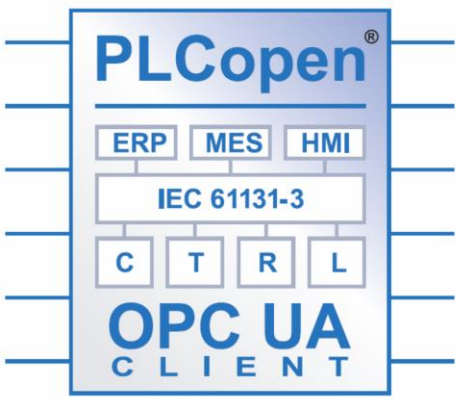
Joined Technical Specification
PLCopen and OPC Foundation

PLCopen OPC-UA Client for IEC61131-3

Official Release Version 1.1



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The following paper

PLCopen OPC-UA Client for IEC61131-3

is a joined document from PLCopen and OPC Foundation.

It summarises the results of the PLCopen OPC UA Task Force, containing contributions of all its members.

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Change Status List:

Version number	Date	Change comment
V 0.9.8	03.04.2014	Release Candidate – as discussed in the web meeting
V 1.0	03.04.2014	Released
V 1.1 RC13	25.08.2016	Release Candidate – as discussed in multiple web meetings Important changes to V1.0 - Rename UA_NodeClass to UA_NodeClassMask - Enum value changed in UAIdentifierType - Extend UAMonitoredSettings with parameter QueueSize - Depricated Structed Data Type UANodeInfo - The graphical representation of the order of the outputs of the FB's have been harmonized: Done, Busy, Error; ErrorID, then general outputs, and finaly the VAR_IN_OUTs. For this reason we separate between V1.0 and V1.1 in the compliance list as seen in the Appendix A. - Moved these Functionsblocks into new chapter "Phased out Functionsblocks": - UA_NamespaceGetIndex - UA_TranslatePath - UA_NodeGetHandle, UA_ReleaseHandle, UA_NodeGetInfo - UA_SubscriptionOperate - UA_MonitoredItemAdd, UA_MonitoredItemRemove, UA_MonitoredItemOperate - UA_Read, UA_Write - UA_MethodeGetHandle, UA_MethodeReleaseHandle New functionality: - Created new Structured Data Type UANodeInformation - Created new Functionblocks with "List" functionality - UA_NamespaceGetIndexList, UA_ServerGetIndexByUriList, - UA_TranslatePathList - UA_NodeGetHandleList, UA_NodeReleaseHandleList - UA_NodeGetInformation - UA_MonitoredItemAddList, UA_MonitoredItemRemoveList - UA_MonitoredItemModifyList, UA_MonitoredItemOperateList - UA_MethodeGetHandleList, UA_MethodReleaseHandleList - UA_EventItemAdd, UA_EventItemOperate, UA_EventItemRemove - UA_HistoryUpdate Added Appendix about Compliance procedure and make use of of PLCopen OPC UA logo

Joined Working Group PLCopen and OPC Foundation

AGREEMENT OF USE

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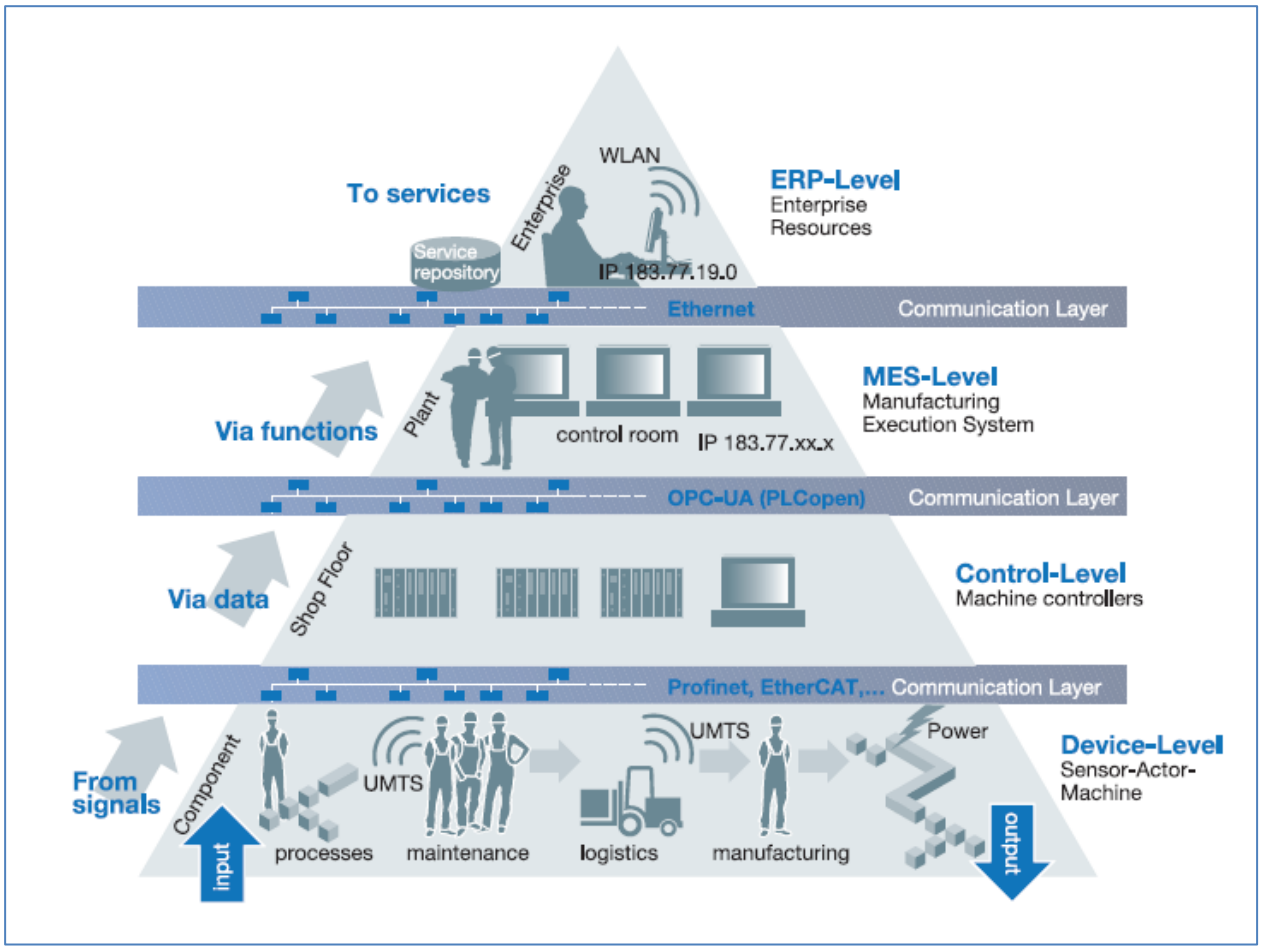
1. Scope

This specification was created by a joint working group of the OPC Foundation and PLCopen. It defines a set of IEC 61131-3 based function blocks for mapping the OPC UA Client functionalities. With this functionality implemented on a controller it becomes possible to initiate a communication session to any other available OPC UA Server.

The interaction between IT and the world of automation is certainly not revolutionary, but corresponds with the established model of the automation pyramid:



This model is fundamentally based on the assumption that, in terms of communication, a controller as a main component of the automation system is “dumb”, and always merely responds to requests “from above”. The higher level is always the client and initiates data requests – the lower layer is always the server and courteously responds. In the modern world the strict separation of levels and the top-down approach of the information flow soften and mix. In a smart network, every device or service must be able to initiate independent communication with all other services.

This document is about OPC-UA client functionality out of the IEC61131-3 controller: A controller can exchange complex data structures horizontally with other controllers independently from fieldbus system or vertically with other devices using an OPC-UA server call in an MES/ERP system in order to collect data or write new production orders to the cloud. It allows a production line to be independently active in combination with integrated OPC UA Security features.

OPC-UA client functionality in a controller does not provide hard deterministic real time and so it’s not a deterministic fieldbus – but UA provides fast, secured communication providing modelling mechanism for information models.

Note: The FUNCTION BLOCKS are based on the second Edition of IEC61131-3.

About the OPC Foundation

The OPC Foundation defines standards for online data exchange between automation systems. They address access to current data (OPC DA), alarms and events (OPC A&E) and historical data (OPC HDA). Those standards are successfully applied in industrial automation.

The new OPC Unified Architecture (OPC-UA) unifies the existing standards and brings them to state-of-the-art technology using service-oriented architecture (SOA). Platform-independent technology allows the deployment of OPC-UA beyond current OPC applications only running on Windows-based PC systems. OPC-UA can also run on embedded systems as well as Linux / UNIX based enterprise systems. The provided information can be generically modelled and therefore arbitrary information models can be provided using OPC-UA.

About PLCopen

PLCopen, as an organization active in industrial control, is creating a higher efficiency in your application software development: in one-off projects as well as in higher volume products. As such it is based on standard available tools to which extensions are and will be defined.

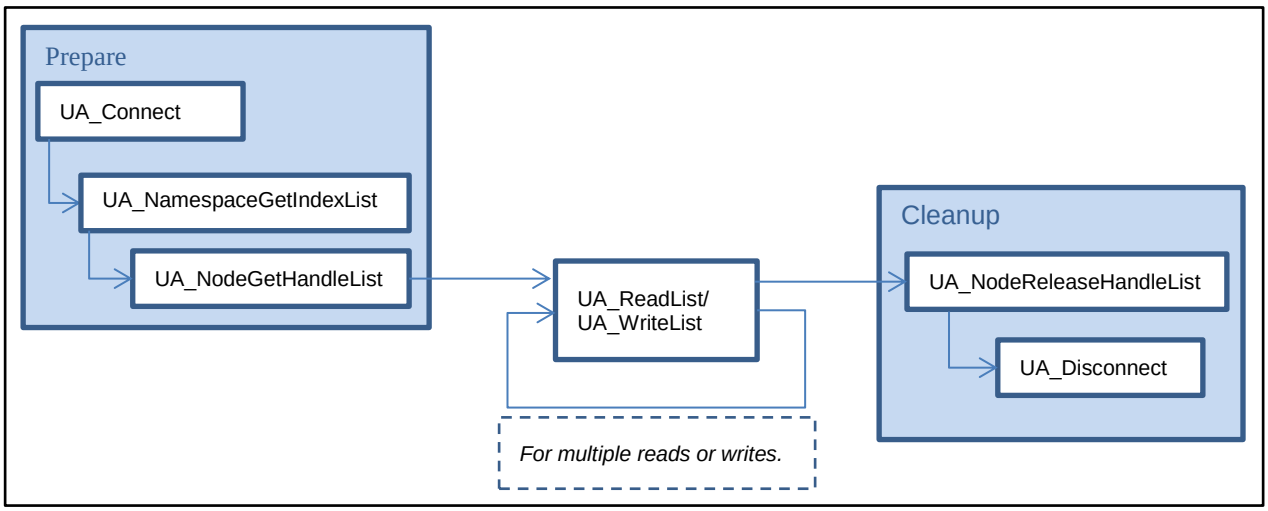
With results like Motion Control Library, Safety, XML specification, Reusability Level and Conformity Level, PLCopen made solid contributions to the community, extending the hardware independence from the software code, as well as reusability of the code and coupling to external software tools. One of the core activities of PLCopen is focused around IEC 61131-3, the only global standard for industrial control programming. It harmonizes the way people design and operate industrial controls by standardizing the programming interface. This allows people with different backgrounds and skills to create different elements of a program during different stages of the software lifecycle: specification, design, implementation, testing, installation and maintenance. Yet all pieces adhere to a common structure and work together harmoniously.

2. The basic sequences for communication

In order to perform an operation like UA_Read, UA_Write, UA_ReadList, UA_WriteList or UA_MethodCall one has to prepare the communication following the sequence of calls as decribed hereunder, after which one has to stop the communication and clean up.

2.1. Read and Write of multiple items

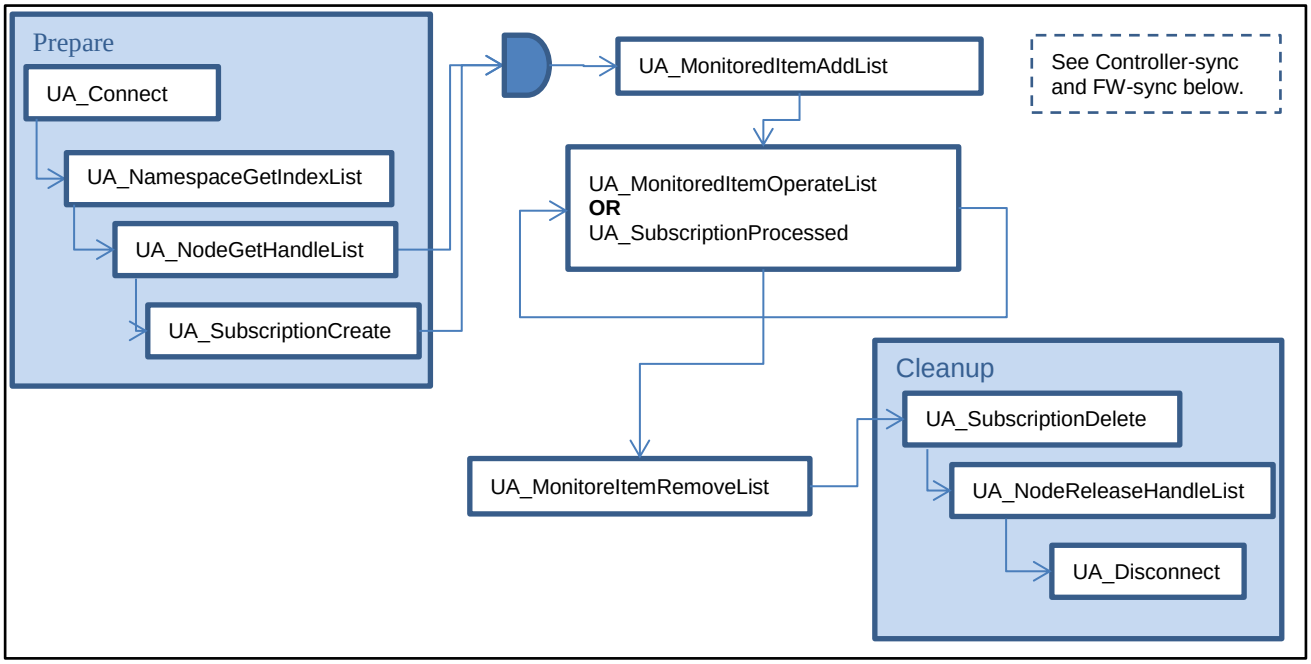
UA_Connect is used to create an (optional secure) transport connection of an OPC-UA session. UA_Connect is to be performed once for each connection. The UA_NamespaceGetIndexList is to be performed once for each namespace. The NodeHdl for a specific node is to be retrieved once. Read and write can be performed as frequent as necessary and permitted by the system. Once the communication is done, the node handle is not required anymore and shall be released via the use of UA_NodeReleaseHandleList for all relevant handles. The connection handle shall be released using UA_Disconnect.



A list is handled as an array of the related base type (e.g. UANodeID or UANodeAdditionalInfo). Additionally, there is a length specified which holds the number of elements in the array. Although several arrays can be connected to the function block (e.g. node handles and variables in case of UA_ReadList) there is only one length because all arrays have the same number of elements to be processed.
The UA_NodeGetHandleList will return an UANodeHdl array. This call will not verify that the given UANodeID is valid. It will just be checked if it is structurally right (e.g. it's not one by *UAIdentifierType* mentioned values) – otherwise an error in the corresponding error element (NodeErrorIDs) will be returned. The output array of UA_NodeGetHandleList can be used unchanged for subsequent calls to function blocks UA_ReadList, UA_WriteList, but the control implementation shall check always the corresponding error element (NodeErrorIDs). In case of any general error no outputs shall be changed from the underlying implementation.

2.2. Monitored Items

The following function blocks are used to create subscriptions and to add monitored items to this subscription.
To create a subscription, a valid connection handle is required. The connection handle is to be acquired using UA_Connect once. UA_SubscriptionCreate will create a subscription, and needs to be called for every subscription needed. The applicable SubscriptionHdl will be returned on successful execution of the function block UA_SubscriptionCreate. In order to monitor an item, a NodeHdl for that specific node is required. In other words, both the applicable UA_SubscriptionCreate and UA_NodeGetHandleList are to be called before calling the related UA_MonitoredItemAddList. UA_MonitoredItemAddList is used to add items to a subscription identified by a SubscriptionHdl. The items to be monitored are to be assigned to this FB in form of NodeHdl. UA_MonitoredItemModifyList can be used to modify monitoring settings like sampling interval, deadband type, and deadband value and hence it can be called optionally.
Take note to delete the subscription. Release the NodeHdl before you disconnect. Unless UA_SubscriptionDelete is called the Subscription will continue working, even if UA_NodeReleaseHandleList is called.



Monitoring of nodes does invert the communication interaction: The control program is initiating the communication but as a consequence the values will be pushed from the UA-Server to the control program.
Like shown in the block diagram above, a subscriptions and monitored items have to be set up.
There are two modes to actually retrieve latest values within the control program:

- **Controller-sync:**
  Using the UA_MonitoredItemAddList function block with UAMonitoringSyncMode "UAMS_ControllerSync" – updated values shall be retrieved after the call UA_MonitoredItemOperateList is finished. This means the control program can decide when values are updated. If this block is not called no updates to the control program will be delivered.
  The currently specified handling of monitored items and subscriptions is based on linking one UA node (identified by NodeHdl) to one PLC variable (defined in the PLC program). By calling the function block UA_MonitoredItemOperateList values delivered from the UA server are transfered into the PLC variables.
  Please see more detailed explanations in vendor specific documentation in particular in cases of QueueSize > 1.

- **FW-sync:**
  The firmware could internally update the values of the memory of the controller.
  After adding monitored items, the control program might call UA_SubscriptionProcessed to know that any values have been changed, but it might be that the control program has no control about when updates are deployed to the control program memory.

In general, a QueueSize bigger than the PLC variable array size will return an error shown in the corresponding NodeErrorIDs in UA_MonitoredItemAddList directly after the call returns, an overflow (values lost) will be shown in the corresponding NodeQualityIDs and the minimum lost values will be shown in the corresponding MinLostValueCount.

The vendor has to decide which mode to provide. Vendor documentation should describe the selected behavior. Especially for the FW-sync way a detailed documentation should state when (i.e. beginning of control program cycle) updates are available to the control program.

