VDMA 40568-1

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OPC UA for Mining – External Standards – Part 1: IREDES

OPC UA für Mining – Exernal Standards – Teil 1: IREDES

VDMA 40568-1:2023-10 is identical with OPC 40568-1 (Release Candidate 1.0)

Application Warning Notice

This draft with date of issue 2023-08-25 is being submitted to the public for review and comment.

Because the final VDMA Specification may differ from this version, the application of this draft is subject to special agreement.

Comments are requested

– preferably as a file by e-mail to joern.lehmann@vdma.org

– or in paper form to VDMA e.V. Mining,
Lyoner Straße 18, 60528 Frankfurt.

Document comprises 50 pages

VDMA

Contents

Figures

Tables

OPC Foundation / VDMA

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Forewords

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

This specification was created by a joint working group of the OPC Foundation and VDMA Mining, AMT Institute of RWTH Aachen University and IREDES

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

This document provides a comprehensive overview of the model information structure of the International Rock Excavation Data Exchange Standard (IREDES) standard which in this case uses OPC UA as carrier and is therefore part of the companion specification mining. Version 1.0 of this document covers most of the IREDES type definitions, most of the IREDES ApplicationBaseClasses as well as the LHD truck equipment profile.

2 Normative references

The following referenced documents are indispensable for the application 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/documents/10000-1/

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

http://www.opcfoundation.org/documents/10000-2/

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

http://www.opcfoundation.org/documents/10000-3/

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

http://www.opcfoundation.org/documents/10000-5/

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

http://www.opcfoundation.org/documents/10000-6/

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

http://www.opcfoundation.org/documents/10000-7/

OPC 40560, *OPC Unified Architecture for Mining - General*

http://opcfoundation.org/UA/Mining/General/

International Rock Excavation Data Exchange Standard (IREDES) – General Definitions and Standard Architecture

https://iredes.org

International Rock Excavation Data Exchange Standard (IREDES) – IREDES Drill Rigs Profile Documentation version 1.3 IREDES Initiative 20Terms, definitions and conventions

3 Terms, definitions and conventions

3.1 Overview

It is assumed that basic concepts of OPC UA information modelling from OPC 10000-1, OPC 10000-2, OPC 10000-3, OPC 10000-5, OPC 10000-6 and OPC 10000-7 are understood in this document. This document will use these concepts to describe the OPC 40568-1 Information Model. For the purposes of this document, the terms and definitions given in the documents referenced in the OPC Core documents and OPC 40160 apply.

3.2 Conventions used in this document

The conventions and definitions described in the OPC Core documents and OPC 40160 apply.

4 General Information to 40568-1: IREDES

4.1 introduction to the OPC UA Companion Specification Mining

For general information on the OPC UA Companion Specification Mining and OPC UA in general, please refer to OPC 40160.

As part of the External Standards section of the OPC UA Companion Specification Mining, the IREDES standard uses OPC UA as carrier.

4.2 Introduction to the IREDES standard

IREDES is a flexible standard architecture for convenient worksite information exchange in the mining industry. It is used for information exchange between mainly mobile equipment and devices on one side and central computer systems on the other side. Also, Machine-to-Machine (“M2M”) communication is covered to a certain extend. Excluded from the standard is any direct communication related to machine remote control as this is inside the product responsibility of the respective suppliers. The standard covers definitions of how to exchange information and what kind of content is exchanged. The flexibility of the standard is achieved by separation between the purpose of information exchange (Application Profile) and the dedicated type equipment using and extending the generic Application Profile information by specific entries for dedicated types of equipment (Equipment Profile).

This principle leads to a matrix structure of the information exchange interface:

1. Application Purpose in the Application Profile (vertical structure)
2. Equipment specific purposes in the respective Equipment Profile (horizontal structure).

The structure of the IREDES standard is shown in Figure 1. The structure is mirrored as far as possible in the IREDES OPC UA information model.

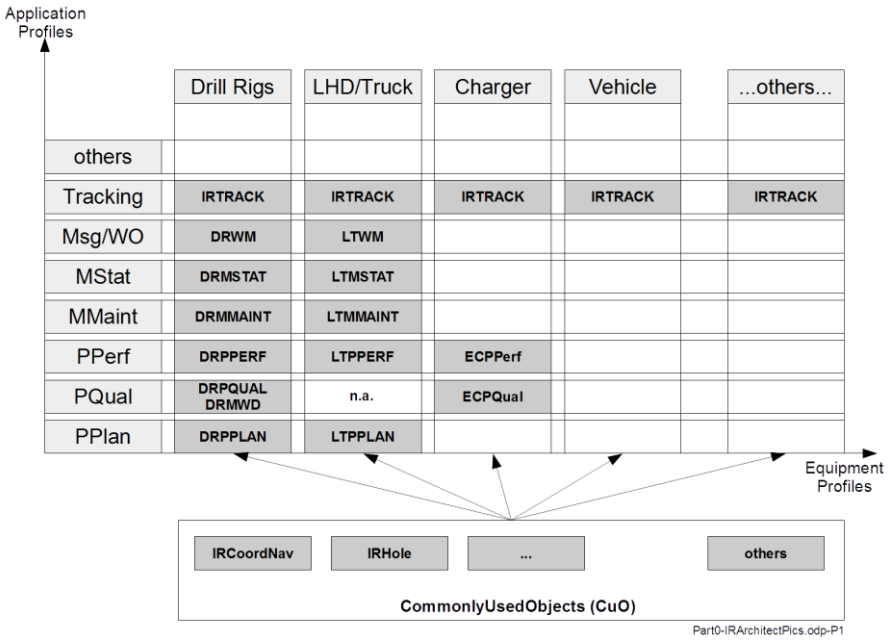

Figure 1 – Structure of the IREDES standard

5 Information Model Overview

The following Figure 2 contains an overview about all ObjectTypes specified in this document and their corresponding relationships.

