

## ▶ PITreader OPC Server UA PITreader Firmware V2.1.x

**PILZ**  
THE SPIRIT OF SAFETY

Operating Manual-1005480-EN-05  
- Control and signal devices



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Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

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SD means Secure Digital

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# 1 Introduction

## 1.1 Validity of documentation

This documentation is valid for the PITreader's OPC UA Server. It is valid until new documentation is published.

## 1.2 Using the documentation

This documentation is intended for instruction and should be retained for future reference.

## 1.3 Definition of symbols

Information that is particularly important is identified as follows:



### **DANGER!**

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.



### **WARNING!**

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.



### **CAUTION!**

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.



### **NOTICE**

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.



### **INFORMATION**

This gives advice on applications and provides information on special features.

## 2 Intended use

The PITreader OPC Server UA is an embedded OPC UA Server.

The PITreader OPC Server UA is available on various device types and versions of the PITreader. Further information can be found in the PITreader operating manual.

The PITreader OPC Server UA is intended for data exchange between a PITreader and an OPC UA Client. This may be visualisation or configuration data, for example.

## 3 Security

To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall industrial security concept that is state of the art.

Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures with care. If necessary, seek advice from Pilz Customer Support.

### 3.1 Implemented security measures

- ▶ The OPC UA Server supports the following security profiles:
  - TransportSecurity - TLS 1.2 with PFS (Part 7 6.6.160)
  - SecurityPolicy [B] - Basic256Sha256 (Part 7 6.6.165)
- ▶ The OPC UA Server uses RSA certificates with a key length of 2048 bit and SHA2 (256 bit).
- ▶ The OPC UA Server can only be started if at least one client certificate is registered in the list of client certificates.
- ▶ The OPC UA Server only accepts connections to clients that can prove their identity with a client certificate registered on the PITreader.
- ▶ The OPC UA Server only accepts encrypted data transfer in "Sign&Encrypt" mode.

### 3.2 Required security measures

- ▶ Please refer to the required security measures in the PITreader operating manual.
- ▶ Treat a client certificate and in particular the corresponding private key with the same care as a password.
- ▶ Protect a client certificate and in particular the corresponding private key from unauthorised access.
- ▶ Before you add the server certificate to the list of trusted certificates on the OPC UA Client, check the server certificate's fingerprint. Only add the server certificate to the list of trusted certificates if the server certificate's fingerprint on the OPC UA Client is identical to the server certificate's fingerprint that is displayed in the PITreader's web application.

## 4 Function description

### 4.1 Functions of the PITreader OPC Server UA

The PITreader OPC Server UA is an embedded OPC Server. The PITreader OPC Server UA is available on various device types and versions of the PITreader.

The OPC UA Server of a PITreader provides visualisation systems with the process data and device data from the PITreader. The OPC UA Server reads the data from the PITreader and displays it in the namespace, where it can be retrieved by an OPC UA Client. A maximum of one client connection at a time can be established to a PITreader's OPC UA Server. The OPC UA Client may be the OPC UA Client of the visualisation system PASvisu, for example, or an OPC UA-enabled Client from a third-party manufacturer.

The PITreader's OPC UA Server can be configured via the PITreader's web application. Various configuration changes are also possible via an OPC UA Client.

