| **EUROMAP 79** | **OPC UA interfaces for plastics and rubber machinery – Data exchange between injection moulding machines and robots** |

Release Candidate 1.00.06, 2024-03-26

EUROMAP 79 (Release Candidate 1.00.06) is identical with

OPC 40079 (Release Candidate 1.00.06) and VDMA 40079:2024-03

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Foreword

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 40079 describes the interface between injection moulding machines (IMM) and robots for data exchange. The target of OPC 40079 is to provide a unique interface for IMM and robots from different manufacturers to ensure compatibility.

The first version of this specification is intended to enable a rather simple implementation with a fixed set of equipment supported. This leads to a fixed number of instances of child elements in several type definitions as described in the "OPC 40079 IMM Fixed DataSet Server Facet" and "OPC 40079 Robot Fixed DataSet Server Facet". The next versions are going to add further *Facets* allowing unlimited equipment and other topics for higher level of integration on production floor.

The first version covers these functionalities:

– Machine is OPC UA client and can optionally be an OPC UA server

– Robot is OPC UA server and can optionally be an OPC UA client

– Realtime exchange of signals via PubSub to prevent mechanical collisions

– Position signals from the IMM: 1 mould, 2 ejectors, 10 cores and 1 additional axes

– Enabling signals from the robot to the IMM to enable/disable movements of the IMM depending on the robot position

– Multiple pub sub connections are possible

– Part tracking

– Signals from the IMM representing the availability of parts in each mould

– Signals from the robot on inserting and removing of parts

– Exchange of production datasets between machine and robot

– Exchange of basic part quality data from IMM to the Robot

– User Login

Future extensions cover these functionalities:

– Machine and robot are OPC UA server and client as well

– Starting of robot interaction into running machine production cycles

– Detailed part quality for each cavity

– Signals from the IMM on the part quality as determined by the machine

– Signals from the robot on the part quality as determined by the robot (e.g. connected vision systems)

– Dynamic scope of equipment as well as modelling of injection units

– Method to stop the robot movement by the IMM before the safety cover is opened

Functionalities/Information not intended to be covered in OPC 40079:

– Robot work space definitions for integration in IMM processes.
– Position/speed of robot axes
– Direct control of machine/robot movements. These are part of the machine/robot program.
– Safety Signals: For safety signals like emergency stop EUROMAP 81 shall be used. As an alternative, the relevant signals of an existing EUROMAP 67 interface can be used.

NOTE: Additional features from the robotics CS can be used but are not mandatory for the use of OPC 40079.

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

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

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

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

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

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

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

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

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

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

OPC 10000-14, *OPC Unified Architecture - Part 14: PubSub*

   http://www.opcfoundation.org/UA/Part14/

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

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

OPC 40083, *OPC UA for Plastics and Rubber Machinery – General Type Definitions*

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

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

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

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 40079 Information Model. For the purposes of this document, the terms and definitions given in the documents referenced in Clause 2 apply.

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

3.2   Conventions used in this document

The conventions described in OPC 40083 apply.

3.3   Abbreviations

HMI   Human Machine Interace

IMM   Injection Moulding Machine

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 40079 covers the following functionalities:

– Realtime exchange of signals to prevent mechanical collisions

– Part tracking

– Exchange of production datasets between machine and robot

– Exchange of basic part quality data from IMM to the Robot

6   OPC 40079 Information Model overview

For the communication between IMM and robot both are publishers and subscribers for the exchange of real-time data. In addition, the robot shall provide (non-real-time) information in an OPC UA server with an address space and the IMM shall connect as client (see 0). For the first version with fixed structure of the position and enabling signals it is not mandatory that the IMM provides an OPC UA server with an address space. However, the information contained in the *ImmToRobotType* (see 7) is the source for published *DataSets* (see Figure 1).
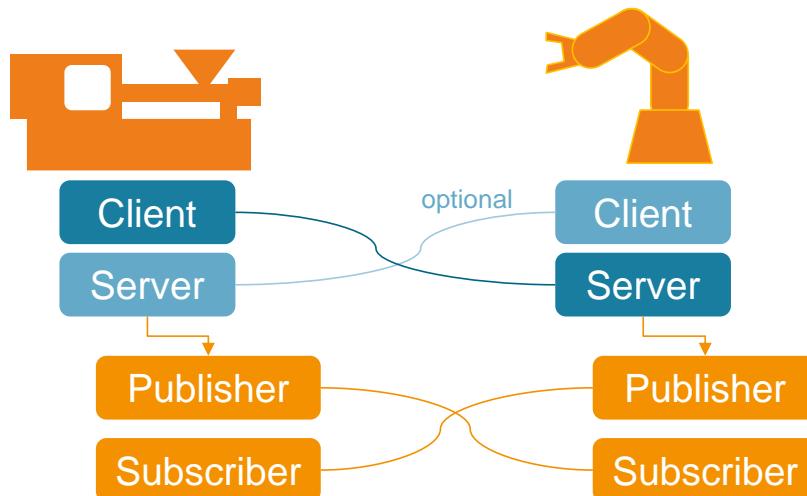
Figure 1 – Combination of Client-Server and PubSub communication

The IMM publishes a fixed set of equipment (mould, ejector, cores, additional axes) containing the position signals in a publisher dataset. The robot subscribes to this dataset from the IMM and publishes a fixed set of enable signals. The IMM again subscribes to this dataset from the robot to receive the enable signals for the same set of equipment. In this manner, the IMM and robot establish a bidirectional 1:1 pub-sub-connection.

It is intended that one published dataset from the IMM contains all equipment for one interacting robot.

Nevertheless, two robots can connect to the same IMM when the IMM publishes two datasets with the equal or differing equipment to be controlled by each one of the robots.

It is free to the IMM to preselect equipment into the publishing dataset controllable by the robot and to skip equipment not to be controlled from the robot.

NOTE: All equipment not used from the machine and all enable signals not used from the robot shall be have the value binary value 0 that can be either "InPosition1", "0.0 [mm]", "NOT_MOVING_0".

NOTE: If the connection is lost, the IMM shall consider all enable signals as false.

Some exemplary usages (see Figure 2):

- One IMM with one mould and one robot → only one dataset needed

- One IMM with two moulds and one robot → IMM publishes two separate datasets, one for each mould; robot publishes two datasets (note: depending on the actual application, such a situation, e.g. tandemmould or stackmould, could be modelled with only one mould, like the standard situation)

- Two IMMs with one mould each and one robot → each IMM publishes one dataset for its mould, robot publishes two datasets

- One IMM with two moulds and two robots → IMM publishes two datasets for its moulds; each robot publishes one dataset

- One IMM with one mould and two robots → IMM publishes one dataset for its mould; each robot publishes one datasets → IMM needs to combine the enable signals
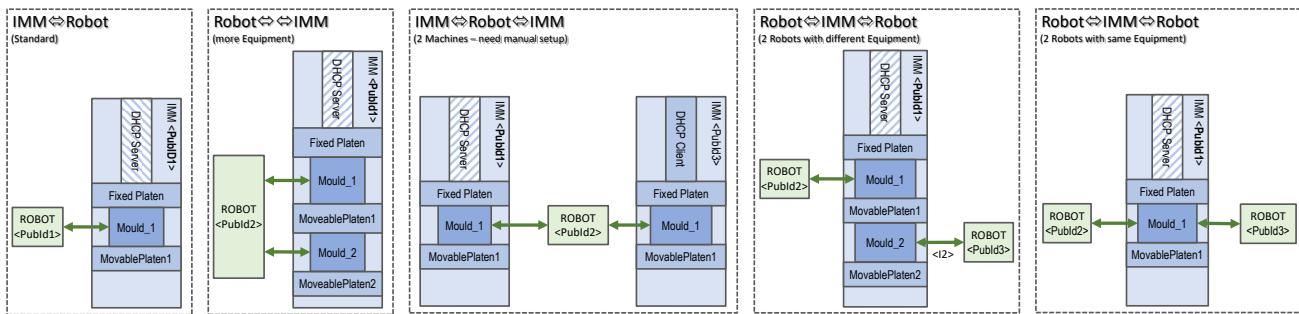
Figure 2 – Use cases with one or two interface instances

A handshake mechanism between the Robot application level and the IMM application level is provided by a *RobotMessageId* send from the robot (see 8.4) and *RobotMessageId_confirmed* send from the IMM (see 7.2). When the robot receives in *RobotMessageId_confirmed* the value sent from *RobotMessageId* back this means a confirmation that all signals within the same publishing dataset have been considered by the IMM.

The IMM shall control all equipment movements according to the received enable signals from the robot and copy back as *RobotMessageId_confirmed* only when having considered all enable signal changes of the robot and has commanded the IMM axes as defined by the robot. The robot has to get back the requested value before entering any critical regions. This mechanism ensures that no contradicting movements are initiated from the machine after this confirmation. However, it can take some time until already existing movements are stopped. If the axes is not moving but in a position that is not enabled any longer, it is not necessary that the IMM moves the axes out of the "forbidden" position. Only new movements are forbidden. This is why the robot needs to check the position/movement signals from IMM before interaction.

Due to this handshake, there is no need to wait until signal communication and message processing times expire although a robot could use a Watchdog for maximum timeout of the *RobotMessageId_confirmed*. This mechanism enables a reliable pub-sub-communication with different signal runtimes or cycle times and would even work on slow delayed communication channels.

7 ImmToRobotType

7.1 Overview

Figure 3 shows the structure of the *ImmToRobotType* and itls location inside the *AddressSpace*.
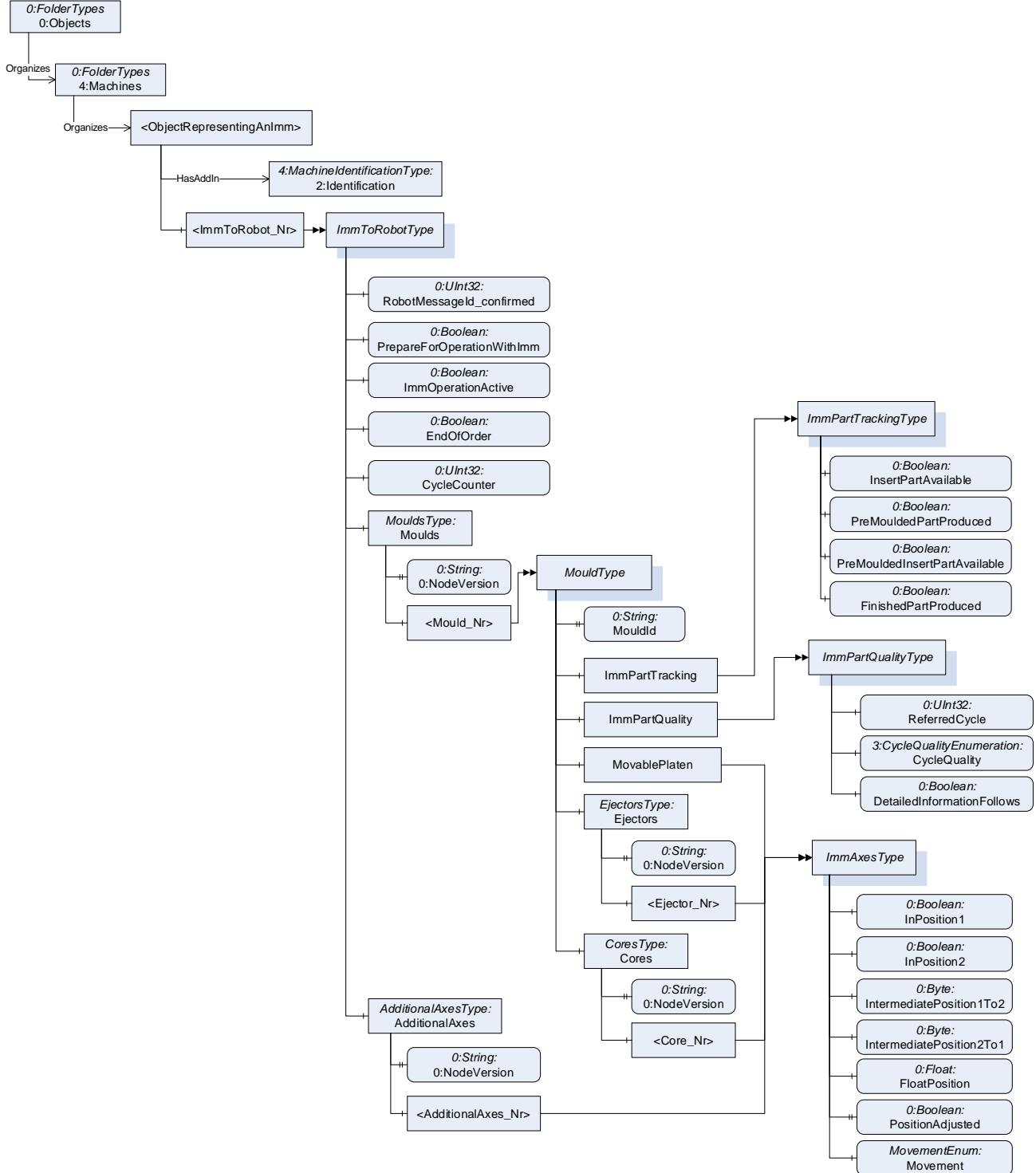
Figure 3 – Overview ImmToRobotType

The *ImmToRobot_Type* represents the interface of the injection moulding machine to the robot and contains all its subcomponents relevant for the interaction with one robot.

The IMM can provide an OPC UA server with an address space (see 6). If so, the instance(s) of *ImmToRobotType* shall be located under an *Object*, which represents the IMM and which is directly located under the *Machines Object* of the Server and has an *Object Identification* as defined in OPC 40001-1.

The BrowseName of the instances shall be "ImmToRobot_1", "ImmToRobot_2"…

IMM uses the *StartPubSub Method* from 8.2 to tell the robot to subscribe to the dataset using the PublisherId of the IMM and to start publishing its own dataset with the enable signals.

The *ImmToRobotType* is formally defined in Table 1.

Table 1 – ImmToRobotType Definiton

Attribute	Value				
BrowseName	ImmToRobotType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasComponent	Variable	RobotMessageId_confirmed	0:UInt32	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PrepareForOperationWithImm	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	ImmOperationActive	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	EndOfOrder	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	CycleCounter	0:UInt32	0:BaseDataVariableType	M, RO
0:HasComponent	Object	Moulds		MouldsType	M
0:HasComponent	Object	AdditionalAxes		AdditionalAxesType	M
Conformance Units					
OPC 40079 ImmToRobot Entry Point					

NOTE: *RobotMessageId_confirmed*, *PrepareForOperationWithImm*, *ImmOperationActive*, *EndOfOrder*, *CycleCounter*, *Moulds* and *AdditionalAxes* are part of the PubSub communication.

The modelling rule optional placeholder is used for the mould and additional axes (e.g. turn-table, shuttle-table) for future use of multiple instances.

For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the instances are fixed: One mould *Mould_1* and one additional axes *AdditionalAxes_1*.

7.2 RobotMessageId_confirmed

With this *Variable,* the IMM confirms, that it has received and considered the enable signal changes coming from the robot with *RobotMessageId* (see 8.4) and has commanded its axes as defined by the robot.

In a proper production cycle, it should not happen that a movement of the IMM is stopped by removing an enable signal by the robot. If this situation should occur anyway, it should be taken into account that the IMM will increment RobotMessageId_confirmed as soon as it has considered the missing enable information and initiated the stop of the movement. However, the stopping process will continue for another time. As an invariant, the robot has to take this into account in this situation as well.

7.3 PrepareForOperationWithImm

With this *Variable,* the IMM requests the robot to prepare for production (e.g. homing, switch on drives, internal checks, prepare gripper). This could be in automatic mode but also in manual mode of the IMM.

In case of insert parts, the robot can disable the closing of the mould.

The robot responds with *ReadyForOperationWithImm*.

If the signal turns to *false* during the operation mode of the robot "operation with injection moulding machine", it is allowed that the robot continues its automatic cycle until the end position.

7.4 ImmOperationActive

This *Variable* indicates that the IMM and the sequence has been started. This could be in automatic mode but also in manual mode of the IMM. In manual mode, it could be used e.g. for setup/testing, eventually without parts being produced.

7.5 EndOfOrder

With this signal, the IMM indicates that the order is complete. Example: The robot must remove the finished part but not pick a new insert.

7.6 CycleCounter

Number of production cycles in the current production.

If no problem was detected during the forming phase, the variable would typically be incremented at the same time as setting the variable *FinishedPartProduced*, e.g. during the opening movement of the mould.

7.7 MouldsType

The *MouldsType* is a container for the instances for the moulds. It It is formally defined in Table 2.

Table 2 – MouldsType Definiton

Attribute	Value				
BrowseName	MouldsType				
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	<Mould_Nr>		MouldType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

The modelling rule optional placeholder for the moulds is applied to allow a flexible number of instances. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the instances are fixed to one mould Mould_1 to achieve a constant dataset.

7.8 MouldType

The *MouldType* includes information about the mould, its position and movement and includes part tracking and quality information. It also includes container object for providing information about the included axes (ejectors, cores). It is formally defined in Table 3.

Table 3 – MouldType Definiton

Attribute	Value				
BrowseName	MouldType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasProperty	Variable	MouldId	0:String	0:PropertyType	O, RO
0:HasComponent	Object	MovablePlaten		ImmAxesType	O
0:HasComponent	Object	Ejectors		EjectorsType	M
0:HasComponent	Object	Cores		CoresType	M
0:HasComponent	Object	ImmPartTracking		ImmPartTrackingType	O
0:HasComponent	Object	ImmPartQuality		ImmPartQualityType	O

For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", *MovablePlaten*, *ImmPartTracking* and *ImmPartQuality* shall be used.

7.8.1 MouldId

This Property is used as identifier of the mould. It can be used for reports.

7.8.2 MovablePlaten

This *Object* describes the movement and position of the movable platen of the mould. The *ImmAxesType* is defined in 7.8.3.

7.8.3 ImmAxesType

The *ImmAxesType* is used to describe the movement and position of one axes of the IMM. It is formally defined in Table 4.

Table 4 – ImmAxesType Definiton

Attribute	Value				
BrowseName	ImmAxesType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasComponent	Variable	InPosition1	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	InPosition2	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	IntermediatePosition1To2	0:Byte	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	IntermediatePosition2To1	0:Byte	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	FloatPosition	0:Float	0:BaseDataVariableType	O, RO
0:HasProperty	Variable	PositionAdjusted	0:Boolean	0:PropertyType	O, RO
0:HasComponent	Variable	Movement	MovementEnum	0:BaseDataVariableType	O, RO

For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the following optional variables shall be used to achieve fixed models:

– For movable platen, ejectors and additional axes: All optional variables shall be used.

– For cores: *InPosition1*, *InPosition2*, *IntermediatePosition1To2*, *IntermediatePosition2To1* and *Movement* shall be used. *FloatPosition* and *PositionAdjusted* shall not be used.

7.8.3.1 InPosition1, InPosition2

InPosition1 and *InPosition2* of type *Boolean* giving the discrete pre-set final positions of the axes in both movement directions. If the axes is not in a final (=end-, =limit-) position, the signal is *false*. Although, the positions are dependent on the manufacturer/programming, the following is agreed:

Table 5 – Defined positions for mould, core, ejector and turn-table as additional axes

	InPosition1	InPosition2
Linear Axes		
Mould (Movable Platen)	Closed	Full open
Ejector	Finally backward (e.g. after the number of its set cycles)	Forward / ejection pos. (e.g. after the number of its set cycles)
Core	Core pullers in moulding position	Core pullers in position to remove moulding
Rotational axes		
Turn-table	*Not used → always false*	Turn-table in working position → if it is important to know, in which position the turn-table is, the *IntermediatePosition1To2* and/or the *FloatPosition* shall be used

NOTE: During compression moulding the mould needs to move a small amount (some mm) from the closed position and back. During this movement *InPosition1* may stay *true*.

7.8.3.2 IntermediatePosition1To2

The IMM can define intermediate position thresholds individually for each movement direction and the equipment is stopped at this position. These positions between the limits *InPosition1* and *InPosition2* are called intermediate positions and are ordered from 1, 2, …, 255.

The values of *IntermediatePosition1To2* are defined for the moving direction starting with *InPosition1 = true* to *InPosition2 = true*.

A new value in *IntermediatePosition1To2* is set by the IMM, when the actual position is equal or greater than the corresponding threshold position. To have clearance to move to an intermediate position, the IMM expects an according enable signal from the robot side. For the movement to intermediate position 1 the IMM presupposes *EnableIntermediatePosition1To2 ≥ 1* and will set *IntermediatePosition1To2 = 1* after reaching the threshold for intermediate position 1.