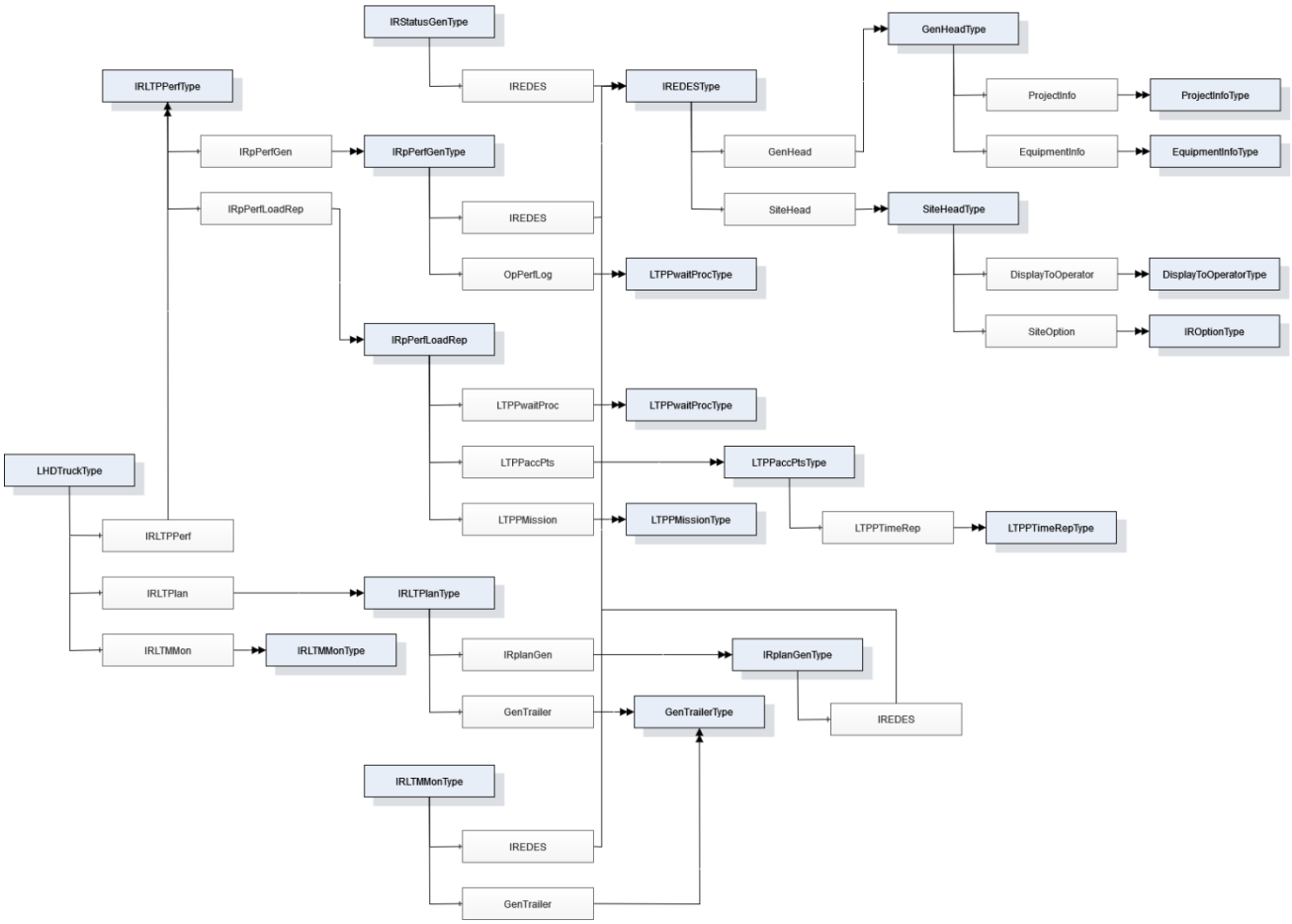

Figure 2 – Information Model Overview

6 Data Types

This section contains the definitions of data types used in the IREDES information model.

6.1 IRLengthDataType

This structure contains data describing lengths. It is formally defined in Table 1

Table 1 – IRLengthDataType Structure

Name	Type	Description
IRLengthDataType	structure	Subtype of structure defined in OPC 10000-3.
Value	0:Double	Data Type for length specification.
Unit	0:EUInformation	Datatype for engineering unit description. Valid values: mm, cm, m, ft.

Note: In http://www.opcfoundation.org/UA/units/un/cefact the relevant unitIds are:

UnitId[mm] = 5066068
UnitId[cm] = 4410708
UnitId[m]=5067858
UnitId[ft]= 4607828

Its representation in the *AddressSpace* is defined in Table 2.

Table 2 – IRLengthDataType Definition

Attribute	Value				
BrowseName	IRLengthDataType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the Structure defined in OPC 10000-3					
Conformance Units					
IREDES Component					

6.2 JobAssignmentTimeDataType

The JobAssignmentTimeDataType union is used for JobAssignment times. It is formally described in Table 3.

Table 3 – JobAssignmentTimeDatatype Union

Name	Type	Description
JobAssignmentTimeDataType	union	
ExpectedFinishTime	0:DateTime	Time Machine is expected to finish the job.
ExpectedDuration	0:Duration	Time the job is going to take to finish.

Its representation in the *AddressSpace* is defined in Table 4.

Table 4 – JobAssignmentTimeDataType Definition

Attributes	Value				
BrowseName	JobAssignmentTimeDataType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of 0:Union defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.3 Mapping for simple IREDES Data Types

Simple IREDES data types will be mapped as described in Table 5.

Table 5 – Mapping for simple IREDES data types

Notation	Data-Type	Value Rank	ArrayDimensions	Description
IRtextShort	String	-1	NULL	Text data type element for short text information provided in the IREDES standard. Limited to 24 characters in its original.
IRtext	String	-1	NULL	Text data type for comments or text information provided in the IREDES standard. Originally limited to 64 characters.
IRtextLong	String	-1	NULL	Text data type element for long text information. Limited to 256 characters in the IREDES standard.
IRangle	Float	-1	NULL	Data Type for angle specification. This data type is limited to values from -360.000 to +360.000.
IRVersion	String	-1	NULL	REDES Version Numbering.
AnyURI	String	-1	NULL	XMLSimpleType

6.4 IRtextShort

This DataType specifies a String for short text information provided in the IREDES standard. It is originally limited to 24 characters. Its representation in the AddressSpace is defined in Table 6.

Table 6 – IRtextShort Definition

Attribute	**Value**				
BrowseName	IRtextShort				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the String DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.4.1 IRtext

This DataType specifies a String for comments or text information provided in the IREDES standard. It is originally limited to 64 characters. Its representation in the AddressSpace is defined in Table 7.

Table 7 – IRtext Definition

Attribute	**Value**				
BrowseName	IRtext				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the String DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.4.2 IRtextLong

This DataType specifies a String for long text information. It is limited to 256 characters in the IREDES standard. Its representation in the AddressSpace is defined in Table 8.

Table 8 – IRtextLong Definition

Attribute	**Value**				
BrowseName	IRtextLong				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the String DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.4.3 IRangle

This DataType specifies a Float for angle specification. It is limited to values from -360.000 to +360.000. Its representation in the AddressSpace is defined in Table 9.

Table 9 – IRangle Definition

Attribute	**Value**				
BrowseName	IRangle				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the Float DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.4.4 IRVersion

This DataType specifies a String for for IREDES Version Numbering. Its representation in the AddressSpace is defined in Table 10.

Table 10 – IRVersion Definition

Attribute	Value				
BrowseName	IRVersion				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the String DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.4.5 AnyURI

This DataType specifies a String as a XMLSimpleType. Its representation in the AddressSpace is defined in Table 11.

Table 11 – AnyURI Definition

Attribute	Value				
BrowseName	AnyURI				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the String DataType defined in OPC 10000-5					
Conformance Units					
IREDES Component					

6.5 DispFlag

The enumeration DispFlag is used to determine when to display messages to the machine operator. It is formally defined in Table 12.

Table 12 – DispFlag Items

Name	Value	Description
MachStart	0	To be displayed when the machine is started. Machine start is defined as switching on the main power supply or power generation.
FileLoad	1	To be displayed as soon as the file is loaded (activated) in the machine's automation system (applicable especially to plan files originating from the mine!).

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

Table 13 – DispFlag Definition

Attribute	Value				
BrowseName	DispFlag				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
IREDES Component					

6.6 Answer

The following enumeration Answer is used to classify answers to work orders. It is formally defined in Table 14

Table 14 – Answer Items

Name	Value	Description
Accepted	0	Order is accepted.
Delayed	1	Order can only be executed with delay.
AcceptedWithCondition	2	Order is accepted under a condition.
Denied	3	Orders denied.

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

Table 15 – Answer Definition

Attribute	Value				
BrowseName	Answer				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
IREDES Component					

6.7 LTPPMptFromType

The enumeration LTPPMptFromType is used to classify mission start points for LHDs. It is formally described in Table 16.

Table 16 – LTPPMptFromType Items

Name	Value	Description
LoadPt	0	Load point
DumpPt	1	Dump point
Parking	2	Parking
Workshop	3	Workshop
Others	4	Others

Its representation in the *AddressSpace* is defined in Table 17.