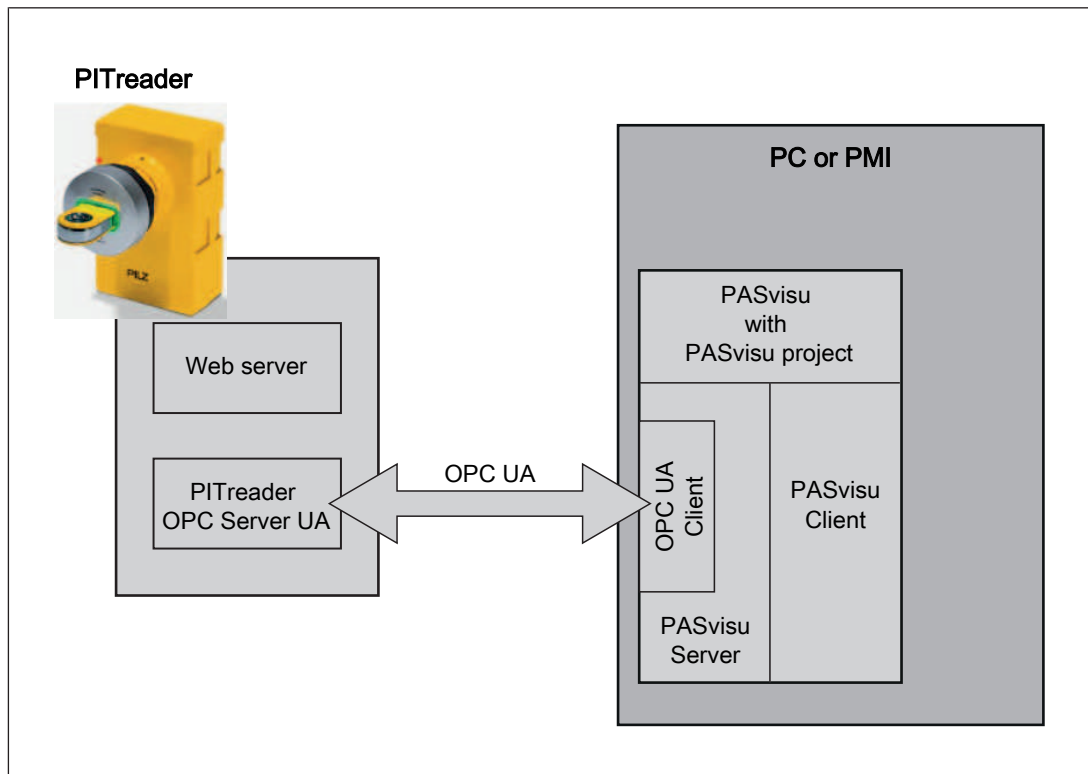


Fig.: Data exchange with PITreader OPC Server UA (principle) - Example with the PASvisu Client

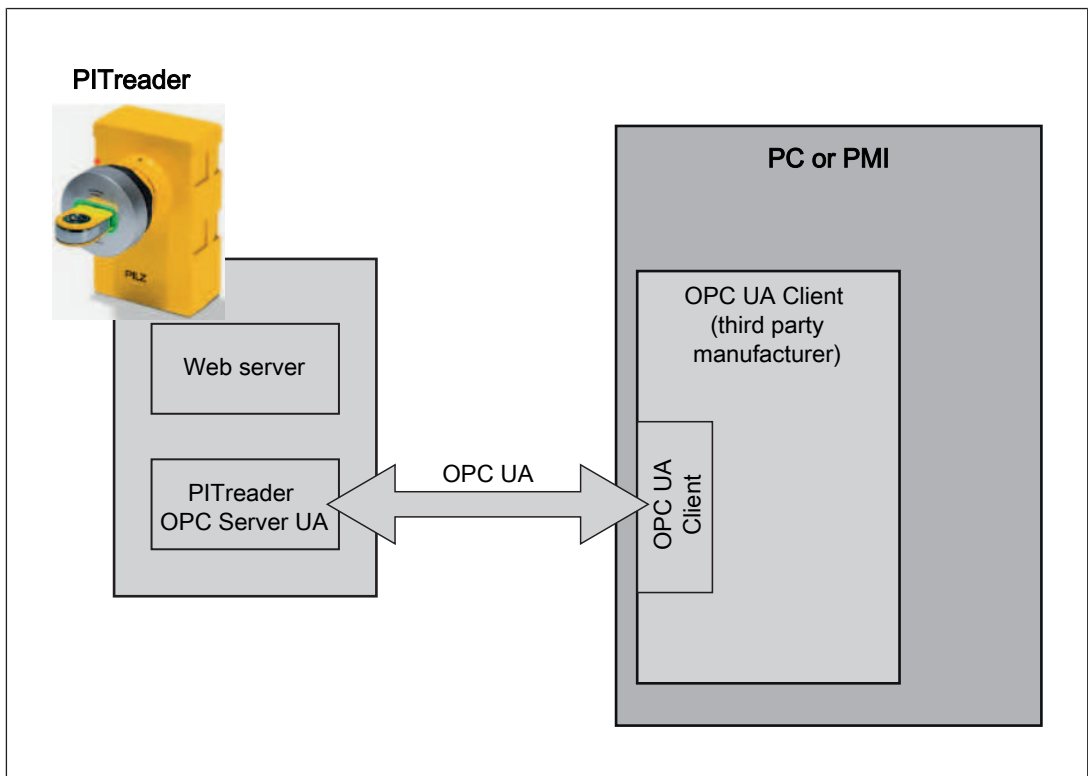


Fig.: Data exchange with PITreader OPC Server UA (principle) - Example with the OPC UA Client from a third-party manufacturer



