European Plastics and Rubber Machinery

EUROMAP 77	OPC UA interfaces for plastics and rubber machinery – Data exchange between injection moulding machines and MES

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History

Date	Changes
14 October 2016	Release Candidate RC1.00 published
11 September 2017	Release Candidate RC2.00 published • Structure changed, general types moved to EUROMAP 83 as superordinate information model
04 May 2018	Release 1.00 published
28 January 2019	The documentation has been updated (version 1.00a) • The use of server specific namespaces and namespace indexes in an EUROMAP 77 server has been clarified (see note and examples in clause 5) • Editorial corrections The model files have not been changed. NOTE: A new version 1.01 of EUROMAP 83 is available which adds an optional *Classification Property* to the *TemperatureZoneType* and *TemperatureZoneCycleParametersType* (the other changes/additions in EUROMAP 83 do not affect EUROMAP 77). However, EUROMAP 77 may still be used with version 1.00 of EUROMAP 83.

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1 Introduction

1.1 Scope and Application

EUROMAP 77 describes the interface between injection moulding machines (IMM) and manufacturing execution systems (MES) for data exchange. MES are used for collecting the information generated by IMM at a central point for easier quality assurance and job and dataset management. The target of EUROMAP 77 is to provide a unique interface for IMM and MES from different manufacturers to ensure compatibility.

The following functionalities are covered:

- General information about the IMM (manufacturer, model, serial number…), current configuration and status of the IMM including moulds, injection units and power units, and logbook of relevant changes on the machine.
- 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 IMM and to release the production.
- Dataset management: IMM store their configurations in so-called datasets. These include information on nominal process parameters (times, temperatures, pressures …) related to the IMM but also to installed handling systems. EUROMAP 77 allows transferring datasets between IMM 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 by the MES

1.2 References

Short name	Title	Version
OPC UA Part 1	OPC Unified Architecture – Part 1: Overview	1.04
OPC UA Part 2	OPC Unified Architecture – Part 2: Security Model	1.03
OPC UA Part 3	OPC Unified Architecture – Part 3: Address Space Model	1.04
OPC UA Part 4	OPC Unified Architecture – Part 4: Services	1.04
OPC UA Part 5	OPC Unified Architecture – Part 5: Information Model	1.04
OPC UA Part 6	OPC Unified Architecture – Part 6: Mappings	1.04
OPC UA Part 7	OPC Unified Architecture – Part 7: Profiles	1.04
OPC UA Part 8	OPC Unified Architecture – Part 8: Data Access	1.04
OPC UA Part 9	OPC Unified Architecture – Part 9: Alarms and Conditions	1.04
OPC UA Part 11	OPC Unified Architecture – Part 11: Historical Access	1.03
OPC UA Part 12	OPC Unified Architecture – Part 12: Discovery	1.03
OPC UA Part 100	OPC Unified Architecture – Part 100: OPC UA for Devices	1.01
EUROMAP 83	OPC UA interfaces for plastics and rubber machinery – General Type definitions	1.00

1.3 Abbreviations

IMM Injection Moulding Machine
MES Manufacturing Execution System

2 Basic security requirements

2.1 Application Security

For the communication between IMM 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 EUROMAP 77 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.

2.2 User security/Access control

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

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

- User names can be manufacturer dependent.
- Standard roles are
  - “EUROMAP77”: read and write access for selected parameters
  - “EUROMAP77_read_only”: no writing permissions
- Manufactures can add additional roles. They may not start with “EUROMAP77”. For these roles, more parameters can be writeable than for the EUROMAP77 role.
- The standard user “EUROMAP77” has the role “EUROMAP77” (and no other additional role), “EUROMAP77_read_only” has the roll “EUROMAP77_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)

3 OPC UA Conformance Units and Profiles

This chapter defines the corresponding profiles and conformance units for the OPC UA Information Model for EUROMAP 77. *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 EUROMAP 77 Information Model companion specification.