Table 17 – LTPPMptFromType Definition

Attribute	Value				
BrowseName	LTPPMptFromType				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
IREDES Component					

6.8 LTPPMptToType

The enumeration LTPPMptToType is used to classify mission end points for LHDs. It is formally described in Table 18.

Table 18 – LTPPMptToType Items

Name	Value	Description
LoadPt	0	Load point
DumpPt	1	Dump point
Parking	2	Parking
Boulder	3	Boulder
Workshop	4	Workshop
Others	5	Others

Its representation in the *AddressSpace* is defined in Table 17.

Table 19 – LTPPMptToType Definition

Attribute	Value				
BrowseName	LTPPMptToType				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
IREDES Component					

6.9 LTPPMaction

The LTPPMaction enumeration is used classify actions carried out at the destination point specified in LTPPMptToN (Table 70). It is formally described in Table 20.

Table 20 – LTPPMaction Items

Name	Value	Description
Load	0	Load
Dump	1	Dump
Parking	2	Parking
Workshop	3	Workshop
Other	4	Other

Its representation in the *AddressSpace* is defined in Table 17.

Table 21 – LTPPMaction Definition

Attribute	Value				
BrowseName	LTPPMaction				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	
Conformance Units					
IREDES Component					

7 OPC UA ObjectTypes

7.1 ProjectInfoType ObjectType

7.1.1 Overview

The ProjectInfoType is an ObjectType which contains additional project information. It is based on the ObjectType and intended to be used as AddIn. Its formal definition can be found in Table 22.

7.1.2 ObjectType Definition

Table 22 – ProjectInfoType ObjectType

Attribute	**Value**				
BrowseName	ProjectInfoType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	Signature	String	0:BaseDataVariableType	O,RW
0:HasComponent	Variable	Comment	String	0:BaseDataVariableType	O,RW
Conformance Units					
IREDES ProjectInfoType					

The component Variables of the ProjectInfoType have additional Attributes defined in Table 23.

Table 23 – ProjectInfoType Attribute values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
DefaultInstanceBrowseName	ProjectInfo	The default BrowseName for instances of this type.

7.1.3 ObjectType Description

The description can be found in Table 24.

Table 24 – ProjectInfoType Attribute values for child Nodes

BrowsePath	**Description Attribute**
Signature	Project signature.
Comment	Comments concerning the project can be added here.

7.2 EquipmentInfoType ObjectType

7.2.1 Overview

The EquipmentInfoType is an ObjectType which contains equipment specific information concerning the main aggregate the information comes from. ATTENTION: the information shall not be required to interpret the standard conformant data set! It's just provided to identify a machine. The ObjectType is based on the BaseObjectType and is intended to be used as AddIn. Its definition is given in Table 25.

7.2.2 ObjectType Definition

Table 25 – EquipmentInfoType ObjectType Definition

Attribute	**Value**				
BrowseName	EquipmentInfoType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-5					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasProperty	Variable	EqpManufact	String	0:PropertyType	M,RO
0:HasProperty	Variable	EqpType	String	0:PropertyType	M,RO
0:HasProperty	Variable	EqpModel	String	0:PropertyType	O,RW
0: HasProperty	Variable	EqpSerNo	String	0:PropertyType	O,RW
0:HasComponent	Variable	EqpSysVer	String	0:BaseDataVariableType	O,RW
0:HasComponent	Variable	EqpInfo	String	0:BaseDataVariableType	O,RW
0:HasComponent	Variable	EqpName	String	0:BaseDataVariableType	O,RW
Conformance Units					
IREDES EquipmentInfoType					

The component Variables of the EquipmentInfoType have additional Attributes defined inTable 26.

Table 26 – EquipmentInfoType Attribute values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	EquipmentInfo	The default BrowseName for instances of this type.

7.2.3 ObjectType Description

The description can be found in Table 27.

Table 27 – EquipmentInfoType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
EqpManufact	Name of the manufacturer.
EqpType	Manufacturer internal type name of the machine.
EqpModel	Equipment model describing the model in the specified EqpType. To be stated if required for unequivocal machine type identification.
EqpSerNo	Serial number of the machine.
EqpSysVer	Version Info Automation System / Software
EqpInfo	Other equipment specific information. Free tex.
EqpName	Used for designation of the machine

7.3 GenHeadType ObjectType

7.3.1 Overview

The GenHeadType ObjectType contains the IREDES General header. It is based on the BaseObjectType and intended to be used as AddIn. It is formally defined in Table 28.

7.3.2 ObjectType definition

Table 28 – GenHeadType ObjectType Definition

Attribute	**Value**				
BrowseName	GenHeadType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasProperty	Variable	FileCreateDate	DateTime	0:PropertyType	M,RW
0:HasProperty	Variable	IRVersion	String	0:PropertyType	M,RW
0:HasProperty	Variable	DownCompat	String	0:PropertyType	M,RW
0:HasAddIn	Object	ProjectInfo		ProjectInfoType	O
0:HasAddIn	Object	EquipmentInfo		EquipmentInfoType	O
Conformance Units					
IREDES GenHeadType					

The component Variables of the GenHeadType have additional Attributes defined in Table 29.

Table 29 – GenHeadType Attribute values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	GenHead	The default BrowseName for instances of this type.

7.3.3 ObjectType Desciption

The description can be found in Table 30.

Table 30 – GenHeadType ObjectType Description

BrowsePath	**Description Attribute**
FileCreateDate	Date of file creation. This is the date/time stamp for initializatioin of the Data Set.
IRVersion	Version of the IREDES main components of the standard. this version number changes any time IREDES top level schemas are modified. Please note to state downward compatibility in the separate Attribute. Type definition see below. Fixed 2.0
DownCompat	Downward compatibility of the profile version stated in “version” can be guaranteed down to the version number stated in this attribute. Fixed 2.0
ProjectInfo	Project specific information. Type definition see below.
EquipmentInfo	Equipment specific information concerning the main aggregate the information comes from. ATTENTION: This information shall not be required to interpret a standard conformant data set.

7.4 DisplayToOperatorType ObjectType

7.4.1 Overview

The DisplayToOperatorType ObjectType is used to display messages to the operator of a machine. It is based on the BaseObjectType and is intended to be used as AddIn. Its formal definition is given in Table 31.

7.4.2 ObjectType definition

Table 31 – DisplayToOperatorType ObjectType Definition

Attribute	**Value**				
BrowseName	DisplayToOperatorType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	DispFlag	DispFlag	0:BaseDataVariableType	O,RW
0:HasComponent	Variable	AckFlag	String	0:BaseDataVariableType	O,RW
0:HasComponent	Variable	DispText	String	0:BaseDataVariableType	O,RW
Conformance Units					
IREDES DisplayToOperatorType					

The component Variables of the DisplayToOperatorType have additional Attributes defined in Table 32.

Table 32 – DisplayToOperatorType Attribute values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	DisplayToOperator	The default BrowseName for instances of this type.

7.4.3 ObjectType description

The description can be found in Table 33.

Table 33 – DisplayToOperatorType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
DispFlag	States under which circumstances the line (message) has to be displayed to the operator
AckFlag	Acknowledgement by the operator that he has read the message. (Will be transferred back as soon as the SiteHead is returned to the mine's computer system with the next protocol exchange. Contains the name of the operator (user name in the Automation system) or simply ACK if automation system does not work with user logins.
DispText	Text to be displayed.

