.1.4	InternalCellPressure.....	41
23.1.5	MaterialCategory	41
24	MaterialConsumptionsType	42
24.1	MaterialConsumptionsType definition	42
24.2	MaterialConsumption.....	42
25	MaterialConsumptionType	42
25.1	MaterialConsumptionType definition	42
25.2	Volume.....	43
25.3	Mass.....	43
25.4	UsedMaterialLot.....	43
25.5	UsedMaterialBagNumber.....	43
26	RfMonitoringType	43
26.1	RfMonitoringType definition	43
26.2	Power	44
26.3	Current.....	44
27	SilosType	44
27.1	SilosType definition	44

27.2	Silo	44
28	SiloMonitoringType	44
28.1	SiloMonitoringType definition	44
28.2	SiloTemperature	45
28.3	SiloPressure	45
29	FillingMonitoringType	45
29.1	FillingMonitoringType definition	45
29.2	BackPressure	46
30	DistanceMonitoringType	46
30.1	DistanceMonitoringType definition	46
30.2	Distance	46
31	MouldMonitoringType	47
31.1	MouldMonitoringType definition	47
31.2	MouldPressure	47
31.3	MouldTemperature	47
32	ParticleFoamJobInformationType	48
32.1	ParticleFoamJobInformationType definition	48
32.2	MaterialDescription	48
32.3	PlannedMaterialLot.....	48
32.4	MouldDescription	48
32.5	ExpectedCycleTimes.....	48
33	ActiveParticleFoamJobValuesType	48
33.1	ActiveParticleFoamJobValuesType definition.....	48
33.2	UsedMaterialLot.....	49
34	CycleTimesDataType.....	49
34.1	CycleTimesDataType definition	49
35	Profiles and Conformance Units	50
35.1	Conformance Units.....	50
35.2	Profiles.....	50
35.2.1	Profile list.....	50
35.2.2	Server Facets	50
36	Namespaces	52
36.1	Namespace Metadata	52
36.2	Handling of OPC UA Namespaces	52
Annex A (normative) OPC 40087 Namespace and mappings		54

Figures

Figure 1 – ParticleFoamMachineType Overview 16

Figure 2 – MachineCharacteristicsType Overview..... 19

Figure 3 – BlockMachineCharacteristicsType Overview 22

Figure 4 – ShapeMachineCharacteristicsType Overview 23

Figure 5 – ProcessMonitoringType Overview 28

Figure 6 – TemperingType Overview 31

Figure 7 – SupplyType Overview 32

Figure 8 – FoamMonitoringType Overview 39

Figure 9 – RfMonitoringType Overview 43

Figure 10 – SilosType Overview 44

Figure 11 – FillingMonitoringType Overview 45

Figure 12 – MouldMonitoringType Overview..... 47

Tables

Table 1 – ParticleFoamMachineType Definition	17
Table 2 – ParticleFoamMachineType Additional Subcomponents	17
Table 3 – Types, methods and events for cyclic jobs	18
Table 4 – ParticleFoamMachineType Additional Subcomponents	18
Table 5 – MachineCharacteristicsType Definition	20
Table 6 – IntegratedHandlingSystemEnumeration Items	20
Table 7 – IntegratedHandlingSystemEnumeration Definition	20
Table 8 – SetMachineTime Method Arguments	21
Table 9 – SetMachineTime Method AddressSpace Definition	21
Table 10 – BlockMachineCharacteristicsType Definition	22
Table 11 – ShapeMachineCharacteristicsType Definition	24
Table 12 – MouldingProcessSourceEnumeration Items	24
Table 13 – MouldingProcessSourceEnumeration Definition	25
Table 14 – FillingHopperDataType Structure	25
Table 15 – FillingHopperDataType Definition	26
Table 16 – ErrorHandlingType Definition	26
Table 17 – Severity levels	26
Table 18 – ResetAllErrors Method AddressSpace Definition	27
Table 19 – ResetErrorById Method Arguments	27
Table 20 – ResetErrorById Method AddressSpace Definition	27
Table 21 – ProcessMonitoringType Definition	29
Table 22 – ProcessStepEnumeration Items	29
Table 23 – ProcessStepEnumeration Definition	29
Table 24 – TemperingType Definition	31
Table 25 – SupplyType Definition	33
Table 26 – SteamSupplyType Definition	33
Table 27 – SteamingTypeEnumeration Items	34
Table 28 – SteamMeasuringPointsType definition	34
Table 29 – WaterSupplyType Definition	35
Table 30 – AirSupplyType Definition	35
Table 31 – VacuumSupplyType Definition	36
Table 32 – SupplyMeasuringType Definition	36
Table 33 – ElectricitySupplyType	37
Table 34 – ElectricityMeasuringType definition	37
Table 35 – Voltage array structure	38
Table 36 – Current array structure	38
Table 37 – PowerFactor array structure	38
Table 38 – PowerFactor array structure	38
Table 39 – FoamMonitoringType Definition	39
Table 40 – MaterialConditionsType definition	40
Table 41 – MaterialConditionType Definition	41
Table 42 – MaterialConsumptionsType Definition	42
Table 43 – MaterialConsumptionType Definition	43
Table 44 – RfMonitoringType Definition	43

Table 45 – SilosType Definition.....44

Table 46 – SiloMonitoringType Definition.....45

Table 47 – FillingMonitoringType Definition45

Table 48 – DistanceMonitoringType Definition.....46

Table 49 – MouldMonitoringType Definition.....47

Table 50 – ParticleFoamJobInformationType Definition48

Table 51 – ActiveParticleFoamJobValuesType Definition48

Table 52 – CycleTimesDataType Structure49

Table 53 – CycleTimesDataType Definition49

Table 54 – Conformance Units for OPC 4008750

Table 55 – Profile URIs for OPC 4008750

Table 56 – OPC 40087 Basic Server Profile51

Table 57 – NamespaceMetadata Object for this Document52

Table 58 – Namespaces used in a OPC 40087 Server53

Table 59 – Namespaces used in this document53

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Forewords

OPC UA is a machine to machine communication technology to transmit characteristics of products (e.g. manufacturer name, device type or components) and process data (e.g. temperatures, pressures or feed rates). To enable vendor unspecific interoperability the description of product characteristics and process data has to be standardized utilizing technical specifications, the OPC UA companion specifications.

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 40087 describes the interface between particle foam machines (block foam and shape moulding machines) and vertically connected systems (e.g. manufacturing execution systems (MES), central control systems, SCADA) or horizontally connected machines/devices for data exchange. The target of OPC 40087 is to provide a unique interface for particle foam machines and MES/connected devices from different manufacturers to ensure compatibility.

The following functionalities are covered:

- General information about the machine (manufacturer, model, serial number...), capabilities, current configuration and status of the machine including steam/radio frequency, cooling, vacuum, injectors
- logbook of relevant changes on the machine
- monitoring of process values
- information about processed material
- energy/material consumption
- Data exchange with automation/handling systems
- Job management: Information on the jobs running on the machine and the parameters of the production cycles and methods to send jobs from the MES to the particle foam machine and to release the production.
- Dataset management: particle foam machines store their configurations in so-called datasets. These include information on nominal process parameters (times, temperatures, pressures ...) related to the particle foam machines but also to installed handling systems. OPC 40087 allows transferring datasets between particle foam machines and MES for building a central repository of datasets.

Following functions are not included:

- Safety related signals like emergency stop
- Direct control of machine movements

Pressure loading equipment and pre-expanders will be dealt with in separate parts.

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 and errata) applies

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

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

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

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

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/Part9/>

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

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

OPC 40001-1, *OPC UA for Machinery - Part 1: Basic Building Blocks*

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

OPC 40001-2, *OPC UA for Machinery - Part 2: Process Values*

<http://www.opcfoundation.org/UA/Machinery/ProcessValues>

OPC 40083: *OPC UA interfaces for plastics and rubber machinery – General Type definitions*

<http://www.opcfoundation.org/UA/PlasticsRubber/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 40087 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.

The same applies to the Container Concept described in OPC 40083, especially the use of the *Property NodeVersion*:

“Several objects can occur several times in the parent object (e.g. several moulds in one machine). For these, container objects are modelled. The benefit is that all instances are collected in one object so that changes can be easily recognized by using a Property NodeVersion which can be subscribed by clients. According to OPC 10000-3 the instances of the container objects shall also trigger a *GeneralModelChangeEvent*.”

3.3 Abbreviations

MES Manufacturing Execution System

UUID Universally unique identifier

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 40087 covers the following functionalities:

- Machine identification: Basic information about the machine such as manufacturer, serial number, model → basis for communication and further allocation of information
- Information about machine capability and configuration for production planning (can I produce the product on this machine?)
- Information about machine status to quickly react on errors and to calculate key performance indicators
- Monitoring of process values (steam, vacuum, compressed air, temperatures, pressures, ...)
- Exchange of quality rules (tolerances for process values) → machine can evaluate product quality
- Providing of information necessary for production planning / synchronizing several machines via central control system (important when sharing resources)
- Providing process/product information relevant for down-stream equipment including handling system
- Job management: Information on the jobs running on the machine and the parameters of the production cycles and methods to send jobs from the MES to the particle foam machine and to release the production.

- Dataset management: Particle foam machines store their configurations in so-called datasets. These include information on nominal process parameters (times, temperatures, pressures ...) related to the particle foam machine but also to installed handling systems.

The following components/process values of a particle foam machine are covered:

- Mould
- Steam/radio frequency
- Water (cooling)
- Vacuum
- Compressed air
- Filling systems with injectors

6 OPC 40087 Information Model Overview

The information model structure of OPC 40087 consists of the root *ObjectType ParticleFoamMachineType*, which contains instances of all other *ObjectTypes* defined in this specification.

The *ParticleFoamMachineType* is defined in chapter 7. The top level objects are separated by use cases:

- Identification and machine state
- Machine configuration and capabilities (*MachineCharacteristics*)
- Status in relation to the MES (*MachineMESStatus*)
- Errors (*ErrorHandling*)
- Process values (*ProcessMonitoring*)
- Users (*Users*)
- Maintenance (*Maintenance*)
- Jobs (*Jobs*)
- Production dataset management (*ProductionDatasetManagement*)

7 ParticleFoamMachineType

7.1 ParticleFoamMachineType definition

This OPC UA *ObjectType* is used for the root *Object* representing a particle foam machine and is described in Table 1.