If intermediate positions are passed in a very short time (fast movements) it could be possible that *IntermediatePosition1To2* could skip some values. Thus, the robot cannot expect to always receive the values in sequence.

Example for moulds:

When the mould is closed *InPosition1* variable is *true*, *IntermediatePosition1To2* is 0 and the *FloatPosition* is approximately 0.0 [mm]. Opening the mould results in an increasing *FloatPosition* and *IntermediatePosition1To2* gets the value 1 when the threshold for the first intermediate position is reached. After reaching the threshold for the second intermediate position the *IntermediatePosition1To2* turns from the value 1 to the value 2. After reaching the last threshold for an opening intermediate position the variable *InPosition2* turns true and the *FloatPosition* gets a maximum value. *IntermediatePosition1To2* stays in the last value.

Example for no Intermediate position:

The *IntermediatePosition1To2* should remain 0 all over.

Example mould with 3 opening intermediate positions and 2 closing intermediate positions:

Figure 4 shows an example with 3 opening intermediate positions and 2 closing intermediate positions.
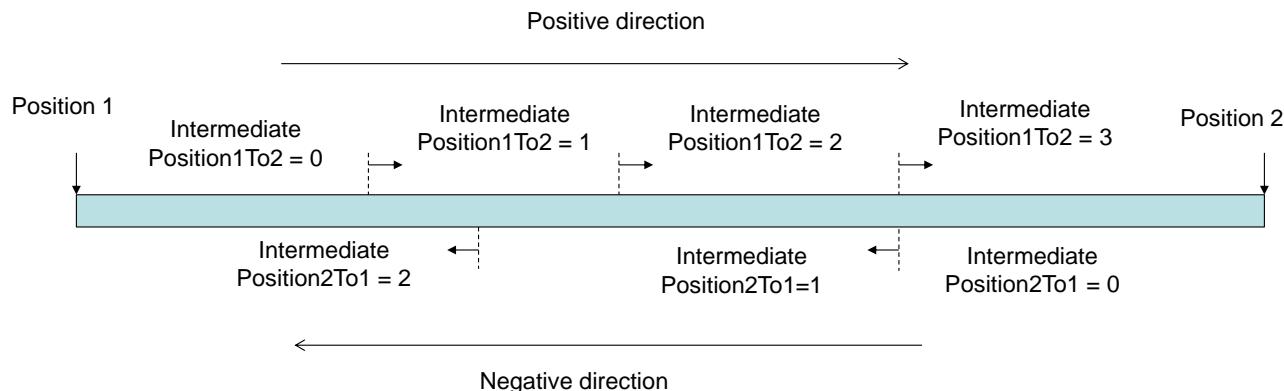
Figure 4 – Definition of intermediate positions signals

The value of *IntermediatePosition1To2* shall always be valid, even when the current movement is in the other direction.

7.8.3.3   IntermediatePosition2To1

The intermediate positions for the direction *InPosition2* towards *InPosition1* are ordered from 1, 2, …, 255.

The values of *IntermediatePosition2To1* are defined for the moving direction starting with *InPosition2 = true* to *InPosition1 = true*.

A new value in *IntermediatePosition2To1* is set by the IMM, when the actual position is equal or less than the corresponding threshold position. To have clearance to move to an intermediate position, the IMM expects an according enable signal to from the robot side. For the movement to intermediate position 2 the IMM presupposes *EnableIntermediatePosition2To1≥2* and will set *IntermediatePosition2To1=2* after reaching the threshold for intermediate position 2.

If intermediate positions are passed in a very short time (fast movements) it could be possible that *IntermediatePosition2To1* could skip some values. Thus, the robot cannot expect to always receive the values in sequence.

7.8.3.4   FloatPosition

The *FloatPosition Variable* allows to give the current position as float value using fixed millimetre unit for linear axes and degrees for rotational axes.

7.8.3.5   PositionAdjusted

The *PositionAdjusted Property* indicates that the position of the axes is correct (homing has been done) and a position of 0 mm corresponds to a fully closed mould, ejector finally backward, core in moulding position (for cores not used in first step). During bootup or while changing a mould *PositionAdjusted = false* shows the robot not to rely on the *FloatPosition* values.

7.8.3.6   Movement

The *Movement Variable* indicates whether the axes is moving or not. The enumeration *MovementEnum* is defined in Table 6.

Table 6 – MovementEnum Items

Name	Value	Description
NOT_MOVING	0	The axes is at rest.
MOVING_IN_POSITIVE_DIRECTION	1	The axes is moving from position 1 to 2
MOVING_IN_NEGATIVE_DIRECTION	2	The axes is moving from position 2 to 1

Its representation in the *AddressSpace* is defined in Table 7.

Table 7 – MovementEnum Definiton

Attribute	Value				
BrowseName	MovementEnum				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*Enumeration* type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0: EnumValueType[]	0:PropertyType	

NOTE: For rotational axes (e.g. turn tables with position 1, 2 and 3) the movement from the highest position (3) to the lowest (1) is also a positive direction.

7.8.4   EjectorsType

The *EjectorsType* is a container for the instances for the ejectors inside a mould. It is formally defined in Table 8.

Table 8 – EjectorsType Definiton

Attribute	Value				
BrowseName	EjectorsType				
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	<Ejector_Nr>		ImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

The modelling rule optional placeholder for the ejectors is applied to allow a flexible number of instances. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the instances are fixed to two ejectors Ejector_1 and Ejector_2 to achieve a constant dataset.

7.8.5 CoresType

The *CoresType* is a container for the instances for the cores inside a mould. It is formally defined in Table 9.

Table 9 – CoresType Definiton

Attribute	Value				
BrowseName	CoresType				
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	<Core_Nr>		ImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

The modelling rule optional placeholder for the cores is applied to allow a flexible number of instances. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the instances are fixed to ten cores Core_1 … Core_10 to achieve a constant dataset.

7.8.6 ImmPartTrackingType

The *ImmPartTrackingType* signals the availability of insert parts, pre-moulded parts and finished parts in a mould. It is formally defined in Table 10.

NOTE: Providing *InsertPartAvailable* by IMM could for example be relevant during start-up so that the robot knows that insert parts are already inserted and the robot does not try to insert another one.

Table 10 – ImmPartTrackingType Definiton

Attribute	Value				
BrowseName	ImmPartTrackingType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasComponent	Variable	InsertPartAvailable	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PreMouldedPartProduced	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PreMouldedInsertPartAvailable	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	FinishedPartProduced	0:Boolean	0:BaseDataVariableType	M, RO
Conformance Units					
OPC 40079 IMM Part Tracking					

NOTE: During automatic production with robot, *FinishedPartProduced* stays *true* until the robot has sent *FinishedPartRemoved*. (During start-up, the IMM sets *FinishedPartProduced* back to *false* when the part fell down.)

7.8.6.1 InsertPartAvailable

It becomes *true* after the robot signals *InsertPartInserted* from the *RobotPartTrackingType* or the parts maybe detected by a sensor. It is expected that the IMM sets the *InsertPartAvailable* to false before the mould movements releasing the parts are started (e.g. mould opening) or due to a sensor or the robot signals *InsertPartRemoved*.

7.8.6.2 PreMouldedPartProduced

It becomes *true* after the IMM produced pre-moulded parts. It is expected that the IMM sets the signal before the mould movements releasing the parts are started (e.g. mould opening).

It becomes *false* when the robot signals PreMouldedPartRemoved (see *RobotPartTracking* in 8.9.6) or the parts had been removed from the IMM (e.g. dropped by ejectors or cores).

If the process has several steps creating pre-moulded parts (e.g. multi-colour machines), *PreMouldedPartProduced* becomes *true* after the first step. *FinishedPartProduced* becomes *true* after the last step.

7.8.6.3 PreMouldedInsertPartAvailable

It becomes *true* after the robot signals *PreMouldedPartInserted* from the *RobotPartTrackingType* or the parts maybe detected by a sensor. It is expected that the IMM sets the *PreMouldedInsertPartAvailable* to *false* before the mould movements releasing the parts are started (e.g. mould opening) or due to a sensor.

7.8.6.4 FinishedPartProduced

It becomes *true* after the IMM produced completely-finished parts. It is expected that the IMM sets the signal before the mould movements releasing the parts are started (e.g. mould opening).

It becomes *false* when the robot signals FinishedPartRemoved (see *RobotPartTracking* in 8.9.6) or the parts had been removed from the IMM (e.g. dropped by ejectors or cores).Figure 5 shows an example of the timing of the signals when the robots wait for full mould opening before removing parts.
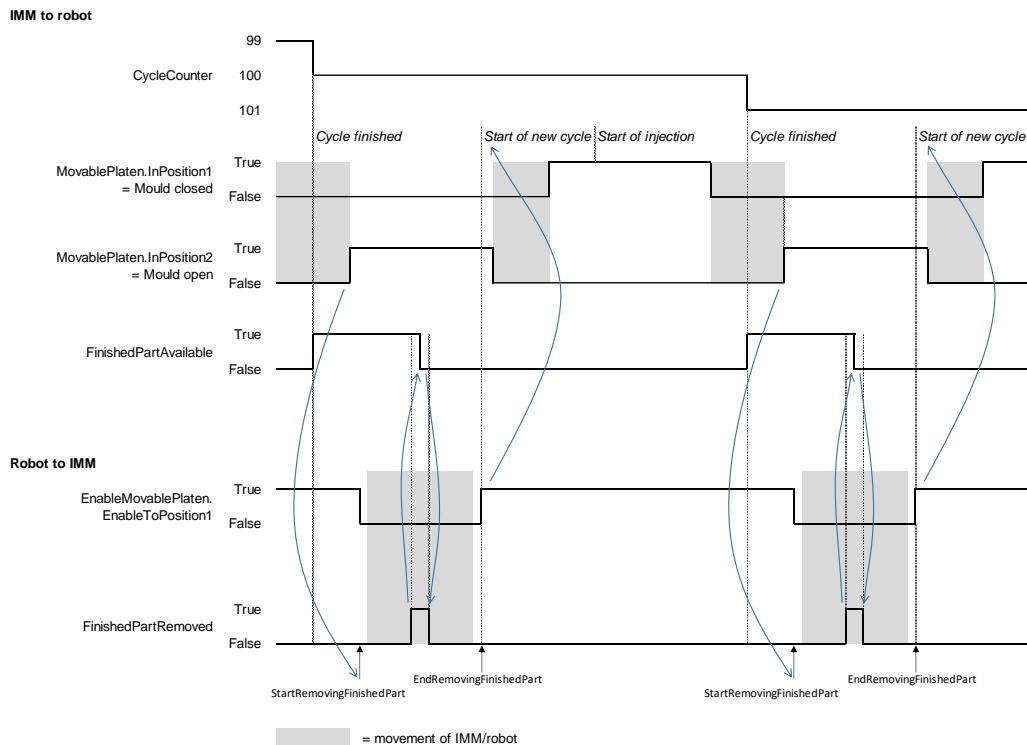
Figure 5 – Example for timing for signals for part tracking (robot waits for full mould opening)

Figure 6 shows an example of the timing of the signals when the robots starts its movements during mould opening (when intermediate position 1 is reached).
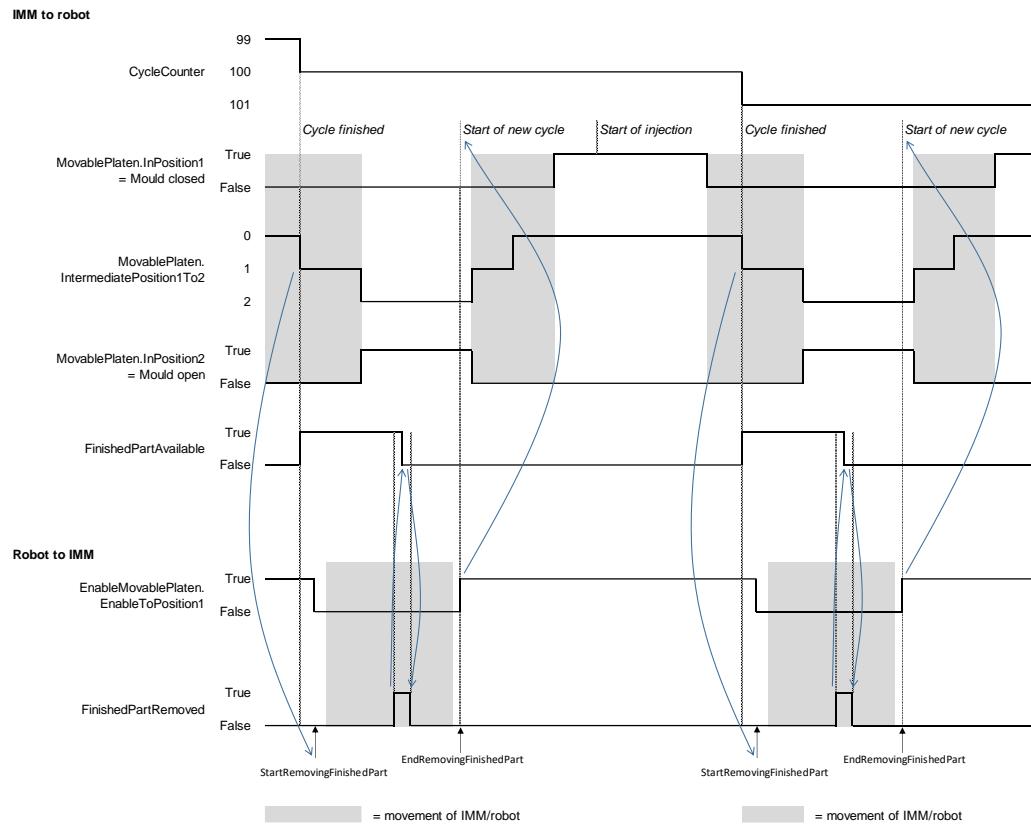
Figure 6 – Example for timing for signals for part tracking (robot starts movement during mould opening)

Another possibility is not no use the signal IntermediatePosition1To2 but the FloatPosition as trigger for starting the robot movement.

7.8.7   ImmPartQualityType

The *IMMPartQualityType* provides summarized information about the quality of produced parts and is formally defined in Table 11.

Table 11 – ImmPartQualityType Definiton

Attribute	Value				
BrowseName	ImmPartQualityType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasComponent	Variable	ReferredCycle	0:UInt32	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	CycleQuality	3:CycleQualityEnumeration	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	DetailedInformationFollows	0:Boolean	0:BaseDataVariableType	M, RO
Conformance Units					
OPC 40079 IMM Part Quality					

NOTE: *ReferredCycle, CycleQuality* and *DetailedInformationFollows* are part of the PubSub communication.

The IMM can provide detailed information about the cycle including quality information for each cavity by calling the *Method ImmToRobotDetailedInformation* (see 8.9.7.3)

If the quality data could be determined within the current cycle, *ReferredCycle* (see 7.6) and *ReferredCycle* have the same value within the current cycle up from the time when the quality data is available.

If the quality data cannot be determined in the current cycle due to, for example, time-consuming evaluation, *ReferredCycle* and *ReferredCycle* have different values all the time.

7.8.7.1 ReferredCycle

Production cycle identified by *ReferredCycle* (see 7.6) to which the quality data – expressed by *CycleQuality* – are referred.

7.8.7.2 CycleQuality

Summarised information on the quality of the whole cycle as determined by the IMM. The *CycleQualityEnumeration* is defined in OPC 40083.

7.8.7.3 DetailedInformationFollows

This Variable is set by the IMM if additional Information to the reffered cycle will be sent by calling the method "ImmToRobotDetailedInformation". This variable could all the time set to *true* or to *false.*

7.9 AdditionalAxesType

The *AdditionalAxesType* is a container for additional axes of the IMM. It is formally defined in Table 12.

Table 12 – AdditionalAxesType Definiton

Attribute	Value				
BrowseName	AdditionalAxesType				
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	<AdditionalAxes_Nr>		ImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

The modelling rule optional placeholder for the additional axes is applied to allow a flexible number of instances. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", the instances are fixed to one additional axes AdditionalAxes_1 to achieve a constant dataset.

8   RobotToImmType

8.1   Overview

Figure 7 shows the structure of the *RobotToImmType* and its location inside the *AddressSpace*.
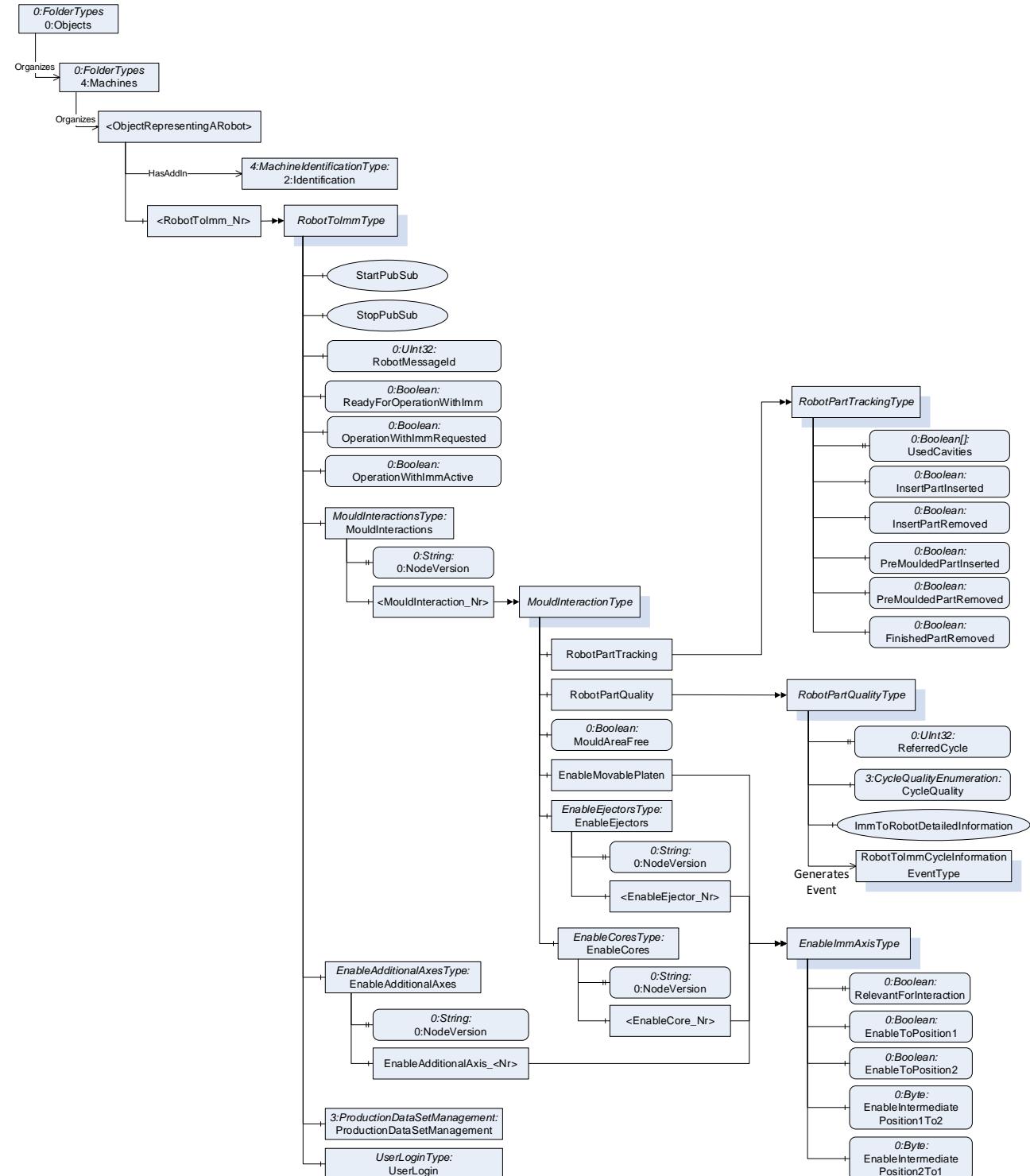
Figure 7 – Overview RobotToImmType

This OPC UA *ObjectType* is used for the root *Object* representing a robot to IMM connection with all its subcomponents relevant for the interaction between this robot and IMM.

The instance(s) of *RobotToImmType* shall be located under an *Object*, which represents the robot and which is directly located under the *Machines Object* of the Server and has an *Object Identification* as defined in OPC 40001-1.

The robot provides one instance for each interaction between one mould of an IMM and the robot. The *BrowseName* shall be "RobotToImm_1", "RobotToImm_2", … . It is up to the manufacturer/integrator to provide a server with a flexible or fixed number of instances. In the first case, new instances can be created via the control system of the robot. In the second case, the number of instances corresponds with the maximal possible connections. In unused instances, the *Method StartPubSub* will not be called so that so unnecessary data is put into the real-time data exchange.