7.5 IROptionType ObjectType

7.5.1 Overview

The IROptionType is based on the BaseObjectType and is intended to be used as AddIn. Its purpose is to allow individual IREDES standard extensions. These extensions will not be processed. The formal definition is given in Table 34.

7.5.2 ObjectType definition

Table 34 – IROptionType definition

Attribute	Value				
BrowseName	IROptionType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	OptionSchema	String	0:BaseDataVariableType	O, RW
Conformance Units					
IREDES IROptionType					

The component Variables of the IROptionType have additional Attributes defined in Table 35.

Table 35 – IROptionType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
DefaultInstanceBrowseName	IROption	The default BrowseName for instances of this type.

7.5.3 ObjectType description

The description can be found in Table 36.

Table 36 – IROptionType Attribute Values for Child Nodes

BrowsePath	Description Attribute
OptionSchema	URI for the schema that will extend the IREDES standard. This schema won't be processed.

7.6 SiteHeadType ObjectType

7.6.1 Overview

The SiteHeadType is based on the BaseObjectType and is intended to be used as AddIn. It represents an optional site header. Its formal definition is given in Table 37.

7.6.2 ObjectType definition

Table 37 – SiteHeadType ObjectType Definition

Attribute	**Value**				
BrowseName	SiteHeadType				
IsAbstract	False				
References	**Node Class**	**Browse Name**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	DisplayToOperator		DisplayToOperatorType	M
0:HasAddIn	Object	SiteOption		IROptionType	M
Conformance Units					
IREDES SiteHeadType					

The component Variables of the SiteHeadType have additional Attributes defined in Table 38.

Table 38 – SiteHeadType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	SiteHead	The default BrowseName for instances of this type.

7.6.3 ObjectType Description

The description can be found in Table 39.

Table 39 – SiteHeadType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
DisplayToOperator	Object used to display messages to the operator of a machine.
SiteOption	Object that holds/references information that will not be processed.

7.7 GenTrailerType ObjectType

7.7.1 Overview

The GenTrailerType is based on the BaseObjectType and is intended to be used as AddIn. It contains a CRC 32 checksum which is calculated over the entire IREDES file. This is used for data integrity. The formal definition of the ObjectType is given in Table 40.

7.7.2 ObjectType definition

Table 40 – GenTrailerType ObjectType Definition

Attribute	**Value**				
BrowseName	GenTrailerType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasProperty	Variable	FileCloseDate	DateTime	0:PropertyType	M, RW
0:HasProperty	Variable	ChkSum	ByteString	0:PropertyType	M, RW
Conformance Units					
IREDES GenTrailerType					

The component Variables of the GenTrailerType have additional Attributes defined in Table 41.

Table 41 – GenTrailerType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	GenTrailer	The default BrowseName for instances of this type.

7.7.3 ObjectType Description

The description can be found in Table 42.

Table 42 – GenTrailerType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
FileCloseDate	Date the file was created
ChkSum	CRC 32 checksum

7.8 IREDESType ObjectType

7.8.1 Overview

The IREDESType is part of a complete IREDES data set. It is intended to be used as AddIn and based on the BaseObjectType. Its formal definition is given in Table 43.

7.8.2 ObjectType definition

Table 43 – IREDESType ObjectType Definition

Attribute	Value				
BrowseName	IREDESType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	GenHead		GenHeadType	M
0:HasAddIn	Object	SiteHead		SiteHeadType	O
0:HasProperty	Variable	IRVersion	String	0:PropertyType	M, RW
HasProperty	Variable	IRDownwCompat	String	0:PropertyType	M, RW
Conformance Units					
IREDES IREDESType					

The component Variables of the IREDESType have additional Attributes defined in Table 44.

Table 44 – IREDESType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
0:DefaultInstanceBrowseName	IREDES	The default BrowseName for instances of this type.

7.8.3 ObjectType description

The description can be found in Table 45.

Table 45 – IREDESType Attribute Values for Child Nodes

BrowsePath	Description Attribute
GenHead	IREDES general header.
SiteHead	Optional site header.
IRVersion	IREDES Base version needed to process this scheme.
IRDownwCompat	Earliest version the IREDES Base system version stated in IRVersion is downward compatible to. Since this version, only extensions have been made but no changes affecting compatibility issues (data type changes etc).

7.9 OpPerfLogType Object Type

7.9.1 Overview

The OpPerfLogType ObjectType is based on the BaseObjectType and is intended to be used as AddIn. Its purpose is to accumulate the time of each operation mode during the reporting period. Its formal definition is given in Table 46.

7.9.2 OpPerfLogType Object Type Definition

Table 46 – OpPerfLogType ObjectType Definition

Attribute	Value				
BrowseName	OpPerfLogType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	Mworking	Duration	0:BaseDataVariableType	M, RW
0:HasComponent	Variable	WaitProcess	Duration	0:BaseDataVariableType	M, RW
0:HasComponent	Variable	WaitOperator	Duration	0:BaseDataVariableType	M, RW
0:HasComponent	Variable	WaitRepair	Duration	0:BaseDataVariableType	M, RW
0:HasComponent	Variable	WaitSamples	Duration	0:BaseDataVariableType	M, RW
0:HasComponent	Variable	TurnedOff	Duration	0:BaseDataVariableType	M, RW
Conformance Units					
IREDES OpPerfLogType					

The component Variables of the OpPerfLogType have additional Attributes defined in Table 47.

Table 47 – OpPerfLogType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
0:DefaultInstanceBrowseName	OpPerfLog	The default BrowseName for instances of this type.

7.9.3 ObjectType Description

The description can be found in Table 48.

Table 48 – OpPerfLogType Attribute Values for Child Nodes

BrowsePath	Description Attribute
Mworking	Machine working.
WaitProcess	Machine waiting for other partners in the process or for process reasons not caused by the machine itself. This may be an (autonomous) machine waiting for access to a shared tramming zone or waiting for access to a dump shaft, a truck to become available etc. See “IREDES Drill Rig profile description” document.
WaitOperator	Time the machine waits for operator assistance during the reporting period. See “IREDES Drill Rig profile description” document.
WaitRepair	Waiting time for repair until the repair is finished and the machine manually is switched on again. See “IREDES Drill Rig profile description” document.
WaitSamples	Waiting time for external supplies like electric power, network connection for remote control (if not in local operation mode), water, material etc. See “IREDES Drill Rig profile description” document.
TurnedOff	Machine intentionally put in “OFF” state. This state is only counted if the machine is intentionally deactivated by an operator. Observe that a “switch off” while the machine is in “Wait Repair” mode will be counted as “wait repair” until the machine is switched on again.

7.10 IRpPerfGenType ObjectType

7.10.1 Overview

The IRpPerfGenType ObjectType is a generic type used report production performance. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 49.

7.10.2 ObjectType Definition

Table 49 – IRpPerfGenType ObjectType Definition

Attribute	**Value**				
BrowseName	IRpPerfGenType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IREDES		IREDESType	M
0:HasProperty	Variable	ReportId	String	0:PropertyType	M, RW
0:HasProperty	Variable	StartLogTime	DateTime	0:PropertyType	M, RW
0:HasProperty	Variable	EndLogTine	DateTime	0:PropertyType	M, RW
0:HasComponent	Variable	Comment	String	0:BaseDataVariableType	O, RW
0:HasAddIn	Object	OpPerfLog		OpPerfLogType	O
Conformance Units					
IREDES IRpPerfGenType					

The component Variables of the IRpPerfGenType have additional Attributes defined in Table 50.

Table 50 – IRpPerfGenType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	IRpPerfGen	The default BrowseName for instances of this type.