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

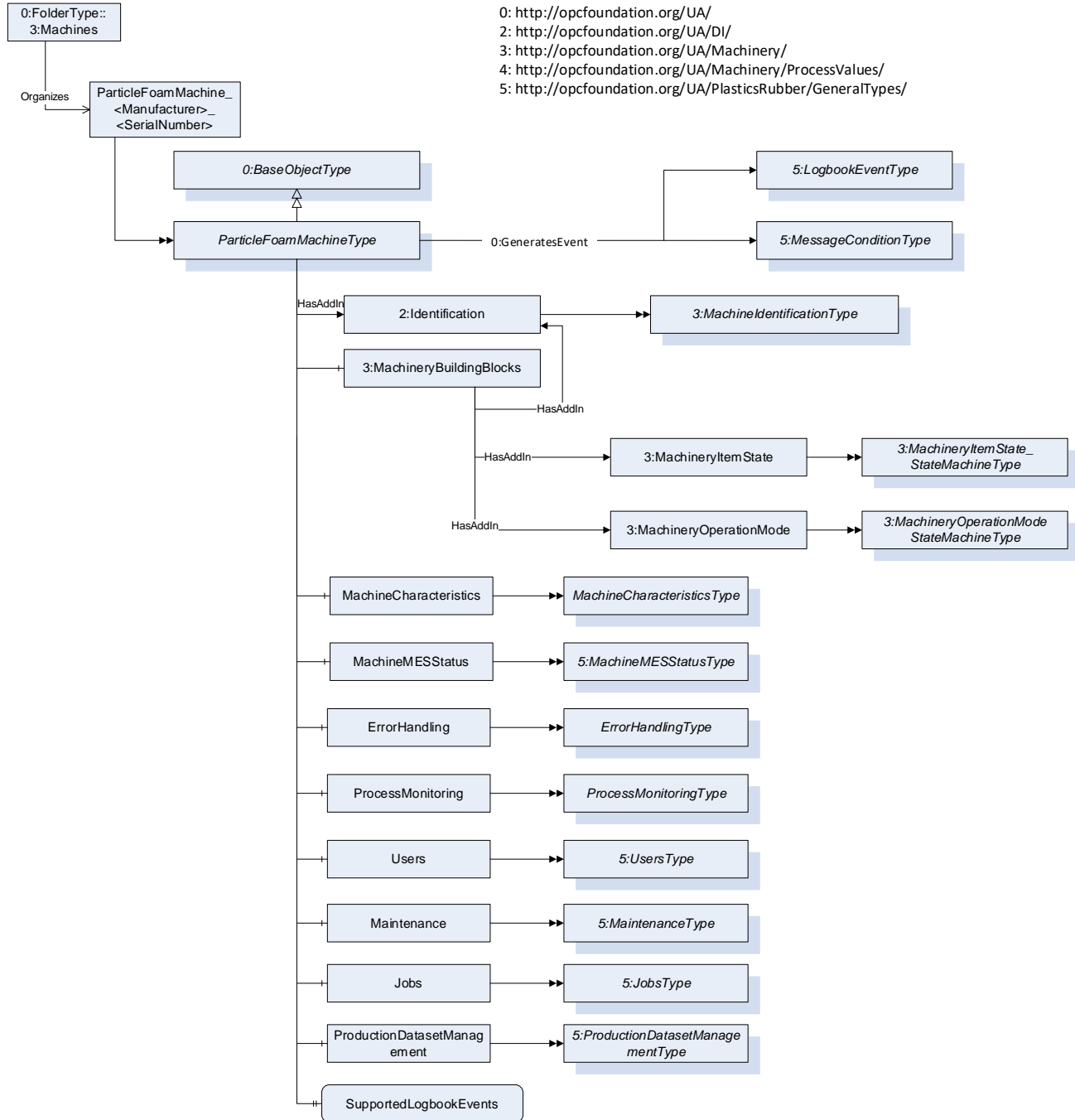


Figure 1 – ParticleFoamMachineType Overview

Table 1 – ParticleFoamMachineType Definition

Attribute	Value				
BrowseName	ParticleFoamMachineType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasAddIn	Object	2:Identification		3:MachineIdentificationType	M
0:HasComponent	Object	3:MachineryBuildingBlocks		0:FolderType	M
0:HasComponent	Object	MachineCharacteristics		MachineCharacteristicsType	M
0:HasComponent	Object	MachineMesStatus		5:MachineMESStatusType	M
0:HasComponent	Object	ErrorHandling		ErrorHandlingType	M
0:HasComponent	Object	ProcessMonitoring		ProcessMonitoringType	M
0:HasComponent	Object	Users		5:UsersType	M
0:HasComponent	Object	Maintenance		5:MaintenanceType	O
0:HasComponent	Object	Jobs		5:JobsType	O
0:HasComponent	Object	ProductionDatasetManagement		5:ProductionDataset ManagementType	O
0:HasProperty	Variable	SupportedLogbookEvents	5:LogbookEventsEnumeration[]	0:PropertyType	M, RO
0:GeneratesEvent	ObjectType	5:MessageConditionType	Defined in OPC 40083		
0:GeneratesEvent	ObjectType	5:LogbookEventType	Defined in OPC 40083		
Conformance Units					
OPC 40087 Basic					
OPC 40087 Maintenance					
OPC 40087 Jobs					
OPC 40087 ProductionDatasetManagement					

7.2 Identification and MachineryBuildingBlocks

The *MachineIdentificationType* is defined in OPC UA for Machinery (OPC 40001-1) and provides basic information on a machine/device.

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

The *Object MachineryBuildingBlocks* contains building blocks from OPC UA for Machinery as defined in OPC 40001-1. For this version of OPC 40087, the *Object* uses the two *AddIns MachineryItemState* and *MachineryOperationMode*.

Table 2 – ParticleFoamMachineType Additional Subcomponents

BrowsePath	References	NodeClass	BrowseName	Data Type	Type Definition	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
3:MachineryBuilding Blocks	0:HasAddIn	Object	2:Identification		3:MachineIdentificationType	M
3:MachineryBuilding Blocks	0:HasAddIn	Object	3:MachineryItem State		3:MachineryItemState_State MachineType	M
3:MachineryBuilding Blocks	0:HasAddIn	Object	3:MachineryOperationMode		3:MachineryOperationModeStateMachineType	M

The *DeviceClass Property* in the *Identification Object* shall have the value "Particle Foam Machine".

7.3 MachineCharacteristics

This *Object* provides information about the machine characteristics, capabilities and current configuration. The *MachineCharacteristicsType* is defined in 8.

7.4 MachineMesStatus

The *MachineMesStatus Object* represents the current status of a machine related to the MES. The *MachineMESStatusType* is defined in OPC 40083.

7.5 ErrorHandling

The *ErrorHandling Object* provides minimal error handling without alarms. The *ErrorHandlingType* is defined in 9.

7.6 ProcessMonitoring

This *Object* provides information about the running production process. The *ProcessMonitoringType* is defined in 10.

7.7 Users

The *Users Object* provides information on the current users on the machine. The *UsersType* is defined in OPC 40083.

7.8 Maintenance

The *Maintenance Object* provides information on the maintenance status of the machine. The *MaintenanceType* is defined in OPC 40083.

7.9 Jobs

The *Jobs Object* is used for managing production jobs on the machine and for information on their status including process parameters (temperatures, pressures...). The *JobsType* is defined in OPC 40083.

7.9.1 Types, methods and events for cyclic jobs

As particle foam machines have a cyclic production, the *Types, Methods and Events* defined in OPC 40083 for cyclic jobs shall be used. For the job information, a *Subtype* of the *CyclicJobInformationType* is used:

Table 3 – Types, methods and events for cyclic jobs

Type/Method/Event	SubType/extended Methods to be used for OPC 40087
5:JobInformationType	ParticleFoamJobInformationType
5:SendJobList	5:SendCyclicJobList
5:RequestJobListEventType	5:RequestCyclicJobListEventType
5:ActiveJobValuesType	ActiveParticleFoamJobValuesType

Table 4 – ParticleFoamMachineType Additional Subcomponents

BrowsePath	References	NodeClass	BrowseName	DataType	TypeDefinition	Other
Jobs	0:HasComponent	Object	5:ActiveJob		ParticleFoamJobInformationType	M
Jobs	0:HasComponent	Object	5:JobInPreparation		ParticleFoamJobInformationType	M
Jobs	0:HasComponent	Object	5:ActiveJobValues		ActiveParticleFoamJobValuesType	M

The *ParticleFoamJobInformationType* is defined in 32.

The *ActiveParticleFoamJobValuesType* is defined in 33.

7.10 ProductionDatasetManagement

Provides methods and events for the exchange of lists of available production datasets and for the transfer of the files themselves. The *ProductionDatasetManagementType* is defined in OPC 40083.

7.11 SupportedLogbookEvents

Provides a list of supported logbook events. The *LogbookEventType* and the *LogbookEventsEnumeration* are defined in OPC 40083.

8 MachineCharacteristicsType

8.1 MachineCharacteristicsType definition

The *MachineCharacteristicsType* provides information about the machine characteristics/capabilities and is formally defined in Table 5. It is an abstract *Object*. Either the *Subtype BlockMachineCharacteristicsType* or *ShapeMachineCharacteristicsType* must be used when creating an instance.

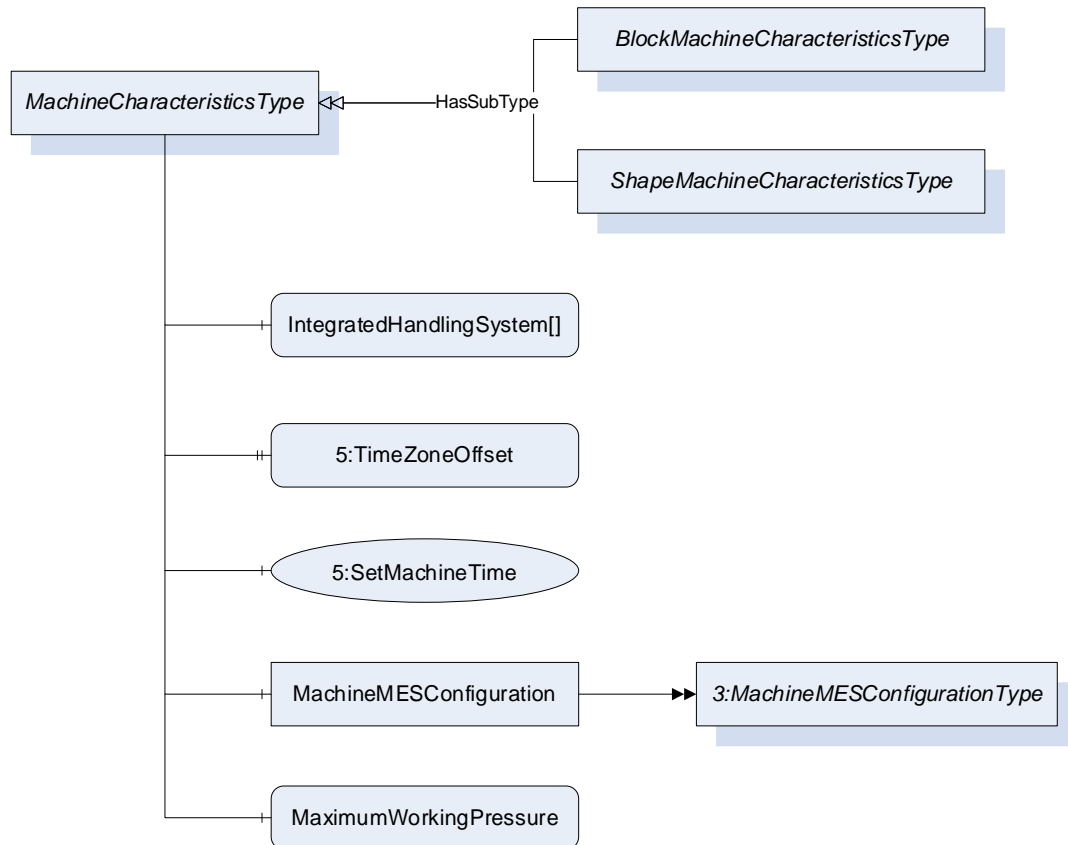


Figure 2 – MachineCharacteristicsType Overview

Table 5 – MachineCharacteristicsType Definition

Attribute	Value				
BrowseName	MachineCharacteristicsType				
IsAbstract	True				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	IntegratedHandlingSystem	IntegratedHandlingSystemEnumeration[2]	0:PropertyType	M, RO
0:HasProperty	Variable	5:TimeZoneOffset	0:TimeZoneDataType	0:PropertyType	M, RO
0:HasComponent	Method	5:SetMachineTime			M
0:HasComponent	Object	MachineMESConfiguration		5:MachineMESConfigurationType	M
0:HasComponent	Variable	MaximumWorkingPressure	0:Double	0:AnalogUnitType	M, RO
0:HasSubtype	ObjectType	BlockMachineCharacteristicsType	Defined in 8.7		
0:HasSubtype	ObjectType	ShapeMachineCharacteristicsType	Defined in 8.8		
Conformance Units					
OPC 40087 Basic					

8.2 IntegratedHandlingSystem

The *IntegratedHandlingSystems* provides information about the handling systems for insert and take out of the part. It is a one-dimensional array with the size fixed to 2. The first entry represents the insert handling system, the second entry represents the take out handling system.

The *IntegratedHandlingSystemEnumeration* is defined in Table 6.