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

Table 1 – *EUROMAP 77 Basic Server Facet* Definition

Conformance Unit	Description	Optional/ Mandatory
EUROMAP 77 Basic	Support of *IMM_MES_InterfaceType* and all mandatory child elements giving information on the injection moulding machine itself, the current configuration and status and the installed injection units, mould and power units.	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 2 – *EUROMAP 77 Jobs Server Facet* Definition

Conformance Unit	Description	Optional/ Mandatory
EUROMAP 77 Jobs	Support of *JobsType* (defined in EUROMAP 83) for the status and management of jobs as well as providing cycle parameters (support of *CycleParametersEventType*)	M

Table 3 – *EUROMAP 77 ProductionDatasetManagement Server Facet* Definition

Conformance Unit	Description	Optional/ Mandatory
EUROMAP 77 ProductionDatasetManagement	Support of *ProductionDatasetManagementType* (defined in EUROMAP 83) for the management and transfer of production datasets between MES and IMM	M

4 Namespaces

4.1 Namespace and identifiers for EUROMAP77 Information Model

This clause 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://www.euromap.org/euromap77/

The CSV released with this version of the specification can be found here:
http://www.euromap.org/files/Opc_Ua.EUROMAP77.1_00.NodeId.csv

NOTE: The latest CSV that is compatible with this version of the specification can be found here:
http://www.euromap.org/files/Opc_Ua.EUROMAP77.NodeId.csv

A computer processable version of the complete Information Model defined in this specification is also provided. It follows the XML Information Model schema syntax defined in OPC UA Part 6.
The Information Model Schema released with this version of the specification can be found here:
http://www.euromap.org/files/Opc_Ua.EUROMAP77.1_00.NodeSet2.xml

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

http://www.euromap.org/files/Opc_Ua.EUROMAP77.NodeSet2.xml

4.2 Namespace Metadata

Table 4 defines the namespace metadata for this specification. The *Object* is used to provide version information on the namespace and an indication about static *Nodes*. Static *Nodes* are identical for all *Attributes* in all *Servers*, including the *Value Attribute*. See OPC UA Part 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 UA Part 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 UA Part 6.

Table 4 – NamespaceMetadata Object for this Specification

Attribute	**Value**		
BrowseName	Euromap77_NamespaceMetadata		
References	**BrowseName**	**DataType**	**Value**
HasProperty	NamespaceUri	String	http://www.euromap.org/euromap77/
HasProperty	NamespaceVersion	String	1.00
HasProperty	NamespacePublicationDate	DateTime	2018-05-04
HasProperty	IsNamespaceSubset	Boolean	False
HasProperty	StaticNodeIdTypes	IdType[]	{Numeric}
HasProperty	StaticNumericNodeIdRange	NumericRange[]	Null
HasProperty	StaticStringNodeIdPattern	String	Null

4.3 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 *Address Space* 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 specification shall not use the standard namespaces.

Table 5 provides a list of mandatory namespaces used in a EUROMAP 77 OPC UA *Server*.

Table 5 – Namespaces used in a EUROMAP 77 Server

Namespace	Description	Use
http://opcfoundation.org/UA/	Namespace for *NodeIds* and *BrowseNames* defined in the OPC UA specification. This namespace shall have namespace index 0.	Mandatory
Local Server URI	Namespace for nodes defined in the local server. This may include types and instances used in a device represented by the server. This namespace shall have namespace index 1.	Mandatory
http://opcfoundation.org/UA/DI/	Namespace for *NodeIds* and *BrowseNames* defined in OPC UA Part 100. The namespace index is server specific.	Mandatory
http://www.euromap.org/euromap83/	Namespace for *NodeIds* and *BrowseNames* defined in EUROMAP 83. The namespace index is server specific.	Mandatory
http://www.euromap.org/euromap77/	Namespace for *NodeIds* and *BrowseNames* 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 *MachineType* or *MachineStatusType* or vendor specific instances of devices in a vendor specific namespace.	Optional

5 IMM_MES_InterfaceType

This OPC UA *ObjectType* is used for the root *Object* representing an injection moulding machine with all its subcomponents. It is formally defined in Table 6.

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

NOTE: In most cases the OPC UA server will be implemented in the control of the IMM so only one instance of *IMM_MES_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 *IMM_MES_InterfaceType* will be created.