The *RobotToImmType* is formally defined in Table 13.

Table 13 – RobotToImmType Definiton

Attribute	Value					
BrowseName	RobotToImmType					
IsAbstract	False					
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**		**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5						
0:HasComponent	Method	StartPubSub				M
0:HasComponent	Method	StopPubSub				M
0:HasComponent	Variable	RobotMessageId	0:UInt32	0:BaseDataVariableType		M, RO
0:HasComponent	Variable	ReadyForOperationWithImm	0:Boolean	0:BaseDataVariableType		M, RO
0:HasComponent	Variable	OperationWithImmRequested	0:Boolean	0:BaseDataVariableType		M, RW
0:HasComponent	Variable	OperationWithImmActive	0:Boolean	0:BaseDataVariableType		M, RO
0:HasComponent	Object	MouldInteractions		MouldInteractionsType		M
0:HasComponent	Object	EnableAdditionalAxes		EnableAdditionalAxesType		M
0:HasComponent	Object	ProductionDatasetManagement		3:ProductionDatasetManagementType		O
0:HasComponent	Object	UserLogin		UserLoginType		O
Conformance Units						
OPC 40079 RobotToImm Entry Point						

8.2   StartPubSub

The *Method StartPubSub* initiates the PubSub connection between 1 IMM and 1 robot interface.

The input parameters contain information about the configuration of the publisher in the IMM for the IMMProcessValues. The robot uses this for configuration of the subscription.

The output parameters contain information about the configuration of the publisher in the robot for the RobotSignals. The IMM uses this for configuration of the subscription.

The signature of this *Method* is specified below. Table 14 and Table 15 specify the *Arguments* and *AddressSpace* representation, respectively.

Signature

```
StartPubSub (
    [in]    0:String        ImmTransportProfileUri,
    [in]    0:String        ImmAddress,
    [in]    0:UInt64        ImmPublisherId,
    [in]    0:UInt16        ImmWriterGroupId,
    [in]    0:UInt16        ImmDataSetWriterId,
    [in]    0:Duration      ImmPublishingInterval,
    [in]    0:Byte          ImmProtocolMajorVersion,
    [in]    0:Byte          ImmProtocolMinorVersion,
    [out]   0:String        RobotTransportProfileUri,
    [out]   0:String        RobotAddress,
    [out]   0:UInt64        RobotPublisherId,
    [out]   0:UInt16        RobotWriterGroupId,
```

```
[out]   0:UInt16          RobotDataSetWriterId,
[out]   0:Duration        RobotPublishingInterval,
[out]   0:Byte            RobotProtocolMajorVersion,
[out]   0:Byte            RobotProtocolMinorVersion);
```

Table 14 – StartPubSub Method Arguments

Argument	Description
ImmTransportProfileUri	Transport Profile used by IMM. The possible values are defined as URI of the transport protocols defined as PubSub transport Facet in OPC 10000-7.
ImmAddress	Network address of IMM publisher
ImmPublisherId	PublisherId of the IMM
ImmWriterGroupId	WriterGroupId of the IMM's writer group which contains the OPC 40079 DataSets
ImmDataSetWriterId	DataSetWriterId of IMM process values for the called interface
ImmPublishingInterval	Publishing interval of the IMM in milliseconds
ImmProtocolMajorVersion	Supported major version of the protocol by IMM → this defines the structure of the published dataset
ImmProtocolMinorVersion	Supported minor version of the protocol by IMM → this defines the structure of the published dataset
RobotTransportProfileUri	Transport Profile used by the robot. The possible values are defined as URI of the transport protocols defined as PubSub transport Facet in OPC 10000-7.
RobotAddress	Network address of robot publisher
RobotPublisherId	PublisherId of the robot
RobotWriterGroupId	WriterGroupId of the robot's writer group which contains the OPC 40079 DataSets
RobotDataSetWriterId	DataSetWriterId of robot signals for the called interface
RobotPublishingInterval	Publishing interval of the robot in milliseconds
RobotProtocolMajorVersion	Supported major version of the protocol by robot → this defines the structure of the published dataset and informs the IMM if the received datasets are interpreted in the correct way
RobotProtocolMinorVersion	Supported minor version of the protocol by robot → this defines the structure of the published dataset and informs the IMM if the received datasets are interpreted in the correct way

For this version of OPC 40079 ("1.0")

– *ImmProtocolMajorVersion* and *RobotProtocolMajorVersion* shall be set to 1,

– *ImmProtocolMinorVersion* and *RobotProtocolMinorVersion* shall be set to 0.

– *ImmTransportProfileUri* and *RobotTransportProfileUri* shall be set to http://opcfoundation.org/UA-Profile/Transport/pubsub-udp-uadp ("PubSub UDP UADP" Profile)

Table 15 – StartPubSub Method AddressSpace Definiton

Attribute	Value				
BrowseName	StartPubSub				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
0:HasProperty	Variable	0:InputArguments	0:Argument[]	0:PropertyType	0:Mandatory
0:HasProperty	Variable	0:OutputArguments	0:Argument[]	0:PropertyType	0:Mandatory

The *Method* should return the status code BadMaxConnectionsReached, 0x80B70000 if a second IMM tries to start PubSub when there is already a first IMM connected.

The following examples show the use of the *Method*. An established session between IMM-Client and Robot-Server is assumed. The example also assumes that each participant already has a unique *PublisherId*.

Figure 8 shows an example for one IMM interacting with two robots.
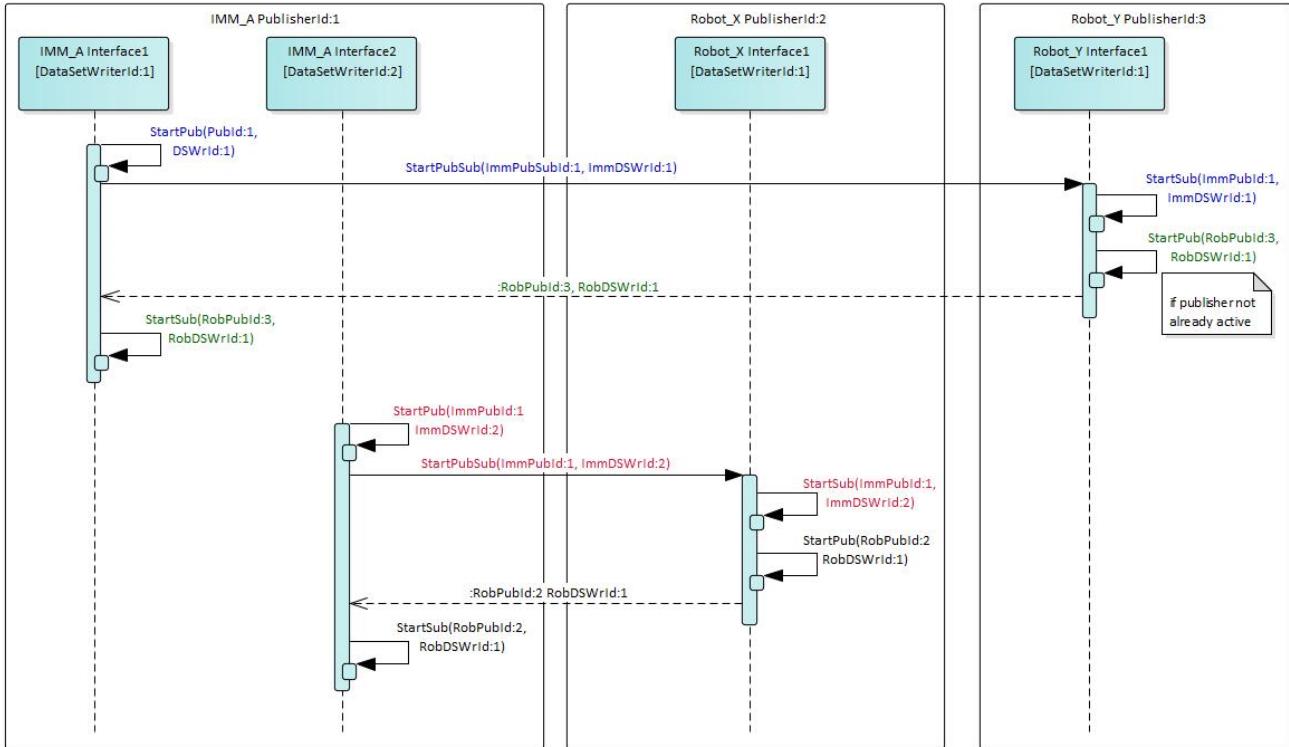
Figure 8 – Example for StartPubSub for 1 IMM with 2 robots

In the sequence shown, the robots use the *StartPubSub Method* as a trigger to start the publisher. As an alternative, the robot can also start its publisher independently earlier.

Figure 9 shows an example for two IMM interacting with one robot.
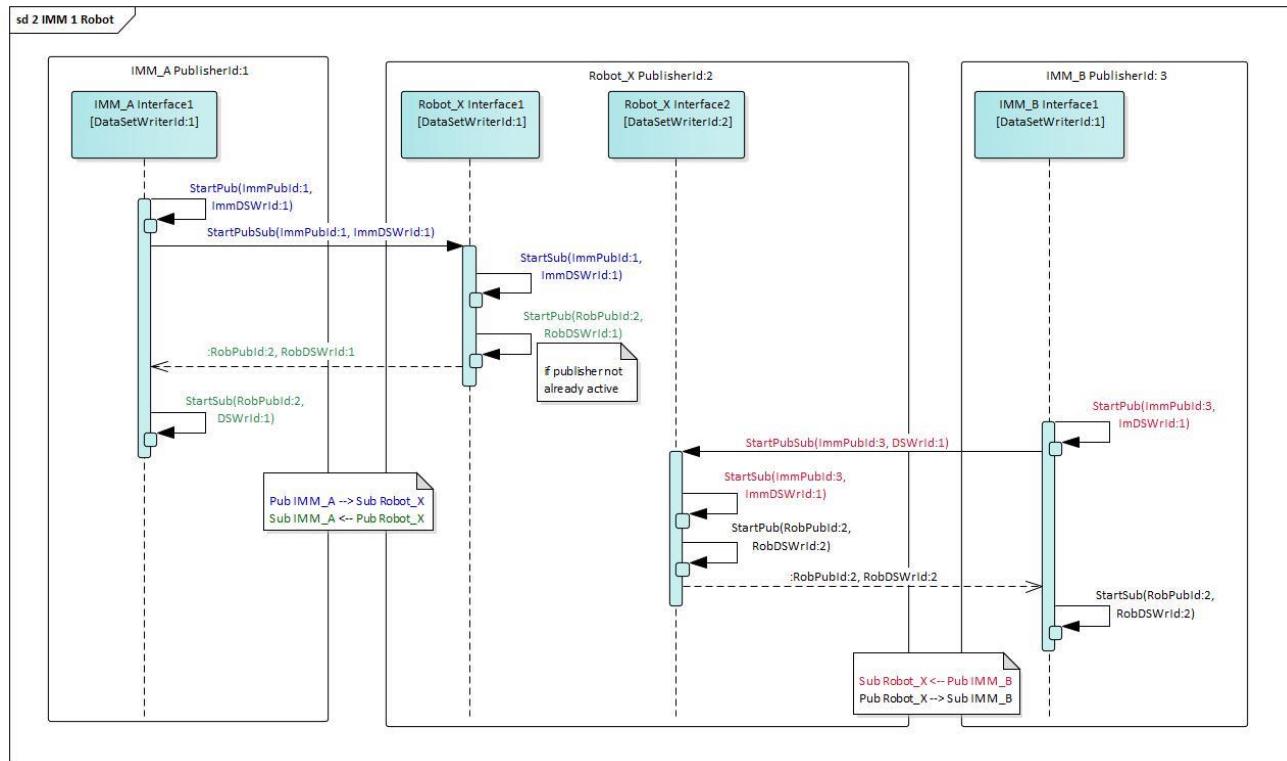
Figure 9 – Example for StartPubSub for 1 robot with 2 IMM

In the sequence shown, the robot uses the *StartPubSub Method* as a trigger to start the publisher.

As an alternative, the robot can also start its publisher independently earlier.

The IMM should request user acknowledge whenever the *RobotPublisherId* has changed since the last time the *Method* was called. This could mean that the entire Robot or the behaviour of the Robot has changed. The same applies when the *RobotDataSetWriterId* has changed – it could mean that a Robot with multiple instances of the interface has changed the instance(interface).

The Robot should request user acknowledge whenever the *ImmPublisherId* has changed since the last time the *Method* was called. This could mean that the entire IMM or the behaviour of the IMM has changed. The same applies when the *ImmDataSetWriterId* has changed – it could mean that an IMM with multiple instances of the interface has changed the instance(interface).

8.3   StopPubSub

The *Method StopPubSub* is used to terminate the PubSub connection between 1 IMM and 1 robot interface without creating alarms. This *Method* should only be called when IMM and robot are in a safe position. It is recommended, that after the call of the *Method* there are no movements of IMM or robot unless confirmed by an operator.

Signature

```
StopPubSub (
    [in]    0:UInt64        ImmPublisherId,
    [in]    0:UInt16        ImmDataSetWriterId,
    [in]    0:UInt64        RobotPublisherId,
    [in]    0:UInt16        RobotDataSetWriterId);
```

Table 16 – StopPubSub Method Arguments

Argument	Description
ImmPublisherId	*PublisherId* of the IMM used by the dataset that will not be published any longer
ImmDataSetWriterId	*DataSetWriterId* of IMM process values dataset that will not be published any longer
RobotPublisherId	*PublisherId* of the robot used by the dataset that shall stop publishing
RobotDataSetWriterId	*DataSetWriterId* of robot signals dataset that shall stop publishing

Table 17 – StopPubSub Method AddressSpace Definiton

Attribute	Value				
BrowseName	StopPubSub				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
0:HasProperty	Variable	0:InputArguments	0:Argument[]	0:PropertyType	0:Mandatory

The IMM shall keep publishing the position signals and subscribing (and considering) the enable signals until the robot has confirmed the received *Method* call by sending the response with (a good or bad) *StatusCode*.

NOTE: As the *DataSetWriteId* is unique within a *PublisherId*, it is not necessary to include all parameters used in *StartPubSub* also in *StopPubSub* to identify, which publisher is stopped.

8.4 RobotMessageId

The robot uses the *RobotMessageId* variable as a marker for the enable signals requested published for the IMM. As soon as the IMM returns the value back in the variable *RobotMessageId_confirmed* the robot can assume that the enable conditions are considered from the IMM. This means it is safe for the robot to enter the IMM if movements have been locked and the *RobotMessageId* was confirmed.

The *RobotMessageId* shall change at least each time any content of the published dataset is changed.

The *RobotMessageId* and *RobotMessageId_confirmed* shall be handled in the robot and IMM application controlling the movements. This provides the validation that both applications are still alive and work properly.

In a proper production cycle it should not happen that a movement of the IMM is stopped by removing an enable signal by the robot. If this situation should occur anyway, it should be taken into account that the IMM will increment RobotMessageId_confirmed as soon as it has considered the missing enable information and initiated the stop of the movement. However, the stopping process will continue for another time. As an invariant, the robot has to take this into account in this situation as well.

8.5 ReadyForOperationWithImm

The robot uses the *ReadyForOperationWithImm* Variable to indicate that it is able to operate with IMM, i.e. all necessary preparations (e.g. homing, preparing gripper, …) have been done.

If *ReadyForOperationWithImm= false*, the robot shall still fill all enable signals and the IMM still shall consider them. However, in most cases the robot will set all enable signals to allow all movements.

8.6 OperationWithImmRequested

This *Variable* indicates, that it is requested that the robot interacts with the IMM.

For starting the interaction, the *Variable* can be written to *true* by the IMM (remote start of robot), but also be set by the robot itself (e.g. by HMI or when loading program).

For stopping the interaction, the *Variable* can also be written to *false* by the IMM (e.g. when job is finished) or set by robot itself.

If the signal is written to *false* during the operation mode of the robot "operation with injection moulding machine", it is allowed that the robot continues its automatic cycle until the end position.

NOTE: This *Variable* is not included in the PubSub dataset of the robot.

8.7 OperationWithImmActive

The robot uses the *OperationWithImmActive Variable* to indicate that it is interacting with the IMM.

If *OperationWithImmActive* = *false*, the robot shall still fill all enable signals and the IMM still shall consider them. However, in most cases the robot will set all enable signals to allow all movements.

8.8   MouldInteractionsType

The *MouldInteractionsType* is a container for signals related to the moulds of the IMM (see 7.7). It is formally defined in Table 18.

Table 18 – MouldInteractionsType Definiton

Attribute	Value				
BrowseName	MouldInteractionsType				
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	<MouldInteraction_Nr>		MouldInteractionType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

For each instance of a mould in the IMM, a corresponsing instance for the enabling and tracking signals shall be created in the robot server. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", there shall be exactly one instance MouldInteraction_1.

8.9   MouldInteractionType

The *MouldInteractionType* is used to enable movements and positions of a mould. It includes the objects for enabling movements and positions of the included equipment (ejectors and cores). It is formally defined in Table 19.

Table 19 – MouldInteractionType Definiton

Attribute	Value				
BrowseName	MouldInteractionType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasComponent	Variable	MouldAreaFree	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Object	EnableMovablePlaten		EnableImmAxesType	O
0:HasComponent	Object	EnableEjectors		EnableEjectorsType	M
0:HasComponent	Object	EnableCores		EnableCoresType	M
0:HasComponent	Object	RobotPartTracking		RobotPartTrackingType	O
0:HasComponent	Object	RobotPartQuality		RobotPartQualityType	O

In the first version with the "OPC 40079 Robot Fixed DataSet Server Facet", the optional objects *EnableMovablePlaten, RobotPartTracking* and *RobotPartQuality* shall be used to achieve constant instances of the *MouldInteractionType*.

8.9.1   MouldAreaFree

NOTE: This signal is kept for compatibility with EUROMAP 67.

The signal is *true* when the robot is outside the mould area and does not interfere with mould opening and closing movements. The signal shall be *false* when the robot is inside the mould area – the protected area shall be defined in the robot systems. However, the IMM always has to consider the enable signals coming from the robot as defined in 8.4.3 if *RelevantForInteraction* is true.

For mould closing, the signal is combined with the signals included in the *EnableType* (see 8.9.3) used for the movable platen in the way described in table Table 20:

Table 20 – Combination of MouldAreaFree and Enable Signals for mould closing

MouldAreaFree	EnableToPosition1	EnableIntermediate Position2To1	Result
true	*true*	any	closing movement allowed
true	*false*	Not used or 0	no closing movement allowed
true	*false*	x > 0	movement until given intermediate position x allowed
false	*true* or *false*	Not used or 0	no closing movement allowed (*MouldAreaFree* overrides *EnableToPosition1*)
false	*true* or *false*	x > 0	movement until given intermediate position x allowed (*MouldAreaFree* overrides *EnableToPosition1* but is overridden by *EnableIntermediatePosition2To1*)

For mould opening, the allowed movement only depends on the enable signals even if *MouldAreaFree* is *false*.

8.9.2 EnableMovablePlaten

The *EnableMovablePlaten* releases the movements of the mould. The *EnableImmAxesType* is defined in 8.9.3.

8.9.3 EnableImmAxesType

The *EnableImmAxesType* is used to release movements and positions of one axes of the IMM and is formally defined in Table 21.

Table 21 – EnableType Definiton

Attribute	Value				
BrowseName	EnableImmAxesType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasProperty	Variable	RelevantForInteraction	0:Boolean	0:PropertyType	M, RW
0:HasComponent	Variable	EnableToPosition1	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	EnableToPosition2	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	EnableIntermediatePosition1To2	0:Byte	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	EnableIntermediatePosition2To1	0:Byte	0:BaseDataVariableType	O, RO

In the first version with the "OPC 40079 Robot Fixed DataSet Server Facet" also the optional variables shall be used to achieve constant instances of the *EnableImmAxesType*.

8.9.3.1 RelevantForInteraction

Indication if the axes is relevant for the IMM-robot-interaction. If true, the robot shall set the enabling signals according to the necessary interaction. If false, all enable signals shall be set to false / 0.

8.9.3.2 EnableToPosition1

The variable *EnableToPosition1* enables the complete movement in the direction towards to *InPosition1* (e.g. mould closing).

Attention: When the signal *EnableToPosition1* is set, all movements towards *InPosition1* are allowed regardless of the content of *EnableIntermediatePositions2to1*.