Table 6 – IntegratedHandlingSystemEnumeration Items

Name	Value	Description
NONE	0	No integrated handling system
OTHER	1	Other type
SixAxesRobot	2	Machine has an integrated six axes robot
TwoAxesRobot	3	Machine has an integrated two axes robot
OneAxisHandlingSystem	4	Machine has an integrated one axis handling system
ConveyorBelt	5	Machine has an integrated conveyor belt

Table 7 – IntegratedHandlingSystemEnumeration Definition

Attribute	Value				
BrowseName	IntegratedHandlingSystemEnumeration				
IsAbstract	False				
Description	Indicates which type of integrated handling system is used on the machine				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:Enumeration defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
OPC 40087 Basic					

8.3 TimeZoneOffset

The *TimeZoneOffset Property* represents the difference of the local time to Coordinated Universal Time (UTC) given by the machine operator or OPC client.

Information: *TimeZoneDataType* (as defined in OPC 10000-3) is a structure with two components:

- *offset* (0:UInt16): Time difference from UTC in minutes (e.g. 120 for daylight saving time in Berlin)

- *daylightSavingInOffset* (0:Boolean): If TRUE, then daylight saving time (DST) is in effect and *offset* includes the DST correction. If FALSE, then the *offset* does not include DST correction and DST may or may not have been in effect.

NOTE: The current UTC time itself is part of OPC 10000-5: *ServerStatus* → *CurrentTime*.

8.4 SetMachineTime

The *SetMachineTime* Method allows setting the server time together with *TimeZoneOffset*.

Signature

```
SetMachineTime (
    [in]    0:DateTime           DateTime
    [in]    0:TimeZoneDataType  TimeZoneOffset);
```

Table 8 – SetMachineTime Method Arguments

Argument	Description
DateTime	Date and time in UTC time
TimeZoneOffset	Time difference from UTC in minutes incl. daylight saving time

Table 9 – SetMachineTime Method AddressSpace Definition

Attribute	Value				
BrowseName	5:SetMachineTime				
References	Node Class	BrowseName	DataType	TypeDefinition	Modelling Rule
0:HasProperty	Variable	InputArguments	Argument[]	0:PropertyType	M

Example: A call with *DateTime* = "2021-04-30 12:00" (UTC time) and *TimeZoneOffset* = {120; true}, sets the (local) machine time to "30-04-2021 14:00" and the time zone to "UTC+2" with active daylight saving time.

8.5 MachineMESConfiguration

The *MachineMESConfiguration* provides information about the current configuration of the machine related to a MES. The *MachineMESConfigurationType* is defined in OPC 40083.

8.6 MaximumWorkingPressure

The *MaximumWorkingPressure* defines the maximum working pressure of the machine (to hold mould closed) in bar or psi.

8.7 BlockMachineCharacteristicsType

8.7.1 BlockMachineCharacteristicsType definition

The *BlockMachineCharacteristicsType* provides machine characteristics valid for block foam machines and is formally defined in Table 10.

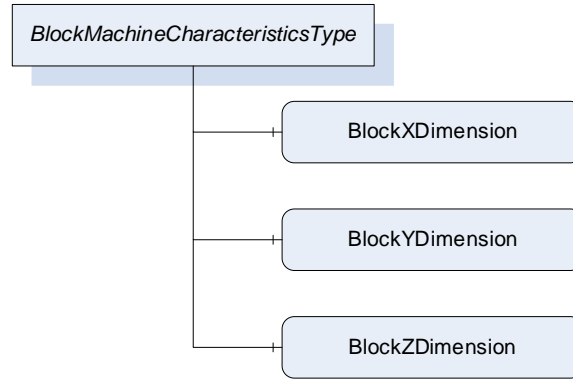


Figure 3 – BlockMachineCharacteristicsType Overview

Table 10 – BlockMachineCharacteristicsType Definition

Attribute	Value				
BrowseName	BlockMachineCharacteristicsType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the MachineCharacteristicsType defined in 8.1					
0:HasComponent	Variable	BlockXDimension	0:Double	0:AnalogUnitRangeType	M, RO
0:HasComponent	Variable	BlockYDimension	0:Double	0:AnalogUnitRangeType	M, RO
0:HasComponent	Variable	BlockZDimension	0:Double	0:AnalogUnitRangeType	M, RO
Conformance Units					
OPC 40087 Block					

8.7.2 BlockXDimension

Minimum and maximum dimension of foam block in x-direction.

8.7.3 BlockYDimension

Minimum and maximum dimension of foam block in y-direction.

8.7.4 BlockZDimension

Minimum and maximum dimension of foam block in z-direction.

8.8 ShapeMachineCharacteristicsType

8.8.1 ShapeMachineCharacteristicsType definition

The *ShapeMachineCharacteristicsType* provides machine characteristics valid for shape foam machines and is formally defined in Table 11.

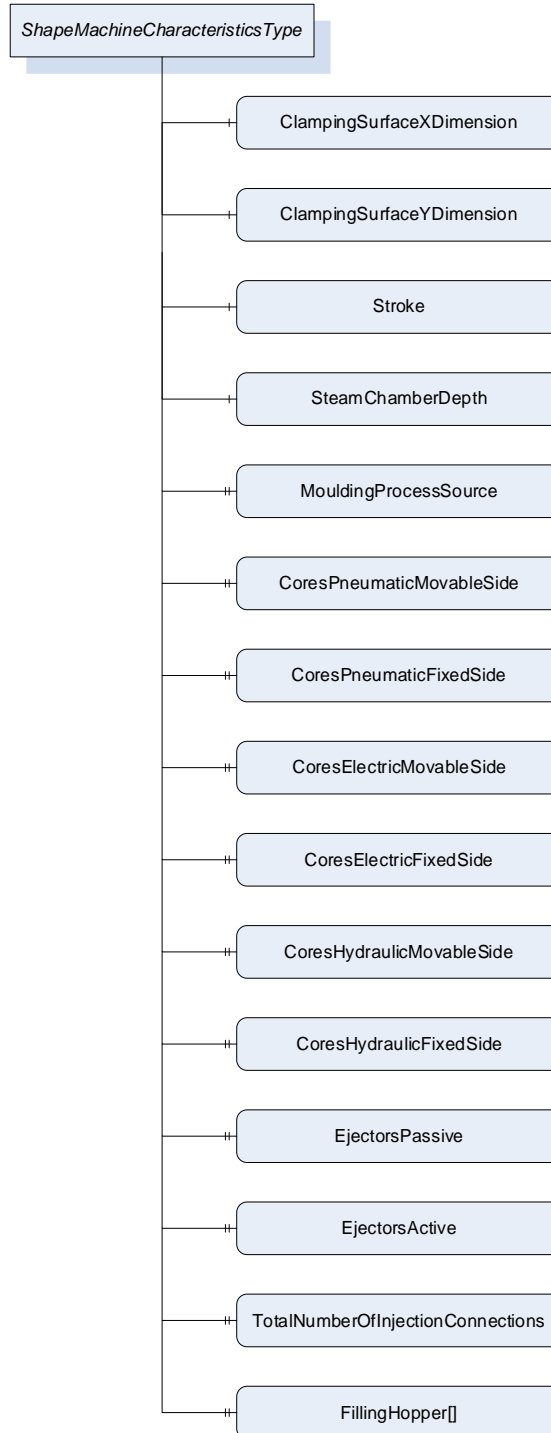


Figure 4 – ShapeMachineCharacteristicsType Overview

Table 11 – ShapeMachineCharacteristicsType Definition

Attribute	Value				
BrowseName	ShapeMachineCharacteristicsType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the MachineCharacteristicsType defined in 8.1					
0:HasComponent	Variable	ClampingSurfaceXDimension	0:Double	0:AnalogUnitRangeType	M, RO
0:HasComponent	Variable	ClampingSurfaceYDimension	0:Double	0:AnalogUnitRangeType	M, RO
0:HasComponent	Variable	Stroke	0:Double	0:AnalogUnitRangeType	M, RO
0:HasComponent	Variable	SteamChamberDepth	0:Double	0:AnalogUnitRangeType	O, RO
0:HasComponent	Variable	MouldingProcessSource	MouldingProcessSourceEnumeration	0:BaseDataVariableType	M, RO
0:HasProperty	Variable	CoresPneumaticMovableSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	CoresPneumaticFixedSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	CoresElectricMovableSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	CoresElectricFixedSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	CoresHydraulicMovableSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	CoresHydraulicFixedSide	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	EjectorsPassive	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	EjectorsActive	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	TotalNumberOfInjectionConnections	0:Byte	0:PropertyType	M, RO
0:HasProperty	Variable	FillingHopper	FillingHopperDataType[]	0:PropertyType	M, RO
Conformance Units					
OPC 40087 Shape					

8.8.2 ClampingSurfaceXDimension

Dimension of the clamping surface in x-direction in mm or inch

8.8.3 ClampingSurfaceYDimension

Dimension of the clamping surface in y-direction in mm or inch

8.8.4 Stroke

Maximum stroke of the platens in mm or inch

8.8.5 SteamChamberDepth

depth of the steam chamber in mm or inch

8.8.6 MouldingProcessSource

Information about the source of the moulding / welding process

The *MouldingProcessSourceEnumeration* is defined in Table 12.

Table 12 – MouldingProcessSourceEnumeration Items

Name	Value	Description
STEAM	0	Steam is used for welding
RF	1	Radio frequency is used for welding
TEMP	2	Tempering (Only heating the mould / Moulding without steam)

Its representation in the *AddressSpace* is defined in Table 13.

Table 13 – MouldingProcessSourceEnumeration Definition

Attribute	Value				
BrowseName	MouldingProcessSourceEnumeration				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
OPC 40087 Shape					

8.8.7 CoresPneumaticMovableSide

Number of connectors for pneumatic cores on movable side of mould

8.8.8 CoresPneumaticFixedSide

Number of connectors for pneumatic cores on fixed side of mould

8.8.9 CoresElectricMovableSide

Number of connectors for electric cores on movable side of mould

8.8.10 CoresElectricFixedSide

Number of connectors for electric cores on fixed side of mould

8.8.11 CoresHydraulicMovableSide

Number of connectors for hydraulic cores on movable side of mould

8.8.12 CoresHydraulicFixedSide

Number of connectors for hydraulic cores on fixed side of mould

8.8.13 EjectorsPassive

Number of connectors for passive ejectors

8.8.14 EjectorsActive

Number of connectors for active ejectors

8.8.15 TotalNumberOfInjectionConnections

Total number of injection connections of the machine (over all filling hoppers)

8.8.16 FillingHopper

Information about the filling hoppers. Array of *FillingHopperDataType*:

Table 14 – FillingHopperDataType Structure

Name	Type	Description
FillingHopperDataType	structure	Subtype of 0:Structure defined in OPC 10000-5
NumberOfInjectionConnections	0:Byte	number of injection connections of the hopper
Volume	0:Double	Volume of the hopper
VolumeUnit	0:EUInformation	Information about the unit used for volume
DosingUnitIntegrated	0:Boolean	Information if a dosing unit (e.g. rotation plate) is installed in the hopper

Its representation in the *AddressSpace* is defined in Table 15.

Table 15 – FillingHopperDataType Definition

Attribute	Value				
BrowseName	FillingHopperDataType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of 0:Structure defined in OPC 10000-5					
Conformance Units					
OPC 40087 Shape					

9 ErrorHandlingType

9.1 ErrorHandlingType definition

The *ErrorHandlingType* provides minimal error handling without alarms and is defined in Table 16.

Table 16 – ErrorHandlingType Definition

Attribute	Value				
BrowseName	ErrorHandlingType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Variable	HighestActiveAlarmSeverity	0:UInt16	0:BaseDataVariable Type	M, RO
0:HasComponent	Variable	ActiveErrors	5:ClassifiedActiveErrorData Type[]	0:BaseDataVariable Type	M, RO
0:HasComponent	Method	ResetAllErrors			O
0:HasComponent	Method	ResetErrorById			O
Conformance Units					
OPC 40087 Basic					

9.2 HighestActiveAlarmSeverity

Description: Indication of the severity of the highest active alarm. It provides a minimal error handling for machines without alarm support. However, the variable shall be filled even if alarms are supported. The following levels are defined:

Table 17 – Severity levels

Range of Severity	Description
0	No active message
1 – 333	Messages of low urgency (Information)
334 – 666	Messages of medium urgency (Warning)
667 – 1000	Messages of high urgency (Error)

Example: 400

9.3 ActiveErrors

Description: List of the active errors of the machine. It provides a minimal error handling for machines without alarm support. However, the variable shall be filled even if alarms are supported. The *ClassifiedActiveErrorDataType* is defined in OPC 40083. If there is no active error, the array is empty.