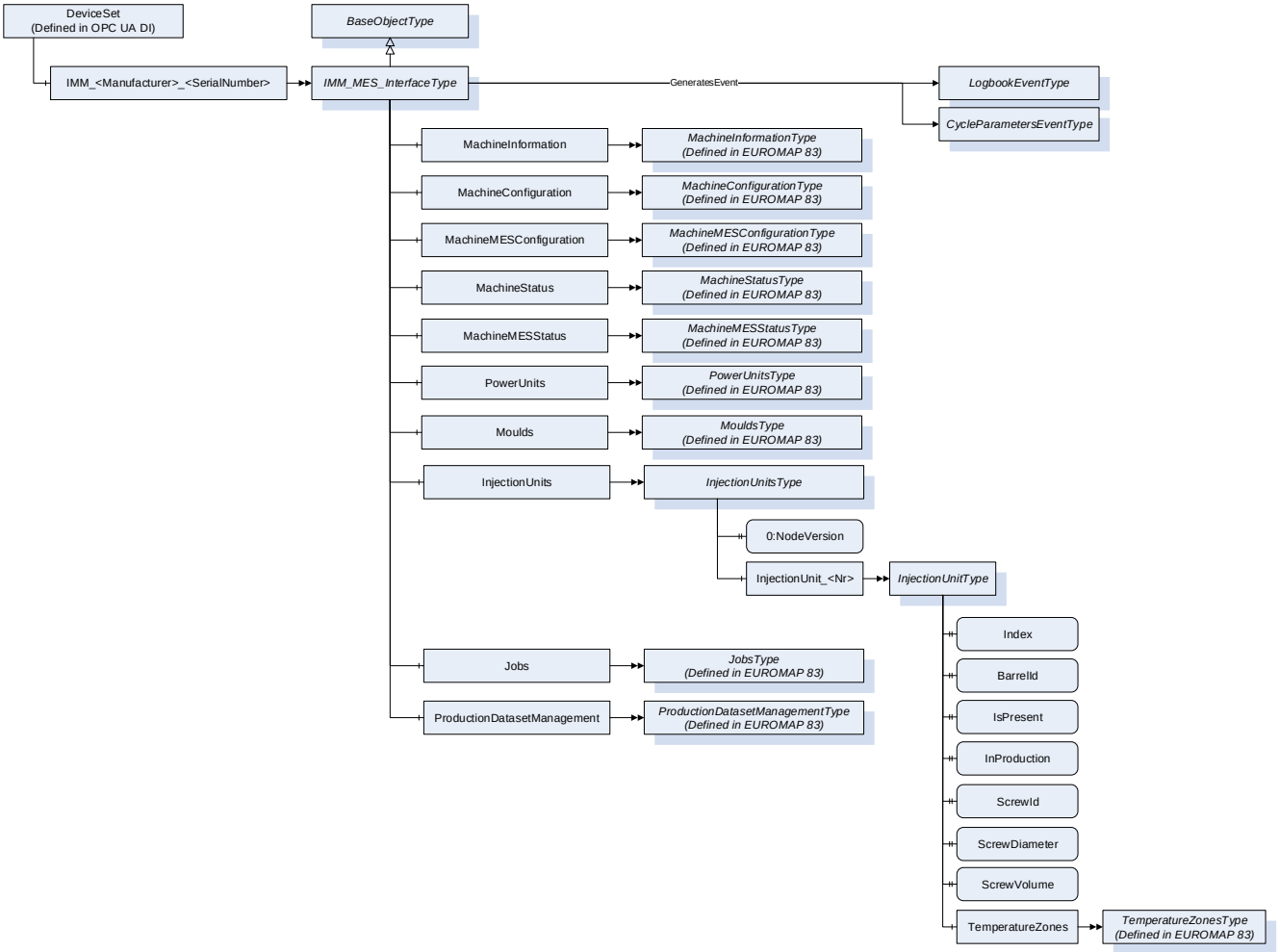

Figure 1 – IMM_MES_InterfaceType Overview

Table 6 – IMM_MES_InterfaceType Definition

Attribute	Value				
BrowseName	IMM_MES_InterfaceType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Modelling Rule**
Subtype of *BaseObjectType* defined in OPC UA Part 5					
HasComponent	Object	MachineInformation		MachineInformationType	M
HasComponent	Object	MachineConfiguration		MachineConfigurationType	M
HasComponent	Object	MachineMESConfiguration		MachineMESConfigurationType	M
HasComponent	Object	MachineStatus		MachineStatusType	M
HasComponent	Object	MachineMESStatus		MachineMESStatusType	M
HasComponent	Object	PowerUnits		PowerUnitsType	M
HasComponent	Object	Moulds		MouldsType	M
HasComponent	Object	InjectionUnits		InjectionUnitsType	M
HasComponent	Object	Jobs		JobsType	O
HasComponent	Object	ProductionDatasetManagement		ProductionDataset ManagementType	O
GeneratesEvent	ObjectType	LogbookEventType	Defined in EUROMAP 83		
GeneratesEvent	ObjectType	CycleParametersEventType	Defined in EUROMAP 83		

The *BrowseName* of the object instance shall be "IMM_<Manufacturer>_<SerialNumber>"
Example: "IMM_ARBURG_0123456"

NOTE: The namespace of this *BrowseName* is the local server URI with namespace index 1 or a vendor specific namespace with server specific namespace index (see Table 5). The *BrowseNames* of the nodes below are in the namespace of the specification where used Type is defined.

Examples:

BrowseName	Namespace	Namespace index	Remarks
IMM_ARBURG_0123456	Local Server URI or vendor specific namespace	1 or server specific	EUROMAP 77 only defines the *IMM_MES_InterfaceType*. The instance is generated in the local server
↓			
MachineStatus	http://www.euromap.org/euromap77/	server specific	The object *MachineStatus* is a child *IMM_MES_InterfaceType* which is defined in EUROMAP 77
↓			
MachineMode	http://www.euromap.org/euromap83/	server specific	The variable *MachineMode* is a child of *MachineStatusType* which is defined in EUROMAP 83.

BrowseName	Namespace	Namespace index	Remarks
IMM_ARBURG_0123456	Local Server URI or vendor specific namespace	1 or server specific	EUROMAP 77 only defines the *IMM_MES_InterfaceType*. The instance is generated in the local server