A vendor may provide both modes (Controller-sync and FW-sync). The parameter QueueSize defined in structure 3.5.8 *UAMonitoringParameter* indicates the mode: With configuration of QueueSize > 1 for the intention not to lose data changes it also becomes the user's responsibility to fetch those values one at a time thus QueueSize is used to determine the mode of operation as follows:

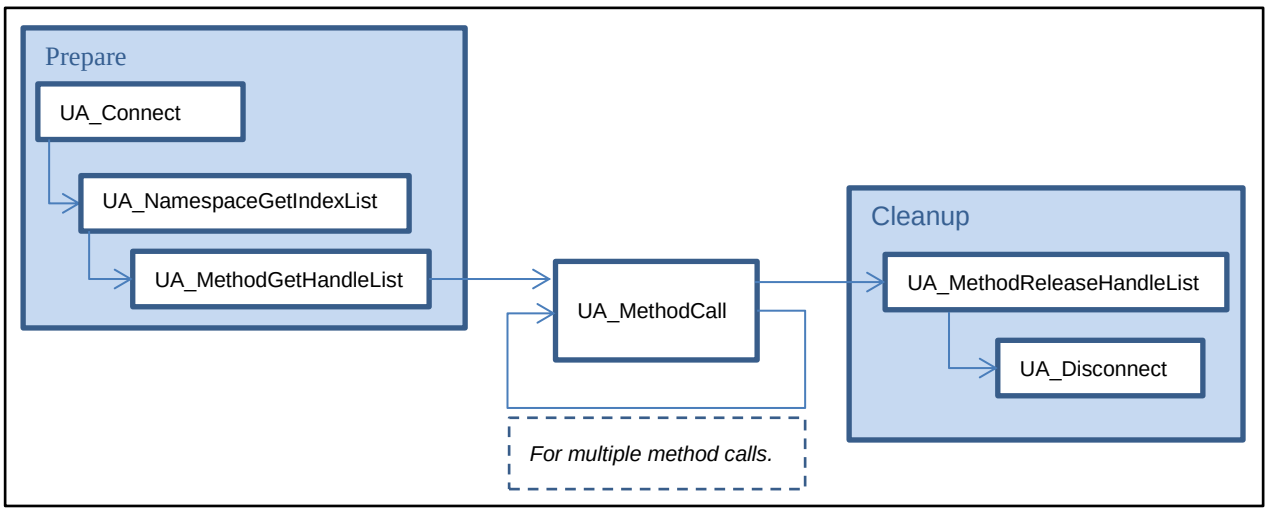
- QueueSize > 0 with a sample queue of that size. If '0' the QueueSize '1' will be applied. This means for a monitored item both, locally and on the server side as many as QueueSize data changes can be stored. The server discards data changes if the publish interval is too large. The client discards data changes if the UA_MonitoredItemOperateList cycle is not sufficient. Discard oldest policy is implied.

The mode of operation is configured independently for each monitored item (input parameter SyncMode of FB UA_MonitoredItemAddList).

Note:
For vendors who support both Controller -sync and FW-sync: If NodeHdls are registered to a subscription with Controller-sync and afterwards UA_SubscriptionProcessed FB for this subscription will be called will result in an error shown in the corresponding NodeErrorIDs and the UA_SubscriptionProcessed FB call will fail.

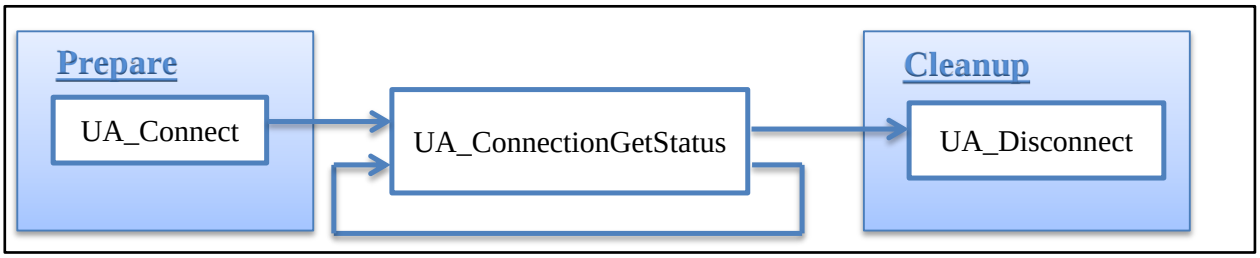
2.3. Using Method Calls

The appropriate sequence for initiating a method call is shown below. A valid method handle is necessary to call a method. Successful call of UA_MethodGetHandleList will deliver a valid MethodHdls.
One shall release the method handle list before you disconnect.



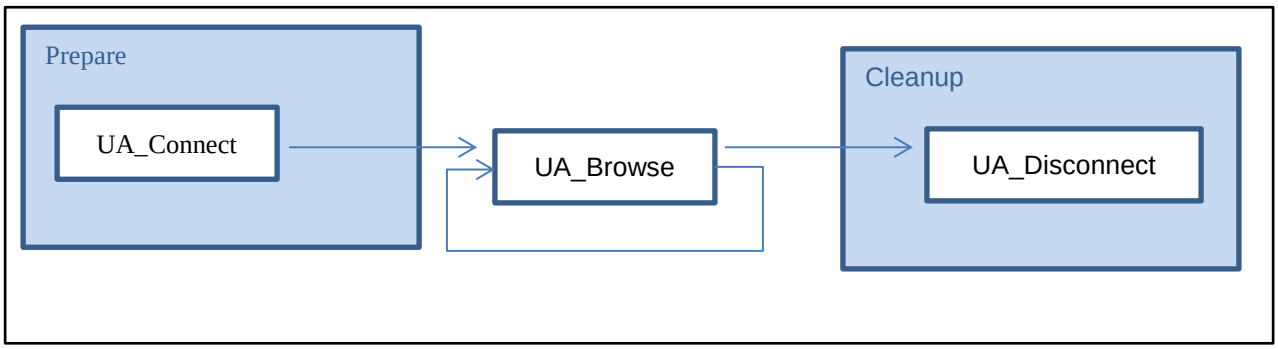
2.4. Diagnostics

This procedure is to check if the connection is still alive. The function block UA_Connect will deliver the ConnectionHdl. UA_ConnectionGetStatus requires this ConnectionHdl as input to deliver the connection status. In case the connection is lost after receiving the handle and while calling the UA_ConnectionGetStatus, ServerState Unknown will be returned.
NOTE: It is recommended to call UA_ConnectionGetStatus periodically but for performance reasons not in every control program cycle.



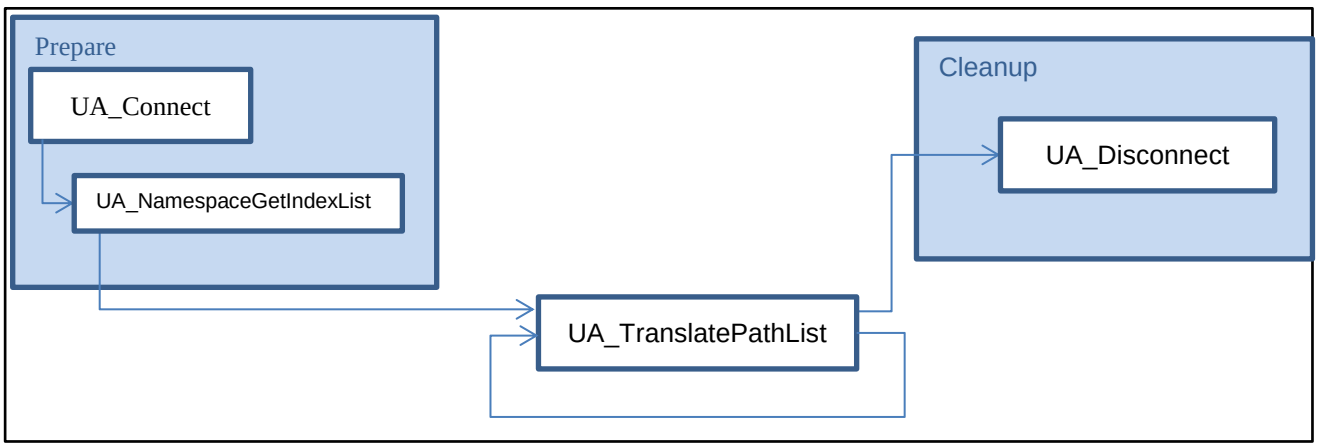
2.5. Browsing

Browsing is used by a client to navigate through the Address Space of an OPC-UA Server. By passing a starting node the server returns a list of nodes by references.
To be able to browse a valid connection handle is required. Function block UA_Connect will deliver the ConnectionHdl. UA_Browse takes a structure for starting Node description and filter criteria. The result is an array of structures for references and target Nodes.
If the ContinuationPointOut output is connected to the ContinuationPointIn input of a consecutive UA_Browse instance, a browse next service can be performed.



2.6. TranslatePath

This function block is used to request that the Server translates one or more UABrowsePaths to UANodeIDs. Each UA_BrowsePath is constructed of a starting UANodeID and a UARelativePath. The specified starting UANodeID identifies the UANodeID from which the UARelativePath is based. The UARelativePath contains a sequence of UARelativePathElement and UAQualifiedName.
One purpose of this function block is to allow programming against type definitions. Since UAQualifiedName shall be unique in the context of type definitions, a user program may create a UABrowsePath that is valid for a type definition and use this path on instances of the type. For example, an ObjectType “Boiler” may have a “HeatSensor” Variable as InstanceDeclaration. A graphical element programmed against the “Boiler” may need to display the Value of the “HeatSensor”. If the graphical element would be called on “Boiler1”, an instance of “Boiler”, it would need to call this Service specifying the UANodeID of “Boiler1” as starting UANodeID and the UABrowsePaths of the “HeatSensor” as browse path. The function block would return the UANodeID of the “HeatSensor” of “Boiler1” and the graphical element could subscribe to its value.
If an OPC UA Node has multiple targets with the same UABrowsePaths, the underlying server will return a list of UANodeIDs. However, since one of the main purposes of this function block is to support programming against type definitions, the UANodeID of the OPC UA Node based on the type definition of the starting OPC UA Node is returned as the first UANodeID in the list.

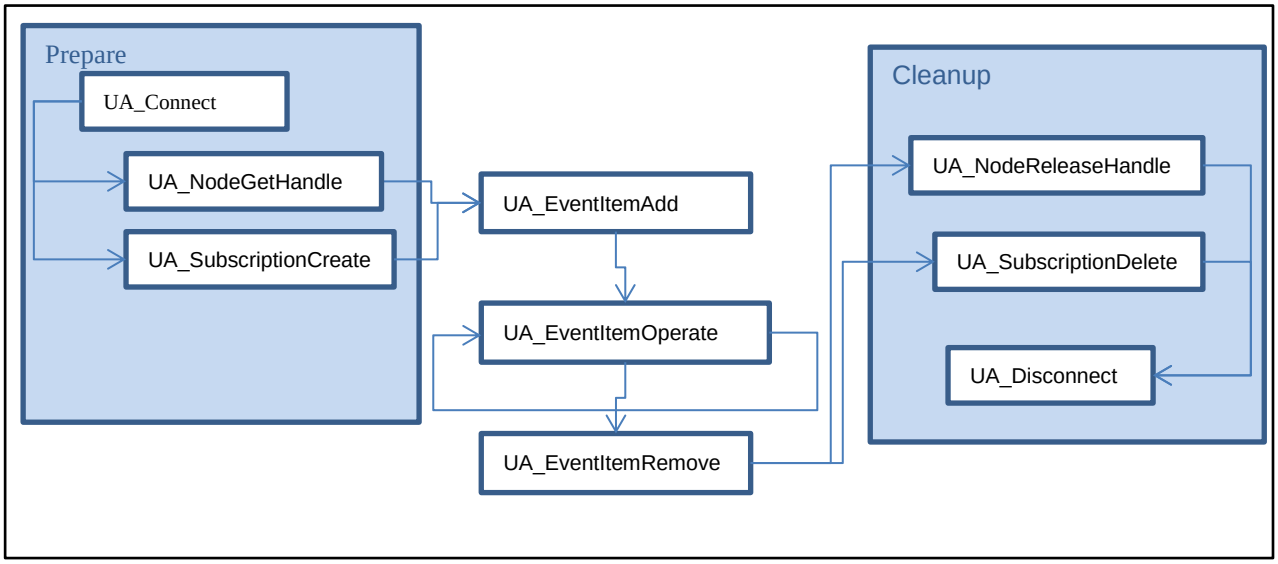


2.7. Monitor Events

A typical OPC-UA Server can be configured to fire Events to a Client. OPC-UA specifies a wide range of different Events. OPC-UA Clients can receive Events when subscribing to an Event Notifier.

In order to monitor an item, a NodeHdl for that specific node is required. Both UA_SubscriptionCreate and UA_NodeGetHandle are to be called before calling UA_EventItemAdd. UA_EventItemAdd is used to add an event item to a subscription mentioned by the SubscriptionHdl. The node of which events are monitored is to be assigned to this FB in form of NodeHdl. UA_EventItemOperate can be used to get information about the incoming events occurred.

Take note to delete the subscription. Release the NodeHdl before you disconnect. If UA_NodeReleaseHandle is called before UA_SubscriptionDelete the Subscription will continue working.



3. Types, DataTypes, Constants and Behaviour

3.1. Derived data types used in this specification

Within the specification the following derived data types are defined:

Derived data types:	Where used	Supported	Which structure
3.5.1 *UAUserIdentityToken*	UASessionConnectInfo		
3.5.2 *UASessionConnectInfo*	UA_Connect		
3.5.3 *UANodeID*	UANodeInformation UABrowseDescription UAReferenceDescription UAExpandedNodeID UA_TranslatePathList UA_NodeGetHandleList UA_NodeGetInformation UA_MethodGetHandleList UA_EventItemAdd		
3.5.4 *UAQualifiedName*	UARelativePathElement UANodeInformation		
3.5.5 *UARelativePathElement*	UARelativePath		
3.5.6 *UARelativePath*	UABrowserPath UA_EventItemAdd		
3.5.7 *UABrowsePath*	UABrowsePath UA_TranslatePathList		
3.5.8 *UAMonitoringParameter*	UA_MonitoredItemAddList UA_MonitoredItemOperateList		
3.5.9 *UALocalizedText*	UANodeInformation UAReferenceDescription		
3.5.10 *UANodeInfo (deprecated)*			
3.5.11 *UANodeInformation*	UA_NodeGetInformation		
3.5.12 *UAIndexRange*	UANodeAdditionalInfo		
3.5.13 *UANodeAdditionalInfo*	UA_MonitoredItemAddList		

	UA_ReadList UA_WriteList		
3.5.14 *UAViewDescription*	UA_Browse		
3.5.15 *UABrowseDescription*	UA_Browse		
3.5.16 *UAReferenceDescription*	UA_Browse		
3.5.17 *UAExpandedNodeID*	UAReferenceDescription		
3.5.18 *UAHADataValue*	UA_HistoryUpdate		
3.5.19 *UAMonitoredVariables*	UA_MonitoredItemAddList		
3.3.1 *UASecurityMsgMode*	UASessionConnectInfo		
3.3.2 *UASecurityPolicy*	UASessionConnectInfo		
3.3.3 *UATransportProfile*	UASessionConnectInfo		
3.3.4 *UAUserIdentityTokenType*	UAUserIdentityToken		
3.3.5 *UAIdentifierType*	UANodeID		
3.3.6 *UADeadbandType*	UAMonitoringParameter		
3.3.7 *UAAttributeID*	UANodeAdditionalInfo		
3.3.8 *UAConnectionStatus*	UA_ConnectionGetStatus		
3.3.9 *UAServerState*	UA_ConnectionGetStatus		
3.3.10 *UAHAUpdateStatusCode*	UAAHDataValue		
3.1.1. **3.3.11 *UABrowseDirection*** Filter the References according to their direction. Value | Name 0 | UABD_Forward 1 | UABD_Inverse 2 | UABD_Both *UA*	UABrowseDescription		
3.3.12 *UAMonitoringSyncMode*	UA_MonitoredItemAddList		
3.4.1 *UANodeClassMask*	UANodeInformation UABrowseDescription UAReferenceDescription		

Table 1- Supported derived data types

3.2. Length of names and ways to shorten them

There are systems that only support a limited number of significant characters in the name. For there rules for shorter names are provided here. These names are still seen as compliant, although have to be mentioned in the certification document.

List of rules to shorten names:

UASecurityMsgMode_	UASMM_
UASecurityPolicy_	UASP_
UATransportProfile_	UATP_
UAUserIdentityTokenType_	UAUITT_
UAIdentifierType_	UAIT_
UADeadbandType_	UADT_
UAHAUpdateStatusCode_	UAHAUSC_
UABrowseDirection_	UABD_
UANodeClassMask_	UANCM_

3.3. Enumerated Data Types

Enumerations do not have values in IEC61131-3 – but in third edition, a new feature called “Type with named value” has been introduced. The column “Value” in tables below address this new feature.

3.3.1. UASecurityMsgMode

Value	Name	Description
0	UASMM_BestAvailable	Best available message security mode to the UA server. The client receives the available message security from the server and selects the best. This could also result in level “none security”.
1	UASMM_None	No security is applied.
2	UASMM_Sign	All messages are signed but not encrypted.
3	UASMM_SignEncrypt	All messages are signed and encrypted.