9.4 ResetAllErrors

Description: Method to reset all errors of the machine.

Signature:

```
ResetAllErrors();
```

The method has no *Input-* or *OutputArguments*.

Table 18 – ResetAllErrors Method AddressSpace Definition

Attribute	Value				
BrowseName	ResetAllErrors				
References	Node Class	BrowseName	Data Type	Type Definition	Modelling Rule

9.5 ResetErrorById

Description: Method to reset one error of the machine.

Signature:

```
ResetErrorById(
    [in] 0:String Id);
```

Table 19 – ResetErrorById Method Arguments

Argument	Description
Id	Id of the error, listed in <i>ActiveErrors</i> , that shall be reset.

Table 20 – ResetErrorById Method AddressSpace Definition

Attribute	Value				
BrowseName	ResetErrorById				
References	Node Class	BrowseName	Data Type	Type Definition	Modelling Rule
HasProperty	Variable	InputArguments	Argument[]	PropertyType	Mandatory

10 ProcessMonitoringType

10.1 ProcessMonitoringType definition

The *ProcessMonitoringType* provides information about the running production process and is formally defined in Table 21.

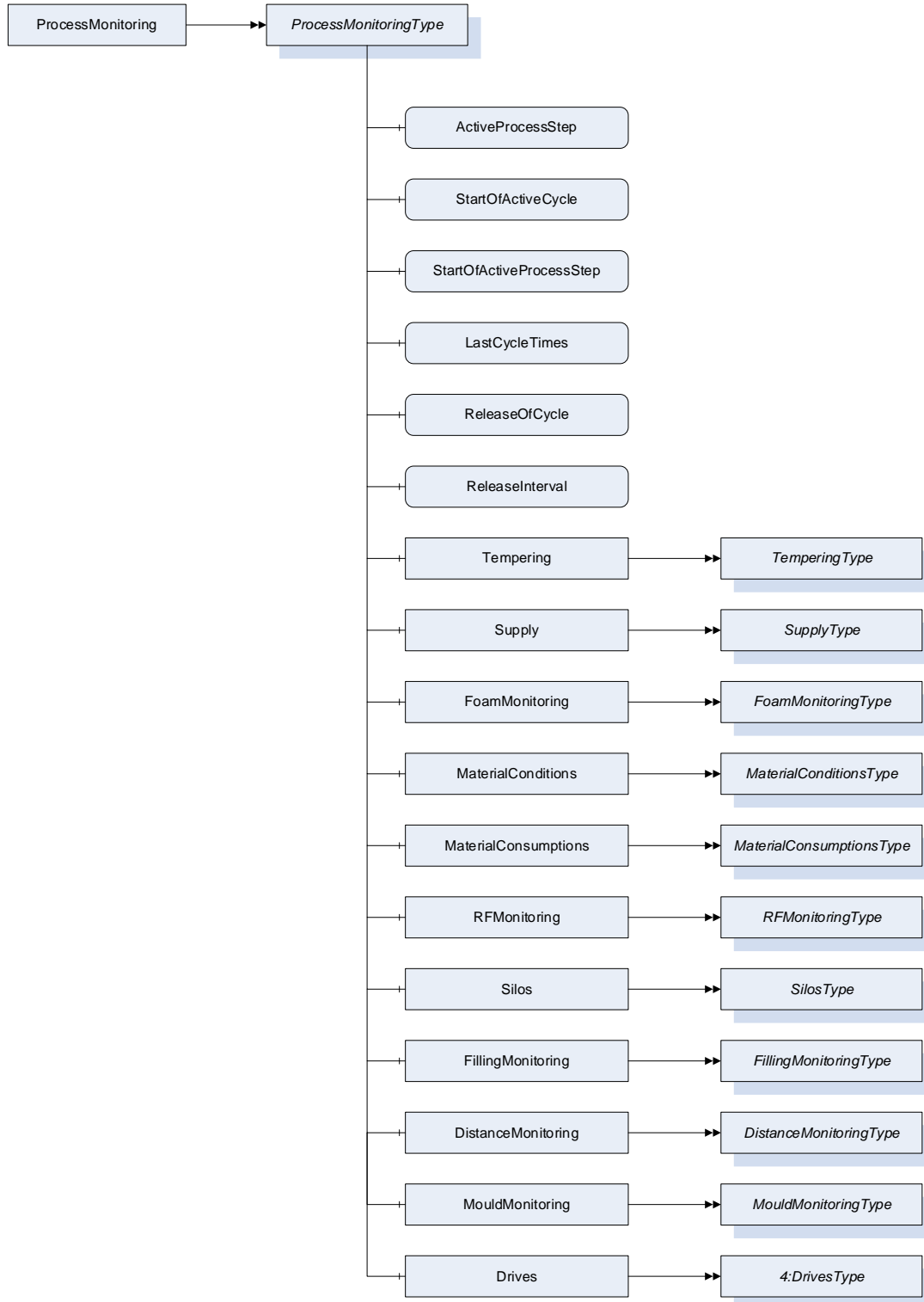


Figure 5 – ProcessMonitoringType Overview

Table 21 – ProcessMonitoringType Definition

Attribute	Value				
BrowseName	ProcessMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Variable	ActiveProcessStep	ProcessStepEnumeration	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	StartOfActiveCycle	0:UtcTime	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	StartOfActiveProcessStep	0:UtcTime	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	LastCycleTimes	0:Duration	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	ReleaseOfCycle	0:UtcTime	0:BaseDataVariableType	O, RW
0:HasComponent	Variable	ReleaseInterval	0:Duration	0:BaseDataVariableType	O, RW
0:HasComponent	Object	Tempering		TemperingType	O
0:HasComponent	Object	Supply		SupplyType	O
0:HasComponent	Object	FoamMonitoring		FoamMonitoringType	O
0:HasComponent	Object	MaterialConditions		MaterialConditionsType	O
0:HasComponent	Object	MaterialConsumptions		MaterialConsumptionsType	O
0:HasComponent	Object	RfMonitoring		RfMonitoringType	O
0:HasComponent	Object	Silos		SilosType	O
0:HasComponent	Object	FillingMonitoring		FillingMonitoringType	O
0:HasComponent	Object	Distances		DistanceMonitoringType	O
0:HasComponent	Object	MouldMonitoring		MouldMonitoringType	O
0:HasComponent	Object	Drives		5:DrivesType	O
Conformance Units					
40087 Basic					

10.2 ActiveProcessStep

This *Variable* of gives information, which is the current process step of the machine. The enumeration *ProcessStepEnumeration* is defined in Table 22.

Table 22 – ProcessStepEnumeration Items

Name	Value	Description
NOT_RUNNING	0	Machine is not running
OTHER	1	Machine is in some other phase
MOULD_CLOSING	2	Machine is in mould closing phase
FILLING	3	Machine is in filling phase
WELDING_STEAMING	4	Machine is in welding/steaming phase
COOLING	5	Machine is in cooling phase
STABILIZING	6	Machine is in stabilizing phase
DEMOULDING	7	Machine is in demoulding phase

Its representation in the *AddressSpace* is defined in Table 23.

Table 23 – ProcessStepEnumeration Definition

Attribute	Value				
BrowseName	ProcessStepEnumeration				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
OPC 40087 Basic					

10.3 StartOfActiveCycle

Time when the active cycle has been started.

10.4 StartOfActiveProcessStep

Time when the active process step has been started.

10.5 LastCycleTimes

Average cycle time of last X cycles to detect deviations. The choice of the sample size X is up to end user.

10.6 ReleaseOfCycle

Time when the next cycle may be started. Can be written by central system / MES to optimize the usage of commonly used resources.

If there is no central control, the variable can just be set to a date in the past (e.g. "2000-01-01") so that the next cycle is always released.

10.7 ReleaseInterval

Maximum interval starting from *ReleaseOfCycle* within which the next cycle may be started. If *ReleaseOfCycle* = 0 there is no limitation.

10.8 Tempering

Provides information about the external source of controlling the temperature of the mould. The *TemperingType* is defined in 11.

10.9 Supply

Provides information about the current state of supply mediums. The *SupplyType* is defined in 12.

10.10 FoamMonitoring

Provides information about parameters influencing condition of the material inside the mould. The *FoamMonitoringType* is defined in 21.

10.11 MaterialConditions

Provides information about the monitored material conditions. The *MaterialConditionsType* is defined in 22.

10.12 MaterialConsumptions

Provides information about the monitored material consumption. The *MaterialConsumptionsType* is defined in 24.

10.13 RfMonitoring

Provides information about RF (radio frequency) used in the particle foam machine. The *RfMonitoringType* is defined in 26.

10.14 Silos

Provides information about the monitored silos. The *SilosType* is defined in 27.

10.15 FillingMonitoring

Provides information about the filling process from the silo into the mould. The *FillingMonitoringType* is defined in 29.

10.16 Distances

Provides information about the monitored distances. The *DistanceMonitoringType* is defined in 30.

10.17 MouldMonitoring

Provides information about the monitored pressures and temperatures in the mould. The *MouldMonitoringType* is defined in 31.

10.18 Drives

Provides information on the drives of the machine. The *DrivesType* is defined in OPC 40083.

11 TemperingType

11.1 TemperingType definition

The *TemperingType* provides information on the external source of controlling the temperature of the mould and is formally defined in Table 24.

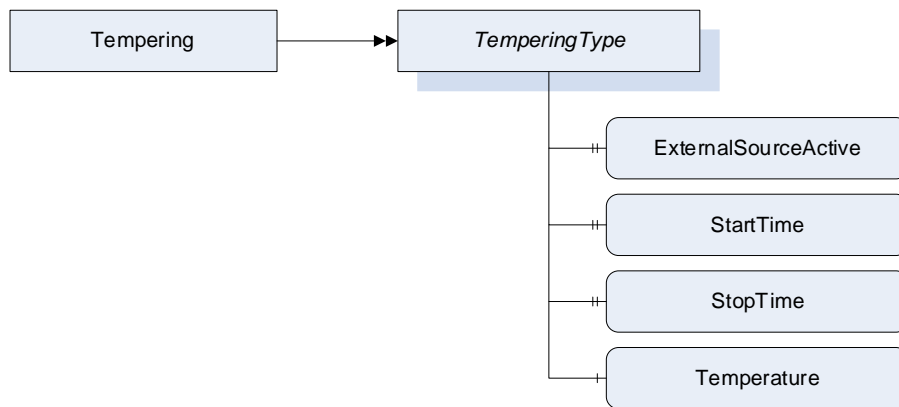


Figure 6 – TemperingType Overview

Table 24 – TemperingType Definition

Attribute	Value				
BrowseName	TemperingType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Variable	ExternalSourceActive	0:Boolean	0:BaseDataVariableType	M
0:HasComponent	Variable	StartTime	0:UtcTime	0:BaseDataVariableType	M
0:HasComponent	Variable	StopTime	0:UtcTime	0:BaseDataVariableType	M
0:HasComponent	Object	Temperature		4:ProcessValueType	M
Conformance Units					
OPC 40087 Tempering					

11.2 ExternalSourceActive

Information, if an external heating source is active.

11.3 StartTime

Start time of the tempering process.

11.4 StopTime

Stop time of the tempering process.

11.5 Temperature

Actual temperature. Includes also set values and limits.

12 SupplyType

12.1 SupplyType definition

The *SupplyType* contains information about the current state of supply mediums and is formally defined in Table 25.