↓			
MachineInformation	http://www.euromap.org/euromap77/	server specific	The object *MachineInformation* is a child of *IMM_MES_InterfaceType* which is defined in EUROMAP 77
↓			
Manufacturer	http://opcfoundation.org/UA/DI/	server specific	The variable *Manufacturer* is a child of the *DeviceType* (supertype of *MachineInfomrationType*) which is defined in OPC UA DI.

BrowseName	Namespace	Namespace index	Remarks
IMM_ARBURG_0123456	Local Server URI or vendor specific namespace	1 or server specific	EUROMAP 77 only defines the *IMM_MES_InterfaceType*. The instance is generated in the local server
↓			
ProductionDataset Management	http://www.euromap.org/euromap77/	server specific	The object *ProductionDataset Management* is a child of *IMM_MES_InterfaceType* which is defined in EUROMAP 77
↓			
ProductionDataset Transfer	http://www.euromap.org/euromap83/	server specific	The object *Production DatasetTransfer* is a child of *ProductionDataset ManagementType* which is defined in EUROMAP 83.
↓			
CloseAndCommit	http://opcfoundation.org/UA/	0	The method *CloseAndCommit* is a child of *Production DatasetTransfer* which has the *TemporaryFile TransferType* as type definition which is defined in OPC UA.

BrowseName	Namespace	Namespace index	
IMM_ARBURG_0123456	Local Server URI or vendor specific namespace	1 or server specific	EUROMAP 77 only defines the *IMM_MES_InterfaceType*. The instance is generated in the local server
↓			
Moulds	http://www.euromap.org/euromap77/	server specific	The object *Moulds* is a child of *IMM_MES_InterfaceType* which is defined in EUROMAP 77
↓			
Mould_1	Local Server URI or vendor specific namespace	1 or server specific	The objects for the moulds are modelled as *OptionalPlaceholder*. The instances are server specific
↓			
Id	http://www.euromap.org/euromap83/	server specific	The property *Id* is a child of *MouldType* which is defined in EUROMAP 83.

6 MachineInformation

The *MachineInformation Object* provides general information on the injection moulding machine. The *MachineInformationType* is defined in EUROMAP 83.

6.1 DeviceClass

The *DeviceClass Property* in the *MachineInformation Object* shall have the value "Injection Moulding Machine".