See Table 5 for a more detailed description of *InPosition1* and *InPosition2.*

NOTE: During compression moulding the mould needs to move a small amount (some mm) from the closed position and back. This movement shall be still allowed even when *EnableToPosition1* is set to false.

8.9.3.3 EnableToPosition2

The variable *EnableToPosition2* enables the complete movement in the direction towards to *InPosition2* (e.g. mould opening).

Attention: When the signal *EnableToPosition2* is set, all movements towards *InPosition2* are allowed regardless of the content of *EnableIntermediatePositions1to2*.

8.9.3.4 EnableIntermediatePosition1To2

The *EnableIntermediatePosition1To2* is used to move axes and stop axes in defined intermediate positions e.g. while mould opening. The *EnableIntermediatePosition1To2* is only considered from the IMM if the *EnableToPosition2* is *false* at the same time.

Example:

If *EnableIntermediatePosition1To2* is set to 1 and *EnableToPosition2* is set to *false* the IMM shall stop the movement from *InPosition1* towards *InPosition2* at the intermediate position 1 of this direction ending up with a value of 1 in the variable *IntermediatePosition1To2*.

See 7.8.3.2 for more details of the intermediate signal definition.

8.9.3.5 EnableIntermediatePosition2To1

The *EnableIntermediatePosition2To1* is used to move axes and stop axes in defined intermediate positions e.g. while mould closing. The *EnableIntermediatePosition2To1* is only considered from the IMM if the *EnableToPosition1* is *false* at the same time.

Example: If *EnableIntermediatePosition2To1* is set to 1 and *EnableToPosition1* is set to *false* the IMM shall stop the movement from *InPosition2* towards *InPosition1* at the intermediate position 1 of this direction ending up with a value of 1 in the variable *IntermediatePosition2To1.*

8.9.4 EnableEjectorsType

The *EnableEjectorsType* is a container for the enabling signals of ejectors of the IMM (see 7.8.4). It is formally defined in Table 22.

Table 22 – EnableEjectorsType Definiton

Attribute	Value				
BrowseName	EnableEjectorsType				
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	<EnableEjector_Nr>		EnableImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

For each instance of an ejector in the IMM, a corresponding instance for the enabling signals shall be created in the robot server. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", there shall be exactly two instances EnableEjector_1 and EnableEjector_2.

8.9.5 EnableCoresType

The *EnableEjectorsType* is a container for the enabling signals of cores of the IMM (see 7.8.5). It is formally defined in Table 23.

Table 23 – EnableCoresType Definiton

Attribute	Value				
BrowseName	EnableCoresType				
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	<EnableCore_Nr>		EnableImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

For each instance of a core in the IMM, a corresponding instance for the enabling signals shall be created in the robot server. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", there shall be exactly ten instances EnableCore_1, …, EnableCore_10.

8.9.6 RobotPartTrackingType

The *RobotPartTrackingType* contains variables triggering the insertion or removal of inserts, pre-moulded parts or finished parts by the robot.

Whenever the robot sets an inserted or removed variable to *true* in the *RobotPartTrackingType* it should get the feedback in the appropriate availability status variable of the IMM (see *ImmPartTrackingType* in 7.8.6). After the IMM has adjusted the part status the robot should set the inserted or removed variable back to *false*.

The raise of *FinishedPartProduced* is the trigger for the robot that the finished part should be removed.

The raise of *PreMouldedPartProduced* is the trigger for the robot that the pre-moulded part should be removed or replaced.

In the first version with the "OPC 40079 Robot Fixed DataSet Server Facet" the *RobotPartTracking* instance shall be used to achieve constant instances of the *MouldInteractionType*.

The *RobotPartTrackingType* is formally defined in Table 24.

Table 24 – RobotPartTrackingType Definiton

Attribute	Value				
BrowseName	RobotPartTrackingType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasProperty	Variable	UsedCavities	0:Boolean[]	0:PropertyType	M, RW
0:HasComponent	Variable	InsertPartInserted	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	InsertPartRemoved	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PreMouldedPartInserted	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PreMouldedPartRemoved	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	FinishedPartRemoved	0:Boolean	0:BaseDataVariableType	M, RO
Conformance Units					
OPC 40079 Robot Part Tracking					

UsedCavities: Information which of the existing cavities are used in the current production. This can be set by the IMM to tell the robot where parts shall be inserted and/or removed. For the first version with the "OPC 40079 Robot Fixed DataSet Server Facet", the array size is fixed to 256.

InsertPartInserted: The robot has inserted insert part(s) in all used cavities

InsertPartRemoved: The robot has removed insert part(s) from all used cavities

PreMouldedPartInserted: The robot has inserted pre-moulded part(s) in all used cavities

PreMouldedPartRemoved: The robot has removed pre-moulded part(s) from all used cavities

FinishedPartRemoved: The robot has removed finished part(s) from all used cavities. The signal stays *true* until the IMM has confirmed it by setting *FinishedPartProducedAvailable* to *false*.

8.9.7 RobotPartQualityType

The *RobotPartQualityType* provides summary information about the last finished cycle. An event for more detailed information is provided.

The robot shall increase the *ReferredCycle* variable as soon as quality information expressed by *CycleQuality* is updated. This can happen before the quality information of the IMM is available.

Additionally, as soon as detailed quality information to finished parts are available, the robot shall raise the *RobotToImmCycleInformationEvent* with the cavity quality details.

The *RobotPartQualityType* is formally defined in Table 25.

Table 25 – RobotPartQualityType Definiton

Attribute	Value				
BrowseName	RobotPartQualityType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
0:HasProperty	Variable	ReferredCycle	0:UInt32	0:PropertyType	M, RO
0:HasComponent	Variable	CycleQuality	3:CycleQualityEnumeration	0:BaseDataVariableType	M, RO
0:HasComponent	Method	ImmToRobotDetailedInformation			O
0:GeneratesEvent	ObjectType	RobotToImmCycle InformationEventType			
Conformance Units					
OPC 40079 Robot Part Quality					

NOTE: *ReferredCycle* and *CycleQuality* are part of the PubSub communication.

8.9.7.1 ReferredCycle

Cycle to which the quality data expressed by *CycleQuality* have been determined by the robot. This number refers to the corresponding *ReferredCycle* provided by the IMM (see 7.6).

8.9.7.2 CycleQuality

Summarised information on the quality of the whole cycle as determined by the robot. The *CycleQualityEnumeration* is defined in OPC 40083.

The robot provides detailed information about the cycle including quality information for each cavity, when it raises the RobotToImmCycleInformationEvent (see 8.9.7.4)

8.9.7.3 ImmToRobotDetailedInformation

The machine shall call the *ImmToRobotDetailedInformation* method as soon as detailed quality information to completely finished parts are available.

Signature

```
ImmToRobotDetailedInformation (
    [in]    0:UInt32                             ReferredCycle,
    [in]    3:CavityCycleQualityEnumeration[]    CavityCycleQuality,
    [in]    0:String[]                           PartId,
    [in]    0:String                             CurrentLotName);
```

All input variables (except *ReferredCycle*) are optional so that they can be NULL or empty.

NOTE: The call of the method ImmToRobotDetailedInformation is optional.

Table 26 – ImmToRobotDetailedQualityInformation Method Arguments

Argument	Description
ReferredCycle	Number of the cycle for which detailed quality information is provided
CavityCycleQuality	Information for each cavity of the quality of the cycle if the injection moulding machine is able to determine this. The *CavityCycleQualityEnumeration* is defined in OPC 40083. Array length = number of cavities. → For the first version with the "OPC 40079 Robot Fixed DataSet Server Facet", the array length is fixed to 256
PartId	The PartId Property is an array with one entry for each cavity that represent the Ids of the parts produced in the cycle. NOTE: The Id(s) may be generated in the machine or coming from outside (e.g. from MES or labelling machine).
CurrentLotName	Name of the current production lot

Table 27 – ImmToRobotDetailedInformation Method AddressSpace Definiton

Attribute	Value				
BrowseName	ImmToRobotDetailedInformation				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
0:HasProperty	Variable	0:InputArguments	0:Argument[]	0:PropertyType	0:Mandatory

8.9.7.4   RobotToImmCycleInformationEventType

As soon as detailed quality information to finished parts are available, the robot shall raise the *RobotToImmCycleInformationEvent* to provide detailed part quality and/or part identification information determined by the robot.

The machine could aggregate this information with their part quality and identification information for the same cycle and – in case of an existing OPC 40077 connection – provides the total information for the MES.

Table 28 – RobotToImmCycleInformationEventType Definiton

Attribute	Value				
BrowseName	RobotToImmCycleInformationEventType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseEventType* defined in OPC 10000-5					
0:HasProperty	Variable	ReferredCycle	0:UInt32	PropertyType	M, RO
0:HasProperty	Variable	CavityCycleQuality	3:CavityCycleQualityEnumeration[]	PropertyType	O, RO
0:HasProperty	Variable	PartId	0:String[]	PropertyType	O, RO
0:HasProperty	Variable	BoxId	0:String	PropertyType	O, RO

ReferredCycle: Number of the cycle for which detailed quality information is given by the robot.

CavityCycleQuality: Information for each cavity of the quality of the cycle if the robot is able to determine this. The *CavityCycleQualityEnumeration* is defined in OPC 40083. Array length = number of cavities. → For the first version with the "OPC 40079 Robot Fixed DataSet Server Facet", the array length is fixed to 256.

PartId: This Property is an array with one entry for each cavity that represent the Ids of the parts produced in the cycle.

   NOTE: The Id(s) may be generated in the machine or coming from outside (e.g. from MES or labelling machine).

BoxId: Id of the current box, where the produced parts have been put in.

8.10   EnableAdditionalAxesType

The *EnableAdditionalAxesType* is a container for the enabling signals of additional axes of the IMM (see 7.9). It is formally defined in Table 29.

Table 29 – EnableAdditionalAxesType Definiton

Attribute	Value				
BrowseName	EnableAdditionalAxesType				
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	<EnableAdditionalAxes_Nr>		EnableImmAxesType	OP
0:GeneratesEvent	ObjectType	0:GeneralModelChangeEventType			

For each instance of an additional axes in the IMM, a corresponsing instance for the enabling signals shall be created in the robot server. For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet", there shall be exactly one instance EnableAdditionalAxes_1.

8.11 ProductionDatasetManagement

The "OPC 40083 OPC UA for Plastics and Rubber Machinery – General Type Definitions" contains the type definitions for the production dataset management. The robot can provide an instance of the *ProductionDatasetManagementType* in the root object.

The IMM is supposed to be the central manager of the production datasets of the entire production cell. These production data sets of several components of the production cell are thought to be BLOB files (binary large objects) and shall never be changed outside the provider of the data.

This means the IMM wraps all production datasets including the own one into one entire BLOB ready to be transferred over OPCUA 40077 to a MES or onto an external file system e.g. USB data storage. If there is a MES system for a production cell the IMM is intended to be the gateway and the manager of production datasets and job information.

When the IMM gets a production request together with the original BLOB the IMM unwraps the received BLOB into the several production datasets (which are BLOBs again) and transfers them unchanged back to the various equipment of the production cell (e.g. robot, …). The *ProductionDatasetManagement* Object from OPC 40083 is used for managing the transfer of these production datasets to the robot.

The IMM shall use the instance of the *ImmToRobotType* e.g. ImmToRobot_1.

Example

The IMM could pack the production data sets of two robots and several tempering devices in a packed container – each contained BLOB can recursively contain data of connected subcomponents…

- IMM_20200306 – Product A – Cell11.7z   … BLOB production dataset entire cell
  - IMMToRobot_1   … Folder for 1st interface
    - ENGEL_Robot.dat   … robot 1 BLOB-File
      -   … subcomponents could be inside …
  - IMMToRobot_ 2   … Folder for 2nd interface
    - KUKA_Robot.bin   … robot 2 BLOB-File
  - OPCUA40082.1_Interface_1   … Folder for the 1st tempering device
    - HBTHERM_Data.dat   … tempering device 1 BLOB-File
  - OPCUA40082.1_Interface_2   … Folder for the 2nd tempering device
    - GWK_Data.dat   … tempering device 2 BLOB-File
  - OPCUA40082.1_Interface_3   … Folder for the 3rd tempering device
    - GWK_Data.dat   … tempering device 3 BLOB-File

The IMM can collect more information regarding the robot dataset calling the *Method GetProductionDatasetList* to obtain a *ProductionDatasetInformationType*.

It is recommended to use the *MachineIdentification AddIn* from "OPC 40001-1 OPC UA for Machinery, Part1: Basic Building Blocks UA for machinery" and to provide this information in the *ProductionDatasetInformationType* returned on *Method* calls of the *GetProductionDatasetList* Method.

Filling ProductionDatasetInformationType

The *ProductionDatasetInformationType* is defined in OPC 40083. In its description, references to *MachineInformation* and *MachineConfiguration* are made. For OPC 40079, when the robot provides the *ProductionDatasetInformationType* structure the fields *Manufacturer*, *SerialNumber*, *Model* should match the entries with same name in the *Identification Object* in accordance with OPC UA for machinery. The *UserMachineName* should match the *CompontentName*.

8.12 User Login

This ObjectType allows to automatically transfer the login information of the user logged in on the IMM to the robot so that there no separate login is necessary.

The Robot as server shows the user who is currently logged in at the robot and provides *Method* s to pass the user currently logged in to the IMM to the robot. The Methods for the remote logging in/out shall be called automatically by the IMM, when a user logs in/out there. The robot can decide whether to accept the login of the IMM user via OPC UA or to deny the *Method* with an error code, e.g. if a user is already logged in at the robot itself or the IMM is not authorized.

Table 30 – UserLoginType Definiton

Attribute	Value				
BrowseName	UserLoginType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:*BaseObjectType* defined in OPC 10000-5					
HasComponent	Object	ActualUser		3:UserType	M
HasComponent	Method	LoginImmUser			M
HasComponent	Method	LogoutImmUser			M
Conformance Units					
OPC 400779 Robot User Login					

8.12.1 ActualUser

The *ActualUser Object* holds always the actual active user on the robot system (HMI). If a remote login of an IMM user via the *Method LoginImmUser* is successfully, the user should appear in this variable. If the IMM user is logged out via the *Method LogoutImmUser,* the *IsPresent* property of the *ActualUser* becomes *false*.

8.12.2 LoginImmUser

When the *Method LoginImmUser* from the robot is called by the IMM, the requested user can be logged in to the robot system. If a user is already logged in to the robot or the passed arguments cannot be interpreted or supported, the server can deny the *Method* and *ActualUser* remains unchanged.

Signature

```
LoginImmUser (
    [in]  0:String              Id,
    [in]  0:String              Name,
    [in]  0:String              CardUid,
    [in]  0:String              UserLevel,
    [in]  0:String              UserRole,
    [in]  0:LocaleId            Language);
```

Table 31 – LoginImmUser Method Arguments

Argument	Description
Id	The *Id* of the user according to 3:*UserType*
Name	The *Name* of the user according to 3:*UserType*
CardUid	The *CardUid* of the user according to 3:*UserType*
UserLevel	The *UserLevel* of the user according to 3:*UserType*
UserRole	The *UserRole* of the user according to 3:*UserType*
Language	The *Language* of the user according to 3:*UserType*

All arguments may contain empty Strings if not supported.

Table 32 – LoginImmUser Method AddressSpace Definiton

Attribute	Value				
BrowseName	LoginImmUser				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
0:HasProperty	Variable	0:InputArguments	0:Argument[]	0:PropertyType	0:Mandatory

8.12.3   LogoutImmUser

The IMM shall report to the robot via the *Method LogoutImmUser* when a user is logged out. The *IsPresent* property of the ActualUser then becomes false again.

Signature

```
LogoutImmUser();
```

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

Table 33 – LogoutImmUser Method AddressSpace Definiton

Attribute	Value				
BrowseName	LogoutImmUser				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**

9 PubSub Communication

9.1 General

For the first version with the "OPC 40079 IMM Fixed DataSet Server Facet" and the "OPC 40079 Robot Fixed DataSet Server Facet" the following applies:

– It is needed to publish one data set for each connection IMM/mould to a robot.

– The structure of the datasets is always constant.

– For multiple connections, multiple datasets are published and subscribed.

– The Publisher UADP Periodic Fixed Layout Facet is used which means (see OPC 10000-14, A.2):

  – Fields within the payload use *RawData Field Encoding*

  – Configuration of UADP NetworkMessage header layout accoring to Table 34:

Table 34 – UADP NetworkMessage header layout

Name	Type	Restrictions
UADPVersion	Bit[0-3]	The version shall be 1
UADPFlags	Bit[4-7]	Bit 4: *PublisherId* enabled Bit 5: *GroupHeader* enabled Bit 6: *PayloadHeader* disabled Bit 7: *ExtendedFlags1* enabled
ExtendedFlags1	Byte	Bit range 0-2: Shall be 011 for *PublisherId* is of *DataType UInt64* Bit 3: *DataSetClassId* disabled Bit 4: *Security* disabled Bit 5: *Timestamp* disabled Bit 6: *PicoSeconds* disabled Bit 7: *ExtendedFlags2* disabled
PublisherId	UInt64	Configured value for the PubSubConnection. The datatype shall be *UInt64*.
GroupHeader		
GroupFlags	Byte	Bit 0: *WriterGroupId* enabled Bit 1: *GroupVersion* enabled Bit 2: *NetworkMessageNumber* enabled Bit 3: *SequenceNumber* enabled Bits 4-6: 0 Bit 7: disabled
WriterGroupId	UInt16	Configured value for the WriterGroup.
GroupVersion	VersionTime	**Shall be set to 0 (no version information is available)**
NetworkMessageNumber	UInt16	**Shall be set to 1**
SequenceNumber	UInt16	Sequence number for each new *NetworkMessage* as defined in OPC 10000-14, 7.2.2.3.

NOTE: Although for part fixed *DataSets* with fixed *DataSetClassId* are used, they are not put into the *NetworkMessage* header. If the *DataSetClassId* is put in the *NetworkMessage* header, then only DataSets of that type may be contained in the *NetworkMessage*. The feature is intended for the special use case that a subscriber processes all messages in a network of a certain type, e.g. diagnostic messages. This is not intended for cyclic point-to-point communication like in OPC 40079.

9.2 IMM side

9.2.1 PublisherId

The *PublisherId* is a unique identifier for a Publisher within a Message Oriented Middleware. It is included in sent messages on the network for purposes of identification or filtering.

9.2.2 Configuration of Publisher

The *ImmProcessValues_Interface_1* dataset is holding all process values including position signals, limit position flags, part tracking as well as the variable *RobotMessageId_confirmed* of part 1.

If multiple connections are provided the instance names shall be *ImmProcessValues_Interface_1, ImmProcessValues_Interface_2, …*

The *PublishedDataSets* of part 1 (*ImmProcessValues_Interface_1*, …) and the datasets of future parts are grouped in the folder *OPC40079_ImmPublishedDataSets*.