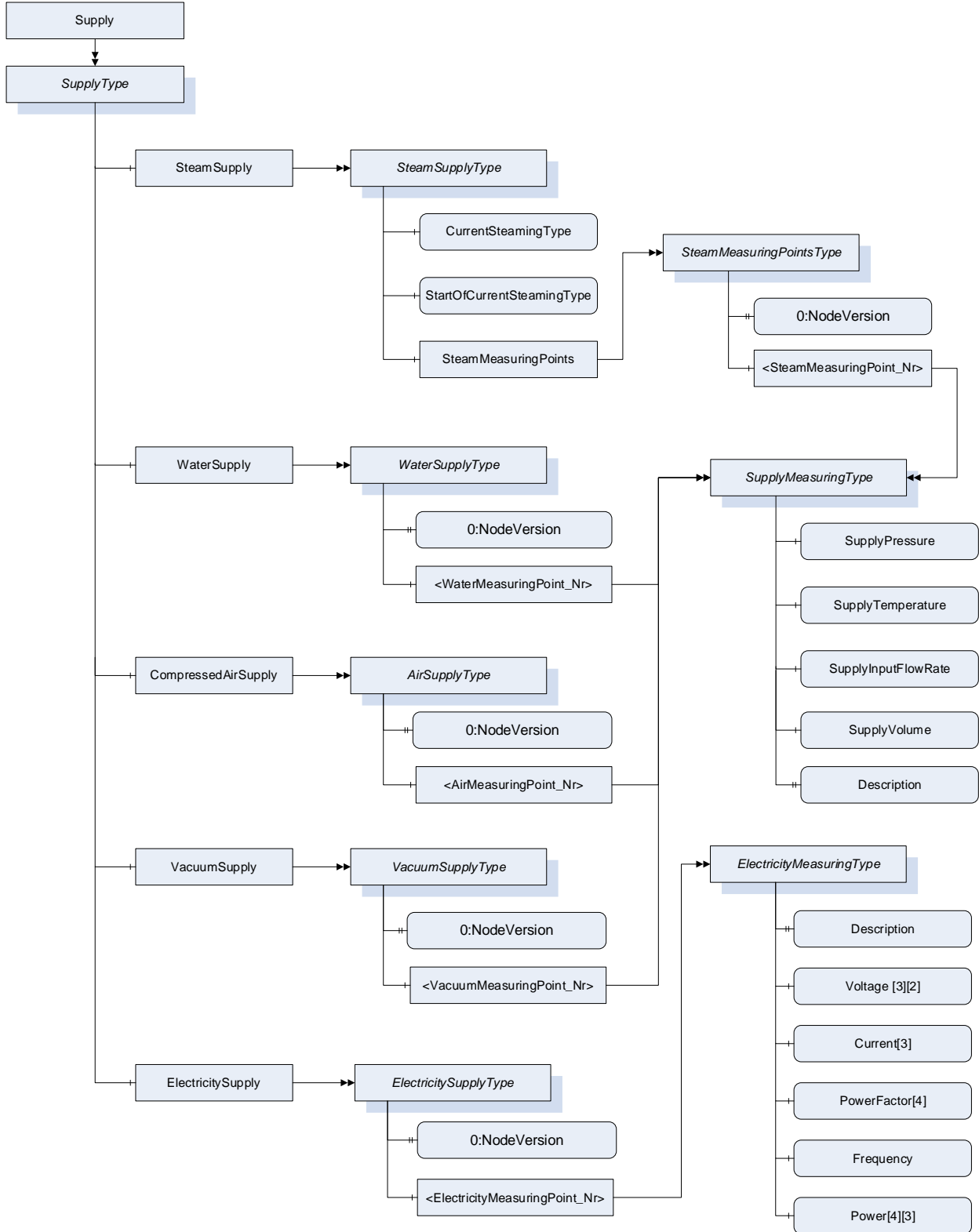


Figure 7 – SupplyType Overview

Table 25 –SupplyType Definition

Attribute	Value				
BrowseName	SupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	SteamSupply		SteamSupplyType	O
0:HasComponent	Object	WaterSupply		WaterSupplyType	O
0:HasComponent	Object	CompressedAirSupply		AirSupplyType	O
0:HasComponent	Object	VacuumSupply		VacuumSupplyType	O
0:HasComponent	Object	ElectricitySupply		ElectricitySupplyType	O
Conformance Units					
OPC 40087 Supply					

12.2 SteamSupply

Provides information on the steam supply. The *SteamSupplyType* is defined in 13.

12.3 WaterSupply

Provides information on the water supply. The *WaterSupplyType* is defined in 15.

12.4 CompressedAirSupply

Provides information on the compressed air supply. The *AirSupplyType* is defined in 16.

12.5 VacuumSupply

Provides information on the vacuum supply. The *VacuumSupplyType* is defined in 17.

12.6 ElectricitySupply

Provides information on the electricity supply. The *ElectricitySupplyType* is defined in 19.

13 SteamSupplyType

13.1 SteamSupplyType definition

The *SteamSupplyType* provides information about the steam supply and is formally defined in Table 26.

Table 26 – SteamSupplyType Definition

Attribute	Value				
BrowseName	SteamSupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Variable	CurrentSteamingType	SteamingTypeEnumeration	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	StartOfCurrentSteamingType	0:UtcTime	0:BaseDataVariableType	M, RO
0:HasComponent	Object	SteamMeasuringPoints		SteamMeasuringPointsType	O
Conformance Units					
OPC 40087 Steam					

13.2 CurrentSteamingType

The *CurrentSteamingType Variable* describes the type of the current steaming process.

The *SteamingTypeEnumeration* is defined in Table 27.

Table 27 – SteamingTypeEnumeration Items

Name	Value	Description
PURGING	0	Purging (from both directions)
CROSS_FROM_FIXED_SIDE	1	Cross steam from fixed side, drain valve moving side - open
CROSS_FROM_MOVING_SIDE	2	Cross steam from moving side, drain valve fixed side - open
SEMI_AUTOCLAVE_FROM_FIXED_SIDE	3	Cross steam from fixed side, drain valve moving side - closed
SEMI_AUTOCLAVE_FROM_MOVING_SIDE	4	Cross steam from moving side, drain valve fixed side - closed
AUTOCLAVE	5	Autoclave (from both directions)
AUTOCLAVE_FIXED_SIDE	6	Autoclave only on fixed side
AUTOCLAVE_MOVING_SIDE	7	Autoclave only on moving side

13.3 StartOfCurrentSteamingType

The start time of the current steaming process.

13.4 SteamMeasuringPoints

The *SteamMeasuringPoints* is a container object, which provides information about the monitored steam measuring points. The *SteamMeasuringPointsType* is defined in 14.

14 SteamMeasuringPointsType

14.1 SteamMeasuringPointsType definition

The *SteamMeasuringPointsType* is a container object, which provides information about the monitored steam measuring points and is formally defined in Table 28.

Table 28 – SteamMeasuringPointsType definition

Attribute	Value				
BrowseName	SteamMeasuringPointsType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<SteamMeasuringPoint_Nr>		SupplyMeasuringType	MP
Conformance Units					
OPC 40087 SteamMeasuringPoints					

14.2 SteamMeasuringPoint

The <*SteamMeasuringPoint_Nr*> provides a placeholder for the steam measuring points. When instances are created the *BrowseNames* shall be "<*SteamMeasuringPoint_Nr*>" where "Nr" is a three-digit number with leading zeros, starting with "001". The *SupplyMeasuringType* is defined in 18.

15 WaterSupplyType

15.1 WaterSupplyType definition

The *WaterSupplyType* is a container object, which provides information about the monitored water supply measuring points and is formally defined in Table 29.

Table 29 – WaterSupplyType Definition

Attribute	Value				
BrowseName	WaterSupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<WaterMeasuringPoint_Nr>		SupplyMeasuringType	MP
Conformance Units					
OPC 40087 WaterSupply					

15.2 WaterMeasuringPoint

The <WaterMeasuringPoint_Nr> provides a placeholder for the water measuring points. When instances are created the *BrowseNames* shall be "<WaterMeasuringPoint_Nr>" where "Nr" is a three-digit number with leading zeros, starting with "001". The *SupplyMeasuringType* is defined in 18.

16 AirSupplyType

16.1 AirSupplyType definition

The *AirSupplyType* is a container object, which provides information about the monitored air supply measuring points and is formally defined in Table 30.

Table 30 – AirSupplyType Definition

Attribute	Value				
BrowseName	AirSupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<AirMeasuringPoint_Nr>		SupplyMeasuringType	MP
Conformance Units					
OPC 40087 AirSupply					

16.2 AirMeasuringPoint

The <AirMeasuringPoint_Nr> provides a placeholder for the air supply measuring points. When instances are created the *BrowseNames* shall be "<AirMeasuringPoint_Nr>" where "Nr" is a three-digit number with leading zeros, starting with "001". The *SupplyMeasuringType* is defined in 18.

17 VacuumSupplyType

17.1 VacuumSupplyType definition

The *VacuumSupplyType* is a container object, which provides information about the monitored vacuum supply measuring points and is formally defined in Table 31.

Table 31 – VacuumSupplyType Definition

Attribute	Value				
BrowseName	VacuumSupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<VacuumMeasuringPoint_Nr>		SupplyMeasuringType	MP
Conformance Units					
OPC 40087 VacuumSupply					

17.2 VacuumMeasuringPoint

The <VacuumMeasuringPoint_Nr> provides a placeholder for the vacuum supply measuring points. When instances are created the *BrowseNames* shall be "<VacuumMeasuringPoint_Nr>" where "Nr" is a three-digit number with leading zeros, starting with "001". The *SupplyMeasuringType* is defined in 17.

18 SupplyMeasuringType

18.1 SupplyMeasuringType definition

The *SupplyMeasuringType* provides information about pressures, temperatures, flow rates and volumes of measuring points and is defined in Table 32.

Table 32 – SupplyMeasuringType Definition

Attribute	Value				
BrowseName	SupplyMeasuringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	SupplyPressure		4:ProcessValueType	O
0:HasComponent	Object	SupplyTemperature		4:ProcessValueType	O
0:HasComponent	Object	SupplyInputFlowRate		4:ProcessValueType	O
0:HasComponent	Object	SupplyVolume		4:ProcessValueType	O
Conformance Units					
OPC 40087 Supply					

For further information, the *Node Attribute Description* shall be used.

18.2 SupplyPressure

The *SupplyPressure Object* provides information about the supply pressure of the monitored medium at the measuring point. The *ProcessValueType* is defined in OPC 40001-2.

18.3 SupplyTemperature

The *SupplyTemperature Object* provides information about the supply temperature of the monitored medium at the measuring point. The *ProcessValueType* is defined in OPC 40001-2.

18.4 SupplyInputFlowRate

The *SupplyInputFlowRate Object* provides information about the input flow rate of the monitored medium at the measuring point. The *ProcessValueType* is defined in OPC 40001-2.

18.5 SupplyVolume

The *SupplyVolume Object* provides information about the supply volume of the monitored medium at the measuring point. The *ProcessValueType* is defined in OPC 40001-2.

Since volume is an integrated value (of e.g. the flow rate), further information about the integration interval is required. This is not covered in this specification, that means the interpretation of the value is up to the user.

19 ElectricitySupplyType

19.1 ElectricitySupplyType definition

The *ElectricitySupplyType* is a container object, which provides information about the monitored electricity supply measuring points and is formally defined in Table 33.

Table 33 – ElectricitySupplyType

Attribute	Value				
BrowseName	ElectricitySupplyType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<ElectricityMeasuringPoint_Nr>		ElectricityMeasuringType	MP
Conformance Units					
OPC 40087 ElectricitySupply					

19.2 ElectricityMeasuringPoint

The <*ElectricityMeasuringPoint_Nr*> provides a placeholder for the electricity supply measuring points. When instances are created the *BrowseNames* shall be “<*ElectricityMeasuringPoint_Nr*>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *ElectricityMeasuringType* is defined in 20.

20 ElectricityMeasuringType

20.1 ElectricityMeasuringType definition

The *ElectricityMeasuringType* represents one electricity measuring point and is defined in Table 34.