7.10.3 ObjectType Description

The description can be found in Table 51.

Table 51 – IRpPerfGenType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
IREDES	Basic IREDES data type. Part of every complete IREDES data set.
ReportId	Report id code, to uniquely identify this log report.
StartLogTime	Start of the reporting period. Date and time when the first entry to this xml-set was made.
EndLogTine	End of the reporting period. Date and time when the last entry to this xml-set was made.
Comment	Project information concerning this log.
OpPerfLog	Object Type which accumulates the time of each operation mode during the reporting period.

7.11 IRplanGenType ObjectType

7.11.1 Overview

The IRplanGenType ObjectType is based on the BaseObjectType and intended to be used as AddIn. Its purpose is to provide a generic datatype for production planning. Its formal definition can be found inTable 52.

7.11.2 ObjectType Definition

Table 52 – IRplanGenType ObjectType Definition

Attribute	**Value**				
BrowseName	IRplanGenType				
IsAbstract	False				
References	**Node Class**	**Browse Name**	**DataType**	**TypeDefinition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstance BrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IREDES		IREDESType	M
0:HasProperty	Variable	PlanName	String	0:PropertyType	M, RW
0:HasProperty	Variable	PlanId	String	0:PropertyType	M, RW
0:HasComponent	Variable	Comment	String [8]	0:BaseDataVariableType	O, RW
0:HasComponent	Variable	Project	String	0:BaseDataVariableType	O, RW
0:HasComponent	Variable	WorkOrder	String	0:BaseDataVariableType	O, RW
Conformance Units					
IREDES IRplanGenType					

The component Variables of the IRplanGenType have additional Attributes defined in Table 53 .

Table 53 – IRplanGenType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
DefaultInstanceBrowseName	IRplanGen	The default BrowseName for instances of this type.

7.11.3 ObjectType Description

The description can be found in Table 54.

Table 54 – IRplanGenType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
IREDES	Basic IREDES data type. Part of every complete IREDES data set.
PlanId	IREDES internal production plan ID used for reference e.g. by Production Quality data sets basing on a particular production plan.
PlanName	Plan logical name to identify this specific plan to the human user. Useful to help the operator of a machine to logical identify a specific plan.
Comment	Comments to the plan for example type of plan, purpose, tools to use.
Project	Project id code. To identify the target project for this plan.
WorkOrder	Work order id code. To identify the work order associated with this plan.

7.12 IRStatusGenType

7.12.1 Overview

The IRStatusGenType is based on the BaseObjectType and intended to be used as AddIn. The IRStatusGenType is a generic datatype for status reporting. Its formal definition can be found in Table 55.

7.12.2 ObjectType Definition

Table 55 – IRStatusGenType ObjectType Definition

Attribute		**Value**			
BrowseName		IRStatusGenType			
IsAbstract		False			
References	**Node Class**	**BrowseName**	**DataType**	**Type-Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-5					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	QualifiedName	0: PropertyType	
0:HasAddIn	Object	IREDES		IREDESType	M
0:HasProperty	Variable	ReportId	String	0:PropertyType	M, RW
0:HasProperty	Variable	StartLogTime	DateTime	0:PropertyType	M, RW
0:HasProperty	Variable	EndLogTime	DateTime	0:PropertyType	M, RW
0:HasComponent	Variable	Comment	String	0:BaseDataVariableType	O, RW
0:HasComponent	Variable	OperatorId	String	0:BaseDataVariableType	O, RW
Conformance Units					
IREDES IRStatusGenType					

The component Variables of the IRStatusGenType have additional Attributes defined in Table 56 .

Table 56 – IRStatusGenType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	IRStatusGen	The default BrowseName for instances of this type.

7.12.3 ObjectType Description

The description can be found in Table 57.

Table 57 – IRStatusGenType Attribute values for child Nodes

BrowsePath	**Description Attribute**
IREDES	Basic IREDES data type. Part of every complete IREDES data set.
ReportId	Report id code, to uniquely identify this log report.
StartLogTime	Start of the reporting period. Date and time when the first entry to this xml-set was made.
EndLogTime	End of the reporting period. Date and time when the last entry to this xml-set was made.
Comment	Project information concerning this log.
OperatorId	Identify the operator of the machine for reference.

7.13 IRLTMMonType

7.13.1 Overview

The IRLTMMonType ObjectType is based on the BaseObjectType and is intended to be used as AddIn. The IRLTMMonType is used for LHD machine monitoring reporting. Its formal definition can be found in Table 58.

7.13.2 ObjectType Definition

Table 58 – IRLTMMonType ObjectType Definition

Attribute	**Value**				
BrowseName	IRLTMMonType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IREDES		IREDESType	M
0:HasAddIn	Object	GenTrailer		GenTrailerType	M
0:HasProperty	Variable	LTMMonVersion	String	0:PropertyType	M
0:HasProperty	Variable	LTMMonDownwCompat	String	0:PropertyType	M
Conformance Units					
IREDES IRLTMMonType					

The component Variables of the IRLTMMonType have additional Attributes defined in Table 59.

Table 59 – IRLTMMonType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	IRLTMMon	The default BrowseName for instances of this type.

7.13.3 ObjectType Description

The description can be found in Table 60.

Table 60 – IRLTMMonType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
IREDES	Basic IREDES data type. Part of every complete IREDES data set.
GenTrailer	Datatype that is used to guarantee the integrity of the data set.
LTMMonVersion	Fixed V 1.0
LTMMonDownwCompat	Fixed V 1.0

7.14 IRLTPlanType ObjectType

7.14.1 Overview

The IRLTPlanType is used for LHD production planning. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 61.

7.14.2 ObjectType Definition

Table 61 – IRLTPlanType ObjectType Definition

Attribute	**Value**				
BrowseName	IRLTPlanType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**Data-Type**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IRplanGen		IRplanGenType	M
0:HasAddIn	Object	GenTrailer		GenTrailerType	M
0:HasProperty	Variable	LTPlanVersion	String	0:PropertyType	M
0:HasProperty	Variable	LTPlanDownwCompat	String	0:PropertyType	M
Conformance Units					
IREDES_IRLTPlanType					

The component Variables of the IRLTPlanType have additional Attributes defined in Table 62.

Table 62 – IRLTPlanType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
DefaultInstanceBrowseName	IRLTPlan	The default BrowseName for instances of this type.

7.14.3 ObjectType Description

The description can be found in Table 63.

Table 63 – IRLTPlanType ObjectType Description

BrowsePath	**Description Attribute**
IRplanGen	Generic datatype for production planning.
GenTrailer	Datatype that is used to ensure the integrity of the data set.
LTPlanVersion	Fixed V 1.0
LTPlanDownwCompat	Fixed V 1.0

7.15 LTPPwaitProcType

7.15.1 Overview

The LTPPwaitProcType ObjectType is used to document process caused waiting time. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 64.

7.15.2 ObjectType Definition

Table 64 – LTPPwaitProcType ObjectType Definition

Attribute	Value				
BrowseName	LTPPwaitProcType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**Data-Type**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	BlastDelay	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	CantDump	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	Traffic	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	NoRock	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	MineUtils	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	RoadMaint	DateTime	0:BaseDataVariableType	O
Conformance Units					
IREDES LTPPwaitProcType					

The component Variables of the LTPPwaitProcType have additional Attributes defined in Table 65.

Table 65 – LTPPwaitProcType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
DefaultInstanceBrowseName	LTPPwaitProc	The default BrowseName for instances of this type.

7.15.3 ObjectType Description

The description can be found in Table 66.