3.3.2. UASecurityPolicy

Value	Name	Description
0	UASP_BestAvailable	Provides the best available security connection to the UA server. The client receives the available policies from the server and selects the best. This can also result in level “none security”.
1	UASP_None	See OPC UA Part 7 Chapter 6.5.123
2	UASP_Basic128Rsa15	See OPC UA Part 7 Chapter 6.5.124
3	UASP_Basic256	See OPC UA Part 7 Chapter 6.5.125
4	UASP_Basic256Sha256	See OPC UA Part 7 Chapter 6.5.126

3.3.3. UATransportProfile

Value	Name	Description
1	UATP_UATcp	See OPC UA Part 7 Chapter 6.5.107
2	UATP_WSHttpBinary	See OPC UA Part 7 Chapter 6.5.109
3	UATP_WSHttpXmlOrBinary	See OPC UA Part 7 Chapter 6.5.110
4	UATP_WSHttpXml	See OPC UA Part 7 Chapter 6.5.108

3.3.4. UAUserIdentityTokenType

Value	Name	Description
0	UAUITT_Anonymous	See OPC UA Part 7 Chapter 6.5.98
1	UAUITT_Username	See OPC UA Part 7 Chapter 6.5.99
2	UAUITT_x509	See OPC UA Part 7 Chapter 6.5.100
3	UAUITT_IssuedToken	See OPC UA Part 7 Chapter 6.5.101

3.3.5. *UAIdentifierType*

Value	Name	Description
0	UAIT_Numeric	see OPC UA Part 3 or Part 6
1	UAIT_String	see OPC UA Part 3 or Part 6
2	UAIT_GUID	see OPC UA Part 3 or Part 6
3	UAIT_Opaque	see OPC UA Part 3 or Part 6

3.3.6. *UADeadbandType*

Value	Name	Description
0	UADT_None	No Deadband calculation should be applied
1	UADT_Absolute	AbsoluteDeadband (See OPC UA Part 4, Chapter 7.16.2)
2	UADT_Percent	PercentDeadband (See OPC UA Part 4, Chapter 7.16.2)

3.3.7. *UAAttributeID*

Value	Name	Description
1	UAAI_NodeID	The canonical identifier for the node.
2	UAAI_NodeClass	The class of the node.
3	UAAI_BrowseName	A non-localized, human readable name for the node.
4	UAAI_DisplayName	A localized, human readable name for the node.
5	UAAI_Description	A localized description for the node.
6	UAAI_WriteMask	Indicates which attributes are writeable.
7	UAAI_UserWriteMask	Indicates which attributes are writeable by the current user.
8	UAAI_IsAbstract	Indicates that a type node may not be instantiated.
9	UAAI_Symmetric	Indicates that forward and inverse references have the same meaning.
10	UAAI_InverseName	The browse name for an inverse reference.
11	UAAI_ContainsNoLoops	Indicates that following forward references within a view will not cause a loop.
12	UAAI_EventNotifier	Indicates that the node can be used to subscribe to events.
13	UAAI_Value	The value of a variable.
14	UAAI_DataType	The node id of the data type for the variable value.
15	UAAI_ValueRank	The number of dimensions in the value.
16	UAAI_ArrayDimensions	The length for each dimension of an array value.
17	UAAI_AccessLevel	How a variable may be accessed
18	UAAI_UserAccessLevel	How a variable may be accessed after taking the user's access rights into account.
19	UAAI_MinimumSamplingInterval	Specifies (in milliseconds) how fast the server can reasonably sample the value for changes.
20	UAAI_Historizing	Specifies whether the server is actively collecting historical data for the variable.
21	UAAI_Executable	Whether the method can be called.
22	UAAI_UserExecutable	Whether the method can be called by the current user.

3.3.8. *UAConnectionStatus*

Value	Name	Description
0	UACS_Connected	UA client is connected to UA server.
1	UACS_ConnectionError	The connection from UA client to UA server has an error.
2	UACS_Shutdown	The UA client has been disconnected from the UA server.

3.3.9. *UAServerState*

Value	Name	Description
0	UASS_Running	The server is running normally. This is the usual state for a server.
1	UASS_Failed	A vendor-specific fatal error has occurred within the server. The server is no longer functioning. The recovery procedure from this situation is vendor-specific. Most *Service* requests should be expected to fail.

2	UASS_NoConfiguration	The server is running but has no configuration information loaded and therefore does not transfer data.
3	UASS_Suspended	The server has been temporarily suspended by some vendor-specific method and is not receiving or sending data.
4	UASS_Shutdown	The server has shut down or is in the process of shutting down. Depending on the implementation, this might or might not be visible to clients.
5	UASS_Test	The server is in Test Mode. The outputs are disconnected from the real hardware, but the server will otherwise behave normally. Inputs may be real or may be simulated depending on the vendor implementation. StatusCode will generally be returned normally.
6	UASS_CommunicationFault	The server is running properly, but is having difficulty accessing data from its data sources. This may be due to communication problems or some other problems preventing the underlying device, control system, etc. from returning valid data. It may be a complete failure, meaning that no data is available, or a partial failure, meaning that some data is still available. It is expected that items affected by the fault will individually return with a BAD FAILURE status code indication for the items.
7	UASS_Unknown	This state is used only to indicate that the OPC UA server does not know the state of underlying servers.

3.3.10. UAHAUpdateStatusCode

Value	Name	Description
0	UAHAUpdateStatusCode_HistorianRaw	A raw data value.
1	UAHAUpdateStatusCode_HistorianCalculated	A data value which was calculated.
2	UAHAUpdateStatusCode_HistorianInterpolated	A data value which was interpolated.
3	UAHAUpdateStatusCode_Reserved	Undefined.
4	UAHAUpdateStatusCode_HistorianPartial	A data value which was calculated with an incomplete interval.
8	UAHAUpdateStatusCode_HistorianExtraData	A raw data value that hides other data at the same timestamp.
16	UAHAUpdateStatusCode_HistorianMultiValue	Multiple values match the Aggregate criteria (i.e. multiple minimum values at different timestamps within the same interval).

3.3.11. UABrowseDirection

Filter the References according to their direction.

Value	Name	Description
0	UABD_Forward	Select only forward References.
1	UABD_Inverse	Select only inverse References.
2	UABD_Both	Select forward and inverse References.

3.3.12. UAMonitoringSyncMode

Value	Name	Description
0	UAMS_Unknown	Unknown SynMode – the default and invalid setting
1	UAMS_ControllerSync	SyncMode is ControllerSync – see chapter 2.2 Monitored Items
2	UAMS_FwSync	SyncMode is FwSync (FirmwareSync) – see chapter 2.2 Monitored Items

3.4. Data Types for Bitmask

3.4.1. UANodeClassMask

Value	Name	Description
0	UANCM_None	No node class (unspecified).
1	UANCM_Object	See OPC UA Part 3 Chapter 8.30

2	UANCM_Variable	See OPC UA Part 3 Chapter 8.30
4	UANCM_Method	See OPC UA Part 3 Chapter 8.30
8	UANCM_ObjectType	See OPC UA Part 3 Chapter 8.30
16	UANCM_VariableType	See OPC UA Part 3 Chapter 8.30
32	UANCM_ReferenceType	See OPC UA Part 3 Chapter 8.30
64	UANCM_DataType	See OPC UA Part 3 Chapter 8.30
128	UANCM_View	See OPC UA Part 3 Chapter 8.30
255	UANCM_All	All node classes combined.

3.5. Structured Data Types

3.5.1. UAUserIdentityToken

UAUserIdentityToken	DataType	Description
UserIdentityTokenType	UAUserIdentityTokenType	Defines the identity Token to authenticate a user during the creation of a Session. See 3.3.4 *UAUserIdentityTokenType*.
TokenParam1	STRING	In case of TokenType “Anonymous” the Param1 will not be evaluated. In case of TokenType “Username” the Param1 contains the user name. In case of TokenType “x509” the Param1 contains the location of the certificate store.
TokenParam2	STRING	In case of TokenType “Anonymous” the Param2 will not be evaluated. In case of TokenType “Username” the Param2 contains the user password. In case of TokenType “x509” the Param2 contains the certificate name.

3.5.2. UASessionConnectInfo

UASessionConnectInfo	DataType	Description
SessionName	STRING	Defines the name of the session assigned by the client. The name is shown in the diagnostics information of the server. In case of empty string the server will generate a session name.
ApplicationName	STRING	Defines the readable name of the OPC UA client application. The string can be empty.
SecurityMsgMode	UASecurityMsgMode	See 3.3.1 *UASecurityMsgMode*.
SecurityPolicy	UASecurityPolicy	See 3.3.2 *UASecurityPolicy*.
CertificateStore	STRING	Defines the location of the certificate store used for the application certificates and trust lists. The structure of the certificate store is vendor specific. In case of empty string the default certificate store is used.
ClientCertificateName	STRING	Defines the name of the client certificate and private key in the certificate store. In case of empty string the default client application certificate is used. Implementation note: The ApplicationURI will be extracted from the certificate.
ServerUri	STRING	Defines the URI of the server.
CheckServerCertificate	BOOL	Flag indicating if the server certificate should be checked with the trust list of the client application.
TransportProfile	UATransportProfile	See 3.3.3 *UATransportProfile*
UserIdentityToken	UAUserIdentityToken	See 3.5.1 *UAUserIdentityToken*
VendorSpecificParameter	Vendor specific	Vendor may define specific parameters. e.g. In case multiple clients are available, client instance can be defined with this parameter. The Vendor specificParameter can be

		empty.
SessionTimeout	TIME	Defines how long the session will survive when there is no connection.
MonitorConnection	TIME	Defines the interval time to check the connection. The connection monitoring has to be done by the client vendor implementation and is defined by the OPC UA specification part 4.
LocaleIDs	ARRAY [1..5] OF STRING[6]	OPC-UA Part3 / Chapter 8.4: <language>[-<country/region>] where <language> is a two letter ISO639 code for language, <country /region> is the three letter ISO3166 code for the country/region. Sample: en-US, zh-CHS

3.5.3. *UANodeID*

UANodeID	DataType	Description
NamespaceIndex	UINT	
Identifier	STRING	In case of IdentifierType GUID the format is like 00000316-0000-0000-C000-000001000046 In case of IdentifierType Opaque string has to be base 64 encoded byte string.
IdentifierType	UAIdentifierType	See 3.3.5 *UAIdentifierType*

3.5.4. *UAQualifiedName*

UAQualifiedName	DataType	Description
NamespaceIndex	UINT	The namespace index where Name resists.
Name	STRING	Name of the qualified name.

3.5.5. *UARelativePathElement*

UARelativePathElement	DataType	Description
ReferenceTypeId	UANodeID	See 3.5.3 *UANodeID*. If the ReferenceTypeId is a NULL-UANodeID the reference type is 33 (OpcUaId_HierarchicalReferences)
IsInverse	BOOL	If true, the inverse references will be evaluated. Default is false.
IncludeSubtypes	BOOL	If true also subtypes from ReferenceTypeId will be evaluated. Default is true.
TargetName	UAQualifiedName	See 3.5.4 *UAQualifiedName*.

3.5.6. *UARelativePath*

UARelativePath	DataType	Description
NoOfElements	UINT	Number of Elements.
Elements	ARRAY OF UARelativePathElement	See 3.5.5 *UARelativePathElement* One relative path element. Length of the array is vendor specific MAX_ELEMENTS_RELATIVEPATH See 3.7 Constants of Array Lengths

3.5.7. *UABrowsePath*

UABrowsePath	DataType	Description
StartingNode	UANodeID	See 3.5.3 *UANodeID*. Starting NodeId from where the relative path will be evaluated.
RelativePath	UARelativePath	See 3.5.6 *UARelativePath*. The relative path which will be evaluated.

3.5.8. *UAMonitoringParameter*

UAMonitoringParameter	DataType	Description
SamplingInterval	TIME	The rate in milliseconds the server checks the underlying

		data source for changes.
QueueSize	UINT	The queue size for the monitoring item. See also 2.2 Monitored Items
DiscardOldest	BOOL	Determine the discard policy in case of queue overflow: TRUE: Discard the oldest in the sample queue FALSE: Discard the newest in the sample queue
DeadbandType	UADeadbandType	See 3.3.6 *UADeadbandType*. This parameter indicates if a deadband is applied and if applied, which type of Deadband.
Deadband	REAL	e.g. percent 0.1%.

3.5.9. *UALocalizedText*

UALocalizedText	DataType	Description
Locale	STRING[6]	OPC-UA Part3 / Chapter 8.4: <language>[-<country/region>] where <language> is a two letter ISO639 code for language, <country /region> is the three letter ISO3166 code for the country/region. Sample: en-US, zh-CHS.
Text	STRING	Contains localized text as a string.

3.5.10. *UANodeInfo (deprecated)*

This UANodeInfo is the first version of declaration – to ease the handling of BrowseName the usage of the second version UANodeInformation is recommended. This also affects *UANodeInformation*.

UANodeInfo	DataType	Description
AccessLevel	BYTE	A bit mask indicating whether the current value of the Value Attribute is readable and writable as well as whether the history of the value is readable and changeable.

Bit	Value	AccessLevel
	0x0	None
0	0x1	CurrentRead
1	0x2	CurrentWrite
2	0x4	HistoryRead
3	0x8	HistoryWrite
4		
5		
6		
7		

ArrayDimension	ARRAY OF UDINT	The length for each dimension of an array value. Length is vendor-specific (MAX_ELEMENTS_ARRAYDIMENSION). See 3.7 Constants of Array Lengths
BrowseName	STRING	The BrowseName is composed of a namespace index and a name. The String representation is of the format [ns:] BrowseName. The browse name may be prefixed by its namespace index. If the namespace prefix is omitted then namespace index 0 is used.
ContainsNoLoops	BOOL	Indicates that following forward references within a view will not cause a loop.
DataType	UANodeID	See 3.5.3 *UANodeID*. The node id of the data type for the variable value.
Description	UALocalizedText	A localized description for the node.
DisplayName	UALocalizedText	A localized human readable name for the node.
EventNotifier	BYTE	This Attribute represents a bit mask that identifies whether the Object can be used to subscribe to Events and whether the history of Events is accessible and changeable.

Bit	Value	EventNotifier

		<table><tr><td></td><td>0x0</td><td>The Object does not produce events and has no event history. (SubscribeToEvents)</td></tr><tr><td>0</td><td>0x1</td><td>The Object produces event notifications.</td></tr><tr><td>1</td><td>0x2</td><td>Reserved. Must always be zero</td></tr><tr><td>2</td><td>0x4</td><td>The Object has an event history which may be read. (HistoryRead)</td></tr><tr><td>3</td><td>0x8</td><td>The Object has an event history which may be updated (HistoryWrite)</td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr><tr><td>6</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr></table>
Executable	BOOL	Whether the method can be called.
Historizing	BOOL	Specifies whether the server is actively collecting historical data for the variable.
InverseName	STRING	The browse name for an inverse reference.
IsAbstract	BOOL	Indicates that a type node may not be instantiated.
MinimumSamplingInterval	TIME	Specifies (in ms) how fast the server can reasonably sample the value for changes.
NodeClass	UANodeClassMask	See *UANodeClassMask*. The base type of the node. An enumeration identifying the NodeClass of a Node such as Object, Variable or Method.
NodeID	UANodeID	See 3.5.3 *UANodeID*. The server unique identifier for the node.
Symmetric	BOOL	Indicates that forward and inverse references have the same meaning.
UserAccessLevel	BYTE	Contains the same information as the AccessLevel but takes user access rights into account. <table><tr><th>Bit</th><th>Value</th><th>AccessLevel</th></tr><tr><td></td><td>0x0</td><td>None</td></tr><tr><td>0</td><td>0x1</td><td>CurrentRead</td></tr><tr><td>1</td><td>0x2</td><td>CurrentWrite</td></tr><tr><td>2</td><td>0x4</td><td>HistoryRead</td></tr><tr><td>3</td><td>0x8</td><td>HistoryWrite</td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr><tr><td>6</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr></table>
UserExecutable	BOOL	Whether the method can be called by the current user.
UserWriteMask	UDINT	Indicates which attributes are writeable by the current user.
ValueRank	DINT	The number of dimensions in the value.
WriteMask	UDINT	Indicates which attributes are writeable.

3.5.11. UANodeInformation

UANodeInformation	DataType	Description
AccessLevel	BYTE	A bit mask indicating whether the current value of the Value Attribute is readable and writable as well as whether the history of the value is readable and changeable. <table><tr><th>Bit</th><th>Value</th><th>AccessLevel</th></tr><tr><td></td><td>0x0</td><td>None</td></tr><tr><td>0</td><td>0x1</td><td>CurrentRead</td></tr><tr><td>1</td><td>0x2</td><td>CurrentWrite</td></tr><tr><td>2</td><td>0x4</td><td>HistoryRead</td></tr></table>

		<table><tr><td>3</td><td>0x8</td><td>HistoryWrite</td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr><tr><td>6</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr></table>
ArrayDimension	ARRAY OF UDINT	The length for each dimension of an array value. Length is vendor-specific (MAX_ELEMENTS_ARRAYDIMENSION). See 3.7 Constants of Array Lengths
BrowseName	UAQualifiedName	See 3.5.4 *UAQualifiedName*.
ContainsNoLoops	BOOL	Indicates that following forward references within a view will not cause a loop.
DataType	UANodeID	See 3.5.3 *UANodeID*. The node id of the data type for the variable value.
Description	UALocalizedText	A localized description for the node.
DisplayName	UALocalizedText	A localized human readable name for the node.
EventNotifier	BYTE	This Attribute represents a bit mask that identifies whether the Object can be used to subscribe to Events and whether the history of Events is accessible and changeable. <table><tr><th>Bit</th><th>Value</th><th>EventNotifier</th></tr><tr><td></td><td>0x0</td><td>The Object does not produce events and has no event history. (SubscribeToEvents)</td></tr><tr><td>0</td><td>0x1</td><td>The Object produces event notifications.</td></tr><tr><td>1</td><td>0x2</td><td>Reserved. Must always be zero</td></tr><tr><td>2</td><td>0x4</td><td>The Object has an event history which may be read. (HistoryRead)</td></tr><tr><td>3</td><td>0x8</td><td>The Object has an event history which may be updated (HistoryWrite)</td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr><tr><td>6</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr></table>
Executable	BOOL	Whether the method can be called.
Historizing	BOOL	Specifies whether the server is actively collecting historical data for the variable.
InverseName	STRING	The browse name for an inverse reference.
IsAbstract	BOOL	Indicates that a type node may not be instantiated.
MinimumSamplingInterval	TIME	Specifies (in ms) how fast the server can reasonably sample the value for changes.
NodeClass	UANodeClassMask	See *UANodeClassMask*. The base type of the node. An enumeration identifying the NodeClass of a Node such as Object, Variable or Method.
Symmetric	BOOL	Indicates that forward and inverse references have the same meaning.
UserAccessLevel	BYTE	Contains the same information as the AccessLevel but takes user access rights into account. <table><tr><th>Bit</th><th>Value</th><th>AccessLevel</th></tr><tr><td></td><td>0x0</td><td>None</td></tr><tr><td>0</td><td>0x1</td><td>CurrentRead</td></tr><tr><td>1</td><td>0x2</td><td>CurrentWrite</td></tr><tr><td>2</td><td>0x4</td><td>HistoryRead</td></tr><tr><td>3</td><td>0x8</td><td>HistoryWrite</td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr></table>

		6 | 7
UserExecutable	BOOL	Whether the method can be called by the current user.
UserWriteMask	UDINT	Indicates which attributes are writeable by the current user.
ValueRank	DINT	The number of dimensions in the value.
WriteMask	UDINT	Indicates which attributes are writeable.

3.5.12. UAIndexRange

UAIndexRange	DataType	Description
StartIndex	UINT	Start index.
EndIndex	UINT	End index.

Note: IndexRange can be defined as follows:
For each Dimension:
1. Start and EndIndex are to be assigned
2. StartIndex must be smaller than EndIndex
3. To access all the elements in a Dimension **it's a must to assign** StartIndex and EndIndex depending on the number of total Elements in the Dimension.
4. A single element in a Dimension can be selected by specifying the same StartIndex and EndIndex.