Table 34 – ElectricityMeasuringType definition

Attribute	Value				
BrowseName	ElectricityMeasuringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Variable	Voltage	0:Double[3][2]	0:AnalogUnitType	O,RO
0:HasComponent	Variable	Current	0:Double[3]	0:AnalogUnitType	O,RO
0:HasComponent	Variable	PowerFactor	0:Double[4]	0:BaseDataVariableType	O,RO
0:HasComponent	Variable	Frequency	0:Double	0:AnalogUnitType	O,RO
0:HasComponent	Variable	Power	0:Double[4][3]	0:AnalogUnitType	O,RO
Conformance Units					
OPC 40087 ElectricitySupply					

For further information, the *Node Attribute Description* shall be used.

20.2 Voltage

The *Voltage* variable provides information about the measured voltages of the electricity measuring point. The 3x2 array is structured as follows:

Table 35 – Voltage array structure

L1 – N	L1 – L2
L2 – N	L2 – L3
L3 – N	L3 – L1

Voltages not measured shall be zero.

20.3 Current

The *Current* variable provides information about the measured currents of the electricity measuring point. The 3x1 array is structured as follows:

Table 36 – Current array structure

L1
L2
L3

Current not measured shall be zero.

20.4 PowerFactor

The *PowerFactor* variable provides information about the ratio of the real power absorbed by the load to the apparent power flowing in the circuit of the electricity measuring point. The 4x1 array is structured as follows:

Table 37 – PowerFactor array structure

L1
L2
L3
Total

Power factors not measured shall be zero.

20.5 Frequency

The *Frequency* variable provides information about the AC frequency of the electricity measuring point.

20.6 Power

The *Power* variable provides information about active, reactive and apparent power of the electricity measuring point. The 4x3 array is structured as follows:

Table 38 – PowerFactor array structure

Active Power L1	Reactive Power L1	Apparent Power L1
Active Power L2	Reactive Power L2	Apparent Power L2
Active Power L3	Reactive Power L3	Apparent Power L3
Active Power L1L2L3	Reactive Power L1L2L3	Apparent Power L1L2L3

Power not measured shall be zero.

21 FoamMonitoringType

21.1 FoamMonitoringType definition

The *FoamMonitoringType* provides information about parameters influencing condition of the material inside the mould and is formally defined in Table 25.

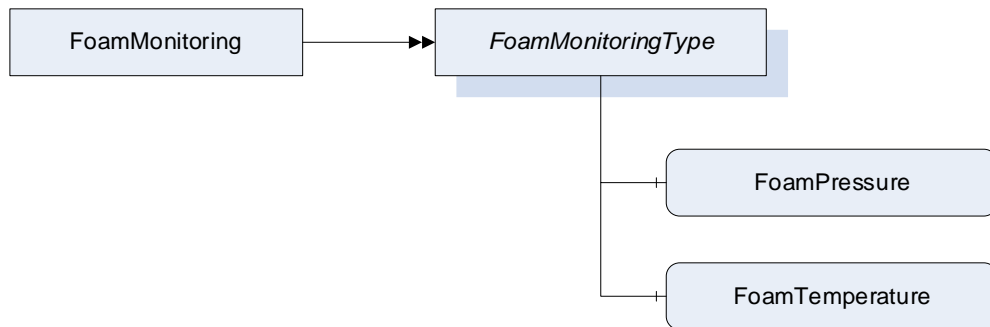


Figure 8 – FoamMonitoringType Overview

Table 39 – FoamMonitoringType Definition

Attribute	Value				
BrowseName	FoamMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	FoamPressure		4:ProcessValueType	M
0:HasComponent	Object	FoamTemperature		4:ProcessValueType	O
Conformance Units					
OPC 40087 FoamMonitoring					

21.2 FoamPressure

Foam pressure is describing a pressure the material is creating against the wall of the cavity during the process.

Foam pressure after the filling step is determining the correct compression ratio / correct filling level.

Foam pressure after the steaming step is an indication of fusion.

Foam pressure after the latest steaming step (e.g. autoclave) determines the expansion ratio, which is linked to surface finish of the moulded component.

Foam pressure after stabilisation time is determining if part is ready for demoulding and is also linked to dimensions of ready component.

21.3 FoamTemperature

Foam temperature is describing a temperature of the material inside the cavity during the moulding process.

Minimum and maximum temperature of the material determines the correct fusion and expansion ratio after steaming and correct contraction after cooling and stabilization for demoulding.

22 MaterialConditionsType

22.1 MaterialConditionsType definition

The *MaterialConditionsType* is a container object, which provides information about the monitored material conditions and is formally defined in Table 40.

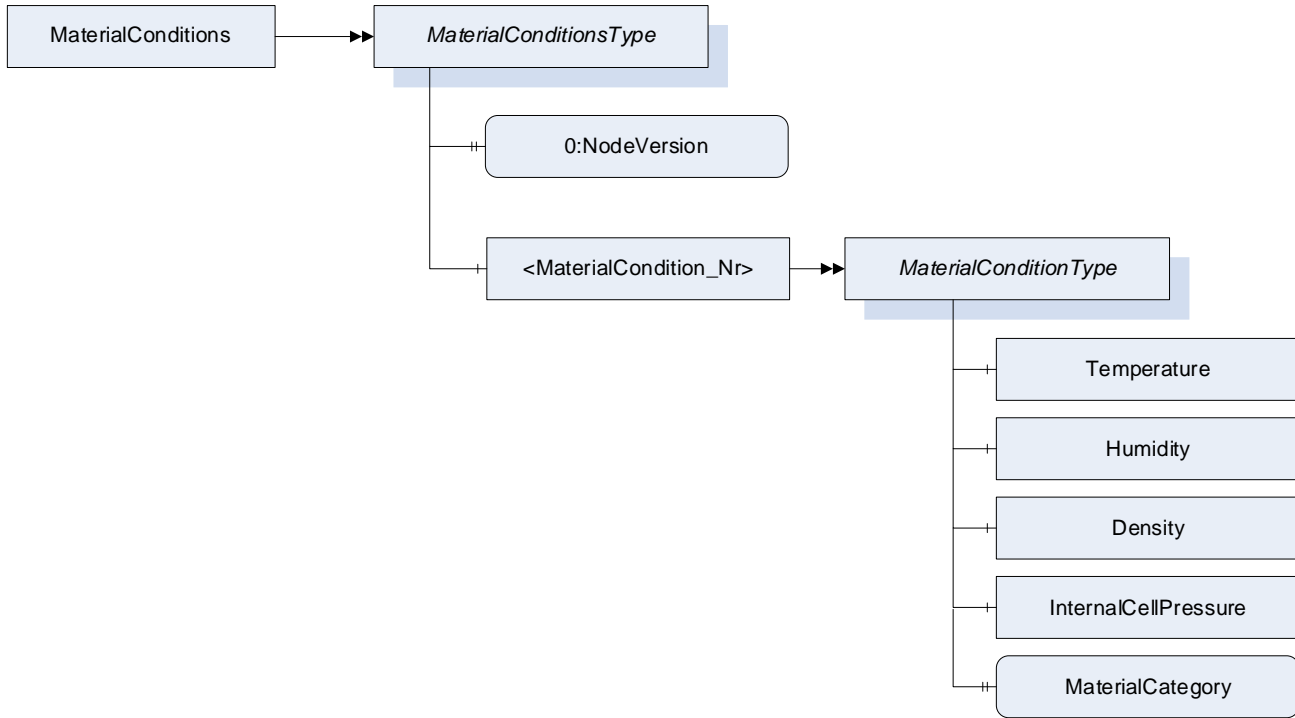


Table 40 – MaterialConditionsType definition

Attribute	Value				
BrowseName	MaterialConditionsType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M,RO
0:HasComponent	Object	<MaterialCondition_Nr>		MaterialConditionType	MP
Conformance Units					
OPC 40087 MaterialCondition					

22.2 MaterialCondition

The *<MaterialCondition_Nr>* provides a placeholder for the material conditions. When instances are created the *BrowseNames* shall be “<MaterialCondition_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *MaterialConditionType* is defined in 23.

23 MaterialConditionType

23.1 MaterialConditionType definition

The *MaterialConditionType* provides information about the condition of the used material and is formally defined in Table 41.

Table 41 – MaterialConditionType Definition

Attribute	Value				
BrowseName	MaterialConditionType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	Temperature		4:ProcessValueType	O
0:HasComponent	Object	Humidity		4:ProcessValueType	O
0:HasComponent	Object	Density		4:ProcessValueType	O
0:HasComponent	Object	InternalCellPressure		4:ProcessValueType	O
0:HasProperty	Variable	MaterialCategory	0:String	0:PropertyType	M
Conformance Units					
OPC 40087 MaterialCondition					

For further information, the *Node Attribute Description* shall be used.

23.1.1 Temperature

Temperature provides information about the material temperature.

23.1.2 Humidity

Humidity provides information about the material humidity.

23.1.3 Density

Density provides information about the material density (not the bulk density).

23.1.4 InternalCellPressure

InternalCellPressure provides information about the internal cell pressure of the material.

23.1.5 MaterialCategory

MaterialCategory provides information about the type of material.

24 MaterialConsumptionsType

24.1 MaterialConsumptionsType definition

The *MaterialConsumptionsType* is a container object, which provides information about the monitored material consumptions and is formally defined in Table 42.

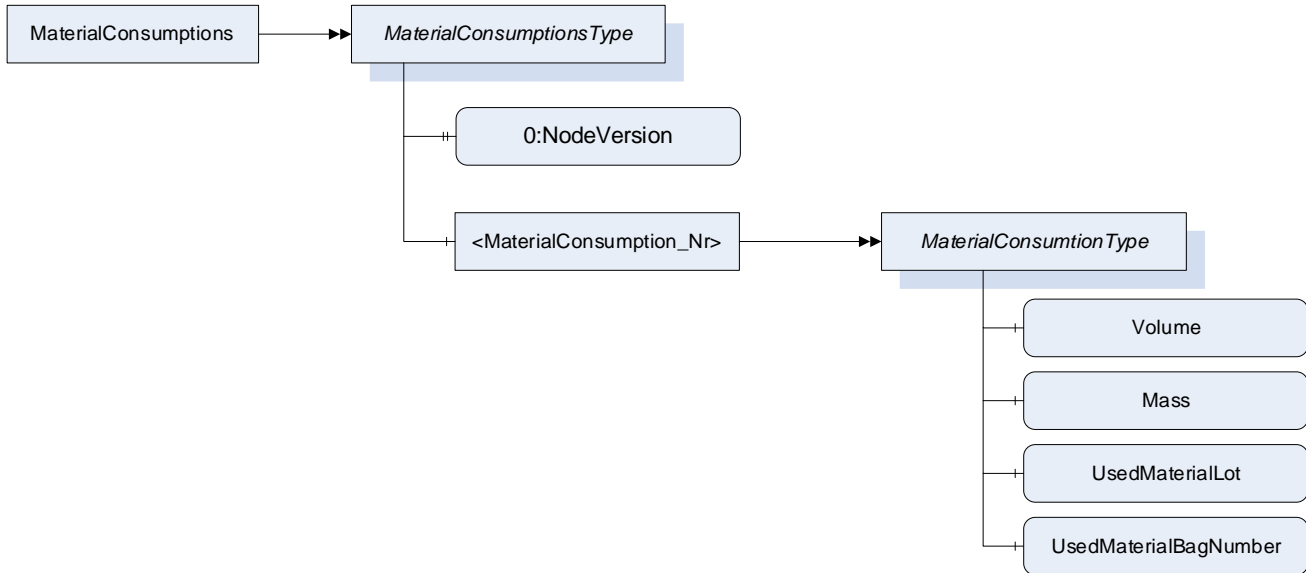


Table 42 – MaterialConsumptionsType Definition

Attribute	Value				
BrowseName	MaterialConsumptionsType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M, RO
0:HasComponent	Object	<MaterialConsumption_Nr>		MaterialConsumptionType	MP
Conformance Units					
OPC 40087 MaterialConsumption					

24.2 MaterialConsumption

The <MaterialConsumption_Nr> provides a placeholder for all material consumptions. When instances are created the *BrowseNames* shall be “<MaterialConsumption_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *MaterialConsumptionType* is defined in 25.