## 4.2 OPC UA properties

The PITreader OPC Server UA supports the following OPC UA properties for access from OPC UA Clients:


- ▶ Supports the UA binary protocol via TCP
- ▶ End point URI / end point URL of the PITreader OPC Server UA:  
`opc.tcp://<IP address>:<Port>`
  - <IP address> IP address of the PITreader containing the PITreader OPC Server UA.
  - <Port> Port number of the PITreader OPC Server UA  
Default setting: 4840

Example: `opc.tcp://192.168.0.12:4840`
- ▶ Supported OPC UA services and service sets  
(in accordance with OPC 10000-4 OPC Unified Architecture - Part 4: Services)  
Only the services and service sets documented here are supported.

Service set	Supported services	Meaning
Secure Channel	<ul style="list-style-type: none"> <li>▶ OpenSecureChannel</li> <li>▶ CloseSecureChannel</li> </ul>	Connection management between OPC UA Clients and OPC UA Servers
Session	<ul style="list-style-type: none"> <li>▶ CreateSession</li> <li>▶ ActivateSession</li> <li>▶ CloseSession</li> <li>▶ Cancel</li> </ul>	Connection management between OPC UA Clients and OPC UA Servers
View	<ul style="list-style-type: none"> <li>▶ Browse</li> <li>▶ BrowseNext</li> <li>▶ TranslateBrowsePathsToNodeIds</li> </ul>	Retrieval of information in the address space
Attributes	<ul style="list-style-type: none"> <li>▶ Read</li> <li>▶ Write</li> </ul>	Read and write data and metadata
MonitoredItem	<ul style="list-style-type: none"> <li>▶ CreateMonitoredItems</li> <li>▶ ModifyMonitoredItems</li> <li>▶ SetMonitoringMode</li> <li>▶ SetTriggering</li> <li>▶ DeleteMonitoredItems</li> </ul>	See [1]
Subscription	<ul style="list-style-type: none"> <li>▶ CreateSubscription</li> <li>▶ ModifySubscription</li> <li>▶ SetPublishingMode</li> <li>▶ Publish</li> <li>▶ Republish</li> <li>▶ DeleteSubscription</li> </ul>	See [1]

[1] Service sets "**Subscription**" and "**MonitoredItems**"

An OPC UA Client can subscribe to data provided by the PITreader OPC Server UA. The purpose of a subscription is to group data using monitored items.

Please note the limit values for the service sets "Subscription" and "MonitoredItem" (see [Limits of the PITreader OPC Server UA](#) [ 11]).

### 4.3 Limits of the PITreader OPC Server UA

The documented limit values for the PITreader OPC Server UA are fixed and cannot be configured.

Designation		Limit value of the PITreader OPC Server UA
Service Set "Subscription" (see also <a href="#">OPC UA properties [9]</a> )		
PublishingInterval		Min. 500 ms
		Max. 15000 ms
		Note: <ul style="list-style-type: none"> <li>▶ For a subscription, if an OPC UA Client uses a value for "PublishingInterval" that is less than 500 ms, the PITreader OPC Server UA will use the minimum value of 500 ms for "PublishingInterval".</li> <li>▶ For a subscription, if an OPC UA Client uses a value for "PublishingInterval" that is greater than 15000 ms, the PITreader OPC Server UA will use the maximum value of 15000 ms for "PublishingInterval".</li> </ul>
Service Set "MonitoredItem" (see also <a href="#">OPC UA properties [9]</a> )		
SamplingInterval		Min. 500 ms
		Max. 15000 ms
Maximum number of monitored items per call		100
Maximum number of monitored items per subscription		100
Sessions		
Maximum number of simultaneous sessions		2
Session timeout in the PITreader OPC Server UA		1 minute
Nodes		
Maximum number of nodes per read access		100
Maximum number of nodes per write access		100
Maximum number of nodes per "Method call"		100
Maximum number of nodes per "Browse"		100
Maximum number of nodes per "Register nodes"		100
Maximum number of nodes per "Translate browse path to IDs"		100

## **4.4 Change the configuration of the PITreader OPC Server UA**

Configuration changes for the PITreader OPC Server UA can be made in the PITreader's web application. The PITreader must be restarted after each configuration change for the changes to take effect.