3.5.13. UANodeAdditionalInfo

UANodeAdditionalInfo	DataType	Description
AttributeID	UAAttributeID	Selects the attribute to be accessed. The default AttributeID is UAAI_Value (13). See 3.3.7 *UAAttributeID*
IndexRangeCount	UINT	Count of valid IndexRange specified. Vendorspecific.
IndexRange	ARRAY OF UAIndexRange	See 3.5.12 *UAIndexRange* Length is vendor-specific (MAX_ELEMENTS_INDEXRANGE See 3.7 Constants of Array Lengths

3.5.14. UAViewDescription

UAViewDescription	DataType	Description
ViewID	UANodeID	Node ID of the view to limit the browse. Empty for browsing the entire Address Space See 3.5.3 *UANodeID*
TimeStamp	DATETIME	*To be discussed*
Version	UDINT	*To be discussed*

3.5.15. UABrowseDescription

UABrowseDescription	DataType	Description
StartingNodeID	UANodeID	Node ID of the starting node to browse. See 3.5.3 *UANodeID*
Direction	UABrowseDirection	Browse direction forward, inverse, both. **3.5.16. See 3.3.11 *UABrowseDirection*** Filter the References according to their direction. Value | Name | Desc 0 | UABD_Forward | Sele 1 | UABD_Inverse | Sele 2 | UABD_Both | Sele *UA* Default value: Forward
ReferenceTypeID	UANodeID	Node ID of the Reference Type the server should follow.

		See 3.5.3 *UANodeID* Default value: Hierachicalreferences
IncludeSubtypes	BOOL	Indicates if also subtypes of the Reference Type should be retuned Default: True
NodeClass	UANodeClassMask	Filter on the Node Class of the retuned Nodes See *UANodeClassMask*
ResultMask	UABrowseResultMask	Selects which fields of the UAReferenceDescription are requested from the server.

UABrowseResultMask	AccessLevel
1	ReferenceType
2	IsForward
4	NodeClass
8	BrowseName
16	DisplayName

3.5.17. *UAReferenceDescription*

UAReferenceDescription	DataType	Description
ReferenceTypeID	UANodeID	Node ID of the ReferenceType followed from the starting Node to the target Node See 3.5.3 *UANodeID*
IsForward	BOOL	Set if followed a forward Reference
NodeID	UAExpandedNodeID	Node ID of the target Node. This could also be a Node in another server. See 3.5.18 *UAExpandedNodeID*
BrowseName	STRING	The qualified name of the target Node.
DisplayName	UALocalizedText	The localized name of the target Node See 3.5.9 *UALocalizedText*
NodeClass	UANodeClassMask	Node Class of the target Node See 3.4.1 *UANodeClassMask*
TypeDefinition	UAExpandedNodeID	Node ID of the Object or Variable type of the target Node. See 3.5.18 *UAExpandedNodeID*

3.5.18. *UAExpandedNodeID*

UAExpandedNodeID	DataType	Description
ServerIndex	UDINT	The *ServerIndex* formatted as a base 10 number.
NamespaceURI	STRING	The *NamespaceUri* formatted as a string. Any reserved characters in the URI shall be replaced with a '%' followed by its 8 bit ANSI value encoded as two hexadecimal digits (case insensitive). For example, the character ';' would be replaced by '%3B'. The reserved characters are ';' and '%'.
ID	UANodeID	An identifier for a node in the address space of an OPC UA *Server*. See 3.5.3 *UANodeID*

3.5.19. *UAHADataValue*

UAHADataValue	DataType	Description

Value	Vendor specific	Vendor specific
StatusCode	UAHAUpdateStatusCode	See 3.3.10 *UAHAUpdateStatusCode*
ServerTimeStamp	DATE_AND_TIME	Vendor specific
SourceTimeStamp	DATE_AND_TIME	Vendor specific

3.5.20. UAMonitoredVariables

UAMonitoredVariables	DataType	Description
Values	Array of Vendor specific	Vendor specific. Array shall have the minimum length as 3.5.8. UAMonitoringParameter→QueueSize
TimeStamps	ARRAY of DT	It is expected, that the SourceTimeStamp from the server is returned. Optional – If exists it shall be the same length as Array of Vendor specific.
NodeQualityIDs	ARRAY of DWORD	Contains an error code for each valid element of the Variable array. See 3.7 Constants of Array Lengths. Optional – If exists it shall be the same length as Array of Vendor specific. In case of "Overflow" Bit '9' will be set if queue size is greater than 1. If this bit is set, not every detected change has been returned since the *Server*'s queue buffer for the *MonitoredItem* reached its limit and had to purge out data and the MinLostValueCount from **Fehler! Verweisquelle konnte nicht gefunden werden.** will be incremented by one (1).
NewValuesCount	UINT	Count of Values (Vendorspecific) which where updated starting from the lowest element of the Values.

3.6. Vendor-specific DataTypes

There are some data types used which are vendor-specific. Please check the specification of the vendor for the concrete implementation. The following table lists these data types and their usage:

Vendor Specific Data Type	Usage at
Variable Identification	Parameter 'Variable' of Function Block 'UA_MonitoredItemAdd' Parameter 'Variable' of Function Block 'UA_MonitoredItemAddList' Parameter 'Variable' of Function Block 'UA_Read' Parameter 'Variables' of Function Block 'UA_ReadList' Parameter 'Variable' of Function Block 'UA_Write' Parameter 'Variables' of Function Block 'UA_WriteList'
Method Arguments	Parameter 'InputArguments' of Function Block 'UA_MethodCall' Parameter 'OutputArguments' of Function Block 'UA_MethodCall'
Event Field Data	Parameter 'EventFields' of Function Block 'UA_EventItemAdd'
UAHADataValue	Value

Additionally, the lengths of some arrays have to be defined by the vendors. These are explained in the following chapter.

3.7. Constants of Array Lengths

The described function blocks make use of arrays.
The length of these arrays is – if not formally limited by the function block – vendor-specific and could be made changeable for resource optimization.
This is a list of arrays and as a naming convention their length-constants.
Every group of arrays should have the same length for ease of use.
All arrays should be defined as [1..CONSTANT-LENGTH], so for instance as ARRAY [1..MAX_ELEMENTS_NODELIST] OF <<DATATYPE>>

CONSTANT-LENGTH	Description
MAX_ELEMENTS_ARRAYDIMENSION	Used at 3.5.11 *UANodeInformation*. Limits the maximum dimensions of a node, which could be used.
MAX_ELEMENTS_INDEXRANGE	Used at 3.5.13 *UANodeAdditionalInfo*. Limits the maximum defined. Could be equal to MAX_ELEMENTS_ARRAYDIMENSION as a general dimension limit.
MAX_ELEMENTS_NODELIST	Limits the number of nodes, which could be used by the List function blocks
MAX_ELEMENTS_MONITORLIST	Limits the number of monitored items, which could be used by the monitored items blocks for each connection.
MAX_ELEMENTS_BROWSERESULT	Limits the number of browse results, which could be used by the Browse block
MAX_ELEMENTS_HISTORYDATA	Limits the number of browse results, which could be used by the HistoryUpdate block
MAX_ELEMENTS_EVENTITEMOPERATE	Limits the number of event items, which could be used by the event items operate block
MAX_ELEMENTS_REGISTER	Limits the number of NodeIDs which can be registered for each connection.
MAX_ELEMENTS_RELATIVEPATH	Limits the number of relative path elements in a relative path.
MAX_ELEMENTS_NAMESPACES	Limits the number of namespaces (either Uris or Indexes)
MAX_ELEMENTS_METHOD	Limits the number of methods
MAX_EVENT_FIELD_SELECTIONS	Limit the number of selections
MAX_ELEMENTS_EVENTITEMLIST	Limit the number of event items

4. Error Codes (ErrorID)

Error codes are 4 bytes long, data type being DWORD.
NOTE: Bit 29 in this DWORD value is used to differentiate between error codes defined by OPC Foundation and error codes defined by PLCopen or Vendor.

Field	Bit Range	Description
Severity	30:31	Indicates whether the *ErrorCode* represents a good, bad or uncertain condition. These bits have the following meanings:

Good success	00	Indicates that the operation was successful and the associated results may be used.
Uncertain Warning	01	Indicates that the operation was partially successful and that associated results might not be suitable for some purposes.
Bad Failure	10	Indicates that the operation failed and any associated results cannot be used.
Reserved	11	Reserved for future use. All *Clients* should treat an *ErrorCode* with this severity as "Bad".

ErrorType	29	Value 0 indicates OPC error. Please find these error codes in OPC UA specification. Value 1 indicates PLCopen or vendor specific error signaled by BIT28.
ErrorType2	28	This flag can be evaluated only if BIT29 is Value 1. Value 0 indicates PLCopen error. Value 1 indicates vendor specific error.

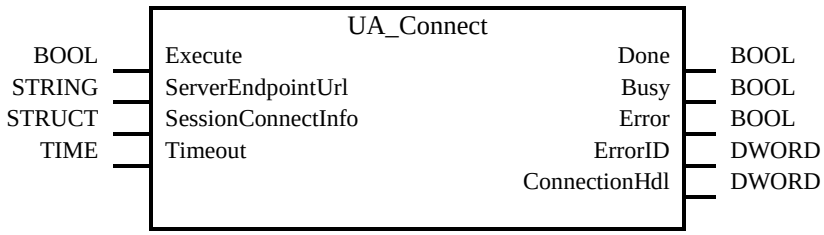
ErrorCode (Bits 0..27)	Define	Description
Category	**General**	
16#A000_0001	PLCopenUA_Bad_FW_PermanentError	Internal, permanent error.
16#A000_0002	PLCopenUA_Bad_FW_TempError	Temp. error; FB could retry to reach FW.
Category	**Connection**	
16#A000_0100	PLCopenUA_Bad_ConnectionError	Connection could not be established.
16#A000_0101	PLCopenUA_Bad_HostNotFound	The requested hostname could not be found.
16#A000_0102	PLCopenUA_Bad_AlreadyConnected	Connection was already established.
16#A000_0103	PLCopenUA_Bad_SecurityFailed	Connection failed due to security setup.
16#A000_0104	PLCopenUA_Bad_Suspended	Connection is suspended.
16#A000_0105	PLCopenUA_Bad_ConnectionInvalidHdl	Provided ConnectionHdl is not known.
Category	**Namespace**	
16#A000_0200	PLCopenUA_Bad_NSNotFound	A namespace with the requested name cannot be found on server.
Category	**Node**	
16#A000_0300	PLCopenUA_Bad_ResultTooLong	Target PLC variable is too short for retrieved data.
16#A000_0301	PLCopenUA_Bad_InvalidType	Invalid or unsupported Type.
16#A000_0302	PLCopenUA_Bad_NodeInvalidHdl	Provided NodeHdl is not known.
16#A000_0303	PLCopenUA_Bad_MethodInvalidHdl	Provided MethodHdl is not known.

16#A000_0304	PLCopenUA_Bad_ReadFailed	Read failed for unknown reason.
16#A000_0305	PLCopenUA_Bad_WriteFailed	Write failed for unknown reason.
16#A000_0306	PLCopenUA_Bad_CallFailed	Method Call failed for unknown reason.
16#A000_0307	PLCopenUA_Bad_InParamFailed	Method Call Input parameter conversion failed.
16#A000_0308	PLCopenUA_Bad_OutParamFailed	Method Call Output parameter conversion failed. ATTENTION: this means the MethodCall was executed successfully but the returned values could not be converted.
Category	**Attribute**	
16#A000_0400	PLCopenUA_Bad_AttributeIdUnknown	Used in UA_NodeGetInformation for elements, which are not in this NodeClass existing.
16#A000_0401	PLCopenUA_Bad_AttributeIdInvalid	Used in UA_NodeGetInformation for elements, which should exist but don't.
Category	**Monitoring**	
16#A000_0500	PLCopenUA_Bad_SubscriptionInvalidHdl	Provided SubscriptionHdl is not known.
16#A000_0501	PLCopenUA_Bad_MonitoredItemInvalidHdl	Provided MonitoredItemHdl is not known.
16#A000_0502	PLCopenUA_Bad_MonitoredItemSyncMismatch	Mixed controller sync and firmware sync in same list
16#A000_0503	PLCopenUA_Bad_SyncModeInvalid	Sync mode invalid

5. Functionblocks

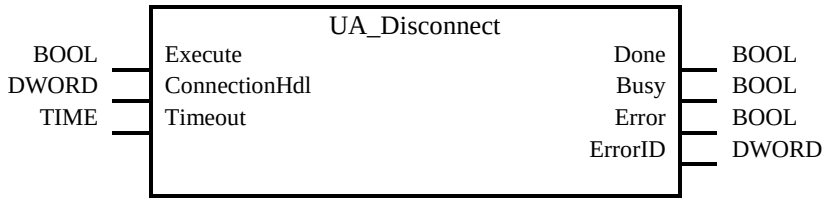
5.1. UA_Connect

FB-Name		**UA_Connect**	
This Function Block is used to create a (optional secure) transport connection and an OPC-UA session. The connection shall be terminated by calling the UA_Disconnect after establishing the connection.			
VAR_INPUT			
B	Execute	BOOL	On rising edge connection is started.
B	ServerEndpointUrl	STRING	URL
B	SessionConnectInfo	STRUCT	See 3.5.2 *UASessionConnectInfo*
B	Timeout	TIME	Maximum time to establish the connection.
VAR_OUTPUT			
B	Done	BOOL	Signals a connection has been initially established.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	ConnectionHdl	DWORD	Connection handle – is valid until UA_Disconnect is called.
Notes: The connection monitoring and the reconnect handling are to be done by the client vendor implementation. The reconnect sequence is defined by the OPC UA specification part 4.			



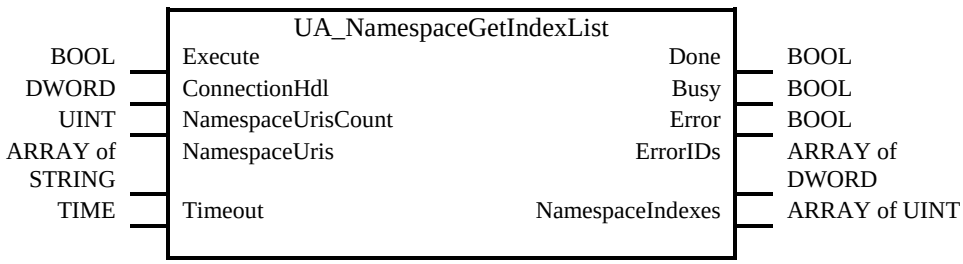
5.2. UA_Disconnect

FB-Name		**UA_Disconnect**	
This Function Block is used to close a transport connection of an OPC-UA session.			
VAR_INPUT			
B	Execute	BOOL	On rising edge connection is terminated.
B	ConnectionHdl	DWORD	Connection handle of connection to be closed.
B	Timeout	TIME	Maximum time to close the connection.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: Calling UA_Disconnect (even in case of timeout or error) will release the ConnectionHdl, all node-handles and MonitoredItems.			



5.3. UA_NamespaceGetIndexList

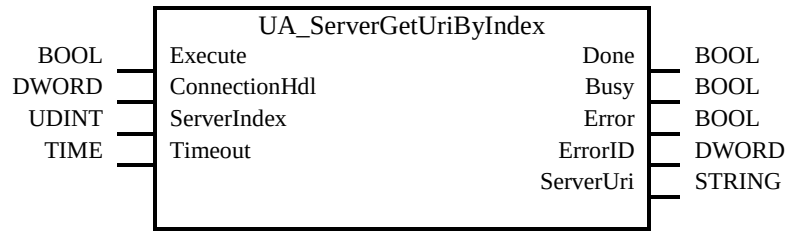
FB-Name		**UA_NamespaceGetIndexList**	
This Function Block is used to get the namespace-indexes of numerus namespace-URIs			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NamespaceUrisCount	UINT	Number of NamespaceUris in Array of NamespaceUris.
B	NamespaceUris	ARRAY of STRING	Array of STRING with the NamespaceUris. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
B	Timeout	TIME	Maximum time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorIDs	ARRAY of DWORD	Error codes. Array shall be the same number of elements as NamespaceUrisCount. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
B	NamespaceIndexes	ARRAY of UINT	Namespace Indexs. Array shall be the same number of elements as NamespaceUris. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
Notes: Reads the Server-Object NamespaceArray (NS:0; Id: 2255) and returns the indexes of the requested elements which can be used in subsequent calls where the Namespace-Array-Index is required - e.g. UA_NodeGetHandleList. This is a convenient function block – could also be done with ReadList and the returned unknown array length of the NamespaceArray could be evaluated in the user program. In case the requested NamespaceUri is not found the error PLCopenUA_Bad_NSNotFound will be returned in the corresponding ErrorIDs.			



5.4. UA_ServerGetUriByIndex

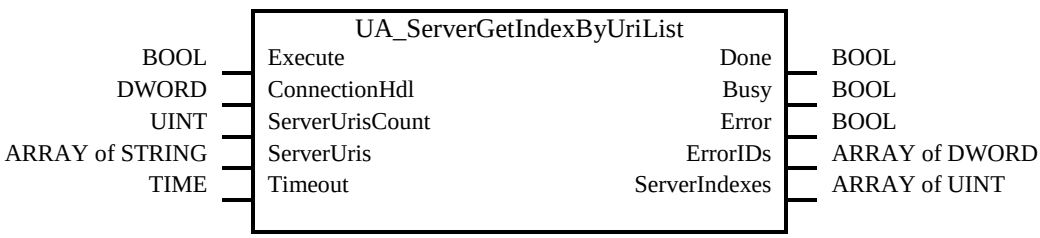
FB-Name		**UA_ServerGetUriByIndex**	
This Function Block is used to get the server-URI with a given index.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	ServerIndex	UDINT	ServerArray Index.
B	Timeout	TIME	Maximum time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.