6.2 EuromapSizeIndication

The value of the *EuromapSizeIndication Property* in the *MachineInformation* Object shall be in accordance with EUROMAP 1, e.g. "3430 V – 3750".

6.3 LogbookEvents

The logbook events defined in EUROMAP 83 can be used. The supported logbook event types shall be listed in *MachineInformation.SupportedLogbookEvents*.

7 MachineConfiguration

The *MachineConfiguration Object* represents the current configuration of the injection moulding machine. The *MachineConfigurationType* is defined in EUROMAP 83.

8 MachineMESConfiguration

The *MachineMESConfiguration Object* represents the current configuration of the injection moulding machine related to the MES. The *MachineMESConfigurationType* is defined in EUROMAP 83.

9 MachineStatus

The *MachineStatus Object* represents the current status of the injection moulding machine. The *MachineStatusType* is defined in EUROMAP 83.

10 MachineMESStatus

The *MachineMESStatus Object* represents the current status of the injection moulding machine related to the MES. The *MachineMESStatusType* is defined in EUROMAP 83.

The *Object* can generate *Events* of *MessageConditionType* which includes a *Classification Property*. For injection moulding machines, the *IMMMessageClassificationEnumeration* defined in Table 7 shall be used (also in the related logbook event).

Table 7 – IMMMessageClassificationEnumeration Definition

	Description	
	Indication which machine part has caused the message	
Value	**machine**	**part**
OTHER_0	This state is used if none of the other entries below apply.	
IMM_INJECTION_UNIT_100	Injection moulding machine	injection unit
IMM_CLAMPING_UNIT_101	Injection moulding machine	clamping unit
IMM_HARDWARE_102	Injection moulding machine	hardware
IMM_COMPRESSED_AIR_CONTROL_103	Injection moulding machine	compressed air control
IMM_MACHINE_MONITORING_104	Injection moulding machine	machine monitoring
IMM_MOULD_105	Injection moulding machine	mould
IMM_EJECTOR_106	Injection moulding machine	ejector
IMM_CORE_PULL_107	Injection moulding machine	core pull
IMM_TABLE_108	Injection moulding machine	table
IMM_INJECTION_PROGRAM_109	Injection moulding machine	injection program
IMM_HYDRAULIC_TEMPERATURE_CONTROL_110	Injection moulding machine	temperature control hydraulic
IMM_CYLINDER_TEMPERATURE_CONTROL_111	Injection moulding machine	cylinder temperature control
IMM_MOULD_TEMPERATURE_CONTROL_112	Injection moulding machine	mould temperature control
IMM_HOT_RUNNER_113	Injection moulding machine	hot runner
IMM_INTERFACES_114	Injection moulding machine	interfaces
IMM_MEASURING_SYSTEM_115	Injection moulding machine	measuring system
IMM_ROBOTIC_SYSTEM_INTERFACE_116	Injection moulding machine	robotic system interface
IMM_SPECIAL_PURPOSE_SIGNALS_117	Injection moulding machine	special purpose signals
IMM_REAL_TIME_ETHERNET_SYSTEM_118	Injection moulding machine	real-time Ethernet system (Varan, Ethercat, ProfiNET, ...)
IMM_MACHINE_CONTROLLER_119	Injection moulding machine	machine controller
IMM_SOFTWARE_MONITORING_120	Injection moulding machine	software monitoring
PERIPHERAL_EXTERNAL_DEVICE_INTERFACE_200	peripheral equipment	external device interface
PERIPHERAL_TEMPERATURE_CONTROL_UNIT_201	peripheral equipment	temperature control unit
PERIPHERAL_ROBOTICS_SYSTEM_202	peripheral equipment	robotics system
PERIPHERAL_LSR_203	peripheral equipment	LSR (Liquid Silicone Rubber)
PERIPHERAL_STRIPPER_UNIT_204	peripheral equipment	stripper unit
PERIPHERAL_DRYER_205	peripheral equipment	dryer
PERIPHERAL_CONVEYOR_BELT_206	peripheral equipment	conveyor belt
PERIPHERAL_SORTER_UNIT_207	peripheral equipment	sorter unit
PERIPHERAL_COLOURING_UNIT_208	peripheral equipment	colouring unit
PERIPHERAL_FEEDING_209	peripheral equipment	feeding unit