Information on the PITreader's web application is available in the PITreader operating manual.

## **4.5 Save and restore configuration**

The configuration of the PITreader OPC Server UA can be saved and restored as part of the device configuration in the PITreader's web application.

The Client certificate is also saved when saving the configuration. The saved Client certificate is restored when restoring the configuration on the PITreader. Should a Client certificate already exist on the PITreader, this is overwritten.

The OPC UA Server certificate is not saved. If no OPC UA Server certificate exists when restoring the configuration on the PITreader, a new certificate is generated automatically.

Information on the PITreader's web application is available in the PITreader operating manual.

## 5 Activate PITreader OPC Server UA

The PITreader OPC Server UA is available on various device types and versions of the PITreader. Further information can be found in the PITreader operating manual.

The PITreader OPC Server UA is deactivated in its default setting or following a factory reset. The OPC UA Server can be activated in the PITreader's web application. Both a server and a client certificate are required to activate the OPC UA Server.

### Prerequisites

- ▶ An Ethernet connection to the PITreader has been established using the configuration PC.  
Information on the procedure is available in the PITreader operating manual, under "Configuration".
- ▶ The web application has been started.

### Procedure

1. In the web application, switch to **Configuration -> OPC UA Server**.
2. Server certificate

#### Generate server certificate

The preferred way to generate a new server certificate is via the **Generate new certificate** button.

Note:

When you connect to the PITreader OPC Server UA with the OPC UA Client for the first time, the generated server certificate is replaced with the OPC UA Client.

#### Use your own server certificate

On the configuration PC, select the file containing your own server certificate (**Browse** button) and click on **Upload**.

Note:

Your own server certificate must meet the following requirements:

- Certificate including private key in PEM format
- RSA certificate with a key length of 2048 bit and SHA2 (256 bit)
- The certificate must include the server's application URI in the "Subject Alternative Name"

Application URI of the PITreader OPC Server UA:

urn:<IP address of the PITreader>:Pilz:PITreader

Precise details are available in the web application under **Configuration -> OPC UA Server**.

3. Client certificate

On the configuration PC, select the file containing the client certificate (**Browse** button) and click on **Upload**.

Note:

The client certificate must meet the following requirements:

- Certificate in DER or PEM format

- RSA certificate with a key length of 2048 bit and SHA2 (256 bit)
- The certificate must include the client's application URI in the "Subject Alternative Name".

4. Activate PITreader OPC Server UA

Activate the PITreader OPC Server UA by first selecting **Activated** and then clicking on **Save**.

Note:

The PITreader OPC Server UA can only be activated if a server certificate has been generated or uploaded, the client certificate has been uploaded and the certificates have been accepted.

## 6 Connection configuration for an OPC UA Client

To enable an OPC UA Client to establish a connection to the PITreader OPC Server UA, various settings must be made for the connection, depending on the tool that is used.

### Settings for the connection configuration

The names of the settings are tool-dependent and may differ from the names listed below:

- ▶ End point URI / end point URL of the PITreader OPC Server UA:

`opc.tcp://<IP address>:<Port>`

`<IP address>` IP address of the PITreader containing the  
PITreader OPC Server UA.

`<Port>` Port number of the PITreader OPC Server UA  
Default setting: 4840

Example: `opc.tcp://192.168.0.12:4840`

Precise details of the end point URI and endpoint URL are available in the web application of the PITreader OPC Server UA under **Configuration -> OPC UA Server**.

- ▶ Security settings

- Security policy: Basic256Sha256

- Encrypted data transmission mode (Message Security Mode): Sign&Encrypt

- ▶ Authentication setting

No additional authentication is required on the PITreader OPC Server UA.

"Anonymous" or something equivalent must be selected, for example, depending on the tool that is used.

## 7 Namespace

With OPC UA, every information unit in the namespace is called a node. The address space is formed from the sum of all the information units / nodes. The OPC specification requires that each node can be identified uniquely in the address space via an identifier (Node ID). The nodes are linked to each other via references.