B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	ServerUri	STRING	The URI from the ServerArray with the given ServerIndex.
Notes: -			



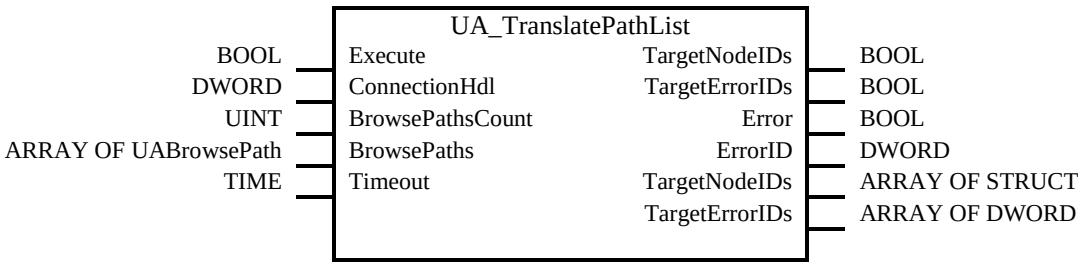
5.5. UA_ServerGetIndexByUriList

FB-Name	**UA_ServerGetIndexByUriList**		
This Function Block is used to get several server-indexes of server-URIs			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	ServerUrisCount	UINT	Number of ServerUris in Array of ServerUris.
B	ServerUris	ARRAY of STRING	Array of STRING with the ServerUris. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
B	Timeout	TIME	Maximum time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorIDs	ARRAY of DWORD	Error codes. Array shall be the same number of elements as ServerUrisCount. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
B	ServerIndexes	ARRAY of UDINT	Server Indexes. Array shall be the same number of elements as ServerUris. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_NAMESPACES)
Notes: Reads the Server-Object ServerArray (NS:0; Id: 2254) and returns the indexes of the requested elements which can be used in subsequent calls where the Server-Array-Index is required - e.g. UA_Browse. This is a convenient function call – could also be done with ReadList and the returned unknown array length of the ServerArray could be evaluated in the user program. In case the requested ServerUri is not found the error PLCopenUA_Bad_NSNotFound will be returned in the corresponding ErrorIDs.			



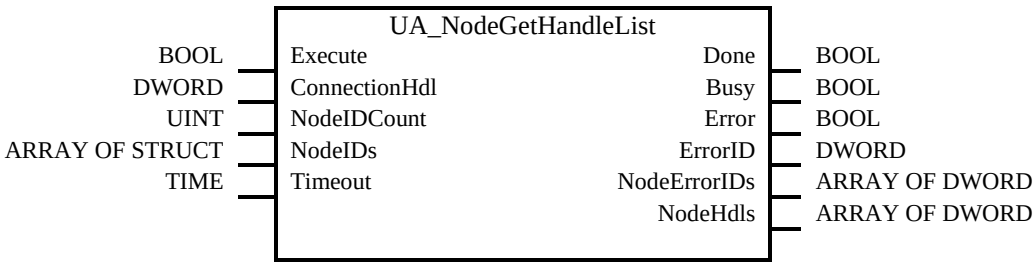
5.6. *UA_TranslatePathList*

FB-Name		**UA_TranslatePathList**	
This Function Block is used to get the node parameters of a node using paths of the node for multiple nodes.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	BrowsePathsCount	UINT	Number of UABrowsePath in Array of BrowsePaths.
B	BrowsePaths	ARRAY OF UABrowsePath	An array of 3.5.7 UABrowsePath with node parameters for starting node and relative path. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_RELATIVEPATH)
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	TargetNodeIDs	ARRAY OF STRUCT	See 3.5.3 *UANodeID*. Structure UANodeID with node parameters. For target node mentioned by BrowsePath at the input of this FB. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths
B	TargetErrorIDs	ARRAY OF DWORD	Array of TargetErrorIDs. Contains an error code for each element of the TargetNodeIDs array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the NoOfElements in BrowsePath array length.
Notes: -			



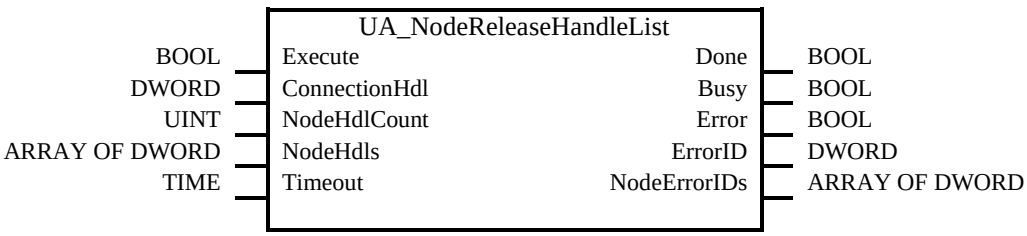
5.7. UA_NodeGetHandleList

FB-Name		**UA_NodeGetHandleList**	
This Function Block is used to get node handles for multiple nodes.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeIDCount	UINT	Number of NodeIDs in Array of NodeIDs.
B	NodeIDs	ARRAY OF UANodeID	See 3.5.3 *UANodeID*. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Array length of NodeIDs and NodeHdls must be same.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB. Set to true if either ErrorID or any of the NodeErrorIDs indicates an error.
B	ErrorID	DWORD	Error code.
B	NodeErrorIDs	ARRAY OF DWORD	Array of NodeErrorIDs. Contains an error code for each valid element of the NodeIds array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the NodesIDs array length.
B	NodeHdls	ARRAY OF DWORD	Array of Node Handles. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Array length of NodeIDs and NodeHdls must be same.
Notes: The NodeHdl is a reference to the internal management object for the node in the client. However, the internal client implementation shall also register the node at the server (“RegisterNode”). This enables the UA-server to optimize the communication.			



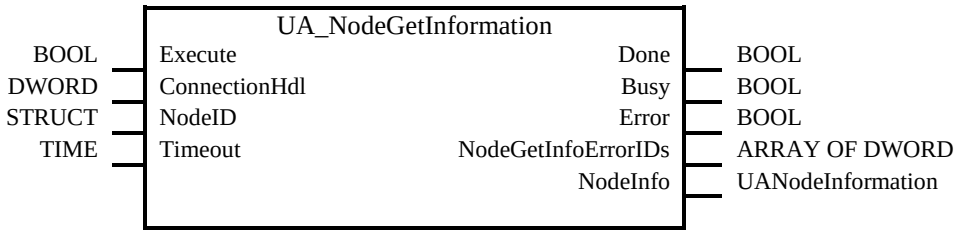
5.8. UA_NodeReleaseHandleList

FB-Name		**UA_NodeReleaseHandleList**	
This Function Block is used to release a set of node handles.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdlCount	UINT	Number of Nodes in NodeHdls Array.
B	NodeHdls	ARRAY OF DWORD	Array of Node handles to be released. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths NULL is not a valid handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB. Set to true if either ErrorID or any of the NodeErrorIDs indicates an error.
B	ErrorID	DWORD	Error code.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each valid element of the NodeHdls array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the NodeHdls array length.
Notes: After calling UA_NodeReleaseHandleList the NodeHdls will be invalid.			



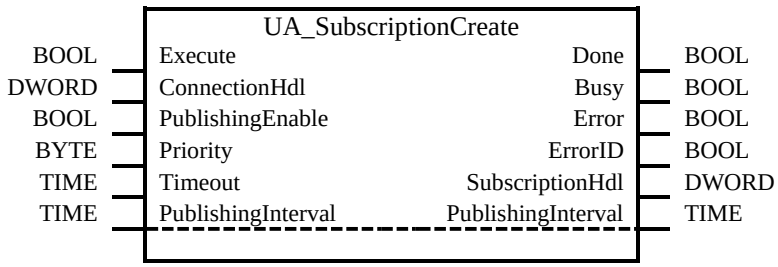
5.9. UA_NodeGetInformation

FB-Name		**UA_NodeGetInformation**	
This Function Block is used to get the node information.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeID	UANodeID	See 3.5.3 *UANodeID*
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	NodeGetInfoErrorIDs	ARRAY [0 .. 21] OF DWORD	Array of DWORD. Contains an error code for each valid element of the NodeHdls array. Shall be same size like number of UANodeInformation elements. Actually, this struct has 22 elements. The NodeGetInfoErrorIDs have the same indices as in the OPC UA specification defined, e.g. (Value = 13). The size of the array is from 0 to 21 where elements 0 and 1 are not being used.
B	NodeInfo	UANodeInformation	See 3.5.11 *UANodeInformation*
Notes: Depend on the responded NodeClass (see *UANodeClassMask*) the corresponding NodeGetInfoErrorID shall have the following errors. - Elements, which are not in this NodeClass existing shall have PLCopenUA_Bad_AttributeIdUnknown. - Elements, which should exist but don't, shall have PLCopenUA_Bad_AttributeIdInvalid. - Valid elements shall have OpcUa_Good.			



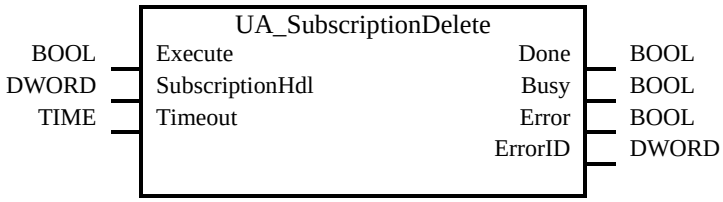
5.10. UA_SubscriptionCreate

FB-Name		**UA_SubscriptionCreate**	
This Function Block can be used to create a subscription.			
VAR_INPUT			
B	Execute	BOOL	On rising edge subscription will be created.
B	ConnectionHdl	DWORD	Connection handle.
B	PublishingEnable	BOOL	Activate the publishing.
B	Priority	BYTE	Priority of the Subscription in the server relative to the other Subscriptions created by this client. See OPC UA Part 4 Chapter 51322 Parameters (Table 86)
B	Timeout	TIME	Maximum time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	SubscriptionHdl	DWORD	Subscription handle.
VAR_IN_OUT			
B	PublishingInterval	TIME	Publishing interval (can be changed by the Server revised publishing interval).
Notes: The connection monitoring and the reconnect handling are to be done by the client vendor implementation. The reconnect sequence is defined by the OPC UA specification part 4. SubscriptionHdl must be unique even if the client is connected to multiple servers.			



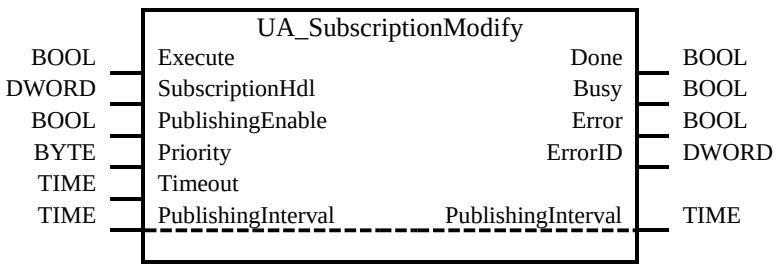
5.11. UA_SubscriptionDelete

FB-Name		**UA_SubscriptionDelete**	
This Function Block can be used to delete a subscription.			
VAR_INPUT			
B	Execute	BOOL	On rising edge, the subscription mentioned by SubscriptionHdl will be deleted.
B	SubscriptionHdl	DWORD	Subscription handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: -			



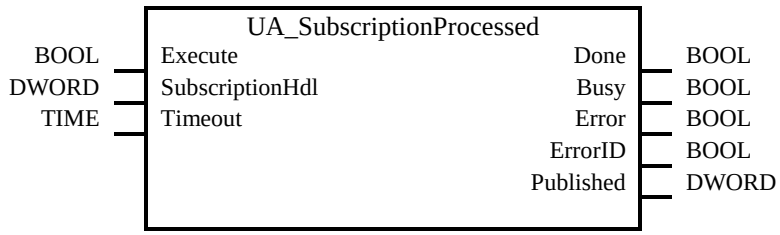
5.12. UA_SubscriptionModify

FB-Name		**UA_SubscriptionModify**	
This Function Block is designed to be optionally called to modify publishing parameters (enable / interval).			
VAR_INPUT			
B	Execute	BOOL	FB operates on rising edge.
B	SubscriptionHdl	DWORD	Subscription handle.
B	PublishingEnable	BOOL	Activates the publishing.
B	Priority	BYTE	Priority of the Subscription in the server relative to the other Subscriptions created by this client.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	PublishingInterval	TIME	Publishing interval (can be changed by the Server revised publishing interval).
Notes: -			



5.13. UA_SubscriptionProcessed

FB-Name		**UA_SubscriptionProcessed**	
This Function Block is designed to be optionally called to check if monitored items have been published. The use of the function block depends on the underlying system – see notes.			
VAR_INPUT			
B	Execute	BOOL	FB operates on each call.
B	SubscriptionHdl	DWORD	Subscription handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	Published	BOOL	Indicates, that variables have been published since the last call.
Notes: It is expected to use this call, if the underlying system WILL publish the values automatically. Shall not be used together with the function block UA_MonitoredItemOperateList. This call is expected to return with a valid result after it is called. See also 2.2 Monitored Items**.**			

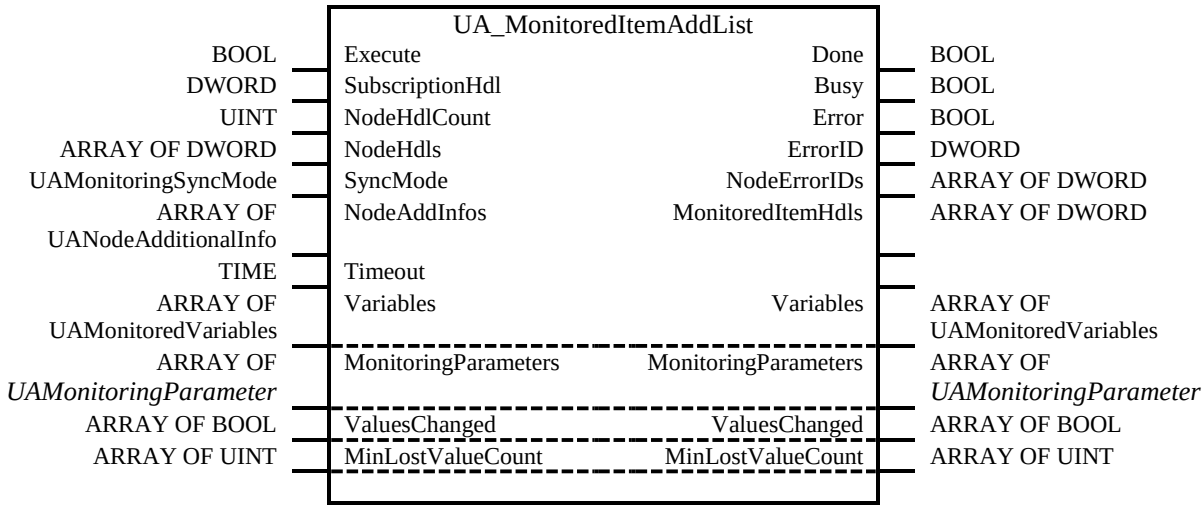


5.14. UA_MonitoredItemAddList

FB-Name		**UA_MonitoredItemAddList**	
This Function Block can be used to add handle of multiple nodes using a list of node handles.			
VAR_INPUT			
B	Execute	BOOL	On rising edge monitored items will be added to a subscription.
B	SubscriptionHdl	DWORD	Subscription handle.
B	NodeHdlCount	UINT	Number of valid elements in the array to add.
B	NodeHdls	ARRAY OF DWORD	Array of Node handles. Max length of array is to be defined by the vendor and shall be same length thanVariables array length. Shall be the same size as NodeHdlCount. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_MONITORLIST)
B	SyncMode	UAMonitoringSyncMode	See 3.3.12 *UAMonitoringSyncMode* See chapter 2.2 Monitored Items for general concept of SyncModes • 0 = UAMSync_Unknown Default, this results into an error code – has to be set to one of the following options • 1 = UAMS_ControllerSync • 2 = UAMS_FwSync
B	NodeAddInfos	ARRAY OF UANodeAdditionalInfo	See 3.5.13 *UANodeAdditionalInfo*. Specifies the attribute and IndexRange. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_MONITORLIST) This parameter is optional. If not existing, the UAAI_Value (13) will be taken from internal implementation.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each element of the Variables array. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same length than NodeHdlCount.
B	MonitoredItemHdls	ARRAY OF DWORD	Array of monitored item handles. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same length than NodeHdlCount.
VAR_IN_OUT			
B	Variables	ARRAY OF UAMonitoredVariables	See 3.5.20 UAMonitoredVariables. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same length as NodeHdlCount
B	MonitoringParameter	ARRAY OF *UAMonitoringParameter*	See 3.5.8 *UAMonitoringParameter* Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same length as NodeHdlCount.
B	ValuesChanged	ARRAY OF BOOL	Indicates that the values of the monitored item have been changed.

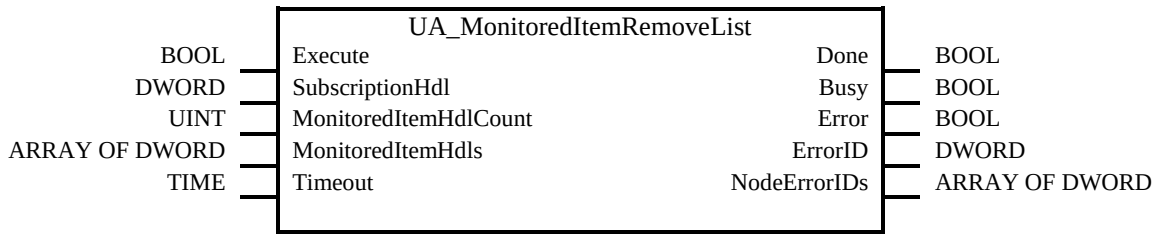
			Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). Shall be the same length as NodeHdlCount. See 3.7 Constants of Array Lengths
B	MinLostValueCount	ARRAY OF UINT	Count the minimum lost values if queue size is > 1 – see also 3.5.20 UAMonitoredVariables.

Notes: VAR_IN_OUT: „Variable" as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as "Variable" and the firmware client just provide the blob (UA memory layout – so called "raw data") into that byte array.
"Variable" could be the name of the variable so the internal firmware can get address, length, data type of variable.