Table 66 – LTPPwaitProcType Attribute Values for Child Nodes

BrowsePath	Description Attribute
BlastDelay	Any Delay caused by blasting operations.
CantDump	Dump point blocked by another machine, boulders or dump shaft filled / truck missing.
Traffic	Traffic caused delays: roadway blocked by another machine / cars / other traffic.
NoRock	Wait for material to handle - No access to material to load.
MineUtils	Waiting for mine utilities.
RoadMaint	Waiting for roadway maintenance.

7.16 LTPPTimeRepType

7.16.1 Overview

The LTPPTimeRepType is used for time reporting concerning a particular load/dump point pair. It is based on the BaseObjectType and intended to be used as an AddIn. Its formal definition can be found in Table 67.

7.16.2 ObjectType Definition

Table 67 – LTPPTimeRepType ObjectType Definition

Attribute	**Value**				
BrowseName	LTPPTimeRepType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasProperty	Variable	LTPPStartTime	UtcTime	0:PropertyType	M
0:HasProperty	Variable	LTPPEndTime	UtcTime	0:PropertyType	M
Conformance Units					
IREDES LTPPTimeRepType					

The component Variables of the LTPPTimeRepType have additional Attributes defined in Table 68.

Table 68 – LTPPTimeRepType Attribute values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
DefaultInstanceBrowseName	LTPPTimeRep	The default BrowseName for instances of this type.

7.16.3 ObjectType Description

The description can be found in Table 69.

Table 69 – LTPPTimeRepType Attribute Values for Child Nodes

BrowsePath	**Description Attribute**
LTPPStartTime	Mission start time
LTPPEndTime	Mission end time

7.17 LTPPMissionType

7.17.1 Overview

The LTPPMissionType is used to generate a report for each tramming order ("mission") run during the reporting period. One object per mission! One "mission" is defined as tramming from A to B. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 70.

7.17.2 ObjectType Definition

Table 70 – LTPPMissionType ObjectType Definition

Attribute	Value				
BrowseName	LTPPMissionType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	LTPPMisSeq	UInt64	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPMptFromN	String	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPMptFromID	String	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMptFromType	LTPPMptFromType	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMptToN	String	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPMptToID	String	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMptToType	LTPPMptToType	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMarea	String	0:BaseDataVariableType	O
0:HasProperty	Variable	LTPPMisstart	DateTime	0:PropertyType	M
0:HasProperty	Variable	LTPPMissEnd	DateTime	0:PropertyType	M
0:HasComponent	Variable	LTPPMwaitPoint	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMaction	LTPPMaction	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPMwaitgen	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMtimeAct	DateTime	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPMpayld	Float	0:BaseDataVariableType	M
0:HasProperty	Variable	LTPPMtramEnd	DateTime	0:PropertyType	M
0:HasComponent	Variable	LTPPMtramDist	Float	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPMopID	String	0:BaseDataVariableType	O
Conformance Units					
IREDES LTPPMissionType					

The component Variables of the LTPPMissionType have additional Attributes defined in Table 71.

Table 71 – LTPPMissionType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
0:DefaultInstanceBrowseName	LTPPMission	The default BrowseName for instances of this type.

7.17.3 ObjectType Description

The description can be found in Table 72.

Table 72 – LTPPMissionType Attribute Values for Child Nodes

BrowsePath	Description Attribute
LTPPMisSeq	Sequence number of the mission. Starting at 1 with the first mission in the reporting period.
LTPPMptFromN	Name of the point where the mission originated (tramming started).
LTPPMptFromID	Electronic (Tag) ID of the point where the mission originated (Tramming started). Electronic ID of the point stated in LTPPMptFromN.
LTPPMptFromType	Type of the point where the mission started.
LTPPMptToN	Name of the destination point, where the tramming finished and the mission ended.
LTPPMptToID	Electronic (tag) ID of the point where the mission ended (destination point).
LTPPMptToType	Type of the point where the mission ended.
LTPPMarea	ID for the mine area the machine is operating in. Usually both departure and destination points should be located in this area.
LTPPMisstart	Time tag when the mission started.
LTPPMissEnd	End time of the mission. Counting ends when the machine is ready to start the next mission, including all waiting before the next mission can be started.
LTPPMwaitPoint	Waiting time for destination point availability.
LTPPMaction	Action to be carried out at destination point specified in LTPPMptTo.
LTPPMwaitgen	Accumulated waiting time during the mission, excluding the time reported in LTPPMwaitPoint.
LTPPMtimeAct	Duration of the action carried out at the destination point in LTPPMaction.
LTPPMpayld	Tonnage of payload carried between start and destination points.
LTPPMtramEnd	Tramming end time: Time stamp when the tramming ended at destination point.
LTPPMtramDist	Tramming distance between start and destination point. Unit: km; Resolution: 0.0001km (10cm).
LTPPMopID	Operator ID

7.18 LTPPaccPtsType

7.18.1 Overview

The LTPPaccPtsType is used to document data for each pair of load point / dump point. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 73.

7.18.2 ObjectType Definition

Table 73 – LTPPaccPtsType ObjectType Definition

Attribute	**Value**				
BrowseName	LTPPaccPtsType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasProperty	Variable	LTPPLdrawPtN	String	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPLdrawPtID	String	0:BaseDataVariableType	O
0:HasProperty	Variable	LTPPLdumpPtN	String	0:PropertyType	M
0:HasComponent	Variable	LTPPLdumpPtID	String	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPLmass	Float	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPLcycl	UInt16	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPLdist	Float	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPLopObserv	String	0:BaseDataVariableType	O
0:HasAddIn	Object	LTPPTimeRep		LTPPTimeRepType	O
Conformance Units					
IREDES LTPPaccPtsType					

The component Variables of the LTPPaccPtsType have additional Attributes defined in Table 74**.**

Table 74 – LTPPaccPtsType Attribute Values for child Nodes

BrowsePath	**Value Attribute**	**Description Attribute**
0:DefaultInstanceBrowseName	LTPPaccPts	The default BrowseName for instances of this type.

7.18.3 ObjectType Description

The description can be found in Table 75.

Table 75 – LTPPaccPtsType Attribute Values for Child Nodes

BrowsePath	Description Attribute
LTPPLdrawPtN	Name of the draw (load point) accessed in the reported job.
LTPPLdrawPtID	Electronic (tag) ID of the draw (load point) in this combination (Name in 1.1.1.1).
LTPPLdumpPtN	Name of the dump point in this combination.
LTPPLdumpPtID	Electronic (tag) ID of the draw (load point) in this combination (Name in 1.1.1.1).
LTPPLmass	Mass transported between this point pair during reporting period in t. Min accuracy: 0.01t.
LTPPLcycl	Number of cycles travelled between this point pair during reporting period.
LTPPLdist	Distance travelled between those two points during reporting period. Accumulated distance of al rounds travelled. Both routes are counted! Accuracy: 0,01 km
LTPPLopObserv	Operator observations regarding the travel way, load or dump points during reporting period (e.g. loose rock, bad roadway,...). Preliminarily a string, later we can add preselect-lists for easier operator input!
LTPPTimeRep	Time reporting for access to the particular load / Dump point pair. Multiple elements may be required as work can be interrupted and restarted again at a later time during reporting period.

7.19 LTPPLoadRepType

7.19.1 Overview

The LTPPLoadRepType is a special type used for LHD load reporting. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition can be found in Table 76.