25 MaterialConsumptionType

25.1 MaterialConsumptionType definition

The *MaterialConsumptionType* provides information about the material consumption of the last finished cycle and is formally defined in Table 43.

Table 43 – MaterialConsumptionType Definition

Attribute	Value				
BrowseName	MaterialConsumptionType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	Volume		4:ProcessValueType	O
0:HasComponent	Object	Mass		4:ProcessValueType	O
0:HasProperty	Variable	UsedMaterialLot	0:String	0:PropertyType	O
0:HasProperty	Variable	UsedMaterialBagNumber	0:String	0:PropertyType	O
Conformance Units					
OPC 40087 MaterialConsumption					

25.2 Volume

Information about the consumed material volume.

25.3 Mass

Information about the consumed material mass.

25.4 UsedMaterialLot

Material lot / batch number of the consumed material.

25.5 UsedMaterialBagNumber

Bag number of the consumed material.

26 RfMonitoringType

26.1 RfMonitoringType definition

The *RfMonitoringType* provides information about RF (radio frequency) and is formally defined in Table 44.

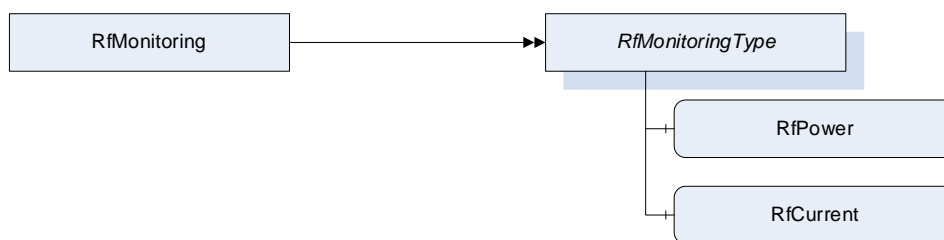


Figure 9 – RfMonitoringType Overview

Table 44 – RfMonitoringType Definition

Attribute	Value				
BrowseName	RfMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	RfPower		4:ProcessValueType	M
0:HasComponent	Object	RfCurrent		4:ProcessValueType	M
Conformance Units					
OPC 40087 RF					

26.2 Power

Information about electric power.

26.3 Current

Information about electric current.

27 SilosType

27.1 SilosType definition

The *SilosType* is a container object, which provides information about the monitored silos and is formally defined in Table 45.

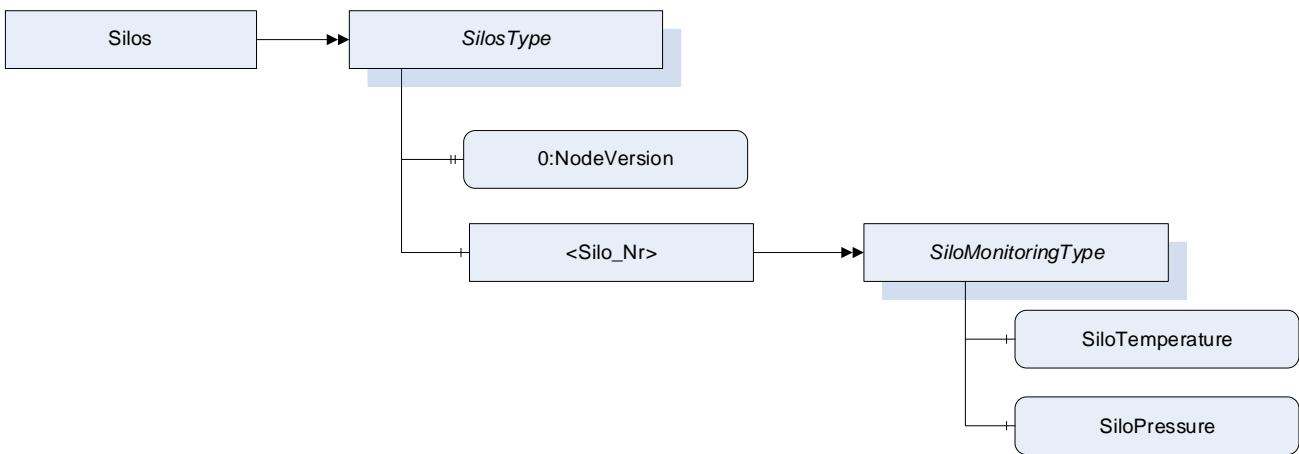


Figure 10 – SilosType Overview

Table 45 – SilosType Definition

Attribute	Value				
BrowseName	SilosType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M, RO
0:HasComponent	Object	<Silo_Nr>		SiloMonitoringType	MP
Conformance Units					
OPC 40087 Silos					

27.2 Silo

The <Silo_Nr> provides a placeholder for all silos. When instances are created the *BrowseNames* shall be “<Silo_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *SiloMonitoringType* is defined in 28.

28 SiloMonitoringType

28.1 SiloMonitoringType definition

The *SiloMonitoringType* provides information about a single silo and is formally defined in Table 46.

Table 46 – SiloMonitoringType Definition

Attribute	Value				
BrowseName	SiloMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasComponent	Object	SiloTemperature		4:ProcessValueType	O
0:HasComponent	Object	SiloPressure		4:ProcessValueType	O
Conformance Units					
OPC 40087 Silos					

For information regarding name and description of the silo, the *Node Attributes DisplayName* and *Description* shall be used.

28.2 SiloTemperature

Information about the silo temperature.

28.3 SiloPressure

information about the pressure inside the silo.

29 FillingMonitoringType

29.1 FillingMonitoringType definition

The *FillingMonitoringType* provides information about the filling process of material from silo into the mold. Filling is controlled via back pressure in the steam chamber / monoblock. The *FillingMonitoringType* is defined in Table 47.

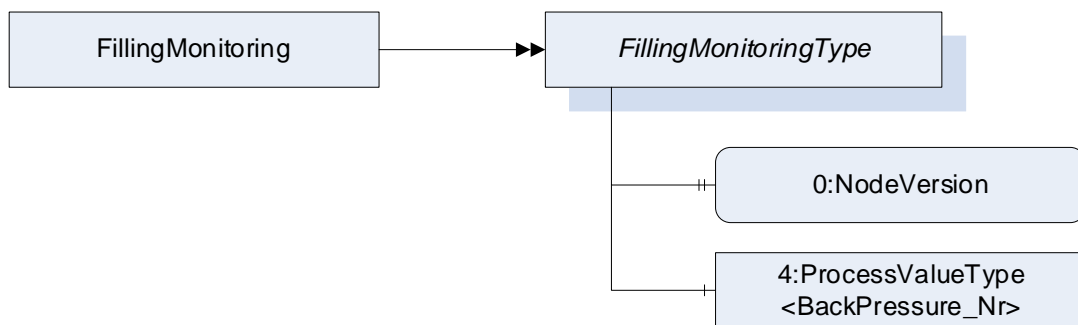


Figure 11 – FillingMonitoringType Overview

Table 47 – FillingMonitoringType Definition

Attribute	Value				
BrowseName	FillingMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M, RO
0:HasComponent	Object	<BackPressure_Nr>		4:ProcessValueType	MP
Conformance Units					
OPC 40087 Filling					

29.2 BackPressure

The *<BackPressure_Nr>* provides a placeholder for all back pressure measuring points. When instances are created the *BrowseNames* shall be “<BackPressure_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *ProcessValueType* is defined in OPC 40001-2.

30 DistanceMonitoringType

30.1 DistanceMonitoringType definition

The *DistanceMonitoringType* is a container object, which provides information about the monitored distances and is formally defined in Table 48.

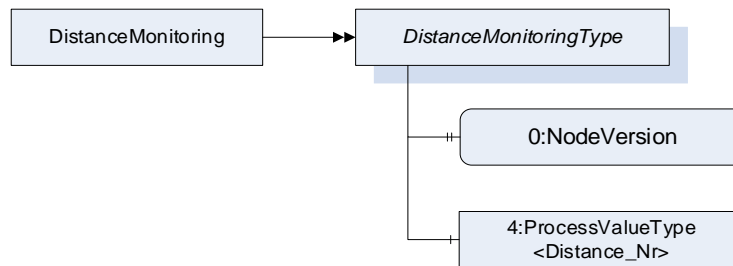


Table 48 – DistanceMonitoringType Definition

Attribute	Value				
BrowseName	DistanceMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M, RO
0:HasComponent	Object	<Distance_Nr>		4:ProcessValueType	MP
Conformance Units					
OPC 40087 Distances					

30.2 Distance

The *<Distance_Nr>* provides a placeholder for all distances. When instances are created the *BrowseNames* shall be “<Distance_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *ProcessValueType* is defined in OPC 40001-2.

For further information, the *Node Attribute Description* shall be used.

31 MouldMonitoringType

31.1 MouldMonitoringType definition

The *MouldMonitoringType* is a container object, which provides information about the monitored pressures and temperatures in the mould and is formally defined in Table 49.

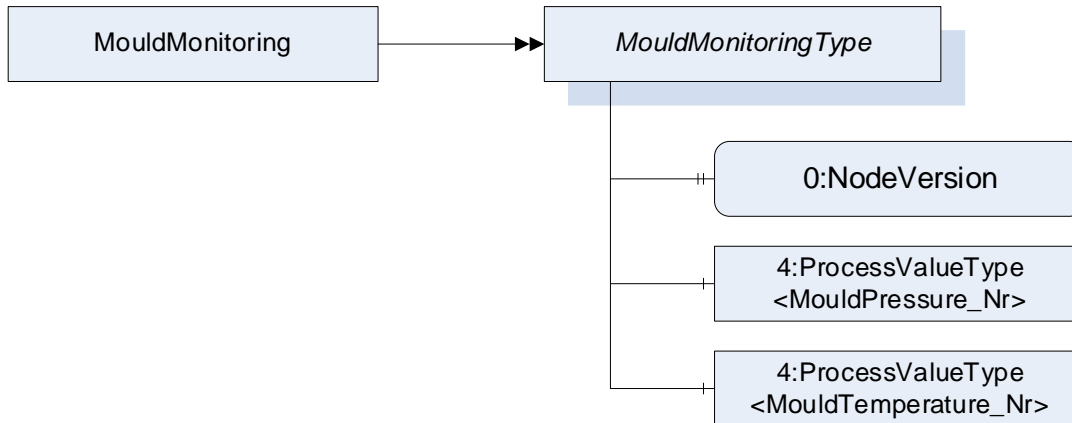


Figure 12 – MouldMonitoringType Overview

Table 49 – MouldMonitoringType Definition

Attribute	Value				
BrowseName	MouldMonitoringType				
IsAbstract	False				
References	Node Class	BrowseName	DataType	TypeDefinition	Other
Subtype of the 0:BaseObjectType defined in OPC 10000-5					
0:HasProperty	Variable	0:NodeVersion	0:String	0:PropertyType	M, RO
0:HasComponent	Object	<MouldPressure_Nr>		4:ProcessValueType	OP
0:HasComponent	Object	<MouldTemperature_Nr>		4:ProcessValueType	OP
Conformance Units					
OPC 40087 MouldMonitoring					

31.2 MouldPressure

The *<MouldPressure_Nr>* provides a placeholder for all pressure measuring points in the mould. When instances are created the *BrowseNames* shall be “<MouldPressure_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *ProcessValueType* is defined in OPC 40001-2.

31.3 MouldTemperature

The *<MouldTemperature_Nr>* provides a placeholder for all temperature measuring points in the mould. When instances are created the *BrowseNames* shall be “<MouldTemperature_Nr>” where “Nr” is a three-digit number with leading zeros, starting with “001”. The *ProcessValueType* is defined in OPC 40001-2.

32 ParticleFoamJobInformationType

32.1 ParticleFoamJobInformationType definition

Additional information on a job for particle foam machines is stored in the *ParticleFoamJobInformationType*. It extends the *5:CyclicJobInformationType*. It is formally defined in Table 50.