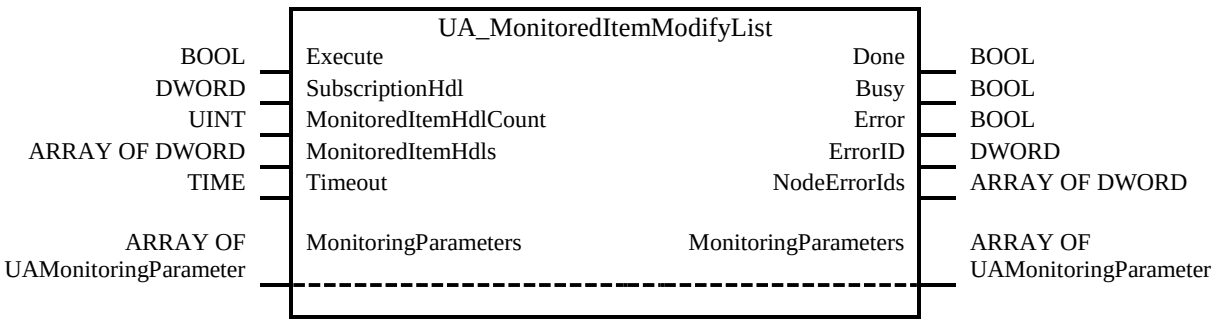
5.15. UA_MonitoredItemRemoveList

FB-Name		**UA_MonitoredItemRemoveList**	
This Function Block can be used to remove multiple nodes from a subscription using a list of node handles.			
VAR_INPUT			
B	Execute	BOOL	On rising edge monitored items will be removed from the subscription.
B	SubscriptionHdl	DWORD	Subscription handle.
B	MonitoredItemHdl Count	UINT	Number of valid elements in the array to remove.
B	MonitoredItemHdls	ARRAY OF DWORD	Monitored item handles. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same size than MonitoredItemHdlCount
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each valid element of the Variables array. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths Shall be the same size than MonitoredItemHdlCount.
Notes: -			



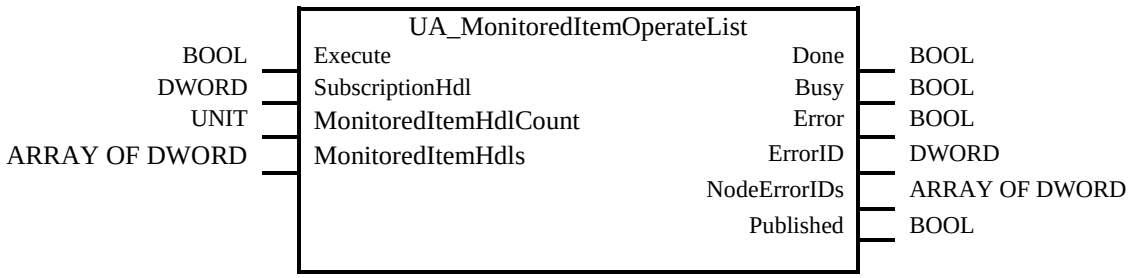
5.16. UA_MonitoredItemModifyList

FB-Name		**UA_MonitoredItemModifyList**	
This Function Block is designed to be optionally called to modify a list of monitored item parameters.			
VAR_INPUT			
B	Execute	BOOL	On rising edge monitored items will be modified.
B	SubscriptionHdl	DWORD	Subscription handle.
B	MonitoredItemHdlCount	UINT	Number of valid elements in the array to modify.
B	MonitoredItemHdls	ARRAY OF DWORD	Array of monitored item handles. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same size than MonitoredItemHdlCount
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	NodeErrorIds	ARRAY OF DWORD	Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths – including the “Overflow bit” indication
VAR_IN_OUT			
B	MonitoringParameters	ARRAY OF UAMonitoringParameter	See 3.5.8 *UAMonitoringParameter*
Notes: -			



5.17. UA_MonitoredItemOperateList

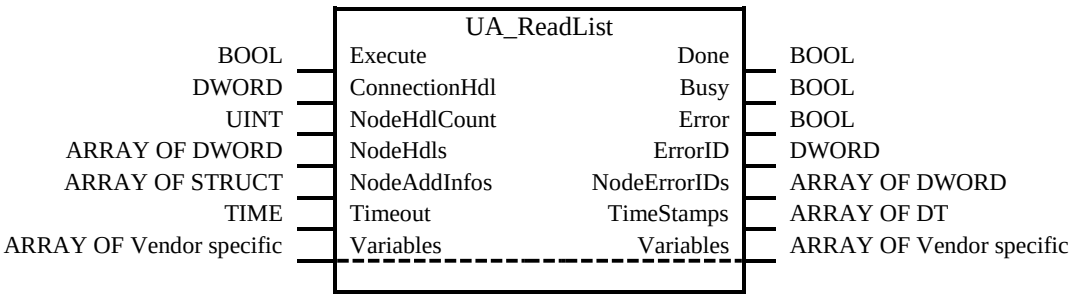
FB-Name		**UA_MonitoredItemOperateList**	
This Function Block is designed to be called to update the values of a list of Variables and the corresponding information in the associated lists like ValuesChanged, TimeStamps and NodeQualityIDs of the control program. The use of the function block depends on the underlying system – see notes.			
VAR_INPUT			
B	Execute	BOOL	On rising edge monitored items will be modified.
B	SubscriptionHdl	DWORD	Subscription handle.
B	MonitoredItemHdlCount	UINT	Number of valid elements in the array to modify.
B	MonitoredItemHdls	ARRAY OF DWORD	Array of monitored item handles. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same size than MonitoredItemHdlCount.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each element of the MonitoredItemHdls-Array. Length is vendor-specific (MAX_ELEMENTS_MONITORLIST). See 3.7 Constants of Array Lengths. Shall be the same length than MonitoredItemHdlCount.
B	Published	BOOL	Indicates, that variables have been published since the last call. At least one element of the array of ValuesChanged will be true.
Notes: It is expected to use this call, if the underlying system will NOT update the values automatically. Shall not be used together with the function block UA_SubscriptionProcessed. After the successful execution it is expected, that the values of the Variables and the corresponding information in the associated lists like ValuesChanged, TimeStamps and NodeQualityIDs have been updated. See also 2.2 Monitored Items.			



5.18. UA_ReadList

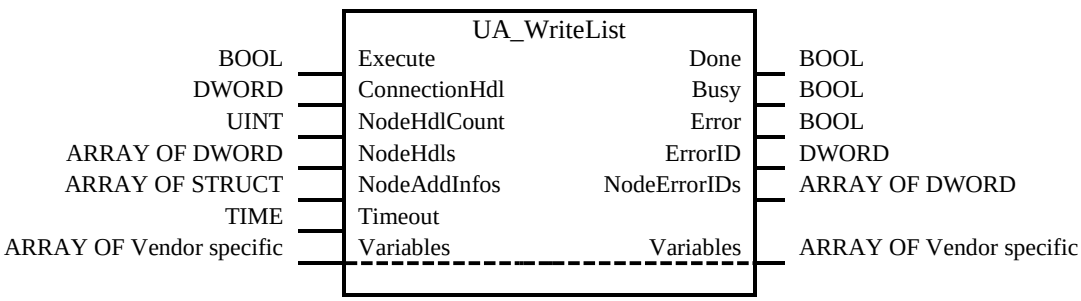
FB-Name		**UA_ReadList**	
This Function Block is used to read values of multiple nodes using a list of node handles.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdlCount	UINT	Number of valid elements in the array to read.
B	NodeHdls	ARRAY OF DWORD	Array of Node Handles. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length.

B	NodeAddInfos	ARRAY OF UANodeAdditionalInfo	See 3.5.13 *UANodeAdditionalInfo*. Array of UANodeAdditionalInfo. Specifies the attribute and IndexRange. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length. This parameter is optional. If not existing the UAAI_Value (13) will be taken from internal implementation.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected
B	Error	BOOL	Signals that an error has occurred within the FB. Set to true if either ErrorID or any of the NodeErrorIDs indicates an error.
B	ErrorID	DWORD	Error code for the OPC UA service call.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each valid element of the Variables array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length.
B	TimeStamps	ARRAY OF DT	Contains a TimeStamp for each valid element of the Variables array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length. This parameter is optional. If not existing the internal client implementation shall not ask for any timestamp from server side.
VAR_IN_OUT			
B	Variables	ARRAY OF Vendor specific	Vendor specific. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths
Notes: Vendors can handle “Variable” in a vendor specific way. Independent of the vendor specific solution the mapping of the controller data type and OPC-UA data type shall be handled in the function block. VAR_IN_OUT: „Variable” as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as “Variable” and the firmware client just provide the blob (UA memory layout – so called “raw data”) into that byte array. “Variable” could be the name of the variable so the internal firmware can get address, length, data type of variable.			



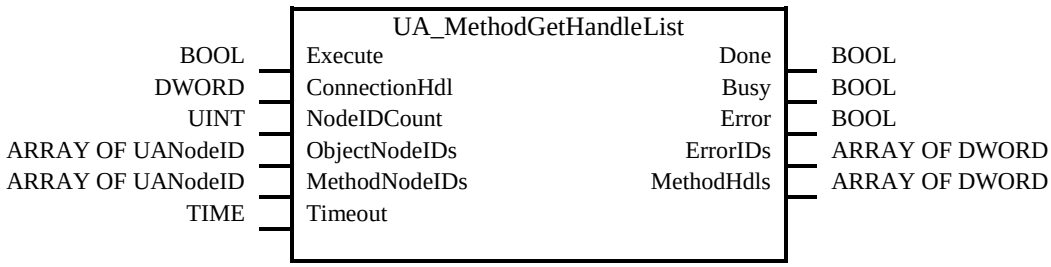
5.19. UA_WriteList

FB-Name		**UA_WriteList**	
This Function Block is used to write values to multiple nodes using a list of node handles.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node values will be written.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdlCount	UINT	Number of valid elements in the array to write.
B	NodeHdls	ARRAY OF DWORD	Array of Node Handles. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length.
B	NodeAddInfos	ARRAY OF UANodeAdditionalInfo	See 3.5.13 *UANodeAdditionalInfo*. Array of UANodeAdditionalInfo. Specifies the attribute and IndexRange. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length. This parameter is optional. If not existing, the UAAI_Value (13) will be taken from internal implementation.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB. Set to true if either ErrorID or any of the NodeErrorIDs indicates an error.
B	ErrorID	DWORD	Error code for the OPC UA service call.
B	NodeErrorIDs	ARRAY OF DWORD	Array of DWORD. Contains an error code for each valid element of the Variables array. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths Shall be same size like the Variables array length.
VAR_IN_OUT			
B	Variables	ARRAY OF Vendor specific	Vendor specific. Length is vendor-specific (MAX_ELEMENTS_NODELIST). See 3.7 Constants of Array Lengths.
Notes: Vendors can handle “Variables” in a vendor specific way. Independent of the vendor specific solution the mapping of the controller data type and OPC-UA data type shall be handled in the function block. VAR_IN_OUT: „Variables” as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as “Variables” and the firmware client just provide the blob (UA memory layout – so called “raw data”) into that byte array. “Variables” could be the name of the variable so the internal firmware can get address, length, data type of variable.			



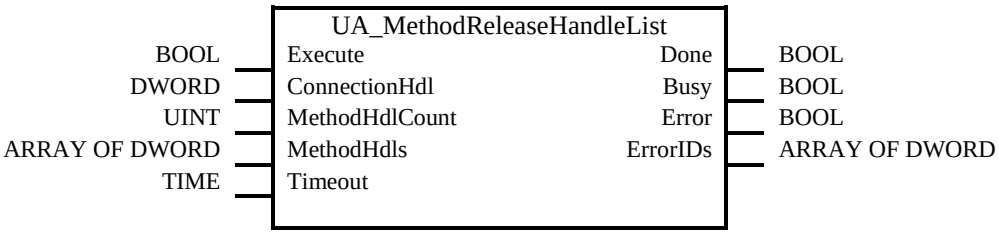
5.20. UA_MethodGetHandleList

FB-Name		**UA_MethodGetHandleList**	
This Function Block is used to get multible method handles for method calls.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeIDCount	UINT	Number of elements the ObjectNodeIDs and MethodNodeIDs shall have.
B	ObjectNodeIDs	ARRAY OF UANodeID	See 3.5.3 *UANodeID*. Array shall have the size of NodeIDCount See 3.7 Constants of Array Lengths
B	MethodNodeIDs	ARRAY OF UANodeID	See 3.5.3 *UANodeID*. Array shall have the size of NodeIDCount See 3.7 Constants of Array Lengths
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorIDs	ARRAY OF DWORD	Error codes.
B	MethodHdls	ARRAY OF DWORD	Method handles.
Notes:			



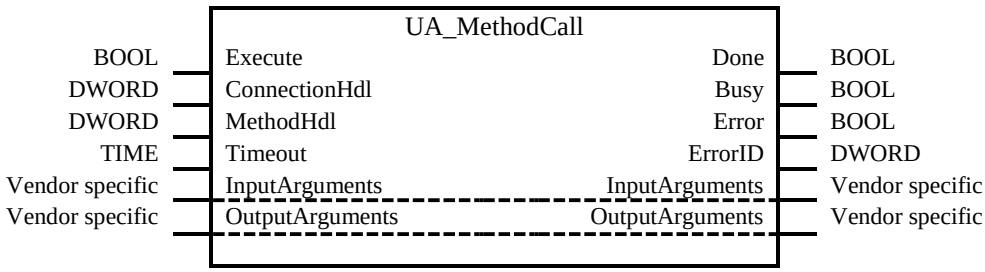
5.21. UA_MethodReleaseHandleList

FB-Name		**UA_MethodReleaseHandleList**	
This Function Block is used to release method handles.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	MethodHdlCount	UINT	Number of elements the MethodHdls shall have.
B	MethodHdls	ARRAY OF DWORD	Method handles to be released. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_METHOD)
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorIDs	ARRAY OF DWORD	Error codes. See 3.7 Constants of Array Lengths (MAX_ELEMENTS_METHOD)
Notes: After calling UA_MethodReleaseHandle or MethodReleaseHandleList the MethodHdl(s) will be invalid.			



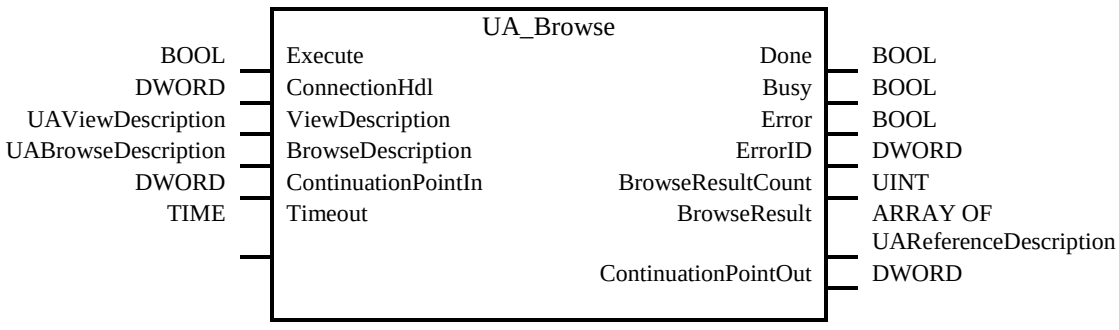
5.22. UA_MethodCall

FB-Name		**UA_MethodCall**	
This Function Block is used to call a method routine.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	MethodHdl	DWORD	Method handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	InputArguments	Vendor specific	Variable containing input parameters. Vendor specific.
B	OutputArguments	Vendor specific	Variable containing output parameters. Vendor specific.
Notes: -			



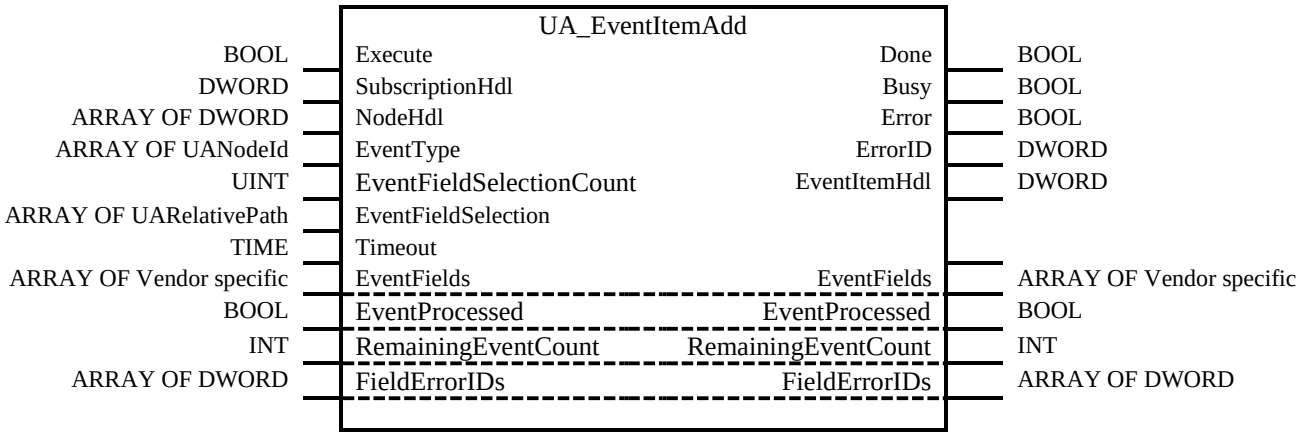
5.23. UA_Browse

FB-Name	**UA_Browse**		
This Function Block is used to navigate through the Address Space. Passing a starting node, the server retuns a list of nodes by references. The MaxArray size is configured for the controller must be passed as the RequestMaxReferencePerNode in the firmeware service call.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	BrowseDescription	UABrowseDescription	Starting Node and other information for navigation. See 3.5.15 *UABrowseDescription* Hint: This parameter is ignored if the ContinuationPointIn is not 0
B	ContinuationPointIn	DWORD	If set to 0 the browse starts with starting node. If set to ContinuationPointOut it can be used for browse next service.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	BrowseResultCount	UINT	The number of entries in the BrowseResult array
B	BrowseResult	ARRAY of UAReferenceDescription	List of references and target node information for the node passing the filter criteria in the request See 3.5.17 *UAReferenceDescription* Length is vendor-specific (MAX_ELEMENTS_BROWSERESULT). See 3.7 Constants of Array Lengths Hint: MaxSize is initialized by a predefined fixed size
B	ContinuationPointOut	DWORD	Set when the server was not able to to deliver all results. Can be used to copy it to ContinuationPointIn for browse next service
Notes: -			