It is recommended to have a separate *WriterGroup* for each connected robot (see Figure 10).
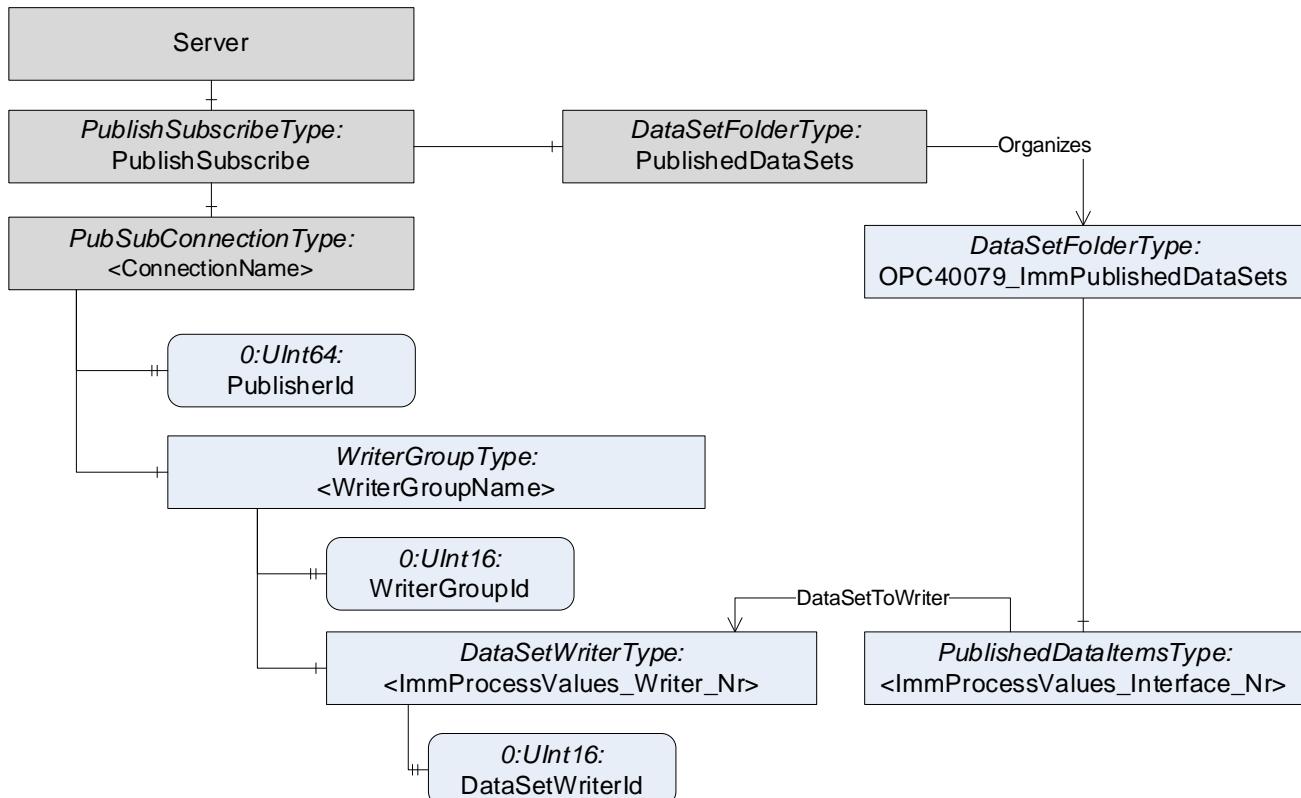
Figure 10 – PublishSubscribe for the IMM

As it is optional for the IMM to provide an OPC UA Server and an address space, the necessary parameters for the PubSub connection (PublisherId, WriterGroupId, DataSetWriterId) are put into the Method *StartPubSub* (see 8.2).

The publishing interval (target) shall be maximum 100 ms. It is recommended to use an interval between 10 and 20 ms.

9.2.3   PublishedDataSet with IMM Process Values

The first version with the "OPC 40079 IMM Fixed DataSet Server Facet" uses a constant publishing data set on the machine side for all interfaces. The *DataSetClassId* of the fixed structure is {f0ade254-0008-4960-bbe6-eaaf6308ada2} (DataType Guid).

```
Name:              "<ImmProcessValues_Interface_Nr>"
DataSetClassId:    {f0ade254-0008-4960-bbe6-eaaf6308ada2}

Fields:[1] Name=RobotMessageId_confirmed, Type=UInt32

     [2] Name=PrepareForOperationWithImm, Type=Boolean
     [3] Name=ImmOperationActive, Type=Boolean
     [4] Name=EndOfOrder, Type=Boolean
     [5] Name=CycleCounter, Type=UInt32
```

```
[6] Name=Mould_1.ImmPartTracking.InsertPartAvailable, Type=Boolean
[7] Name=Mould_1.ImmPartTracking.PreMouldedPartProduced, Type=Boolean
[8] Name=Mould_1.ImmPartTracking.PreMouldedInsertPartAvailable, Type=Boolean
[9] Name=Mould_1.ImmPartTracking.FinishedPartProduced, Type=Boolean

[10] Name=Mould_1.ImmPartQuality.ReferredCycle, Type=UInt32
[11] Name=Mould_1.ImmPartQuality.CycleQuality, Type=Enumeration
[12] Name= Mould_1.ImmPartQuality.DetailedInformationFollows, Type=Boolean

[13] Name=Mould_1.MovablePlaten.InPosition1, Type=Boolean
[14] Name=Mould_1.MovablePlaten.InPosition2, Type=Boolean
[15] Name=Mould_1.MovablePlaten.IntermediatePosition1To2, Type=Byte
[16] Name=Mould_1.MovablePlaten.IntermediatePosition2To1, Type=Byte
[17] Name=Mould_1.MovablePlaten.FloatPosition, Type=Float
[18] Name=Mould_1.MovablePlaten.PositionAdjusted, Type=Boolean
[19] Name=Mould_1.MovablePlaten.Movement, Type=Enumeration → Int32

[20] Name=Mould_1.Ejector_1.InPosition1, Type=Boolean
[21] Name=Mould_1.Ejector_1.InPosition2, Type=Boolean
[22] Name=Mould_1.Ejector_1.IntermediatePosition1To2, Type=Byte
[23] Name=Mould_1.Ejector_1.IntermediatePosition2To1, Type=Byte
[24] Name=Mould_1.Ejector_1.FloatPosition, Type=Float
[25] Name=Mould_1.Ejector_1.PositionAdjusted, Type=Boolean
[26] Name=Mould_1.Ejector_1.Movement, Type=Enumeration → Int32

[27] Name=Mould_1.Ejector_2.InPosition1, Type=Boolean
 … // same for Ejector_2 as for Ejector_1

[34] Name=Mould_1.Core_1.InPosition1, Type=Boolean
[35] Name=Mould_1.Core_1.InPosition2, Type=Boolean
[36] Name=Mould_1.Core_1.IntermediatePosition1To2, Type=Byte
[37] Name=Mould_1.Core_1.IntermediatePosition2To1, Type=Byte
[38] Name=Mould_1.Core_1.Movement, Type=Enumeration → Int32

[39] Name=Mould_1.Core_2.InPosition1, Type=Boolean
 … // same for Core_2 to Core_10 as for Core_1

[84] Name=AdditionalAxes_1.InPosition1, Type=Boolean
[85] Name=AdditionalAxes_1.InPosition2, Type=Boolean
[86] Name=AdditionalAxes_1.IntermediatePosition1To2, Type=Byte
[87] Name=AdditionalAxes_1.IntermediatePosition2To1, Type=Byte
[88] Name=AdditionalAxes_1.FloatPosition, Type=Float
[89] Name=AdditionalAxes_1.PositionAdjusted, Type=Boolean
[90] Name=AdditionalAxes_1.Movement, Type=Enumeration → Int32
```

9.3 Robot side

9.3.1 PublisherId

The *PublisherId* is a unique identifier for a Publisher within a Message Oriented Middleware. It is included in sent messages on the network for purposes of identification or filtering.

9.3.2 Configuration of Publisher

The robot publishes the *RobotSignals_Interface_1* dataset holding the enable and part tracking as well as the *RobotMessageId* for the first connection.

If multiple connections are provided the instance names shall be *RobotSignals_Interface_1, RobotSignals_Interface_2, …*

The *PublishedDataSets* instance of part 1 *RobotSignals_Interface_1*, … and datasets of following parts are grouped in the folder *OPC40079_RobotPublishedDataSets*.

It is recommended to have a separate *WriterGroup* for each connected IMM (see Figure 11).
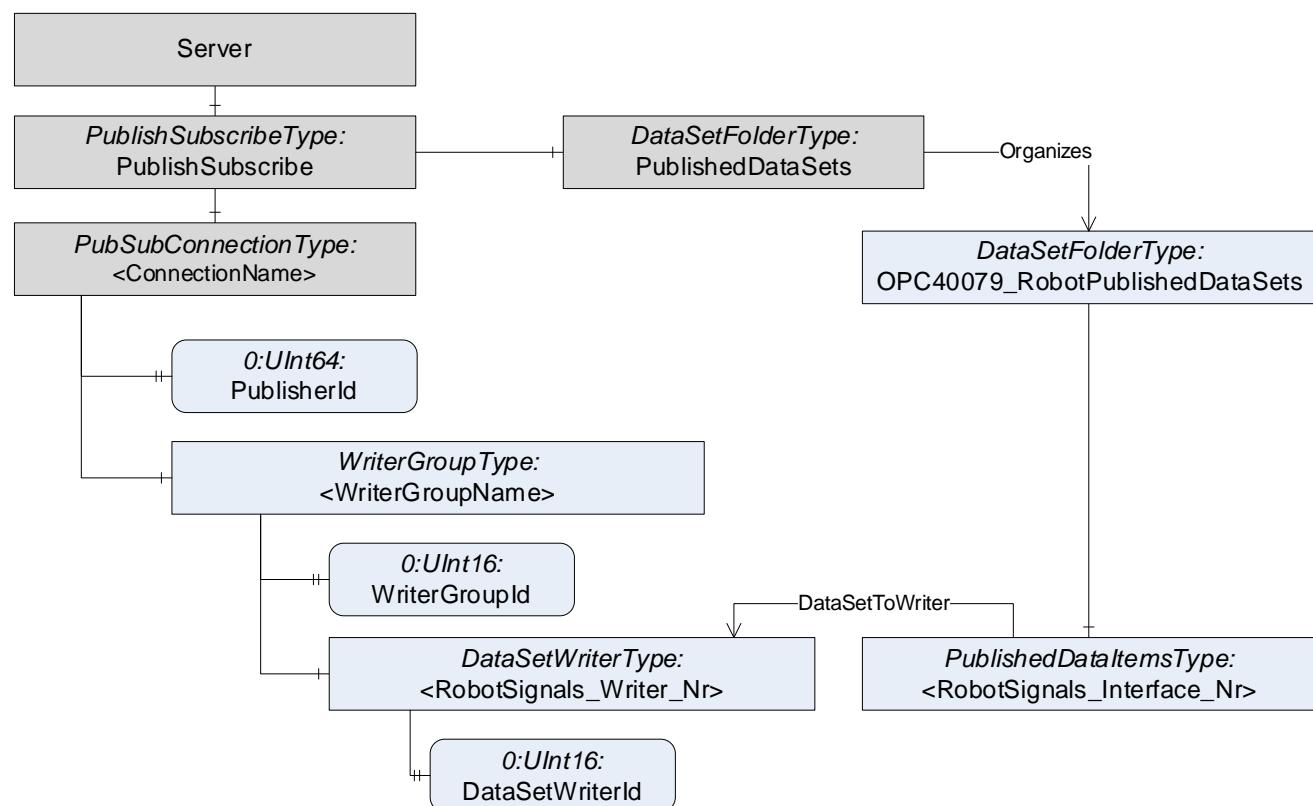
Figure 11 – PublishSubscribe for the robot

The publishing interval (target) shall be maximum 100 ms. It is recommended to use an interval between 10 and 20 ms.

9.3.3 PublishedDataSet with Robot Signals

The first version with the "OPC 40079 Robot Fixed DataSet Server Facet" uses one constant publishing dataset on the robot side for all interfaces.

The *DataSetClassId* of the fixed structure is {830f4c53-2b6e-40fe-84b5-78abd16f08ed} (DataType Guid).

```
Name:               "<RobotSignals_Interface_Nr>"
DataSetClassId:     {830f4c53-2b6e-40fe-84b5-78abd16f08ed}

Fields: [1] Name=RobotMessageId, Type=UInt32

        [2] Name=ReadyForOperationWithImm, Type=Boolean
        [3] Name=OperationWithImmActive, Type=Boolean
        [4] Name=OperationWithImmRequested, Type=Boolean

        [5] Name=MouldInteraction_1.MouldAreaFree, Type=Boolean

        [6] Name=MouldInteraction_1.RobotPartTracking.InsertPartInserted, Type=Boolean
        [7] Name=MouldInteraction_1.RobotPartTracking.InsertPartRemoved, Type=Boolean
        [8] Name=MouldInteraction_1.RobotPartTracking.PremouldedPartInserted, Type=Boolean
        [9] Name=MouldInteraction_1.RobotPartTracking.PremouldedPartRemoved, Type=Boolean
        [10] Name=MouldInteraction_1.RobotPartTracking.FinishedPartRemoved, Type=Boolean

        [11] Name=MouldInteraction_1.RobotPartQuality.ReferredCycle, Type=UInt32
        [12] Name=MouldInteraction_1.RobotPartQuality.CycleQuality, Type=Enumeration → Int32

        [13] Name=MouldInteraction_1.EnableMovablePlaten.RelevantForInteraction, Type=Boolean
        [14] Name=MouldInteraction_1.EnableMovablePlaten.EnableToPosition1, Type=Boolean
        [15] Name=MouldInteraction_1.EnableMovablePlaten.EnableToPosition2, Type=Boolean
        [16] Name=MouldInteraction_1.EnableMovablePlaten.EnablerIntermediatePosition1To2, Type=Byte
        [17] Name=MouldInteraction_1.EnableMovablePlaten.EnableIntermediatePosition2To1, Type=Byte

        [18] Name=MouldInteraction_1.EnableEjector_1.RelevantForInteraction, Type=Boolean
         …      // same as for EnableMovablePlaten

        [23] Name=MouldInteraction_1.EnableEjector_2.RelevantForInteraction, Type=Boolean
         …

        [28] Name=MouldInteraction_1.EnableCore_1.RelevantForInteraction, Type=Boolean
         …
        [73] Name=MouldInteraction_1.EnableCore_10.RelevantForInteraction, Type=Boolean
         …
        [78] Name=EnableAdditionalAxes_1.RelevantForInteraction, Type=Boolean
         …
        [82] Name=EnableAdditionalAxes_1.EnableIntermediatePosition2To1, Type=Boolean
```

10 Profiles and ConformanceUnits

10.1 Conformance Units

This chapter defines the corresponding *Conformance Units* for the OPC UA Information Model for OPC 40079.

Table 35 – Conformance Units for OPC 40079 – IMM side

Category	Title	Description
Server	OPC 40079 ImmToRobot Entry Point	Support of *ImmToRobotType* with all mandatory children as entry point. The instance(s) are located under an *Object*, which represents the IMM and which is directly located under the *Machines Object* and has an *Object Identification* as defined in OPC 40001-1.

Server	OPC 40079 IMM Fixed Position Signals	Support of the following instances in *ImmToRobotType*:
		- one mould *Mould_1*
		  - two ejectors *Ejector_1* and *Ejector_2* with support of all optional children of *AxesType*
		  - ten cores *Core_1 … Core_10* with support of *InPosition1*, *InPosition2*, *IntermediatePosition1To2*, *IntermediatePosition2To1* and *Movement* of *AxesType*
		- one additional axes *AdditionalAxes_1* with support of all optional of *ImmAxesType*

Server	OPC 40079 IMM Part Tracking	Support of *ImmPartTrackingType* and provision of the *ImmPartTracking* instance in the *MouldType*
Server	OPC 40079 IMM Part Quality	Support of *ImmPartQualityType* and provision of the *ImmPartQuality* instance in the *MouldType*
Client	OPC 40079 IMM Start and Stop PubSub	IMM is able to call methods StartPubSub and StopPubSub
Publisher	OPC 40079 IMM Publisher UADP Periodic Fixed Layout Configuration	The IMM has a publisher configured in accordance with clause 9 of OPC 40079 using UADP Periodic Fixed Layout Facet.
Publisher	OPC 40079 IMM Publish Fixed DataSet	Support of publishing the fixed *DataSet* with *DataSetClassId* {f0ade254-0008-4960-bbe6-eaaf6308ada2} (see 9.2.3 of OPC 40079)
Subscriber	OPC 40079 IMM Subscribe Fixed DataSet	Support of subscribing the fixed *DataSet* from the robot with *DataSetClassId* {830f4c53-2b6e-40fe-84b5-78abd16f08ed} (see 9.3.3 of OPC 40079) and behaves accordingly

Table 36 – Conformance Units for OPC 40079 – robot side

Category	Title	Description
Server	OPC 40079 RobotToImm Entry Point	Support of *RobotToImmType* with all mandatory children as entry point. The instance(s) are located under an *Object*, which represents the robot and which is directly located under the *Machines Object* and has an *Object Identification* as defined in OPC 40001-1.

Server	OPC 40079 Robot Fixed Enable Signals	Support of the following instances in *RobotToImmType*:
		- one instance *MouldInteraction_1*
		  - use of *EnableMovablePlaten*
		  - two ejectors *EnableEjector_1* and *EnableEjector_2* with support of all optional children of *EnableType*
		  - ten cores Core_1 … Core_10 support of *InPosition1*, *InPosition2*, *IntermediatePosition1To2*, *IntermediatePosition2To1* and *Movement* of *AxesType*
		- one additional axes *EnableAdditionalAxes_1* with support of all optional of *EnableImmAxesType*

Server	OPC 40079 Robot Part Tracking	Support of *RobotPartTrackingType* and provision of the *RobotPartTracking* instance in the *MouldInteractionType*
Server	OPC 40079 Robot Part Quality	Support of *RobotPartQualityType* and provision of the *RobotPartQuality* instance in the *MouldInteractionType*
Server	OPC 400779 Robot ProductionDatasetManagement	Support the ProductionDatasetManagement Object for the management and transfer of production datasets between IMM and robot is provided
Server	OPC 400779 Robot User Login	Support the ProductionDatasetManagement Object for the management and transfer of production datasets between IMM and robot is provided
Publisher	OPC 40079 Robot Publisher UADP Periodic Fixed Layout Configuration	The robot has a publisher configured in accordance with clause 9 of OPC 40079 using UADP Periodic Fixed Layout Facet.
Publisher	OPC 40079 Robot Publish Fixed DataSet	Support of publishing the fixed *DataSet* with *DataSetClassId* {830f4c53-2b6e-40fe-84b5-78abd16f08ed} (see 9.3.3 of OPC 40079)
Subscriber	OPC 40079 Robot Subscribe Fixed DataSet	Support of subscribing the fixed *DataSet* from the IMM with *DataSetClassId* {f0ade254-0008-4960-bbe6-eaaf6308ada2} (see 9.2.3 of OPC 40079) and behaves accordingly

10.2 Profiles

10.2.1 Profile list

Table 37 lists all Profiles defined in this document and defines their URIs.

Table 37 – Profile URIs for OPC 40079

Profile	URI
OPC 40079 IMM Fixed DataSet Profile	http://opcfoundation.org/UA-Profile/PlasticsRubber/ImmToRobot/ImmFixedDataSet
OPC 40079 Robot Fixed DataSet Profile	http://opcfoundation.org/UA-Profile/PlasticsRubber/ImmToRobot/RobotFixedDataSet

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

10.2.2 OPC 40079 IMM Fixed DataSet Profile

This is the profile necessary on the IMM to establish an OPC 40079 connection with fixed DataSet in accordance with the first version of this specification.

Table 38 – OPC 40079 IMM Fixed DataSet Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0:Embedded Server 2017 (defined in OPC 10000-7)	O
Profile	0:Publisher UADP Periodic Fixed Layout Facet (defined in OPC UA Part 7)	M
ImmToRobot	OPC 40079 ImmToRobot Entry Point	O
Machinery	4:Machinery Machine Identification Server Facet	O
ImmToRobot	OPC 40079 IMM Fixed Position Signals	O
ImmToRobot	OPC 40079 IMM Part Tracking	O
ImmToRobot	OPC 40079 IMM Part Quality	O
Client	0:Method Client Facet (defined in OPC UA Part 7)	M
ImmToRobot	OPC 40079 IMM Start and Stop PubSub	M
ImmToRobot	OPC 40079 IMM Publisher UADP Periodic Fixed Layout Configuration	M
ImmToRobot	OPC 40079 IMM Publish Fixed DataSet	M
ImmToRobot	OPC 40079 IMM Subscribe Fixed DataSet	M

10.2.3 OPC 40079 Robot Fixed DataSet Profile

This is the profile necessary on the robot to establish an OPC 40079 connection connection with fixed DataSet in accordance with the first version of this specification.

Table 39 – OPC 40079 Robot Fixed DataSet Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0:Embedded Server 2017 (defined in OPC 10000-7)	M
Profile	0:UADP Periodic Fixed Layout Facet	M
Machinery	4:Machinery Machine Identification Server Facet	M
Server	0:Method Server Facet (defined in OPC UA Part 7)	M
ImmToRobot	OPC 40079 RobotToImm Entry Point	M
ImmToRobot	OPC 40079 Robot Fixed Enable Signals	M
ImmToRobot	OPC 40079 Robot Part Tracking	M
ImmToRobot	OPC 40079 Robot Part Quality	M
ImmToRobot	OPC 40079 Robot Publisher UADP Periodic Fixed Layout Configuration	M
ImmToRobot	OPC 40079 Robot Publish Fixed DataSet	M
ImmToRobot	OPC 40079 Robot Subscribe Fixed DataSet	M
ImmToRobot	OPC 400779 Robot ProductionDatasetManagement	O
ImmToRobot	OPC 400779 Robot User Login	O

11 Namespaces

11.1 Namespace Metadata

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 40 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 40 – NamespaceMetadata Object for this Document

Attribute	Value	
BrowseName	http://opcfoundation.org/UA/PlasticsRubber/ImmToRobot/	
Property	**DataType**	**Value**
NamespaceUri	String	http://opcfoundation.org/UA/PlasticsRubber/ImmToRobot/
NamespaceVersion	String	RC 1.00.06
NamespacePublicationDate	DateTime	03/26/2024
IsNamespaceSubset	Boolean	False
StaticNodeIdTypes	IdType []	0
StaticNumericNodeIdRange	NumericRange []	
StaticStringNodeIdPattern	String	

11.2 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 41 provides a list of mandatory and optional namespaces used in an OPC 40079 OPC UA *Server*.