### Namespaces

A namespace is defined via its URI (Unique Resource Identifier). The namespace URI describes a node set resource. Each namespace has a namespace index. The allocation of the namespace indices to the namespace URIs is stored in a table on the Server.

#### Namespace table of the PITreader OPC Server UA:

Namespace URI	Description
http://opcfoundation.org/UA/	Basic specifications defined by the OPC Foundation, such as basic data types for example.  The PITreader OPC Server UA supports a reduced standard namespace (not compliant with Compliance Test Tool (CTT))
<ApplicationUri>	ApplicationUri of the PITreader OPC Server UA: urn:<IP Address>:<Application Name> ▶ IP address: IP address of the PITreader containing the PITreader OPC Server UA ▶ Application Name: Pilz:PITreader
urn:Pilz:Device:Nameplate	Namespace specified by Pilz for generic product data
urn:Pilz:Device:Network:eth0	Namespace specified by Pilz for network data.
urn:Pilz:PITreader	Namespace specified by Pilz for specific product data
urn:Pilz:PITreader:UserData	Namespace specified by Pilz for information regarding the user data configured by the user in the PITreader's user data configuration



## 7.1 Standard namespace (OPC Foundation)

The PITreader OPC Server UA supports various node identifiers (NodeId) from the namespace standardised by the OPC Foundation.

### Node set namespace URI

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

### Structure and content

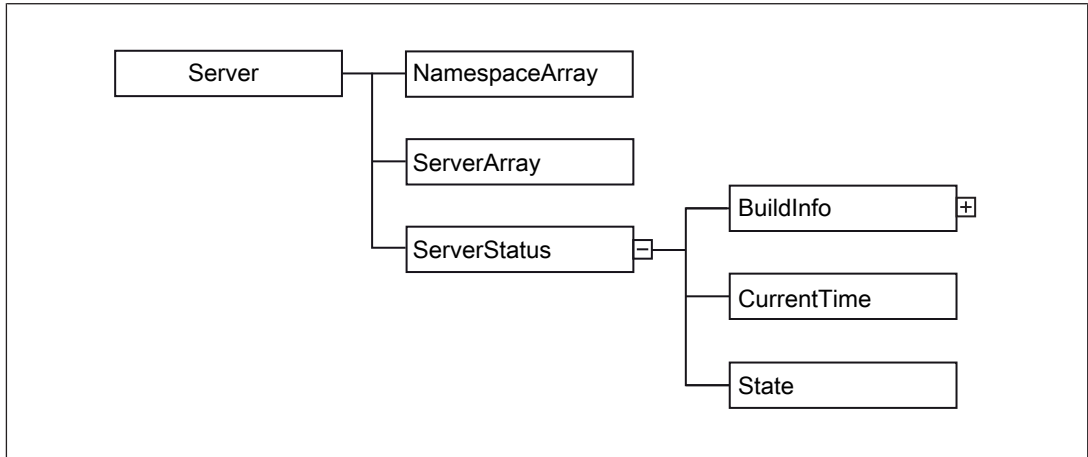



Fig.: Structure in the standard namespace

DisplayName	Node Identifier		Meaning
	IdentifierType	Identifier	
Server	Numeric	2253	Basic node for the standard namespace
Path: Server/			
NamespaceArray	Numeric	2255	<ul style="list-style-type: none"> <li>▶ Data type: Array of String</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;Namespace URI&gt; e.g. urn:Pilz:PITreader</li> </ul> See namespace table under <a href="#">Namespace</a> [16]
			Path: Server/NamespaceArray
ServerArray	Numeric	2254	<ul style="list-style-type: none"> <li>▶ Data type: Array of String</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;ApplicationUri of the PITreader OPC Server UA&gt; e.g. urn:192.168.0.12:Pilz:PITreader</li> </ul> See namespace table under <a href="#">Namespace</a> [16]
			Path: Server/ServerArray

DisplayName	Node Identifier		Meaning
	IdentifierType	Identifier	
ServerStatus	Numeric	2256	Area containing information on the server status ▶ Data type: ExtensionObject – ServerStatusDataType (structure node)
	Path: Server/ServerStatus		
BuildInfo	Numeric	2260	Area containing information on the current build of the PITreader OPC Server UA ▶ Data type: ExtensionObject – BuildInfo (structure node)  See <a href="#">Server/ServerStatus/BuildInfo</a> [  19]
	Path: Server/ServerStatus/BuildInfo		
CurrentTime	Numeric	2258	Current device time ▶ Data type: Variant ▶ Access: Read ▶ Content: <Device time in UTC format>
	Path: Server/ServerStatus/CurrentTime		
State	Numeric	2259	Status of the PITreader OPC Server UA ▶ Data type: Variant ▶ Access: Read ▶ Content: <OPC Server Status>
	Path: Server/ServerStatus/State		