Value	Description	
	Indication which machine part has caused the message	
	machine	**part**
PERIPHERAL_EXTERNAL_ALARMS_210	peripheral equipment	external alarms
PERIPHERAL_VACUUM_CONTROL_211	peripheral equipment	vacuum control
PERIPHERAL_PRINTER_INTERFACE_212	peripheral equipment	printer interface
OPERATION_QUALITY_MONITORING_300	operation	quality monitoring
OPERATION_MANUAL_OPERATION_301	operation	manual operation
OPERATION_EMERGENCY_STOP_302	operation	emergency stop
OPERATION_JOB_STATUS_303	operation	production status

11 PowerUnits

The PowerUnits Object is a container for the power unit(s) of the injection moulding machines. The *PowerUnitsType* is defined in EUROMAP 83.

12 Moulds

The Moulds Object is a container for the mould(s) of the injection moulding machines. The *MouldsType* is defined in EUROMAP 83.

13 InjectionUnitsType

This *ObjectType* is a container for the injection unit(s) (see container concept in EUROMAP 83). It is formally defined in Table 8.

Table 8 – InjectionUnitsType Definition

Attribute	**Value**				
BrowseName	InjectionUnitsType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Modelling Rule**
Subtype of *BaseObjectType* defined in OPC UA Part 5					
HasProperty	Variable	0:NodeVersion	String	PropertyType	M, R
HasComponent	Object	InjectionUnit_<Nr>		InjectionUnitType	OP

When instances for injection units are created, the *BrowseNames* shall be “InjectionUnit_<Nr>” (starting with 1).

14 InjectionUnitType

14.1 InjectionUnitType Definition

This *ObjectType* represents the description and status of the injection unit(s). It is formally defined in Table 9.

Table 9 – InjectionUnitType Definition

Attribute	**Value**				
BrowseName	InjectionUnitType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Modelling Rule**
Subtype of *BaseObjectType* defined in OPC UA Part 5					
HasProperty	Variable	Index	UInt32	PropertyType	M, R
HasProperty	Variable	BarrelId	String	PropertyType	M, R
HasProperty	Variable	IsPresent	Boolean	PropertyType	M, R
HasProperty	Variable	InProduction	Boolean	PropertyType	M, R
HasProperty	Variable	ScrewId	String	PropertyType	O, R
HasComponent	Variable	ScrewDiameter	Double	AnalogItemType	O, R
HasComponent	Variable	ScrewVolume	Double	AnalogItemType	O, R
HasComponent	Variable	MaxScrewStroke	Double	AnalogItemType	O, R
HasComponent	Object	TemperatureZones		TemperatureZonesType	M

14.2 Index

The *Index Property* gives the number of the injection unit.

14.3 BarrelId

The *BarrelId Property* provides the Id (e.g. serial number) of the barrel.

14.4 IsPresent

It is allowed to create instances of all InjectionUnits that **can** be connected to the machine (e.g. due to available connectors) to avoid dynamical creation of objects. The *IsPresent Property* provides information if the *InjectionUnit* is physically installed on the injection machines.

14.5 InProduction

The *InProduction Property* provides information if the *InjectionUnit* is used in the current running production.

14.6 ScrewId

The *ScrewId Property* represents the Id of the screw installed in the *InjectionUnit*.

14.7 ScrewDiameter

ScrewDiameter represents the diameter of the screw installed in the *InjectionUnit*.

14.8 ScrewVolume

ScrewVolume represents the volume of the screw installed in the *InjectionUnit*.

14.9 MaxScrewStroke

Max*ScrewStroke* represents the maximum stroke of the screw installed in the *InjectionUnit*.

14.10 TemperatureZones

This *Object* is a container for the barrel temperature zones of the injection unit. The *TemperatureZonesType* is formally defined in EUROMAP 83. Inside the container the *BarrelTemperatureZoneType* shall be used.

15 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 EUROMAP 83.