Table 41 – Namespaces used in a OPC 40079 Server

NamespaceURI	Description	Use
http://opcfoundation.org/UA/	Namespace for *NodeIds* and *BrowseNames* defined in the OPC UA specification. This namespace shall have namespace index 0.	Mandatory
Local Server URI	Namespace for nodes defined in the local server. This namespace shall have namespace index 1.	Mandatory
http://opcfoundation.org/UA/DI/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 10000-100. The namespace index is *Server* specific.	Mandatory
http://opcfoundation.org/UA/Machinery/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 40001-1. The namespace index is *Server* specific.	Mandatory

NamespaceURI	Description	Use
http://opcfoundation.org/UA/PlasticsRubber/ GeneralTypes/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 40083. The namespace index is server specific.	Mandatory
http://opcfoundation.org/UA/PlasticsRubber/ ImmToRobot/	Namespace for *NodeIds* and *BrowseNames* defined in this document. The namespace index is *Server* specific.	Mandatory
Vendor specific types	A *Server* may provide vendor-specific types like types derived from *ObjectTypes* defined in this document in a vendor-specific namespace.	Optional
Vendor specific instances	A *Server* 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 42 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 42 – Namespaces used in this document

NamespaceURI	Namespace Index	Example
http://opcfoundation.org/UA/	0	0:NodeVersion
http://opcfoundation.org/UA/DI/	2	2:Identification
http://opcfoundation.org/UA/PlasticsRubber/GeneralTypes/	3	3:CycleQualityEnumeration
http://opcfoundation.org/UA/Machinery/	4	4:MachineIdentificationType

Annex A
(normative)

OPC 40079-1 Namespace and mappings

A.1 Namespace and identifiers for OPC 40079-1 Information Model

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

```
<SymbolName>, <Identifier>, <NodeClass>
```

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

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

The *NamespaceUri* for all *NodeIds* defined here is http://opcfoundation.org/UA/PlasticsRubber/ImmToRobot/

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

– http://www.opcfoundation.org/UA/schemas/PlasticsRubber/ImmToRobot/RC1.00.0/NodeIds.csv [not available yet]

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

– http://www.opcfoundation.org/UA/schemas/PlasticsRubber/ImmToRobot/NodeIds.csv [not available yet]

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 10000-6.

The Information Model Schema for this version of the document (including any revisions, amendments or errata) can be found here:

– http://www.opcfoundation.org/UA/schemas/PlasticsRubber/ImmToRobot/RC1.00.0/Opc.Ua.PlasticsRubber.ImmToRobot.NodeSet2.xml [not available yet]

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

– http://www.opcfoundation.org/UA/schemas/PlasticsRubber/ImmToRobot//Opc.Ua.PlasticsRubber.ImmToRobot.NodeSet2.xml [not available yet]

Annex B
(normative)

Definition of fixed DataSetClasses

B.1 Fixed DataSet for IMM

As described in 9.2.3, the first version with the "OPC 40079 IMM Fixed DataSet Server Facet" uses a constant publishing data set on the machine side for all interfaces. The *DataSetClass OPC40079IFixedDataSet* is formally defined in

Table 43 – OPC40079ImmFixedDataSet Definitions

Attribute	Value
BrowseName	OPC40079ImmFixedDataSet
DataType	DataSetMetaDataType

Value	{
	Name: OPC40079ImmFixedDataSet,
	Description: Fixed DataSet for IMM side of OPC 40079,
	Fields: [
	{
	Name: RobotMessageId_confirmed,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 7,
	DataType: i=7,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: 08835cba-3bd5-454c-bac9-e58aa2668dd5,
	Properties: [],
	},
	{
	Name: PrepareForOperationWithImm,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 1,
	DataType: i=1,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: 638faa52-d15a-4369-8e61-7dcb2a767edc,
	Properties: [],
	},
	{
	Name: ImmOperationActive,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 1,
	DataType: i=1,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: 7997bc46-d795-4b22-9e4a-0c124b5c92d7,
	Properties: [],
	},
	{
	Name: EndOfOrder,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 1,
	DataType: i=1,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: 33ecd14d-17c9-41de-8254-95cf819e28bd,
	Properties: [],
	},
	{
	Name: CycleCounter,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 7,
	DataType: i=7,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: 4a2e1e9f-3bb5-4bb6-9cfa-ffc4e53cacb2,
	Properties: [],
	},
	{
	Name: Mould_1.ImmPartTracking.InsertPartAvailable,
	Description: "",
	FieldFlags: 0,
	BuiltInType: 1,
	DataType: i=1,

```
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 6eac8189-249b-4d3a-a167-bffc0043898a,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartTracking.PreMouldedPartProduced,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: f82e8c09-1f33-42dc-ab18-b406441d3d82,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartTracking.PreMouldedInsertPartAvailable,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: d044d1bd-bf34-44b7-a9ee-43feab1d4a3e,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartTracking.FinishedPartProduced,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 7a2a2dcc-4e5b-4d03-86b7-7444e31a8d4c,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartQuality.ReferredCycle,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 7,
                DataType: i=7,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 375b0590-9a03-4bed-a873-ab54a8b60978,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartQuality.CycleQuality,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 6,
                DataType: ns=2;i=3019,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 65484084-f480-4cd4-b12a-fe14600e5ec7,
                Properties: [],
        },
        {
                Name: Mould_1.ImmPartQuality.DetailedInformationFollows,
                Description: "",
                FieldFlags: 0,
```

BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 571f240c-4d51-4b9e-8487-c78400676dfc,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.InPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 803162cf-2b48-4e76-94a1-544b30bdf9d1,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.InPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 67262d21-a97f-4be4-8776-5e8116bfd7d5,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.IntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: e8edcbff-fb42-48d9-9072-dd82fe43a1f9,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.IntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 06b7c8d6-f90d-441c-8a2f-6c9ee322f3b8,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.FloatPosition,
Description: "",
FieldFlags: 0,
BuiltInType: 10,
DataType: i=10,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 5cab3282-c31d-4963-9334-10f5ea48fd2a,
Properties: [],
},
{
Name: Mould_1.MovablePlaten.PositionAdjusted,

                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 990beda4-cff9-4eed-b9a7-4c2ff2f0805a,
                    Properties: [],
                },
                {
                    Name: Mould_1.MovablePlaten.Movement,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 6,
                    DataType: ns=1;i=3005,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 1a44ce6f-a3bf-4872-ab49-0e92f3d29142,
                    Properties: [],
                },
                {
                    Name: Mould_1.Ejector_1.InPosition1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: df2eff1c-36ac-4f8b-a6eb-9e61d8dc7845,
                    Properties: [],
                },
                {
                    Name: Mould_1.Ejector_1.InPosition2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: c8d5151c-9777-41bc-9bbe-8c6850ce5619,
                    Properties: [],
                },
                {
                    Name: Mould_1.Ejector_1.IntermediatePosition1To2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 4ca95d4d-39ea-48b3-af1c-6a9a152d3091,
                    Properties: [],
                },
                {
                    Name: Mould_1.Ejector_1.IntermediatePosition2To1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: aaf63dd6-8543-4189-8242-b62b70eb15e9,
                    Properties: [],
                },

```
                            {
                                Name: Mould_1.Ejector_1.FloatPosition,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 10,
                                DataType: i=10,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: fa899c7f-ab1d-4925-9898-ae596bd6fd93,
                                Properties: [],
                            },
                            {
                                Name: Mould_1.Ejector_1.PositionAdjusted,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 1,
                                DataType: i=1,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: d26202da-dad5-42fd-89b7-2d3d67a8b0f4,
                                Properties: [],
                            },
                            {
                                Name: Mould_1.Ejector_1.Movement,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 6,
                                DataType: ns=1;i=3005,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: a8873699-761a-4dee-bfa6-f53e626e46e4,
                                Properties: [],
                            },
                            {
                                Name: Mould_1.Ejector_2.InPosition1,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 1,
                                DataType: i=1,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: 49689d81-6c55-4f07-b3a0-b348762f0859,
                                Properties: [],
                            },
                            {
                                Name: Mould_1.Ejector_2.InPosition2,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 1,
                                DataType: i=1,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: 51f2911b-d419-4bcc-85d7-310a6dd3a0af,
                                Properties: [],
                            },
                            {
                                Name: Mould_1.Ejector_2.IntermediatePosition1To2,
                                Description: "",
                                FieldFlags: 0,
                                BuiltInType: 3,
                                DataType: i=3,
                                ValueRank: -1,
                                ArrayDimensions: null,
                                MaxStringLength: 0,
                                DataSetFieldId: 392f2b4b-0c7d-45d9-bb33-84928e6fe7e4,
```

          Properties: [],
      },
      {
        Name: Mould_1.Ejector_2.IntermediatePosition2To1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 3,
        DataType: i=3,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 71243c85-09fe-4d99-baad-3185da7daed1,
        Properties: [],
      },
      {
        Name: Mould_1.Ejector_2.FloatPosition,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 10,
        DataType: i=10,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: d01b6497-dc04-4cca-bc35-77c423066c11,
        Properties: [],
      },
      {
        Name: Mould_1.Ejector_2.PositionAdjusted,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: ed606b91-0f2e-463d-92ad-f7294790b998,
        Properties: [],
      },
      {
        Name: Mould_1.Ejector_2.Movement,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 6,
        DataType: ns=1;i=3005,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: a35057ab-a53e-4a7b-b263-82fde1ccd707,
        Properties: [],
      },
      {
        Name: Mould_1.Core_1.InPosition1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: cf346ecb-fd13-4453-8ebd-81a2d662f658,
        Properties: [],
      },
      {
        Name: Mould_1.Core_1.InPosition2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,

```
                                      MaxStringLength: 0,
                                      DataSetFieldId: 9536e1f5-68ee-44b7-9b10-5f8dfba71fd8,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_1.IntermediatePosition1To2,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 3,
                                      DataType: i=3,
                                      ValueRank: -1,
                                      ArrayDimensions: null,
                                      MaxStringLength: 0,
                                      DataSetFieldId: 1e59d377-ff5f-40fe-8153-d2c131649124,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_1.IntermediatePosition2To1,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 3,
                                      DataType: i=3,
                                      ValueRank: -1,
                                      ArrayDimensions: null,
                                      MaxStringLength: 0,
                                      DataSetFieldId: ec902b41-632b-43c6-ae53-6b7cee654bed,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_1.Movement,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 6,
                                      DataType: ns=1;i=3005,
                                      ValueRank: -1,
                                      ArrayDimensions: null,
                                      MaxStringLength: 0,
                                      DataSetFieldId: a49f051f-82b4-4953-a323-be824203dc54,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_2.InPosition1,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 1,
                                      DataType: i=1,
                                      ValueRank: -1,
                                      ArrayDimensions: null,
                                      MaxStringLength: 0,
                                      DataSetFieldId: d2f361f3-bbad-4cca-b0e6-b83f3a3a69d9,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_2.InPosition2,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 1,
                                      DataType: i=1,
                                      ValueRank: -1,
                                      ArrayDimensions: null,
                                      MaxStringLength: 0,
                                      DataSetFieldId: e24da2ec-644f-450f-8510-890ebfba1017,
                                      Properties: [],
                                  },
                                  {
                                      Name: Mould_1.Core_2.IntermediatePosition1To2,
                                      Description: "",
                                      FieldFlags: 0,
                                      BuiltInType: 3,
                                      DataType: i=3,
```

                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: e8ee807d-b42b-4a64-a42d-2afc5e027e7e,
                Properties: [],
            },
            {
                Name: Mould_1.Core_2.IntermediatePosition2To1,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 3,
                DataType: i=3,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 842d89a2-3242-4824-847c-c3a695f9a453,
                Properties: [],
            },
            {
                Name: Mould_1.Core_2.Movement,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 6,
                DataType: ns=1;i=3005,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 80c665e1-de9a-4638-8f0a-d1cdb4a3bfa2,
                Properties: [],
            },
            {
                Name: Mould_1.Core_3.InPosition1,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 0721c950-4a0e-4560-a324-c04ce708fa56,
                Properties: [],
            },
            {
                Name: Mould_1.Core_3.InPosition2,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: f6862b68-526f-4d62-a5e2-39e443d6f304,
                Properties: [],
            },
            {
                Name: Mould_1.Core_3.IntermediatePosition1To2,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 3,
                DataType: i=3,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 0244133e-dc9a-43ff-bf9d-b4ac55644559,
                Properties: [],
            },
            {
                Name: Mould_1.Core_3.IntermediatePosition2To1,
                Description: "",
                FieldFlags: 0,

BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 743749c0-316f-4f1d-90c8-11e614e23833,
Properties: [],
},
{
Name: Mould_1.Core_3.Movement,
Description: "",
FieldFlags: 0,
BuiltInType: 6,
DataType: ns=1;i=3005,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: c9590f69-13e5-4ccd-a6d3-81cf3dcd7736,
Properties: [],
},
{
Name: Mould_1.Core_4.InPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 0e056ed0-5ea0-4438-86b9-651d4da08333,
Properties: [],
},
{
Name: Mould_1.Core_4.InPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: e6fdfcc0-3957-400f-88d5-bc8f6b01adcf,
Properties: [],
},
{
Name: Mould_1.Core_4.IntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: a9770fe4-d41d-4c2f-b35d-f450285b52b7,
Properties: [],
},
{
Name: Mould_1.Core_4.IntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 9ca52f04-b2b7-41df-aca5-2c2383071223,
Properties: [],
},
{
Name: Mould_1.Core_4.Movement,

Description: "",
FieldFlags: 0,
BuiltInType: 6,
DataType: ns=1;i=3005,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 8590eb73-ee89-4960-ada3-1b5ce7b24f72,
Properties: [],
},
{
Name: Mould_1.Core_5.InPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: e019719a-8d33-4bed-9c84-4fd0c93f76f7,
Properties: [],
},
{
Name: Mould_1.Core_5.InPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 3a0120b0-5fd8-40b4-8fd6-2fafaa8d7e91,
Properties: [],
},
{
Name: Mould_1.Core_5.IntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 0f67470d-c2cb-4fcd-8c05-5c45f1a67329,
Properties: [],
},
{
Name: Mould_1.Core_5.IntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: c70d6b46-f669-4adf-bc98-2dc153eaa1c7,
Properties: [],
},
{
Name: Mould_1.Core_5.Movement,
Description: "",
FieldFlags: 0,
BuiltInType: 6,
DataType: ns=1;i=3005,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: f56d5157-74b8-4fe1-be74-b2f1113fc524,
Properties: [],
},

```
                                          {
                                            Name: Mould_1.Core_6.InPosition1,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 1,
                                            DataType: i=1,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: b04f2ae9-9ffb-4413-a53a-57d95efce005,
                                            Properties: [],
                                          },
                                          {
                                            Name: Mould_1.Core_6.InPosition2,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 1,
                                            DataType: i=1,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: 4182be1e-d519-4437-842e-c15ac6f89caf,
                                            Properties: [],
                                          },
                                          {
                                            Name: Mould_1.Core_6.IntermediatePosition1To2,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 3,
                                            DataType: i=3,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: 11308265-7688-4b0b-8c00-9afbe5bc5f83,
                                            Properties: [],
                                          },
                                          {
                                            Name: Mould_1.Core_6.IntermediatePosition2To1,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 3,
                                            DataType: i=3,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: 76e708cc-8a0a-471d-b288-ce47407fe987,
                                            Properties: [],
                                          },
                                          {
                                            Name: Mould_1.Core_6.Movement,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 6,
                                            DataType: ns=1;i=3005,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: bce7b84c-25e7-4d9a-83b7-91760351c0b1,
                                            Properties: [],
                                          },
                                          {
                                            Name: Mould_1.Core_7.InPosition1,
                                            Description: "",
                                            FieldFlags: 0,
                                            BuiltInType: 1,
                                            DataType: i=1,
                                            ValueRank: -1,
                                            ArrayDimensions: null,
                                            MaxStringLength: 0,
                                            DataSetFieldId: a6b8b6ce-e700-4a5e-8238-aa31d84b44a1,
```

```
            Properties: [],
        },
        {
            Name: Mould_1.Core_7.InPosition2,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 1,
            DataType: i=1,
            ValueRank: -1,
            ArrayDimensions: null,
            MaxStringLength: 0,
            DataSetFieldId: d36ec1dc-4b40-4c29-867f-d74a32d444e7,
            Properties: [],
        },
        {
            Name: Mould_1.Core_7.IntermediatePosition1To2,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 3,
            DataType: i=3,
            ValueRank: -1,
            ArrayDimensions: null,
            MaxStringLength: 0,
            DataSetFieldId: a145da1a-a6ba-4477-b368-df5ac710cbf6,
            Properties: [],
        },
        {
            Name: Mould_1.Core_7.IntermediatePosition2To1,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 3,
            DataType: i=3,
            ValueRank: -1,
            ArrayDimensions: null,
            MaxStringLength: 0,
            DataSetFieldId: e9791250-71b0-462c-988c-4559e454eccd,
            Properties: [],
        },
        {
            Name: Mould_1.Core_7.Movement,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 6,
            DataType: ns=1;i=3005,
            ValueRank: -1,
            ArrayDimensions: null,
            MaxStringLength: 0,
            DataSetFieldId: 8d1a3c4b-94e6-4f37-8d0e-af104743e166,
            Properties: [],
        },
        {
            Name: Mould_1.Core_8.InPosition1,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 1,
            DataType: i=1,
            ValueRank: -1,
            ArrayDimensions: null,
            MaxStringLength: 0,
            DataSetFieldId: b120deca-9de1-49a7-8dfc-683ff7d76ed8,
            Properties: [],
        },
        {
            Name: Mould_1.Core_8.InPosition2,
            Description: "",
            FieldFlags: 0,
            BuiltInType: 1,
            DataType: i=1,
            ValueRank: -1,
            ArrayDimensions: null,
```

MaxStringLength: 0,
DataSetFieldId: 9ed4ee32-2d48-4295-8486-09d10b77cd4d,
Properties: [],
},
{
Name: Mould_1.Core_8.IntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 48ca5faf-8770-45f3-9fdf-76190f476c83,
Properties: [],
},
{
Name: Mould_1.Core_8.IntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 810255be-f197-49eb-a712-66a2cccba1ca,
Properties: [],
},
{
Name: Mould_1.Core_8.Movement,
Description: "",
FieldFlags: 0,
BuiltInType: 6,
DataType: ns=1;i=3005,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 55ed3bdc-d986-4c02-b63c-a0709879b912,
Properties: [],
},
{
Name: Mould_1.Core_9.InPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: f3a885ef-cec4-4fe0-8bb8-22923cb21dc9,
Properties: [],
},
{
Name: Mould_1.Core_9.InPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: dc9f13ec-5316-459e-a6a1-0e0106496332,
Properties: [],
},
{
Name: Mould_1.Core_9.IntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,

```
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 98238025-2462-4d12-9e67-3d2367604e5d,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_9.IntermediatePosition2To1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: a0b4ee12-70a3-4582-89cb-68b017d6690f,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_9.Movement,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 6,
                    DataType: ns=1;i=3005,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 641fae97-e500-444a-8697-1f51d1a0bd26,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_10.InPosition1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 60d9f416-5dbe-4c42-9496-1e91fd03bc83,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_10.InPosition2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: dc9b99b2-a18b-4d0b-8dfc-0874136fff06,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_10.IntermediatePosition1To2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 22b2111e-6300-438d-8c9f-a881727cddc1,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_10.IntermediatePosition2To1,
                    Description: "",
                    FieldFlags: 0,
```

```
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: f8ae0548-4363-4602-936e-27ab842b433d,
                    Properties: [],
                },
                {
                    Name: Mould_1.Core_10.Movement,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 6,
                    DataType: ns=1;i=3005,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 934b7bf9-8a94-46be-b0fa-aabb81f28c7d,
                    Properties: [],
                },
                {
                    Name: AdditionalAxes_1.InPosition1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: b3ef99ab-52d4-42c6-a235-87e7883ed290,
                    Properties: [],
                },
                {
                    Name: AdditionalAxes_1.InPosition2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 1866bc3c-0290-48a5-bb6c-abb22db0e19b,
                    Properties: [],
                },
                {
                    Name: AdditionalAxes_1.IntermediatePosition1To2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: dfb9fe90-ef11-466f-a045-6d6abdd459a8,
                    Properties: [],
                },
                {
                    Name: AdditionalAxes_1.IntermediatePosition2To1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 6a34531d-c91c-4098-adb5-bf803ef29025,
                    Properties: [],
                },
                {
                    Name: AdditionalAxes_1.FloatPosition,
```