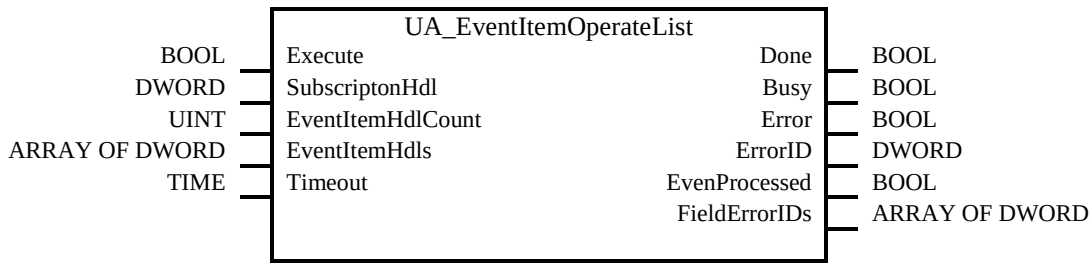
5.24. UA_EventItemAdd

FB-Name	**UA_EventItemAdd**		
This Function Block is used to add handles for events.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	SubscriptionHdl	DWORD	Subscription handle.
B	NodeHdl	DWORD	Handle of the node to monitor for emitted events. Events are only produced by the node classes Object and View. Whether a node is actually producing events or not may be determined by its EventNotifier attribute.
B	EventType	UANodeID	Type of the event to monitor. The EventType will be included as OfType operator in the Where Clause of the event monitored item filter.
B	EventFieldSelectionCount	UINT	Number of elements in EventFieldSelections
B	EventFieldSelections	ARRAY of UARelativePath	Array of UARelativePath for the event fields to select. The path starts from the event type node. The FieldSelection is used as Select Clause of the event monitored item filter. Examples are 0: Message selects the Message event field 0: ActiveState/0: Id selects the Boolean representation of the Alarm ActiveState. Length is vendor-specific (MAX_EVENT_FIELD_SELECTIONS). See 3.7 Constants of Array Lengths Hint: MaxSize is initialized by a predefined fixed size
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code
B	EventItemHdl	DWORD	Event Item Handle. The handle can be used to process the published events with UA_EventItemOperate and remove them from the subscription with UA_EventItemRemove.
VAR_IN_OUT			
B	EventFields	ARRAY OF Vendor specific	Vendor specific list of variables used to receive the events field data for one event occurance. Vendor specific.
B	EventProcessed	BOOL	Indicates that the values of the event item have been changed.
B	RemainingEventCount	UINT	Number of remaining events available for processing
B	FieldErrorIDs	ARRAY of DWORD	Contains an error code for each valid element of the EventFieldSelection array. Length is vendor-specific (MAX_EVENT_FIELD_SELECTIONS). See 3.7 Constants of Array Lengths – including the “Overflow bit” indication.
Notes: -			



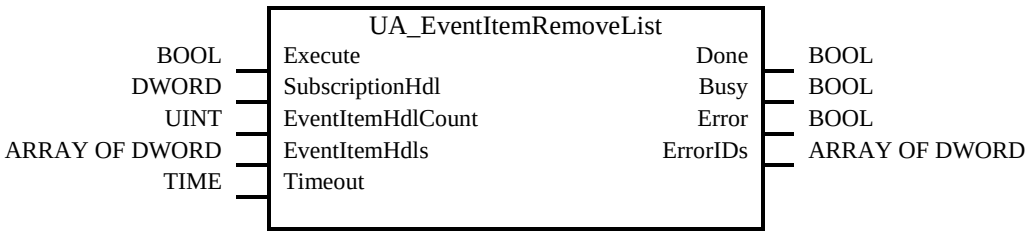
5.25. UA_EventItemOperateList

FB-Name		**UA_EventItemOperateList**	
This Function Block is used to get a list of event infomation.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	SubscriptionHdl	DWORD	Subscription handle.
B	EventItemHdlCount	UINT	Number of elements the EventItemHdls shall have.
B	EventItemHdls	ARRAY OF DWORD	Event Item Handles Length is vendor-specific (MAX_ELEMENTS_EVENTITEMLIST). See 3.7 Constants of Array Lengths
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	EventProcessed	BOOL	Indicates if a new event was processed.
B	FieldErrorIDs	ARRAY of DWORD	Contains an error code for each valid element of the EventFieldSelection array. Length is vendor-specific (MAX_ELEMENTS_EVENTITEMOPERATE). See 3.7 Constants of Array Lengths – including the “Overflow bit” indication.
Notes: The EventFields has to be defined what is the best declaration in IEC language for 25 different event type structures.			



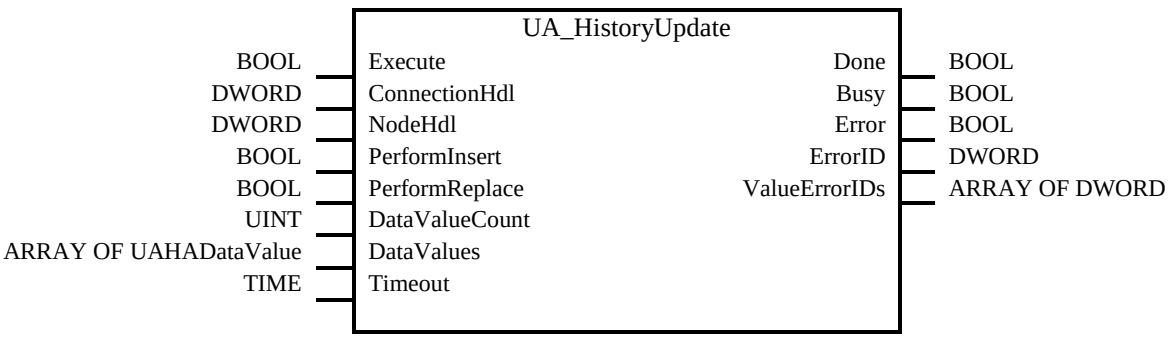
5.26. UA_EventItemRemoveList

FB-Name		**UA_EventItemRemoveList**	
This Function Block can be used to remove an event item handle from a subscription.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	SubscriptionHdl	DWORD	Subscription handle.
B	EventItemHdlCount	UINT	Number of elements the EventItemHdls shall have.
B	EventItemHdls	ARRAY OF DWORD	Event item handles. Length is vendor-specific (MAX_ELEMENTS_EVENTITEMLIST). See 3.7 Constants of Array Lengths
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorIDs	ARRAY OF DWORD	Error codes
Notes: -			



5.27. UA_HistoryUpdate

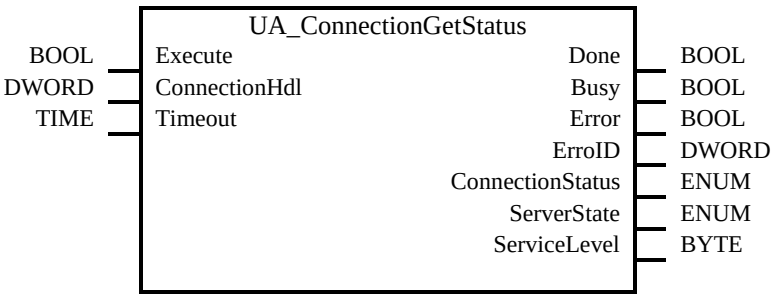
<table>
<tr><td colspan="2">FB-Name</td><td colspan="2">UA_HistoryUpdate</td></tr>
<tr><td colspan="4">This Function Block is used to insert or replace or update data in the historical database.</td></tr>
<tr><td colspan="4">VAR_INPUT</td></tr>
<tr><td>B</td><td>Execute</td><td>BOOL</td><td>FB performs its task on rising edge on this input.</td></tr>
<tr><td>B</td><td>ConnectionHdl</td><td>DWORD</td><td>Connection handle.</td></tr>
<tr><td>B</td><td>NodeHdl</td><td>DWORD</td><td>Node handle.</td></tr>
<tr><td>B</td><td>PerformInsert</td><td>BOOL</td><td rowspan="2"><table><tr><th>Perform Insert</th><th>Perform Replace</th><th>Description</th></tr><tr><td>True</td><td>False</td><td>The passed value will only be written to the history if no value exists at the specified timestamp.</td></tr><tr><td>False</td><td>True</td><td>The passed value will only be written to the history if a value exists at the specified timestamp. The existing value will be replaced.</td></tr><tr><td>True</td><td>True</td><td>The passed value will be inserted if no value exists for the timestamp but will also replace an existing value at the given timestamp.</td></tr></table></td></tr>
<tr><td>B</td><td>PerformReplace</td><td>BOOL</td></tr>
<tr><td>B</td><td>DataValueCount</td><td>UNIT</td><td>Number of values to be inserted, replaced or updates</td></tr>
<tr><td>B</td><td>DataValues</td><td>ARRAY of UAHADataValue</td><td>Array of UAHADataValue
See 3.5.19 UAHADataValue</td></tr>
<tr><td>B</td><td>Timeout</td><td>TIME</td><td>Time to response.</td></tr>
<tr><td colspan="4">VAR_OUTPUT</td></tr>
<tr><td>B</td><td>Done</td><td>BOOL</td><td>FB has completed its task.</td></tr>
<tr><td>B</td><td>Busy</td><td>BOOL</td><td>The FB is not finished and new output values are to be expected</td></tr>
<tr><td>B</td><td>Error</td><td>BOOL</td><td>Signals that an error has occurred within the Function Block.</td></tr>
<tr><td>B</td><td>ErrorID</td><td>DWORD</td><td>Error code. (StatusCode)</td></tr>
<tr><td>B</td><td>ValueErrorIDs</td><td>ARRAY OF DWORD</td><td>Contains an error code for each valid element.</td></tr>
<tr><td colspan="4">Notes: The idea of this scenario is to have an OPC UA server with HA (Historical Access) functionality available, either local on the same system or remotely in the network. In traditional way the OPC-UA Server is responsible to collect data on his own from the underlying process. This FB UA_HistoryUpdate allows the OPC UA-HA Server to stay inactive and wait that an OPC UA client is actively pushing data into OPC UA-HA-Server making use of the Server’s HistoryUpdate interface.</td></tr>
</table>



6. Diagnosis

6.1. UA_ConnectionGetStatus

FB-Name		**UA_ConnectionGetStatus**	
This Function Block is used to get the connection status.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	ConnectionStatus	ENUM	See 3.3.8 *UAConnectionStatus*. The outputs ServerState and ServiceLevel are only valid if the ConnectionStatus is UAConnectionStatus_Connected.
B	ServerState	ENUM	See 3.3.9 *UAServerState*. The ServerState is UAServerState_UNKOWN if the ConnectionStatus is not UAConnectionStatus_Connected.
B	ServiceLevel	BYTE	ServiceLevel describes the ability of the Server to provide its data to the client. The value range is from 0 to 255, where 0 indicates the worst and 255 indicates the best. The intent is to provide the clients an indication of availability among redundant Servers.
Notes: -			



7. Phased out structured Data Types

The following structured Data Types have been released with specification v1. For future use it's recommended to work with the new version of these structured Data Types.

7.1. UAMonitoredSettings

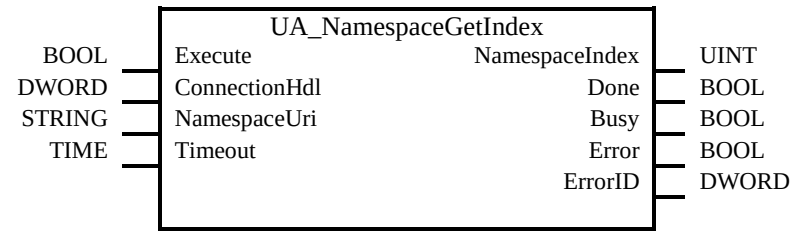
UAMonitoringSettings	DataType	Description
SamplingInterval	TIME	The rate in milliseconds the server checks the underlying data source for changes.
DeadbandType	UADeadbandType	See 3.3.6 *UADeadbandType*. This parameter indicates if a deadband is applied and if applied, which type of Deadband.
Deadband	REAL	e.g. percent 0.1%.

8. Phased out Functionblocks

The following Functionsblocks have been released with specification v1. For future use it's recommended to work with the new "List" version of these Functionsblocks.
Example: Instead of multiple times calling UA_NamespaceGetIndex or UA_Read to handle one node it makes sense to reduce effort and complexity by using once only UA_NamespaceGetIndexList and UA_ReadList.
Customers who implemented their applications based on these set of Functionsblock of v1.0 can continue using this standard – but should think about using the newly specified Functionblocks in the future.

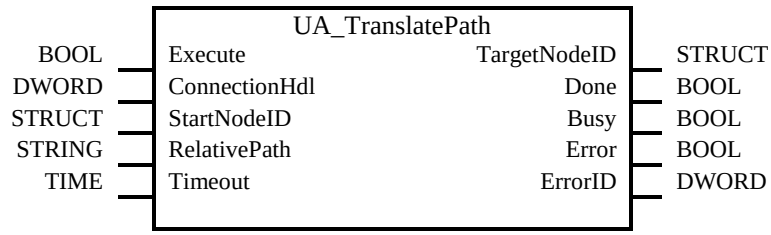
8.1. UA_NamespaceGetIndex

FB-Name		**UA_NamespaceGetIndex**	
This Function Block is used to get the namespace-index of a namespace-URI			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NamespaceUri	STRING	Namespace URI.
B	Timeout	TIME	Maximum time to response.
VAR_OUTPUT			
B	NamespaceIndex	UINT	Namespace Index.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: This FB is deprecated and just for backward compatibility – better use UA_NamespaceGetIndexList			



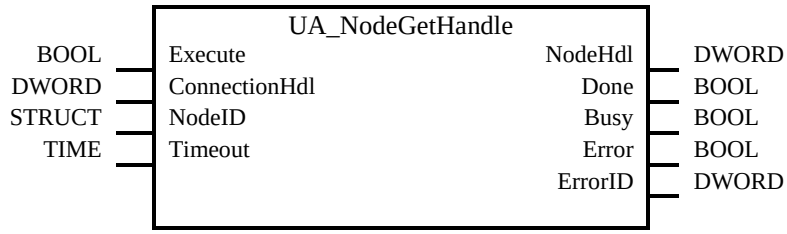
8.2. UA_TranslatePath

FB-Name		**UA_TranslatePath**	
This Function Block is used to get the node parameters of a node using path of the node.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	StartNodeID	STRUCT	See 3.5.3 *UANodeID*. Structure UANodeID with node parameters for starting node.
B	RelativePath	STRING	Path of the Target node; BNF of RelativePath is defined in the OPC UA specification Part 4.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	TargetNodeID	STRUCT	See 3.5.3 *UANodeID*. Structure UANodeID with node parameters. For target node mentioned by RelativePath at the input of this FB.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: This FB is deprecated and just for backward compatibility – better use UA_TranslatePathList			



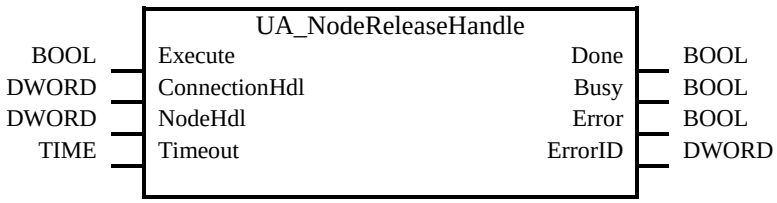
8.3. UA_NodeGetHandle

FB-Name		**UA_NodeGetHandle**	
This Function Block is used to get the node handle.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeID	STRUCT	See 3.5.3 *UANodeID*
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	NodeHdl	DWORD	Node handle.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: The NodeHdl is a reference to the internal management object for the node in the client. But the client shall also register the node at the server (“RegisterNode”). This enables the UA-server to optimize the communication. The scope of the NodeHdl is the connection. So a NodeHdl is unique for a connection but could be equal to a NodeHdl of another connection. This FB is deprecated and just for backward compatibility – better use UA_NodeGetHandleList			



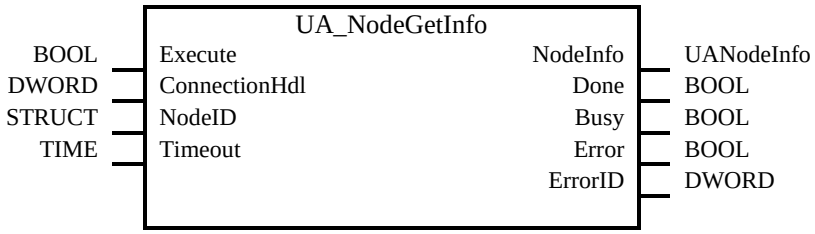
8.4. *UA_NodeReleaseHandle*

FB-Name		**UA_NodeReleaseHandle**	
This Function Block is used to release the node handle.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdl	DWORD	Node handle to be released.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: After calling UA_NodeReleaseHandle the NodeHdl will be invalid. This FB is deprecated and just for backward compatibility – better use UA_NodeReleaseHandleList			



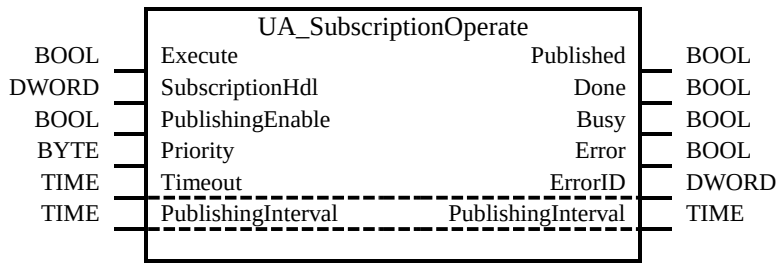
8.5. *UA_NodeGetInfo*

FB-Name		**UA_NodeGetInfo**	
This Function Block is used to get the node information.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeID	STRUCT	See 3.5.3 *UANodeID*
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	NodeInfo	STRUCT	See 3.5.10 UANodeInfo
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: This FB is deprecated and just for backward compatibility – better use UA_NodeGetInformation			



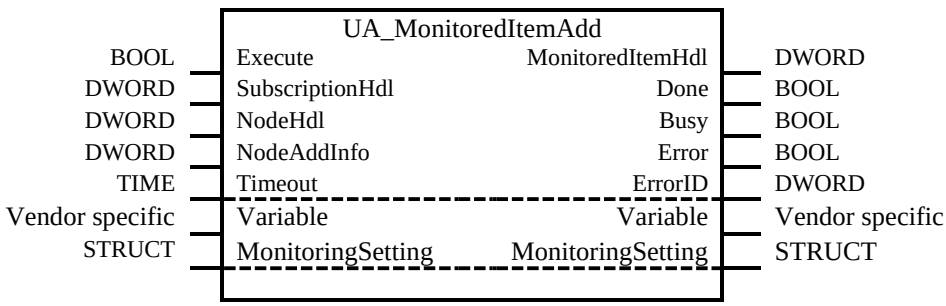
8.6. UA_SubscriptionOperate

FB-Name		**UA_SubscriptionOperate**	
This Function Block is designed to be optionally called -even cyclically- to check if the variables have been published and to check and modify publishing parameters (enable / interval).			
VAR_INPUT			
B	Execute	BOOL	FB operates on rising edge.
B	SubscriptionHdl	DWORD	Subscription handle.
B	PublishingEnable	BOOL	Activates the publishing.
B	Priority	BYTE	Priority of the Subscription in the server relative to the other Subscriptions created by this client.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Published	BOOL	Indicates, that variables have been published since the previous call.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	PublishingInterval	TIME	Publishing interval (can be changed by the Server revised publishing interval).
Notes: This FB is deprecated and just for backward compatibility – better use UA_NodeGetInformation			



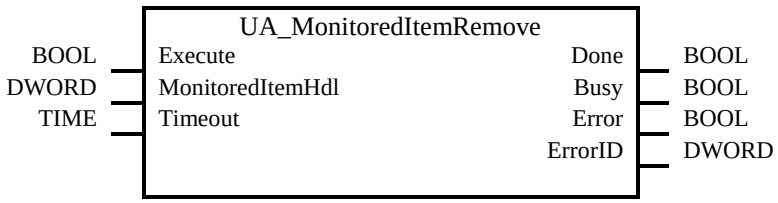
8.7. UA_MonitoredItemAdd

FB-Name		**UA_MonitoredItemAdd**	
This Function Block can be used to add handle that values are updated by subscription.			
VAR_INPUT			
B	Execute	BOOL	On rising edge monitored item will be added to a subscription.
B	SubscriptionHdl	DWORD	Subscription handle.
B	NodeHdl	DWORD	Node handle.
B	NodeAddInfo	DWORD	See 3.5.13 *UANodeAdditionalInfo*. Specifies the attribute and IndexRange.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	MonitoredItemHdl	DWORD	Monitored item handle.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	Variable	Vendor specific	To be defined by vendor.
B	MonitoringSettings	STRUCT	See 7.1 *UAMonitoredSettings* (phased out structured data types)
Notes: VAR_IN_OUT: „Variable" as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as "Variable" and the firmware client just provide the blob (UA memory layout – so called "raw data") into that byte array. "Variable" could be the name of the variable so the internal firmware can get address, length, data type of variable.			