In the *5:CyclicJobInformationType*, as defined in OPC 40083, the *Properties MouldId* and *NumCavities* have the *ModellingRule* optional. When the *ParticleFoamJobInformationType* is used for a OPC 40087 interface for a shape machine, these *Properties* become mandatory and shall be filled by the server.

Table 50 – ParticleFoamJobInformationType Definition

Attribute	Value				
BrowseName	ParticleFoamJobInformationType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of <i>5:CyclicJobInformationType</i> defined in OPC 40083					
0:HasProperty	Variable	MaterialDescription	0:String[]	0:PropertyType	O, RO
0:HasProperty	Variable	PlannedMaterialLot	0:String[]	0:PropertyType	O, RO
0:HasProperty	Variable	MouldDescription	0:String	0:PropertyType	O, RO
0:HasProperty	Variable	ExpectedCycleTimes	CycleTimes DataType	0:PropertyType	O, RO
Conformance Units					
OPC 40087 Jobs					

32.2 MaterialDescription

Human readable description(s) of the used material(s)

32.3 PlannedMaterialLot

Planned lot(s) of the used material(s)

32.4 MouldDescription

Human readable description of the used mould.

32.5 ExpectedCycleTimes

Provides the expected durations for the process steps. The *CycleTimesDataType* is defined in 34

33 ActiveParticleFoamJobValuesType

33.1 ActiveParticleFoamJobValuesType definition

Additional information on the active job for particle foam machines is stored in the *ActiveParticleFoamJobValuesType*. It extends the *5:ActiveCyclicJobValuesType*. It is formally defined in Table 51.

Table 51 – ActiveParticleFoamJobValuesType Definition

Attribute	Value				
BrowseName	ActiveParticleFoamJobValuesType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	Type Definition	Other
Subtype of <i>5:ActiveCyclicJobValuesType</i> defined in OPC 40083					
0:HasProperty	Variable	UsedMaterialLot	0:String[]	0:PropertyType	O, RO
Conformance Units					
OPC 40087 Jobs					

33.2 UsedMaterialLot

Used lot(s) of the used material(s).

34 CycleTimesDataType

34.1 CycleTimesDataType definition

This structure contains the time and durations of the several process steps of one production cycle. The structure is defined in Table 52.

Table 52 – CycleTimesDataType Structure

Name	Type	Description
CycleTimesDataType	structure	Subtype of 0:Structure defined in OPC 10000-5
StartTime	0:UtcTime	Start of the production cycle
EndTime	0:UtcTime	End of the production cycle
MouldClosing	0:Duration	Duration of mould closing phase
Filling	0:Duration	Duration of filling phase
WeldingSteaming	0:Duration	Duration of welding/steaming phase
Cooling	0:Duration	Duration of cooling phase
Stabilizing	0:Duration	Duration of stabilizing phase
Demoulding	0:Duration	Duration of demoulding phase

If the process does not contain all phases, the durations of the missing phases shall be 0.

Its representation in the *AddressSpace* is defined in Table 53.

Table 53 – CycleTimesDataType Definition

Attribute	Value				
BrowseName	CycleTimesDataType				
IsAbstract	False				
References	Node Class	BrowseName	Data Type	TypeDefinition	Other
Subtype of 0:Structure defined in OPC 10000-5					
Conformance Units					
OPC 40087 Jobs					

35 Profiles and Conformance Units

This chapter defines the corresponding profiles and conformance units for the OPC UA Information Model for OPC 40087. *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*.

35.1 Conformance Units

This chapter defines the corresponding *Conformance Unit* for OPC 40087.

Table 54 – Conformance Units for OPC 40087

Category	Title	Description
Server	OPC 40087 Basic	Support of <i>ParticleFoamMachineType</i> and all mandatory child elements giving information on the particle foam machine and its status. There is at least one instance of the <i>ParticleFoamMachineType</i> in the <i>Machines Object</i> .
Server	OPC 40087 Maintenance	Support of the <i>MaintenanceType</i> defined in OPC 40083.
Server	OPC 40087 Jobs	Support of the <i>JobsType</i> defined in OPC 40083 and the additional <i>ParticleFoamJobInformationType</i> and <i>ActiveParticleFoamJobValuesType</i> defined in this specification.
	OPC 40087 ProductionDatasetManagement	Support of the <i>ProductionDatasetManagement</i> defined in OPC 40083.
	OPC 40087 Block	Support of the <i>BlockMachineCharacteristicsType</i>
	OPC 40087 Shape	Support of the <i>ShapeMachineCharacteristicsType</i>
	OPC 40087 Tempering	Support of the <i>TemperingType</i>
	OPC 40087 Supply	Support of the <i>SupplyType</i>
	OPC 40087 Steam	Support of the <i>SteamSupplyType</i>
	OPC 40087 SteamMeasuringPoints	Support of the <i>SteamMeasuringPointsType</i>
	OPC 40087 WaterSupply	Support of the <i>WaterSupplyType</i>
	OPC 40087 AirSupply	Support of the <i>CompressedAirSupplyType</i>
	OPC 40087 VacuumSupply	Support of the <i>VacuumSupplyType</i>
	OPC 40087 ElectricitySupply	Support of the <i>ElectricitySupplyType</i>
	OPC 40087 RF	Support of the <i>RfMonitoringType</i>
	OPC 40087 FoamMonitoring	Support of the <i>FoamMonitoringType</i>
	OPC 40087 Filling	Support of the <i>FillingType</i>
	OPC 40087 Distances	Support of the <i>DistanceMonitoringType</i>
	OPC 40087 Silos	Support of the <i>SilosType</i>
	OPC 40087 MouldMonitoring	Support of the <i>MouldMonitoringType</i>
	OPC 40087 MaterialCondition	Support of the <i>MaterialConditionsType</i>
	OPC 40087 MaterialConsumption	Support of the <i>MaterialConsumptionsType</i>
	OPC 40087 AlarmSupport	Support of the 0:A & C Alarm Server Facet

35.2 Profiles

35.2.1 Profile list

The following tables specify the facets available for *Servers* that implement the OPC 40087 Information Model companion specification.

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

Table 55 lists all Profiles defined in this document and defines their URIs.

Table 55 – Profile URIs for OPC 40087

Profile	URI
OPC 40082-5 Basic Server Profile	http://opcfoundation.org/UA-Profile/PlasticsRubber/Moulds/Server/Basic

35.2.2 Server Facets

35.2.2.1 Overview

The following sections specify the *Facets* available for *Servers* that implement the OPC 40087 companion specification. Each section defines and describes a *Facet* or *Profile*.

35.2.2.2 OPC 40087 Basic Server Profile**Table 56 – OPC 40087 Basic Server Profile**

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0:Embedded Server 2017 (defined in OPC 10000-7)	M
Profile	0:ComplexType Server Facet (defined in OPC 10000-7)	M
Profile	0:Standard Event Subscription Server Facet (defined in OPC 10000-7)	M
Profile	0:Method Server Facet (defined in OPC 10000-7)	M
Profile	2:BaseDevice Server Facet (defined in OPC 10000-100)	M
Profile	3:Machinery Machine Identification Server Facet	M
Profile	3:Machinery State Server Facet	M
Profile	4:Machinery-Process Values Base Server Facet	M
OPC 40087	OPC 40087 Basic	M
OPC 40087	OPC 40087 Maintenance	O
OPC 40087	OPC 40087 Jobs	O
OPC 40087	OPC 40087 ProductionDatasetManagement	O
OPC 40087	OPC 40087 Block	O
OPC 40087	OPC 40087 Shape	O
OPC 40087	OPC 40087 Tempering	O
OPC 40087	OPC 40087 Supply	O
OPC 40087	OPC 40087 Steam	O
OPC 40087	OPC 40087 SteamMeasuringPoints	O
OPC 40087	OPC 40087 WaterSupply	O
OPC 40087	OPC 40087 AirSupply	O
OPC 40087	OPC 40087 VacuumSupply	O
OPC 40087	OPC 40087 ElectricitySupply	O
OPC 40087	OPC 40087 RF	O
OPC 40087	OPC 40087 FoamMonitoring	O
OPC 40087	OPC 40087 Filling	O
OPC 40087	OPC 40087 Distances	O
OPC 40087	OPC 40087 Silos	O
OPC 40087	OPC 40087 MouldMonitoring	O
OPC 40087	OPC 40087 MaterialCondition	O
OPC 40087	OPC 40087 MaterialConsumption	O
OPC 40087	OPC 40087 AlarmSupport	O

36 Namespaces

36.1 Namespace Metadata

Table 57 defines the namespace metadata for this document. 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 10000-5 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 OPC 10000-5.

The version information is also provided as part of the *ModelTableEntry* in the *UANodeSet XML* file. The *UANodeSet XML* schema is defined in OPC 10000-6.

Table 57 – NamespaceMetadata Object for this Document

Attribute	Value	
BrowseName	http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/	
Property	DataType	Value
NamespaceUri	String	http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/
NamespaceVersion	String	RC 1.0.0
NamespacePublicationDate	DateTime	2025-01-01
IsNamespaceSubset	Boolean	False
StaticNodeIdTypes	IdType []	0
StaticNumericNodeIdRange	NumericRange []	
StaticStringNodeIdPattern	String	

Note: The *IsNamespaceSubset Property* is set to *False* as the *UaNodeSet XML* file contains the complete *Namespace*. *Servers* only exposing a subset of the *Namespace* need to change the value to *True*.

36.2 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 58 provides a list of mandatory and optional namespaces used in an OPC 40087 OPC UA *Server*.

Table 58 – Namespaces used in a OPC 40087 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 namespace shall have namespace index 1.	Mandatory
http://opcfoundation.org/UA/DI/	Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC 10000-100. The namespace index is <i>Server</i> specific.	Mandatory
http://opcfoundation.org/UA/Machinery/	Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC UA for Machinery – Part 1: Basic Building Blocks (OPC 40001-1). The namespace index is <i>Server</i> specific.	Mandatory
http://opcfoundation.org/UA/Machinery/ProcessValues/	Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC UA for Machinery – Part 2: Process Values (OPC 40001-2). The namespace index is <i>Server</i> 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/ParticleFoam/	Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in this document. The namespace index is <i>Server</i> specific.	Mandatory
Vendor specific types	A <i>Server</i> may provide vendor-specific types like types derived from <i>ObjectTypes</i> defined in this document in a vendor-specific namespace.	Optional
Vendor specific instances	A <i>Server</i> provides vendor-specific instances of the standard types or vendor-specific instances of vendor-specific types in a vendor-specific namespace. It is recommended to separate vendor specific types and vendor specific instances into two or more namespaces.	Mandatory

Table 59 provides a list of namespaces and their indices used for *BrowseNames* in this document. The default namespace of this document is not listed since all *BrowseNames* without prefix use this default namespace.

Table 59 – Namespaces used in this document

NamespaceURI	Namespace Index	Example
http://opcfoundation.org/UA/	0	0:EngineeringUnits
http://opcfoundation.org/UA/DI/	2	2:DeviceClass
http://opcfoundation.org/UA/Machinery/	3	3:MachineIdentificationType
http://opcfoundation.org/UA/Machinery/ProcessValues/	4	4:ProcessValueType
http://opcfoundation.org/UA/PlasticsRubber/GeneralTypes/	5	5:MachineInformationType

Annex A (normative)

OPC 40087 Namespace and mappings

A.1 NodeSet and supplementary files for OPC 40087 Information Model

The OPC 40087 *Information Model* is identified by the following URI:

<http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/>

Documentation for the NamespaceUri can be found [here](#).

The *NodeSet* associated with this version of specification can be found here:

<https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/&v=1.0.0&i=1>

The *NodeSet* associated with the latest version of the specification can be found here:

<https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/&i=1>

Supplementary files for the OPC 40087 *Information Model* can be found here:

<https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/&v=1.0.0&i=2>

The files associated with the latest version of the specification can be found here:

<https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/PlasticsRubber/ParticleFoam/&i=2>