7.19.2 ObjectType Definition

Table 76 – LTPPLoadRepType ObjectType Definition

Attribute	Value				
BrowseName	LTPPLoadRepType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**Data Type**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasComponent	Variable	LTPPCyclTot	UInt64	0:BaseDataVariableType	M
0:HasComponent	Variable	LTPPdistTot	Float	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPwrkDist	Float	0:BaseDataVariableType	O
0:HasComponent	Variable	LTPPloadTot	Float	0:BaseDataVariableType	M
0:HasAddIn	Object	LTPPwaitProc		LTPPwaitProcType	O
0:HasAddIn	Object	LTPPaccPts		LTPPaccPtsType	O
0:HasAddIn	Object	LTPPMission		LTPPMissionType	O
Conformance Units					
IREDES LTPPLoadRepType					

The component Variables of the LTPPLoadRepType have additional Attributes defined in Table 77.

Table 77 – LTPPLoadRepType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
DefaultInstanceBrowseName	LTPPLoadRep	The default BrowseName for instances of this type.

7.19.3 ObjectType Description

The description can be found in Table 78.

Table 78 – LTPPLoadRepType Attribute Values for Child Nodes

BrowsePath	Description Attribute
LTPPCyclTot	Total number of working cycles (rounds) completed during the reporting period
LTPPdistTot	Overall distance travelled in during the reporting period. This includes also non-performance related tramming e.g. to workshop,... Minimum accuracy required by the standard: 0,1 km
LTPPwrkDist	Total distance travelled in a working mode (as reported by MWorking) during the reporting period.
LTPPloadTot	Total load carried under all completed working cycles during reporting period. Minimum accuracy required by the standard: 0,01
LTPPwaitProc	Process caused waiting time - LHD specific! Specifies details of the WaitProc timing in the Application Profile!
LTPPaccPts	Report data for each pair of load point / dump point.
LTPPMission	See LTPPMissionType.

7.20 IRLTPPerfType

7.20.1 Overview

The IRLTPPerfType ObjectType is used for LHD production performance reporting. It is based on the BaseObjectType and intended to be used as AddIn. Its formal definition is given in Table 79.

7.20.2 ObjectType Definition

Table 79 – IRLTPPerfType ObjectType Definition

Attribute	**Value**				
BrowseName	IRLTPPerfType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	Data Type	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IRpPerfGen		IRpPerfGenType	M
0:HasAddIn	Object	LTPPLoadRep		LTPPLoadRepType	M
0:HasProperty	Variable	LTPPerfVersion	String	0:PropertyType	M
0:HasProperty	Variable	LTPPerfDownwCompat	String	0:PropertyType	M
Conformance Units					
IREDES IRLTPPerfType					

The component Variables of the IRLTPPerfType have additional Attributes defined in Table 80**.**

Table 80 – IRLTPPerfType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
0:DefaultInstanceBrowseName	IRLTPPerf	The default BrowseName for instances of this type.

7.20.3 ObjectType Description

The description can be found in Table 81.

Table 81 – IRLTPPerfType Attribute Values for Child Nodes

BrowsePath	Description Attribute
IRpPerfGen	Generic type used report production performance.
LTPPLoadRep	Reports on how much material has been transported between load and dump points during the reporting period.
LTPPerfVersion	Fixed V 1.0
LTPPerfDownwCompat	Fixed V 1.0

7.21 IRLHDTruckType ObjectType

7.21.1 Overview

The IREDES IRLHDTruckType ObjectType is intended to be used as AddIn or for instantiation. It constitutes a complete IREDES IRLHDTruck equipment profile. It is based on the BaseObjectType. Its formal definition can be found in Table 82.

7.21.2 ObjectType Definition

Table 82 – IRLHDTruckType ObjectType Definition

Attribute	Value				
BrowseName	IRLHDTruckType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**Data Type**	**Type Definition**	**Other**
Subtype of BaseObjectType as defined in OPC 10000-3					
0:HasProperty	Variable	0:DefaultInstanceBrowseName	0:QualifiedName	0:PropertyType	
0:HasAddIn	Object	IRLTPPerf		IRLTPPerfType	M
0:HasAddIn	Object	IRLTPlan		IRLTPlanType	M
0:HasAddIn	Object	IRLTMMon		IRLTMMonType	M
Conformance Units					
IREDES IRLHDTruckType					

The component Variables of the IRLHDTruckType have additional Attributes defined in Table 83.

Table 83 – IRLHDTruckType Attribute Values for child Nodes

BrowsePath	Value Attribute	Description Attribute
DefaultInstanceBrowseName	IRLHDTruck	The default BrowseName for instances of this type.

7.21.3 ObjectType Description

The description can be found in Table 84Table 81.

Table 84 – IRLHDTruckType Attribute Values for Child Nodes

BrowsePath	Description Attribute
IRLTPPerf	IRLHD production performance reporting.
IRLTPlan	IRLHD production planning.
IRLTMMon	IRLHD machine monitoring reporting.

8 Profiles and Conformance Units

This chapter defines the corresponding profiles and conformance units for the OPC UA Information Model for OPC 40568-1. Profiles are named groupings of conformance units. Facets are Profiles that will be combined with other Profiles to define the complete functionality of an OPC UA Server or Client. The following tables specify the facets available for servers that implement the OPC 40568-1 Information Model companion specification.

8.1 Conformance Units

Table 85 defines the corresponding *ConformanceUnits* for the OPC UA Information Model for OPC 40568- IREDES

Table 85 – Conformance Units for OPC 40568 IREDES

Category	Title	Description
Server	IREDES Component	Supports the IREDESType type definition.
Server	IREDES ProjectInfoType	Supports the ProjectInfoType and has at least one instance of it in the address space
Server	IREDES EquipmentInfoType	Supports the EquipmentInfoType and has at least one instance of it in the address space
Server	IREDES GenHeadType	Supports the GenHeadType and has at least one instance of it in the address space
Server	IREDES DisplayToOperatorType	Supports the DisplayToOperatorType and has at least one instance of it in the address space
Server	IREDES IROptionType	Supports the IROptionType and has at least one instance of it in the address space
Server	IREDES SiteHeadType	Supports the SiteHeadType and has at least one instance of it in the address space
Server	IREDES GenTrailerType	Supports the GenTrailerType and has at least one instance of it in the address space
Server	IREDES IREDESType	Supports the IREDESType and has at least one instance of it in the address space
Server	IREDES OpPerfLogType	Supports the OpPerfLogType and has at least one instance of it in the address space
Server	IREDES IRplanGenType	Supports the IRplanGenType and has at least one instance of it in the address space
Server	IREDES IRStatusGenType	Supports the StatusGenType and has at least one instance of it in the address space
Server	IREDES IRLTMMonType	Supports the IRLTMMonType and has at least one instance of it in the address space
Server	IREDES IRLTPlanType	Supports the IRLTPlanType and has at least one instance of it in the address space
Server	IREDES LTPPwaitProcType	Supports the LTPPwaitProcType and has at least one instance of it in the address space
Server	IREDES LTPPTimeRepType	Supports the LTPPTimeRepType and has at least one instance of it in the address space
Server	IREDES LTPPMissionType	Supports the LTPPMissionType and has at least one instance of it in the address space
Server	IREDES LTPPaccPtsType	Supports the LTPPaccPtsType and has at least one instance of it in the address space
Server	IREDES LTPPLoadRepType	Supports the LTPPLoadRepType and has at least one instance of it in the address space
Server	IREDES IRLTPPerfType	Supports the IRLTPPerfType and has at least one instance of it in the address space
Server	IREDES IRLHDTruckTyoe	Supports the IRLHDTruckTyoe and has at least one instance of it in the address space
Client	IREDES component client query	Supports querying variable instance declarations of the IREDESType

8.2 Profiles

8.2.1 Profile list

Table 86 lists all Profiles defined in this document and defines their URIs.