                Description: "",
                FieldFlags: 0,
                BuiltInType: 10,
                DataType: i=10,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 46979c7f-9f12-4f63-bf17-46a017adf99c,
                Properties: [],
            },
            {
                Name: AdditionalAxes_1.PositionAdjusted,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 8d65a605-cd4e-4f83-93f4-9c2ea42362c7,
                Properties: [],
            },
            {
                Name: AdditionalAxes_1.Movement,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 6,
                DataType: ns=1;i=3005,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 313351ca-34de-4d0e-bf18-9197fb73eed6,
                Properties: [],
            },
        ],
        DataSetClassId: f0ade254-0008-4960-bbe6-eaaf6308ada2,
        configurationVersion: 696384000.696384000
    }

References	NodeClass	BrowseName	DataType	TypeDefinition
0:ComponentOf by the 0:DataSetClasses defined in OPC 10000-14				
0:HasTypeDefinition	VariableType	0:BaseDataVariableType	0:DataSetMetaDataType	-

B.2 Fixed DataSet for robot

As described in 9.3.3, the first version with the "OPC 40079 Robot Fixed DataSet Server Facet" uses a constant publishing data set on the robot side for all interfaces. The *DataSetClass OPC40079RobotFixedDataSet* is formally defined in

Table 44 – OPC40079RobotFixedDataSet Definitions

Attribute	Value
BrowseName	OPC40079RobotFixedDataSet
DataType	DataSetMetaDataType

| Value | {
Name: OPC40079RobotFixedDataSet,
Description: Fixed DataSet for robot side of OPC 40079,
Fields: [
    {
      Name: RobotMessageId,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 7,
      DataType: i=7,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: f6961934-fbb8-4595-a463-dc6f4420ae4c,
      Properties: [],
    },
    {
      Name: ReadyForOperationWithImm,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: e735c2c9-ade2-4f7a-85f4-affb5bc3ee79,
      Properties: [],
    },
    {
      Name: OperationWithImmActive,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: a521a00c-4bf4-4670-92a0-fc85b167c7da,
      Properties: [],
    },
    {
      Name: OperationWithImmRequested,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: c705dd00-fb60-4775-ba4a-06f012086b00,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.MouldAreaFree,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: 0f39e8e7-5d45-4261-bd53-9e201e40950d,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.RobotPartTracking.InsertPartInserted,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1, |
|---|---|

                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: fcc26df3-f67c-4d26-a902-2fc4fa0ee193,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartTracking.InsertPartRemoved,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 23764a84-ab47-4ff0-a966-398cfb3de315,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartTracking.PreMouldedPartInserted,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 7c2d1a5c-2b17-403f-b872-07aa8191c5f9,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartTracking.PreMouldedPartRemoved,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 831c625e-8a55-426b-89f7-49751e24927e,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartTracking.FinishedPartRemoved,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: c2845c11-1dfd-4a17-a211-d11ce44ce668,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartQuality.ReferredCycle,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 7,
                    DataType: i=7,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: a4c3804e-5466-4ddf-a9b0-53f522dad56a,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.RobotPartQuality.CycleQuality,
                    Description: "",
                    FieldFlags: 0,

BuiltInType: 6,
DataType: ns=2;i=3019,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: d778ba08-7f81-487b-ad9e-6db3c4a5b9b3,
Properties: [],
},
{
Name: MouldInteraction_1.EnableMovablePlaten.RelevantForInteraction,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 79934987-7d04-43f0-b831-2cf4d1f16efb,
Properties: [],
},
{
Name: MouldInteraction_1.EnableMovablePlaten.EnableToPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 97d23f2d-790e-4eaf-b050-28ab94fc0097,
Properties: [],
},
{
Name: MouldInteraction_1.EnableMovablePlaten.EnableToPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 876ef602-f93b-4707-8d99-bf76a0e01eac,
Properties: [],
},
{
Name:
MouldInteraction_1.EnableMovablePlaten.EnableIntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 62a1939b-1b93-4917-b0ef-d63b0cab3db8,
Properties: [],
},
{
Name:
MouldInteraction_1.EnableMovablePlaten.EnableIntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: cab73679-b054-4f7e-bc62-1b5f12e5f6b1,
Properties: [],
},

{
    Name: MouldInteraction_1.EnableEjector_1.RelevantForInteraction,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 6923f38a-b99d-43f3-b132-e673995da2ce,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableEjector_1.EnableToPosition1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: ba081bb6-74d5-4b11-8cad-4cecb709d8dd,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableEjector_1.EnableToPosition2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 1437e736-8304-4460-8603-a88a54487be6,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableEjector_1.EnableIntermediatePosition1To2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 72e1dcec-e1e2-43b1-9282-89a959ce3775,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableEjector_1.EnableIntermediatePosition2To1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 0bd9f30c-7467-405d-aca5-1fee1dcfa163,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableEjector_2.RelevantForInteraction,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 6f06a516-72bb-452e-a5e4-92794bf4cd88,

Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableEjector_2.EnableToPosition1,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: 68b3468a-39c5-40ed-abb7-dbdfe0afc697,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableEjector_2.EnableToPosition2,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: e9b9bf69-6d4c-4751-91ef-8cacb426f27d,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableEjector_2.EnableIntermediatePosition1To2,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 3,
      DataType: i=3,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: cf71f991-8857-4605-838f-bf6a548cccb1,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableEjector_2.EnableIntermediatePosition2To1,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 3,
      DataType: i=3,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: 5d99203e-7cfc-4bb5-9e63-9c3936093a86,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableCore_1.RelevantForInteraction,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,
      MaxStringLength: 0,
      DataSetFieldId: 42afd1b8-c62c-4bbd-8133-78412950dd5e,
      Properties: [],
    },
    {
      Name: MouldInteraction_1.EnableCore_1.EnableToPosition1,
      Description: "",
      FieldFlags: 0,
      BuiltInType: 1,
      DataType: i=1,
      ValueRank: -1,
      ArrayDimensions: null,

        MaxStringLength: 0,
        DataSetFieldId: d8d58199-057b-4970-aa3a-cc8c122b90ac,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_1.EnableToPosition2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 8353e25f-f628-4d28-8217-0e0cdf893c22,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_1.EnableIntermediatePosition1To2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 3,
        DataType: i=3,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 5cc9742d-0e7d-45b2-bfa7-afa5d7c541d3,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_1.EnableIntermediatePosition2To1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 3,
        DataType: i=3,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 0db455e8-cbcd-4d03-9548-6771ed293484,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_2.RelevantForInteraction,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: f3abda13-f697-48b2-9bb0-6b607ea8aaa6,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_2.EnableToPosition1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 65c68046-00b2-4cca-af46-60de2ba5aa40,
        Properties: [],
      },
      {
        Name: MouldInteraction_1.EnableCore_2.EnableToPosition2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,

        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 258fc12c-57b1-47ae-ba6c-c20f762d7c89,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_2.EnableIntermediatePosition1To2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 3,
        DataType: i=3,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: eeadd621-02d4-41da-a09f-6918b48c9499,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_2.EnableIntermediatePosition2To1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 3,
        DataType: i=3,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 47f074a4-2d35-4035-a1e9-9f24e374dee0,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_3.RelevantForInteraction,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 1eed76e6-e45a-4d8f-84fc-998c8b140001,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_3.EnableToPosition1,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 53f68f55-7510-44fd-b1ec-c90fa82f684c,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_3.EnableToPosition2,
        Description: "",
        FieldFlags: 0,
        BuiltInType: 1,
        DataType: i=1,
        ValueRank: -1,
        ArrayDimensions: null,
        MaxStringLength: 0,
        DataSetFieldId: 07585296-ddd7-40ff-94d6-0bc9531ab7f7,
        Properties: [],
    },
    {
        Name: MouldInteraction_1.EnableCore_3.EnableIntermediatePosition1To2,
        Description: "",
        FieldFlags: 0,

BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 8a87de34-f46f-4baa-bf49-cc2ce31cdbd3,
Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_3.EnableIntermediatePosition2To1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 3d6e11ad-4d3a-4edd-9530-36033a5964c5,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_4.RelevantForInteraction,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 480e3b7b-59bd-48af-89ac-29180b286844,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_4.EnableToPosition1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 0cc1142e-7b2a-46bd-9ba6-5f6884278537,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_4.EnableToPosition2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 8367c87f-3ce4-4dd7-950e-b9f53a1e26f3,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_4.EnableIntermediatePosition1To2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: b0800f7a-2834-443a-90e4-29ecf5a9272f,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_4.EnableIntermediatePosition2To1,

Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: c20ba0e9-8c50-43cb-867a-825fad17bc90,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_5.RelevantForInteraction,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 8939bcf5-6407-4972-a3e7-b6edb067b610,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_5.EnableToPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: bf43a990-da7d-44ec-82f9-019d0e37d7dc,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_5.EnableToPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 0d666639-db17-4b9b-88e4-5c2849a90976,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_5.EnableIntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: a2616371-d4b8-4f31-a9da-246b825f7301,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_5.EnableIntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: faafa096-0f60-48bb-9cce-7c9e598c29ef,
Properties: [],
},

{
    Name: MouldInteraction_1.EnableCore_6.RelevantForInteraction,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 8b753548-56bc-4ef0-9834-ddf4a82a75d4,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_6.EnableToPosition1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 6b8adaa2-eea6-47d2-a0a3-074efe7d879c,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_6.EnableToPosition2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 4e0d60b3-dbc2-43f3-90e3-99e3aca295d3,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_6.EnableIntermediatePosition1To2,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 5a9b50c1-5430-43f1-91ef-6a9788349b4f,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_6.EnableIntermediatePosition2To1,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 3,
    DataType: i=3,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: d0dede6a-24de-48c8-86a8-e4b81d0e13ea,
    Properties: [],
},
{
    Name: MouldInteraction_1.EnableCore_7.RelevantForInteraction,
    Description: "",
    FieldFlags: 0,
    BuiltInType: 1,
    DataType: i=1,
    ValueRank: -1,
    ArrayDimensions: null,
    MaxStringLength: 0,
    DataSetFieldId: 82c5f1a8-8064-4296-825c-f2af15c63deb,

                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_7.EnableToPosition1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: e8938402-6fa5-4f48-ab7a-3ffc4c2084bb,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_7.EnableToPosition2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: e8e08e91-047e-4962-ac9d-640fd6744726,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_7.EnableIntermediatePosition1To2,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 6a85716e-0ad7-49c9-98f5-a69c98872772,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_7.EnableIntermediatePosition2To1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 3,
                    DataType: i=3,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: deec4f72-d73f-43d8-af4a-171a098e43a6,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_8.RelevantForInteraction,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,
                    MaxStringLength: 0,
                    DataSetFieldId: 7945bd2d-c359-49f9-a9c2-f66efb96999e,
                    Properties: [],
                },
                {
                    Name: MouldInteraction_1.EnableCore_8.EnableToPosition1,
                    Description: "",
                    FieldFlags: 0,
                    BuiltInType: 1,
                    DataType: i=1,
                    ValueRank: -1,
                    ArrayDimensions: null,

MaxStringLength: 0,
DataSetFieldId: ea3cb8d7-f673-4e41-9265-6fb00deb610e,
Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_8.EnableToPosition2,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 1,
  DataType: i=1,
  ValueRank: -1,
  ArrayDimensions: null,
  MaxStringLength: 0,
  DataSetFieldId: e98c67f7-d62c-446e-9507-cd90c0d1d084,
  Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_8.EnableIntermediatePosition1To2,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 3,
  DataType: i=3,
  ValueRank: -1,
  ArrayDimensions: null,
  MaxStringLength: 0,
  DataSetFieldId: 9fc1d472-1040-4a9e-aaad-96a42870075d,
  Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_8.EnableIntermediatePosition2To1,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 3,
  DataType: i=3,
  ValueRank: -1,
  ArrayDimensions: null,
  MaxStringLength: 0,
  DataSetFieldId: c43f7620-a6c4-42ef-bbc0-bbb5de28cab3,
  Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_9.RelevantForInteraction,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 1,
  DataType: i=1,
  ValueRank: -1,
  ArrayDimensions: null,
  MaxStringLength: 0,
  DataSetFieldId: 84097c50-8548-4e70-a270-82537bec079c,
  Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_9.EnableToPosition1,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 1,
  DataType: i=1,
  ValueRank: -1,
  ArrayDimensions: null,
  MaxStringLength: 0,
  DataSetFieldId: 756dc7f0-d515-4c33-bbb5-5c825c0f9ade,
  Properties: [],
},
{
  Name: MouldInteraction_1.EnableCore_9.EnableToPosition2,
  Description: "",
  FieldFlags: 0,
  BuiltInType: 1,
  DataType: i=1,

                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 2591b4da-fddf-4110-822b-8d4762cfea34,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_9.EnableIntermediatePosition1To2,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 3,
                DataType: i=3,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 6fa4c778-236f-4e16-800d-5e4eff6fde1c,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_9.EnableIntermediatePosition2To1,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 3,
                DataType: i=3,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 4c7e5030-758e-4631-af22-f587076fc41a,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_10.RelevantForInteraction,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 91ff921c-4479-4776-a74c-a5a28350e2bb,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_10.EnableToPosition1,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: 79b29903-07a4-4dfe-82ef-7c7a01e730fe,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_10.EnableToPosition2,
                Description: "",
                FieldFlags: 0,
                BuiltInType: 1,
                DataType: i=1,
                ValueRank: -1,
                ArrayDimensions: null,
                MaxStringLength: 0,
                DataSetFieldId: c3f71f49-d6f0-48ac-9a3c-ba4387e3b78b,
                Properties: [],
            },
            {
                Name: MouldInteraction_1.EnableCore_10.EnableIntermediatePosition1To2,
                Description: "",
                FieldFlags: 0,

BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 81fcb151-aa64-4846-8530-1c13d474d0a1,
Properties: [],
},
{
Name: MouldInteraction_1.EnableCore_10.EnableIntermediatePosition2To1,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 0b23f006-3396-4fd1-849f-b7edc3081b55,
Properties: [],
},
{
Name: EnableAdditionalAxes_1.RelevantForInteraction,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 7ab021d7-3f3e-4486-9ea5-2aeb0ac0ae59,
Properties: [],
},
{
Name: EnableAdditionalAxes_1.EnableToPosition1,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 4f749936-4dda-484b-9ef2-bc59f07b9b7b,
Properties: [],
},
{
Name: EnableAdditionalAxes_1.EnableToPosition2,
Description: "",
FieldFlags: 0,
BuiltInType: 1,
DataType: i=1,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: 2b8e795f-534b-4978-af35-1a4bb322aa68,
Properties: [],
},
{
Name: EnableAdditionalAxes_1.EnableIntermediatePosition1To2,
Description: "",
FieldFlags: 0,
BuiltInType: 3,
DataType: i=3,
ValueRank: -1,
ArrayDimensions: null,
MaxStringLength: 0,
DataSetFieldId: fb95bd8f-fb9e-49d7-b91c-b9d4edaacbec,
Properties: [],
},
{
Name: EnableAdditionalAxes_1.EnableIntermediatePosition2To1,

	Description: "",
	FieldFlags: 0,
	BuiltInType: 1,
	DataType: i=1,
	ValueRank: -1,
	ArrayDimensions: null,
	MaxStringLength: 0,
	DataSetFieldId: e63774e2-f6d8-41d7-b237-87f9509f4e97,
	Properties: [],
	   },
	  ],
	DataSetClassId: 830f4c53-2b6e-40fe-84b5-78abd16f08ed,
	configurationVersion: 696384000.696384000
	}				

References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**
0:ComponentOf by the 0:DataSetClasses defined in OPC 10000-14				
0:HasTypeDefinition	VariableType	0:BaseDataVariableType	0:DataSetMetaDataType	-

Annex C
(informative)

Example timing diagrams

This Annex shows example timing diagrams for different applications.

Figure 12 shows an example timing diagram for starting and ending of interaction in automatic mode.

1 Robot prepares for production
2 Robot synchronises with IMM and takes over control
3 No new inserts by robot
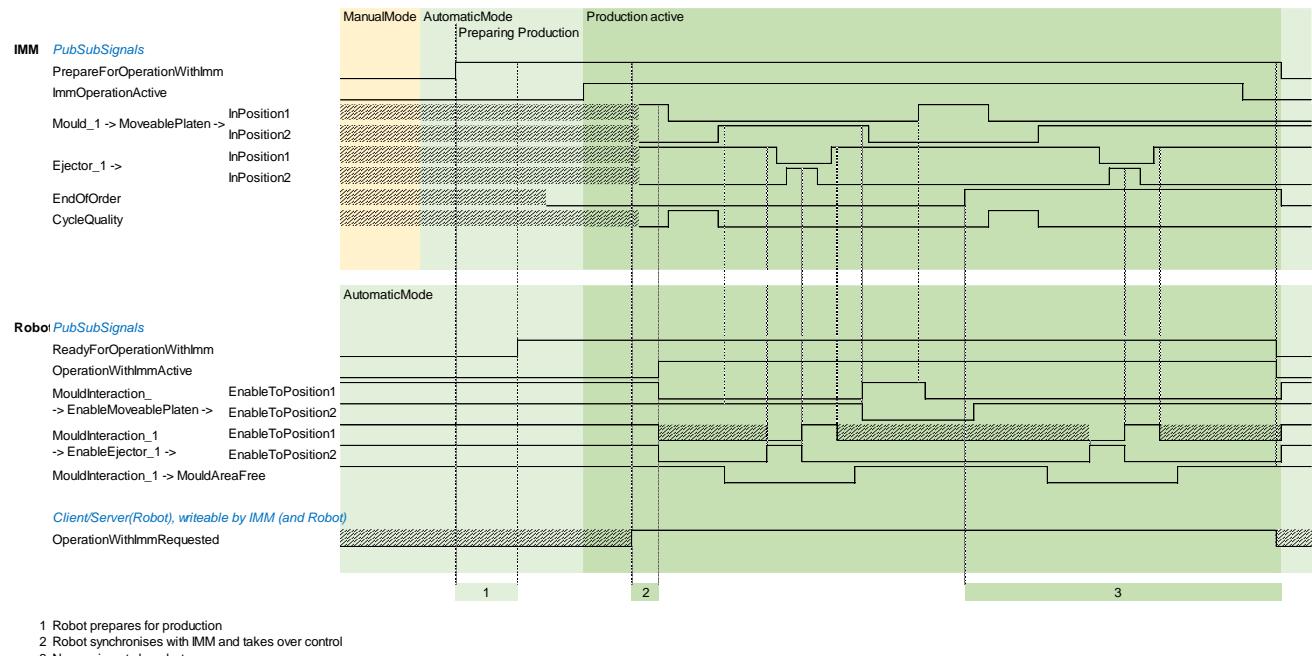
Figure 12 – Example timing diagram for starting and ending of interaction in automatic mode

Figure 13 shows an example timing diagram for starting and ending of interaction with manual inserting of parts.
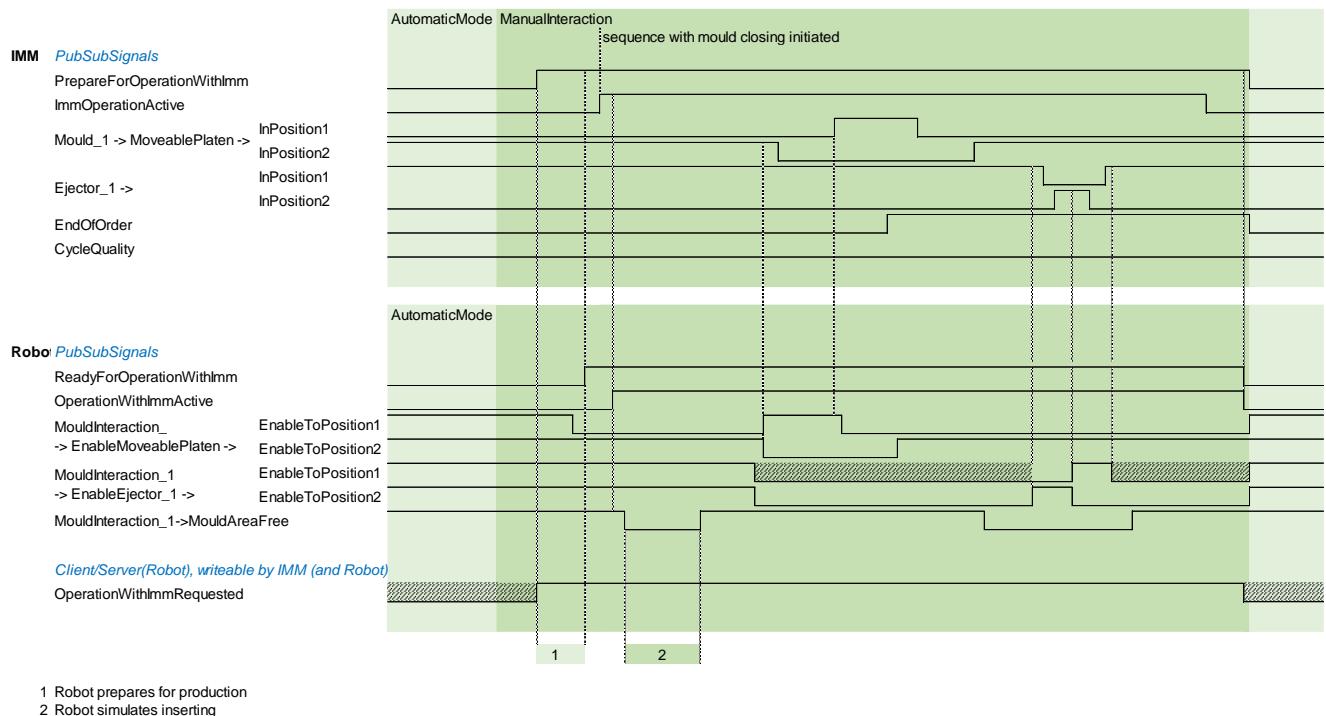
Figure 13 – Example timing diagram for starting and ending of interaction with manual inserting of parts

Annex D
(informative)

Network aspects for interoperability

These recommendations should be used to achieve plug and play behaviour in the field. Complex production cell with more machines and/or robot can provide detailed settings.