15.1 Types, methods and events for cyclic jobs

As IMM have a cyclic production, the Types, Methods and Events defined in EUROMAP 83 for cyclic jobs shall be used:

Table 10 – Types, methods and events for cyclic jobs

Type/Method/Event	SubType/extended Methods to be used for EUROMAP 77
JobInformationType	CyclicJobInformationType
SendJobList	SendCyclicJobList
RequestJobListEventType	RequestCylicJobListEventType
ActiveJobValuesType	ActiveCyclicJobValuesType

15.2 Optional properties in CyclicJobInformationType

In the *CyclicJobInformationType,* as defined in EUROMAP 83, the Properties *MouldId* and *NumCavities* have the *ModellingRule* optional. When the *CyclicJobInformationType* is used for a EUROMAP 77 interface, these *Properties* become mandatory and shall be filled by the server.

15.3 InjectionUnitCycleParametersType

The *InjectionUnitCycleParametersType* represents information on the production cycle related to an injection unit. This type is used to extend the *CycleParametersEventType* defined in EUROMAP 83. The *BrowseNames* of the additional objects shall be “InjectionUnitCycleParameters_<Nr>” (starting with 1)

Table 11 – Example of an event type derived from CycleParametersEventType with two moulds and two injection units

Attribute	Value				
BrowseName	ExampleCycleParametersEventType				
IsAbstract	false				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Modelling Rule**
Subtype of *CycleParametersEventType* defined in EUROMAP 83					
HasComponent	Object	MouldCycleParameters_1		Example1Mould CycleParametersType	M
HasComponent	Object	MouldCycleParameters_2		Example2Mould CycleParametersType	M
HasComponent	Object	InjectionUnitCycleParameters_1		Example1InjectionUnit CycleParametersType	M
HasComponent	Object	InjectionUnitCycleParameters_2		Example2InjectionUnit CycleParametersType	M

The *Types Example1MouldCycleParametersType* and *Example2MouldCycleParametersType* used in the example are subtypes of the *MouldCycleParametersType* defined in EUROMAP 83. The *Types Example1InjectionUnitCycleParametersType* and *Example2InjectionUnitCycleParametersType* are subtypes of the *InjectionUnitCycleParametersType* which is formally defined Table 12.

Table 12 – InjectionUnitCycleParametersType Definition

Attribute	Value				
BrowseName	InjectionUnitCycleParametersType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Modelling Rule**
Subtype of *BaseObjectType* defined in OPC UA Part 5					
HasProperty	Variable	Index	UInt32	PropertyType	M
HasComponent	Variable	CushionVolume	Double	AnalogItemType	M
HasComponent	Variable	CushionStroke	Double	AnalogItemType	O
HasComponent	Variable	PlastificationVolume	Double	AnalogItemType	M
HasComponent	Variable	DecompressionVolumeBeforePlastification	Double	AnalogItemType	O
HasComponent	Variable	DecompressionVolumeAfterPlastification	Double	AnalogItemType	O
HasComponent	Variable	HydraulicPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	SpecificPressureMaximum	Double	AnalogItemType	M
HasComponent	Variable	PlastificationRotationalSpeedMaximum	Double	AnalogItemType	O
HasComponent	Variable	PlastificationRotationalSpeedAverage	Double	AnalogItemType	O
HasComponent	Variable	PlastificationCircumferentialSpeedMaximum	Double	AnalogItemType	O
HasComponent	Variable	PlastificationCircumferentialSpeedAverage	Double	AnalogItemType	O
HasComponent	Variable	InjectionSpeedMaximum	Double	AnalogItemType	O
HasComponent	Variable	InjectionSpeedAverage	Double	AnalogItemType	O
HasComponent	Variable	TransferVolume	Double	AnalogItemType	O
HasComponent	Variable	TransferStroke	Double	AnalogItemType	O
HasComponent	Variable	HoldHydraulicPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	HoldHydraulicPressureAverage	Double	AnalogItemType	O
HasComponent	Variable	HoldSpecificPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	HoldSpecificPressureAverage	Double	AnalogItemType	O
HasComponent	Variable	CavityPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	PlastificationHydraulicPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	PlastificationHydraulicPressureAverage	Double	AnalogItemType	O
HasComponent	Variable	PlastificationSpecificPressureMaximum	Double	AnalogItemType	O
HasComponent	Variable	PlastificationSpecificPressureAverage	Double	AnalogItemType	O
HasComponent	Variable	TransferHydraulicPressure	Double	AnalogItemType	O
HasComponent	Variable	TransferSpecificPressure	Double	AnalogItemType	O
HasComponent	Variable	TransferCavityPressure	Double	AnalogItemType	O
HasComponent	Variable	BackPressure	Double	AnalogItemType	O
HasComponent	Variable	InjectionTime	Duration	BaseDataVariableType	M
HasComponent	Variable	DosingTime	Duration	BaseDataVariableType	M
HasComponent	Variable	FlowIndex	Double	AnalogItemType	O
HasComponent	Variable	InjectionStartPosition	Double	AnalogItemType	O
HasComponent	Variable	VPChangeOverPosition	Double	AnalogItemType	O