Table 86 – Profile URIs for OPC 40568-1

Profile	URI
IREDES Core Server Facet	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Server/Core
IREDES Server Facet	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Server/IREDES
IREDES Base Server Profile	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Server/Base
IREDES Core Client Facet	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Client/Core
IREDES Client Facet	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Client/IREDES
IREDES Base Client Profile	http://opcfoundation.org/UA-Profile/Mining/ExternalStandards/IREDES/Client/Base

8.2.2 Server Facets

8.2.2.1 Overview

The following sections specify the *Facets* available for *Servers* that implement the OPC 40568- OPC UA for Mining – External Standards – IREDES companion specification. Each section defines and describes a *Facet* or *Profile*.

8.2.2.2 IREDES Core Server Facet

Table 87 defines a Facet that describes the fundamental base functionalities an OPC UA server is expected to process for serving OPC UA CS Mining IREDES Information Model. However, this will not allow to serve meaningful OPC UA CS Mining IREDES information models and purely serves to describe the fundamental Profiles and Facets required for basic server operation.

Table 87 –IREDES Core Server Facet

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0:Core 2022 Server Facet http://opcfoundation.org/UA-Profile/Server/Core2022Facet	M
Profile	0: Base Server Behaviour Facet http://opcfoundation.org/UA-Profile/Server/Behaviour	M
Profile	0:Data Access Server Facet http://opcfoundation.org/UA-Profile/Server/DataAccess	M

8.2.2.3 IREDES Server Facet

Table 88 defines a facet that describes the functionalities of an OPC UA External Standards – IREDES server is expected to process in regard to being able to serve a component recursion of Object instances. Specifically, this is referring to the Components Instance – Declaration of the IREDESType definition provided in chapter 7.8.

Table 88 – IREDES IREDES Server Facet

Group	Conformance Unit / Profile Title	Mandatory / Optional
IREDES	IREDES Component	M
IREDES	IREDES ProjectInfoType	O
IREDES	IREDES EquipmentInfoType	O
IREDES	IREDES GenHeadType	O
IREDES	IREDES DisplayToOperatorType	O
IREDES	IREDES IROptionType	O
IREDES	IREDES SiteHeadType	O
IREDES	IREDES GenTrailerType	O
IREDES	IREDES IREDESType	O
IREDES	IREDES OpPerfLogType	O
IREDES	IREDES IRpPerfGenType	O
IREDES	IREDES IRplanGenType	O
IREDES	IREDES IRStatusGenType	O
IREDES	IREDES IRLTMMonType	O
IREDES	IREDES IRLTPlanType	O
IREDES	IREDES LTPPwaitProcType	O
IREDES	IREDES LTPPTimeRepType	O
IREDES	IREDES LTPPMissionType	O
IREDES	IREDES LTPPaccPtsType	O
IREDES	IREDES LTPPLoadRepType	O
IREDES	IREDES IRLTPPerfType	O
IREDES	IREDES IRLHDTruckType	O

8.2.2.4 IREDES Base Server Profile

Table 89 defines a Profile that describes the functionalities of an OPC UA server that is used serve OPC UA CS Mining External Standards IREDES Information Models. Servers complying to this profile can be used to serve IREDES OPC UA Information Models.

Table 89 – IREDES Base Server Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	IREDES Core Server Facet	M
Profile	IREDES IREDES Server Facet	M

8.2.3 Client Facets

8.2.3.1 Overview

The following tables specify the *Facets* available for *Clients* that implement the OPC 40568 - 1 External Standards – IREDES companion specification.

8.2.3.2 IREDES Core Client Facet

Table 90 defines a *Facet* that describes the base characteristics for all OPC UA *Clients* that make use of this companion specification. Additional *Profiles* will define support for various information models that are part of this document.

Table 90 –IREDES Core Client Facet

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0:Core 2022 Client Facet https://profiles.opcfoundation.org/UA-Profile/Client/Core2022Facet	M
Profile	0: Base Client Behaviour Facet http://opcfoundation.org/UA-Profile/Client/Behaviour	M
Profile	0:AddressSpace Lookup Client Facet http://opcfoundation.org/UA-Profile/Client/AddressSpaceLookup	M
Profile	0: Diagnostic Client Facet http://opcfoundation.org/UA-Profile/Client/Diagnostic	M
Profile	0: Attribute Read Client Facet http://opcfoundation.org/UA-Profile/Client/AttributeRead	M
Profile	0: Attribute Write Client Facet http://opcfoundation.org/UA-Profile/Client/AttributeWrite	M
Profile	0: DataChange Subscriber Client Facet http://opcfoundation.org/UA-Profile/Client/DataChangeSubscriber2021	M
Profile	0: Durable Subscription Client Facet http://opcfoundation.org/UA-Profile/Client/DurableSubscription	M
Profile	0:DataAccess Client Facet http://opcfoundation.org/UA-Profile/Client/DataAccess	M
Profile	0: Aggregate Subscriber Client Facet http://opcfoundation.org/UA-Profile/Client/AggregateSubscriber	M

8.2.3.3 IREDES Client Facet

Defines a profile that describes the functionalities of an OPC UA CS Mining External Standards – IREDES Client to query information provided by an OPC UA CS Mining External Standards – IREDES server serving a component recursion of object instances. Specifically, this is referring to the Components Instance – Declaration of the IREDESType defined in chapter 7.8.

Table 91 – IREDES Client Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
IREDES	IREDES Component Client Query	M

8.2.3.4 IREDES Base Client Profile

IREDES Base Client Profile defines a Facet that describes the functionalities of an OPC UA client that is used to query an OPC UA server that implements the IREDES Server Profile.

Table 92 – IREDES Base Client Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	IREDES Core Client Facet	M
Profile	IREDES Client Facet	M

9 Namespaces

9.1 Namespace Metadata

Table 93 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 93 – NamespaceMetadata Object for this Document

Attribute	Value	
BrowseName	http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES	
Property	**DataType**	**Value**
NamespaceUri	String	http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES
NamespaceVersion	String	1.0.0
NamespacePublicationDate	DateTime	2023-09-01
IsNamespaceSubset	Boolean	False
StaticNodeIdTypes	IdType []	0
StaticNumericNodeIdRange	NumericRange []	
StaticStringNodeIdPattern	String	

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

9.2 Handling of OPC UA Namespaces

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

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

Table 94 provides a list of mandatory and optional namespaces used in an OPC 40568-1 OPC UA *Server*.

Table 94 – Namespaces used in a OPC 40568 - 1 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/Mining/ExternalStandards/IREDES	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 95 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 95 – Namespaces used in this document

NamespaceURI	Namespace Index	Example
http://opcfoundation.org/UA/	0	0:EngineeringUnits

Annex A
(normative)

OPC 40568-1 Namespace and mappings

A.1 NodeSet and supplementary files for OPC 40568-1 Information Model

The OPC 40568-1 *Information Model* is identified by the following URI:

http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES

Documentation for the NamespaceUri can be found here.

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

https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES&v=1.0.0&i=1

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

https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES&i=1

Supplementary files for the OPC 40568-1 *Information Model* can be found here:

https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES&v=1.0.0&i=2

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

https://reference.opcfoundation.org/nodesets/?u=http://opcfoundation.org/UA/Mining/ExternalStandards/IREDES&i=2

A.2 Capability Identifier

The capability identifier for this document shall be:

`IREDES`

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