D.1 Preferred network connectors and speed

The Ethernet ports should support at least 100 Mbit/s. If 1000 Mbit/s is supported Auto-Negotiation should be supported to provide the possibility of both 100 Mbit/s and 1000 Mbit/s connections.

The recommended plugs are M12, 8-pin, x-coded (see IEC 61076-2-109), CAT 6 (see Figure 14)
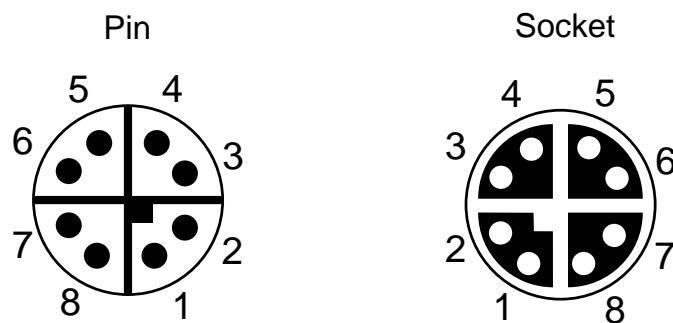
Figure 14 – M12 plug x-coded

On the IMM side, the socket should be used, the cable coming from the robot should have pins

D.2 Preferred safety connectors

Either the safety connector from EUROMAP 81 or the safety signals from the EUROMAP 67 should be used. The safet connector should be placed near the M12 network plug

D.3 IP addresses

All devices in the (sub) network must have unique IP addresses. To achieve this, it is recommended that the IMM provides a DHCP server. Each robot should provide a DHCP client and adjust it's IP address accordingly. If more than one IMM is connected over one network only one IMM should be a DHCP server and the other should use a proper static IP addresses manually assigned or use a DHCP client.

D.4 Ports

The standard port for the OPC UA discovery service is 4840. The communication itself could via via another port if necessary.

D.5 Encryption of signals

For Part 1 TLS encryption is optional. A not encrypted data exchange should be possible. If IMM and robot support TLS encryption it should be used.

D.6 OPC UA PubSub communication

Each IMM and each Robot can use Multicast as well as Unicast for publishing the datasets. Both should work. The PubSub multicast endpoint for IMM and Robot in the network should be

opc.udp://239.0.0.79:4840/

The *PublisherId* of IMM and Robot in the network must be unique – the proposal is to use the Mac-address as *PublisherId*. Example:

Table 45 – PublisherId and Mac-Address

Mac-Address of IMM	00:80:41:ae:fd:7e
IMM *PublisherId*	0x008041aefd7e [UInt64]

The *Method* call *StartPubSub* from 8.2 is used to exchange *PublisherId* from IMM to Robot and back to the IMM to achieve a bidirectional PubSub connection.

There is no upper limit for the pub sub cycle time as Part 1 defines a handshake mechanism for a safe communication. More the IMM and the robot can use different cycle times.

Nevertheless, higher cycle times speed up the handshake mechanism. To achieve at least comparable communication times as when using the EUROMAP 67 digital IO interface cycle times should be between 2 ms and 8 ms.

Annex E
(informative)

Mapping between EUROMAP 67(.1) and OPC 40079

EUROMAP 67 is the interface between IMM and robot based on hard wired signals. The following tables show where the signals defined in EUROMAP 67 are now located in the OPC 40079 information model.

Table 46 – Mapping of EUROMAP 67 signals to OPC 40079 – from IMM to robot

Signals in EUROMAP 67(.1)		Matching Variable in OPC 40079
Contact No.	**Signal designation**	
ZA1 ZC1	Emergency stop of machine, channel 1	*Not included in OPC 40079.* *(Use separate interface, e.g. EUROMAP 81)*
ZA2 ZC2	Emergency stop of machine channel 2	
ZA3 ZC3	Safety devices of machine channel 1	
ZA4 ZC4	Safety devices of machine channel 2	
ZA5 Optional	Reject	*IMMPartQualityType* → *CycleQuality + Method IMMToRobotDetailedQualityInformation* NOTE: *CycleQualityEnumeration* and *CavityCycleQualityEnumeration* are defined in OPC 40083
ZA6	Mould closed	*MouldType* → *MovablePlaten* → *InPosition1*
ZA7	Mould open position	*MouldType* → *MovablePlaten* → *InPosition2*
ZA8 Optional	Intermediate mould opening position	*MouldType* → *MovablePlaten* → *IntermediatePosition1To2 / IntermediatePosition2To1* NOTE: OPC 40079 allows 255 intermediate positions for each direction
ZB2	Enable operation with handling device / robot (Automatic)	*PrepareForOperationWithImm ImmOperationActive* NOTE: Signal split into two signals
ZB3	Ejector back position	*MouldType* → *Ejectors* → *Ejector_1* → *InPosition1*
ZB4	Ejector forward position	*MouldType* → *Ejectors* → *Ejector_1* → *InPosition2*
ZB5 Optional	Core pullers 1 in position 1 (Core pullers 1 free for handling device / robot to approach)	*MouldType* → *Cores* → *Core_1* → *InPosition1*
ZB6 Optional	Core pullers 1 in position 2 (Core pullers 1 in position to remove moulding)	*MouldType* → *Cores* → *Core_1* → *InPosition2*
ZB7 Optional	Core pullers 2 in position 1 (Core pullers 2 free for handling device / robot to approach)	*MouldType* → *Cores* → *Core_2* → *InPosition1*
ZB8 Optional	Core pullers 2 in position 2 (Core pullers 2 in position to remove moulding)	*MouldType* → *Cores* → *Core_2* → *InPosition2*

Table 47 – Mapping of EUROMAP 67 signals to OPC 40079 – from robot to IMM

Signals in EUROMAP 67(.1)		Matching Variable in OPC 40079
Contact No.	Signal designation	
A1 C1	Emergency stop of handling device / robot Channel 1	*Not included in OPC 40079.*
A2 C2	Emergency stop of handling device / robot Channel 2	*(Use separate interface, e.g. EUROMAP 81)*
A3 C3	Mould area free	*MouldInteractionType → MouldAreaFree*
A6	Enable mould closure	*MouldInteractionType → EnableMovablePlaten → EnableToPosition1*
A7 Optional	Enable full mould opening	*MouldInteractionType → EnableMovablePlaten → EnableToPosition2*
B2	Handling device / robot operation mode (operation with handling device / robot)	*RobotToImmType → OperationWithImmActive*
B3	Enable ejector back	*MouldInteractionType → EnableEjectors → EnableEjector_1 → EnableToPosition1*
B4	Enable ejector forward	*MouldInteractionType → EnableEjectors → EnableEjector_1→ EnableToPosition2*
B5 Optional	Enable movement of core pullers 1 to position 1 (Enable movement for handling device / robot to approach freely)	*MouldInteractionType → EnableCores → EnableCore_1 → EnableToPosition1*
B6 Optional	Enable movement of core pullers 1 to position 2 (Enable core pullers 1 to remove the moulding)	*MouldInteractionType → EnableCores → EnableCore_1 → EnableToPosition2*
B7 Optional	Enable movement of core pullers 2 to position 1 (Enable movement for handling device / robot to approach freely)	*MouldInteractionType → EnableCores → EnableCore_2 → EnableToPosition1*
B8 Optional	Enable movement of core pullers 2 to position 2 (Enable core pullers 2 to remove the moulding)	*MouldInteractionType → EnableCores → EnableCore_2 → EnableToPosition2*

EUROMAP 67.1 defines additional/modified signals for IMM with shuttle-/turntable, but which can be useful also for "normal" machines, e.g. "End of order", "Insert part(s) inserted". This is modeled as *AdditionalAxes* in OPC 40079.

Table 48 – Mapping of additional/modified EUROMAP 67.1 signals to OPC 40079 – from IMM to robot

Signals in EUROMAP 67(.1)		Matching Variable in OPC 40079
Contact No.	Signal designation	
ZA6 Optional	Start handling device/robot at position 2 (E)	
ZA7	Table in position, general	Use of *<AdditionalAxes_Nr>* and its position signals
ZA8 Optional	Start handling device/robot at position 3 (F)	
ZC5	End of order	*ImmToRobotType → EndOfOrder*
ZC6	Insert part(s) in mould	*ImmPartTrackingType → InsertPartAvailable*
ZC7	Part available	*ImmPartTrackingType → FinishedPartProducedAvailable* (or *PreMouldedPartProducedAvailable*)

Table 49 – Mapping of additional/modified EUROMAP 67.1 signals to OPC 40079 – from robot to IMM

Signals in EUROMAP 67(.1)		Matching Variable in OPC 40079
Contact No.	Signal designation	
A3 C3	Table area free	No direct matching → Use of *<EnableAdditionalAxes_Nr>* and its signals for enabling movements
A6	Enable table motion	Use of *<EnableAdditionalAxes_Nr>* and its signals for enabling movements
C6	Insert part(s) inserted	*RobotPartTrackingType → InsertPartInserted*
C7	Moulded part(s) removed	*RobotPartTrackingType → FinishedPartRemoved* (or *PreMouldedPartRemoved*)

Annex F
(informative)

Example PartQuality Diagrams

The *CycleQuality* Information of IMM and robot can be available at different timings, even in different production cycles. This Annex shows examples of different timing situations.
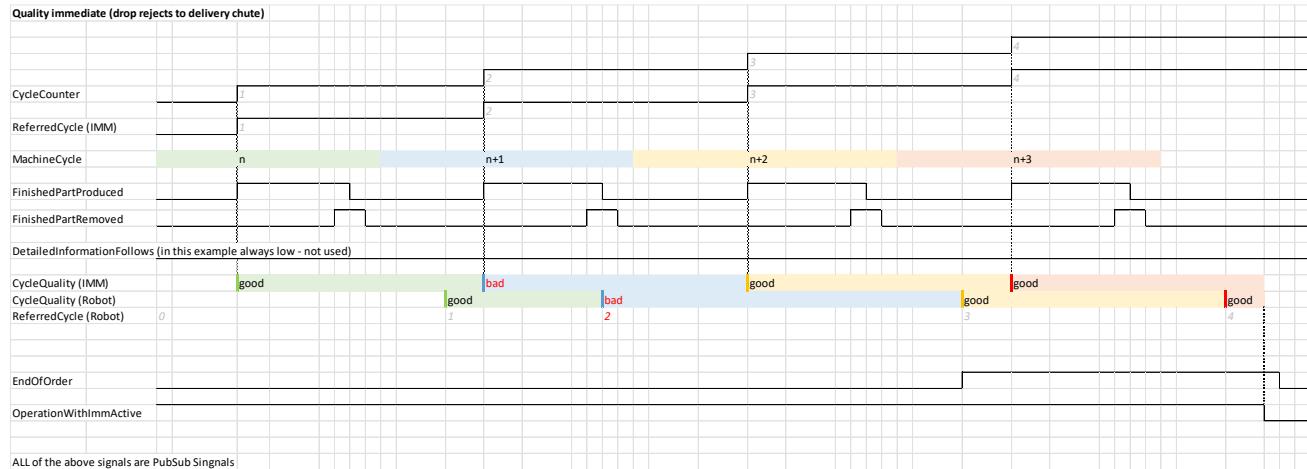

**Figure 15: Part Quality is available immediatly**
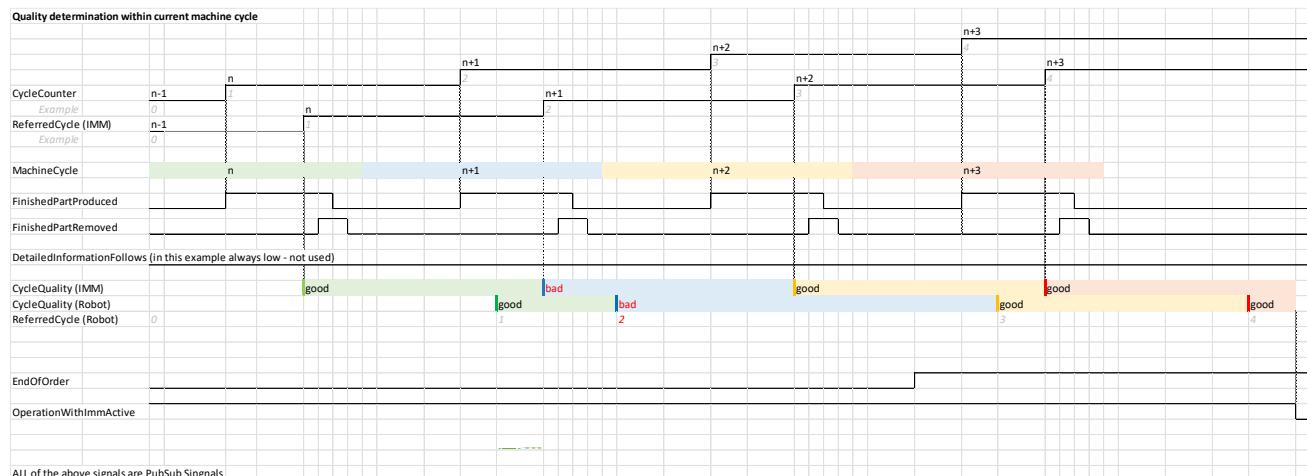
**Figure 16: Part Quality is available within the current machine cycle**
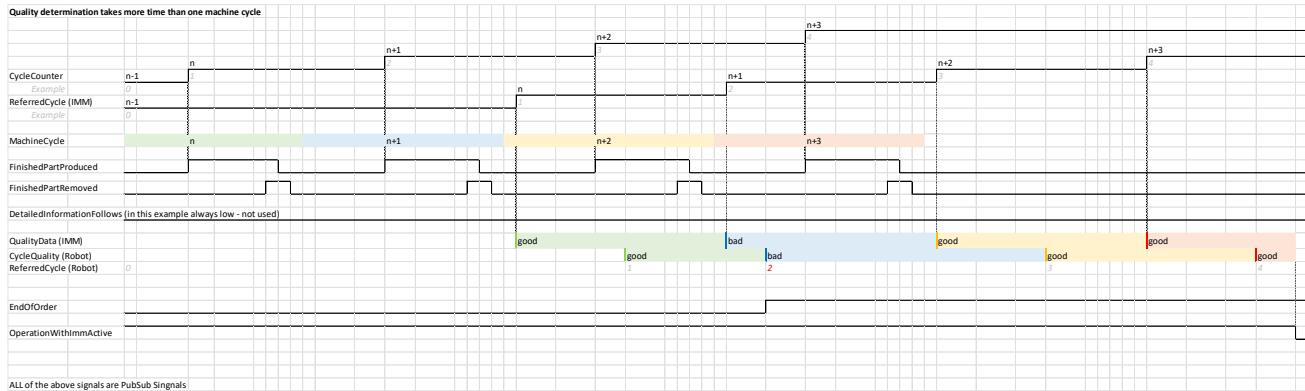
**Figure 17: Part Quality is available with n cycles delay, IMM before robot**
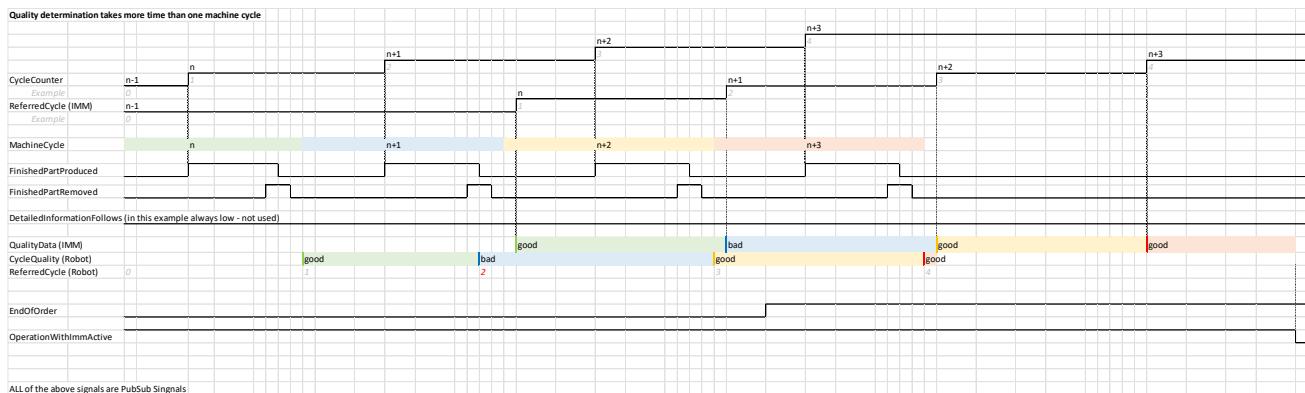
Figure 18: Part Quality is available with n cycles delay, robot before IMM
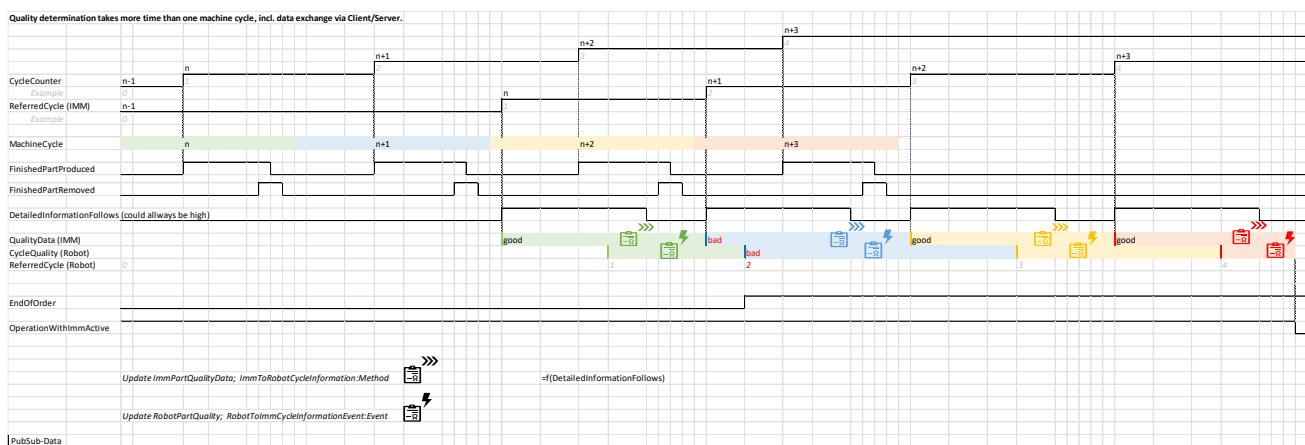

Figure 19: Part Quality is available with n cycles dealy, including Client/Server data exchange