Table 13 contains a description of the parameters listed in Table 12.

Table 13 – Description of cycle parameters

Parameter	Description
Index	Index of the InjectionUnit (see 14.2)
CushionVolume	Material volume remained in front of the screw after injection and holding pressure
CushionStroke	Stroke position at cushion
PlastificationVolume	Volume dosed by the machine for the next injection shot
DecompressionVolumeBeforePlastification	Decompression before plastification is the movement of the screw in the opposite direction to injection
DecompressionVolumeAfterPlastification	Decompression after plastification is the movement of the screw in the opposite direction to injection
HydraulicPressureMaximum	Maximum pressure in the hydraulic cylinder
SpecificPressureMaximum	Pressure in front of the screw tip
PlastificationRotationalSpeedMaximum	Maximum plastification speed of the injection unit (RPM)
PlastificationRotationalSpeedAverage	Average plastification speed of the injection unit (RPM)
PlastificationCircumferentialSpeedMaximum	Maximum screw circumferential speed for plastification (e.g. mm/s)
PlastificationCircumferentialSpeedAverage	Average screw circumferential speed for plastification (e.g. mm/s)
InjectionSpeedMaximum	Maximum injection speed (e.g. mm/s)
InjectionSpeedAverage	Average injection speed (e.g. mm/s)
TransferVolume	Switch-over point to the holding pressure via volume
TransferStroke	Switch-over point to the holding pressure via stroke
HoldHydraulicPressureMaximum	Maximum holding pressure in the hydraulic cylinder
HoldHydraulicPressureAverage	Average holding pressure in the hydraulic cylinder
HoldSpecificPressureMaximum	Maximum holding pressure in front of the screw
HoldSpecificPressureAverage	Average holding pressure in front of the screw
CavityPressureMaximum	Maximum pressure during the injection process in the cavity or mould
PlastificationHydraulicPressureMaximum	Maximum plastification pressure in cylinder
PlastificationHydraulicPressureAverage	Average plastification pressure in cylinder
PlastificationSpecificPressureMaximum	Maximum plastification pressure in front of the screw tip
PlastificationSpecificPressureAverage	Average plastification pressure in front of the screw tip
TransferHydraulicPressure	Hydraulic pressure in the cylinder during switch-over to the holding pressure
TransferSpecificPressure	Pressure in front of the screw tip during switch-over to the holding pressure
TransferCavityPressure	Cavity pressure in the mould during switch-over to the holding pressure
BackPressure	Back pressure is the melt-pressure against the screw movement during dosage
InjectionTime	Time required to fill the cavity or mould
DosingTime	Time to melt-up the plastic granulates and feed the melt for the next injection shot to the front of the screw
FlowIndex	Integral of the injection pressure over the injection time as measure for the injection work
InjectionStartPosition	Start position of the injection
VPChangeOverPosition	Screw position at switching between injection (V) and holding pressure (P)

The *InjectionUnitCycleParametersType* is abstract and the OPC server of the machine shall create a derived type with the additional objects of *TemperatureZoneCycleParametersType* (defined in EUROMAP 83) for the temperature zones of the barrel. The *BrowseNames* of the objects shall be “BarrelTemperatureZoneCycleParameters _<Nr>” (starting with 1 for each injection unit).

16 ProductionDatasetManagement

The *ProductionDatasetManagement Object* is used for managing production datasets which are files containing the configuration of a machine. The *ProductionDatasetManagementType* is defined in EUROMAP 83.