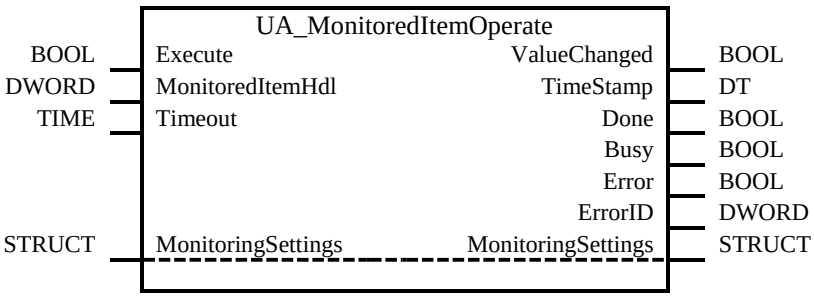
8.8. UA_MonitoredItemRemove

FB-Name		**UA_MonitoredItemRemove**	
This Function Block can be used to remove a handle from a subscription.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	MonitoredItemHdl	DWORD	Monitored item handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: -			



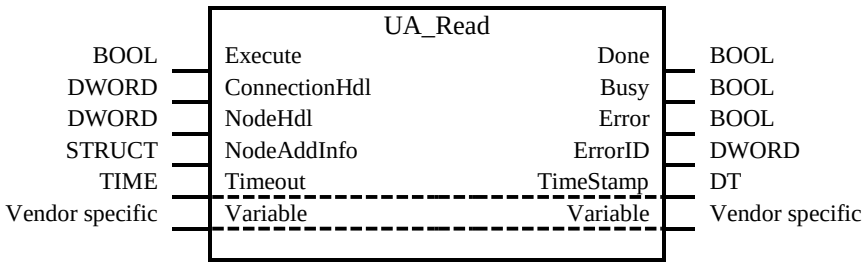
8.9. *UA_MonitoredItemOperate*

FB-Name		**UA_MonitoredItemOperate**	
This Function Block is designed to be optionally called to check and modify monitored item parameters.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	MonitoredItemHdl	DWORD	Monitored item handle.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	ValueChanged	BOOL	Indicates that the value of the monitored item has been changed.
B	TimeStamp	DT	TimeStamp
B	RemainingValueCount	UINT	Number of remaining value changes available for processing This parameter is for diagnostic purpose and relates to the que size: High numbers indicate that the systemis overloaded and should result in reducing the sample rate to faster process incoming MonitiredItems.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	MonitoringSettings	STRUCT	See 7.1 *UAMonitoredSettings* (phased out structured data types)
Notes: -			



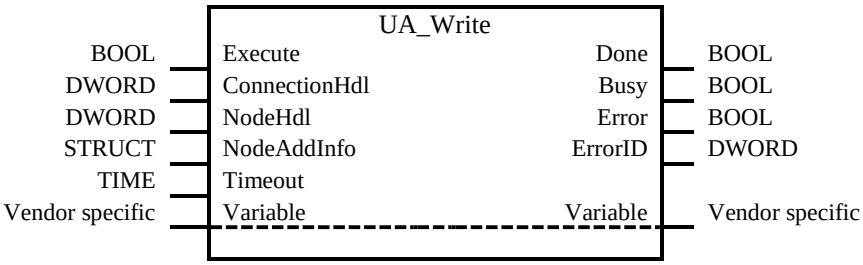
8.10. UA_Read

FB-Name	**UA_Read**		
This Function Block is used to read the value of a single node.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be read.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdl	DWORD	Node handle.
B	NodeAddInfo	UANodeAdditionalInfo	See 3.5.13 *UANodeAdditionalInfo*. Specifies the attribute and IndexRange. This parameter is optional. If not existing the UAAI_Value (13) will be taken from internal implementation.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
B	TimeStamp	DT	TimeStamp. This parameter is optional. If not existing the internal client implementation shall not ask for any timestamp from server side.
VAR_IN_OUT			
B	Variable	Vendor specific	Vendor specific
Notes: Vendors can handle “Variable” in a vendor specific way. Independent of the vendor specific solution the mapping of the controller data type and OPC-UA data type shall be handled in the function block. VAR_IN_OUT: „Variable” as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as “Variable” and the firmware client just provide the blob (UA memory layout – so called “raw data”) into that byte array. “Variable” could be the name of the variable so the internal firmware can get address, length, data type of variable. This FB is deprecated and just for backward compatibility – better use UA_ReadList			



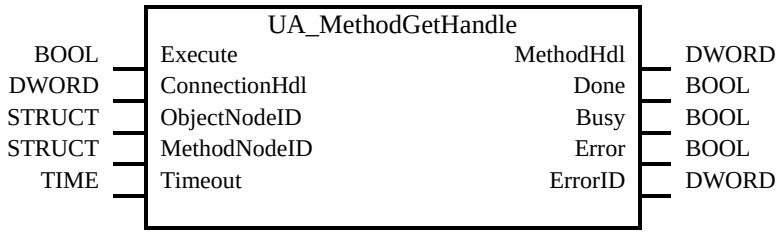
8.11. UA_Write

FB-Name		**UA_Write**	
This Function Block is used to write a value to a single node.			
VAR_INPUT			
B	Execute	BOOL	On rising edge node information will be written.
B	ConnectionHdl	DWORD	Connection handle.
B	NodeHdl	DWORD	Node handle.
B	NodeAddInfo	STRUCT	See 3.5.13 *UANodeAdditionalInfo*. Specifies the attribute and IndexRange. This parameter is optional. If not existing the UAAI_Value (13) will be taken from internal implementation.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
VAR_IN_OUT			
B	Variable	Vendor specific	To be defined by vendor.
Notes: Vendors can handle “Variable” in a vendor specific way. Independent of the vendor specific solution the mapping of the controller data type and OPC-UA data type shall be handled in the function block. VAR_IN_OUT: „Variable” as would provide best type save solution for users: The client firmware is able to map the UA memory layout to the controller layout. The firmware client can receive the type definition from the UA-Server. Workaround would be to provide a byte array as “Variable” and the firmware client just provide the blob (UA memory layout – so called “raw data”) into that byte array. “Variable” could be the name of the variable so the internal firmware can get address, length, data type of variable. This FB is deprecated and just for backward compatibility – better use UA_WriteList			



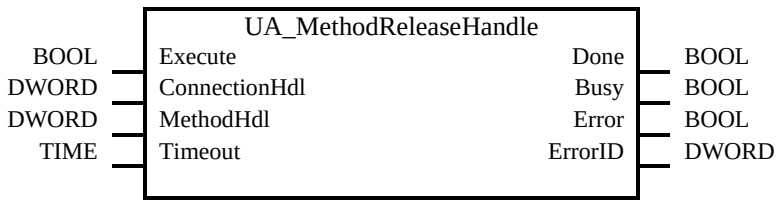
8.12. UA_MethodGetHandle

FB-Name		**UA_MethodGetHandle**	
This Function Block is used to get the method handle for a method call.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	ObjectNodeID	STRUCT	See 3.5.3 *UANodeID*.
B	MethodNodeID	STRUCT	See 3.5.3 *UANodeID*.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	MethodHdl	DWORD	Method handle.
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: This FB is deprecated and just for backward compatibility – better use UA_MethodGetHandleList			



8.13. UA_MethodReleaseHandle

FB-Name		**UA_MethodReleaseHandle**	
This Function Block is used to release the method handle.			
VAR_INPUT			
B	Execute	BOOL	FB performs its task on rising edge on this input.
B	ConnectionHdl	DWORD	Connection handle.
B	MethodHdl	DWORD	Method handle to be released.
B	Timeout	TIME	Time to response.
VAR_OUTPUT			
B	Done	BOOL	FB has completed its task.
B	Busy	BOOL	The FB is not finished and new output values are to be expected.
B	Error	BOOL	Signals that an error has occurred within the FB.
B	ErrorID	DWORD	Error code.
Notes: After calling UA_MethodReleaseHandle the MethodHdl will be invalid. This FB is deprecated and just for backward compatibility – better use UA_MethodReleaseHandleList			



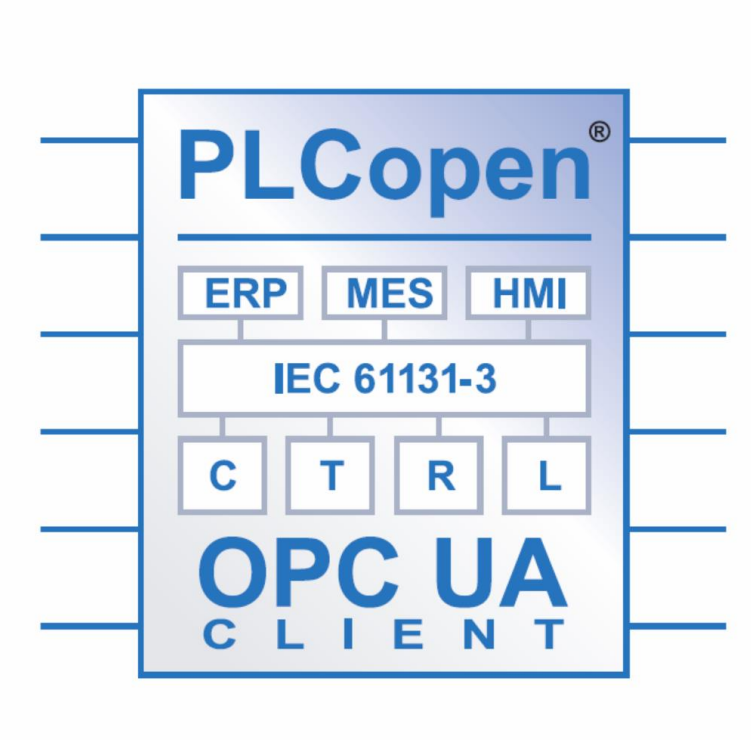
Appendix A. Compliance Procedure and Compliance List

Listed in this Appendix are the requirements for the compliance statement from the supplier of the PLCopen OPC UA Client for IEC61131-3. The compliance statement consists of two main groups: supported data types and supported Function Blocks, in combination with the applicable inputs and outputs. The supplier is required to fill out the tables for the used data types and Function Blocks, according to their product, committing their support to the specification.

By submitting these tables to PLCopen, and after approval by PLCopen, the list will be published on the PLCopen website, www.PLCopen.org, as well as a shortform overview, as specified in Appendix A 2 Supported Data types and Appendix A 3 Overview of the Function Blocks as below.

In addition to this approval, the supplier is granted access and usage rights of the PLCopen OPC UA Client logo, as described in Appendix A 4:

The "PLCopen OPC UA Client for IEC61131-3" Logo and Its Usage:



Function Blocks and Inputs and Outputs
An implementation which claims compliance with this PLCopen OPC UA specification shall offer a set of Function Blocks for communication, meaning one or more Function Blocks, with at least the **basic** input and output variables, marked as "**B**" in the tables. These inputs and outputs have to be supported to be compliant.
For higher-level systems and future extensions any subset of the **extended** input and output variables, marked as "**E**" in the tables can be implemented.
Vendor specific additions are marked with "**V**", and can be listed as such in the supplier documentation.

- **Basic** input/output variables are mandatory — Marked in the tables with the letter "**B**"
- **Extended** input /output variables are optional — Marked in the tables with the letter "**E**"
- **Vendor Specific** additions — Marked in the vendor's compliance documentation with "**V**"

All the vendor specific items will not be listed in the comparison table on the PLCopen website, but in the detailed vendor specific list, which also is published.
All vendor specific in- and outputs of all FBs must be listed in the certification list of the supplier. With this, the certification listing from a supplier describes all the I/Os of the relevant FBs, including vendor-specific extensions, and thus showing the complete FBs as used by the supplier.
For compliance reason we identify in the FUNCTIONBLOCK overview the difference of "V1.0" or "V1.1" or "No" (empty field) support.

Appendix A 1. Statement of Supplier

Supplier name	
Supplier address	
City	
Country	
Telephone	
Fax	
Email address	
Product Name	
Product version	
Release date	

I hereby state that the following tables as filled out and submitted do match our product as well as the accompanying user manual, as stated above.

Name of representation (person):

Date of signature (dd/mm/yyyy):

Signature:

Appendix A 2. Overview of the Functionblocks

Chapter	Function Block	Supported V1.0 / V1.1 / No	Comments
5.1	UA_Connect		
5.2	UA_Disconnect		
0	UA_NamespaceGetIndexList		
5.4	UA_ServerGetUriByIndex		
5.5	UA_ServerGetIndexByUriList		
5.6	UA_TranslatePathList		
5.7	UA_NodeGetHandleList		
5.8	UA_NodeReleaseHandleList		
5.9	UA_NodeGetInformation		
5.10	UA_SubscriptionCreate		
5.11	UA_SubscriptionDelete		
5.12	UA_SubscriptionModify		
5.13	UA_SubscriptionProcessed		
0	UA_MonitoredItemAddList		
0	UA_MonitoredItemRemoveList		
5.16	UA_MonitoredItemModifyList		
5.17	UA_MonitoredItemOperateList		
5.18	UA_ReadList		
5.19	UA_WriteList		
5.20	UA_MethodGetHandleList		
5.21	UA_MethodReleaseHandleList		
5.22	UA_MethodCall		
5.23	UA_Browse		
5.24	UA_EventItemAdd		
5.25	UA_EventItemOperateList		
5.26	UA_EventItemRemoveList		
5.27	UA_HistoryUpdate		
6.1	UA_ConnectionGetStatus		
8	***Phased out Functionsblocks***		
8.1	UA_NamespaceGetIndex		
8.2	UA_TranslatePath		
8.3	UA_NodeGetHandle		
8.4	UA_NodeReleaseHandle		
8.5	UA_NodeGetInfo		
8.6	UA_SubscriptionOperate		
8.7	UA_MonitoredItemAdd		
8.8	UA_MonitoredItemRemove		
8.9	UA_MonitoredItemOperate		
8.10	UA_Read		
8.11	UA_Write		
8.12	UA_MethodGetHandle		
8.13	UA_MethodReleaseHandle		

Appendix A 3. The "PLCopen OPC UA Client for IEC61131-3" Logo and Its Usage

For quick identification of compliant products, PLCopen and OPC Foundation have developed a logo for the "PLCopen OPC UA Client for IEC61131-3" functionality:

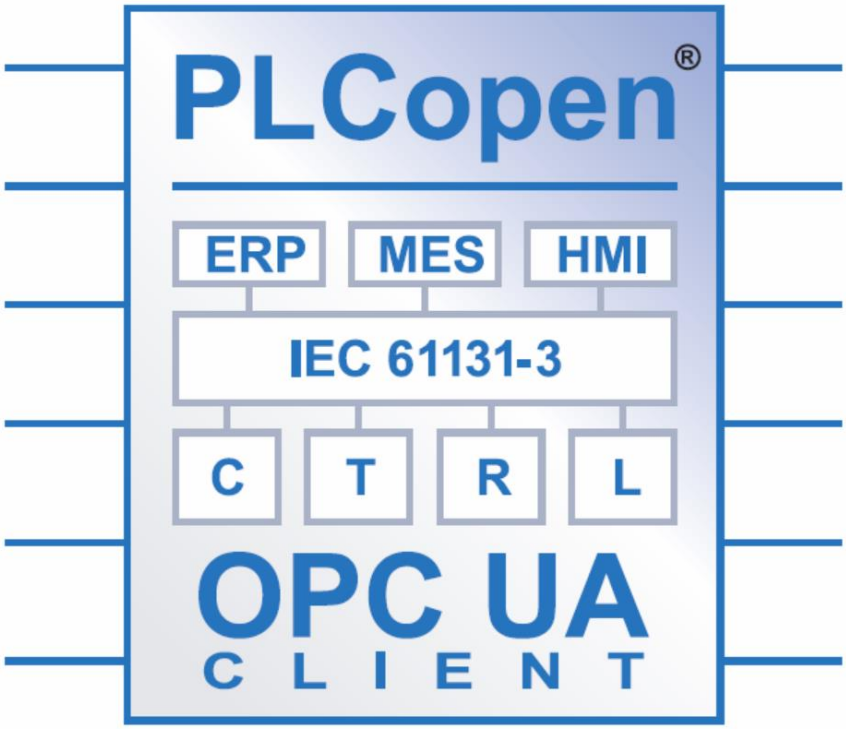


Figure 1: The "PLCopen OPC UA Client for IEC61131-3" Logo

This "PLCopen OPC UA client for IEC61131-3" logo is owned and trademarked by both PLCopen and the OPC Foundation.

In order to use this logo free-of-charge, the relevant company has to fulfill all the following requirements:

1. the company has to be a voting member of PLCopen or OPC Foundation;
2. the company has to comply with the existing specification, as specified by the PLCopen OPC Foundation Techncial Committee 4 - Communication, and as published by PLCopen and OPC Foundation, and of which this statement is a part;
3. this compliance application is provided in written form by the company to PLCopen, clearly stating the applicable software package and the supporting elements of all the specified tables, as specified in the document itself;
4. in case of non-fulfillment, which has to be decided by PLCopen and / or OPC Foundation, the company will receive a written statement concerning this from PLCopen and / or OPC Foundation. The company will have a one-month period to either adopt their software package in such a way that it complies, represented by the issuing of a new compliance statement, or remove all reference to the specification, including the use of the logo, from all their specification, be it technical or promotional material;
5. the logo has to be used as is - meaning the full logo. It may be altered in size providing the original scale and color setting is kept.
6. the logo has to be used in the context of PLCopen OPC UA communication.