### 7.1.1 Server/ServerStatus/BuildInfo

The PITreader OPC Server UA supports various node identifiers (NodeId) from the namespace standardised by the OPC Foundation.

**Node set namespace URI**

http://opcfoundation.org/UA/

**Structure and content**

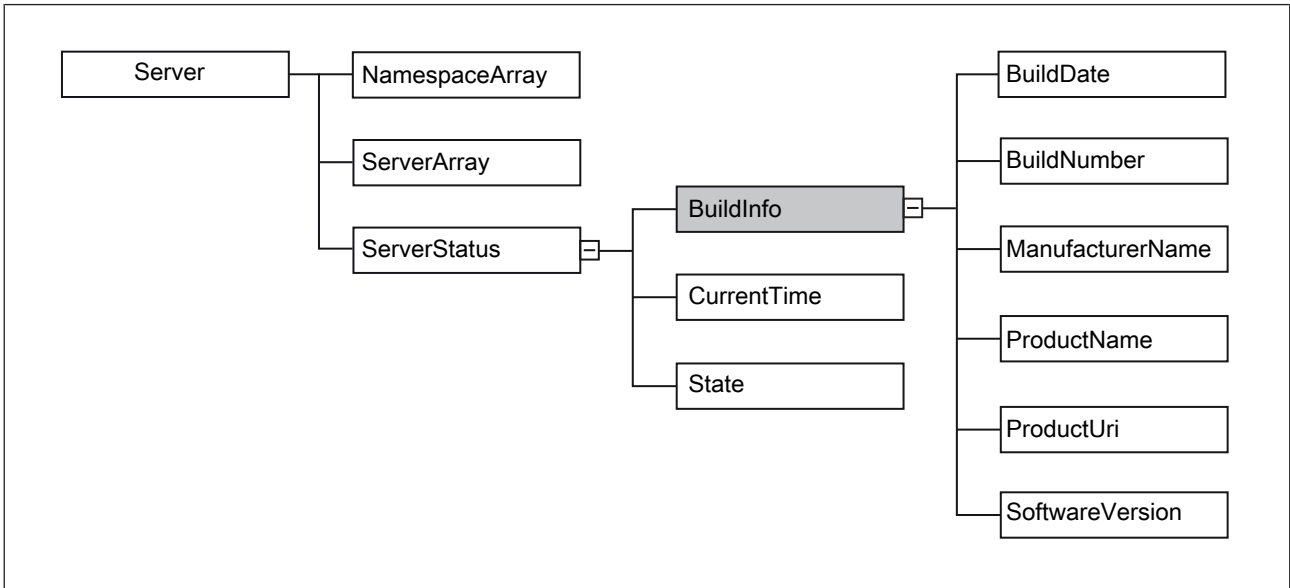


Fig.: Bereich Server/ServerStatus/BuildInfo

DisplayName	Node Identifier		Meaning
	IdentifierType	Identifier	
BuildInfo	Numeric	2260	Area containing information on the current build of the PITreader OPC Server UA ▶ Data type: ExtensionObject – BuildInfo (structure node)
Path: Server/ServerStatus/BuildInfo/			
BuildDate	Numeric	2266	Time stamp of the build on the PITreader firm-ware ▶ Data type: Variant ▶ Access: Read
Path: Server/ServerStatus/BuildInfo/BuildDate			
BuildNumber	Numeric	2265	Build version of the PITreader firmware ▶ Data type: Variant ▶ Access: Read
Path: Server/ServerStatus/BuildInfo/BuildNumber			

DisplayName	Node Identifier		Meaning
	IdentifierType	Identifier	
ManufacturerName	Numeric	2263	Manufacturer ▶ Data type: Variant ▶ Access: Read ▶ Content: "Pilz GmbH & Co. KG, D-73760 Ostfildern, <a href="https://www.pilz.com">https://www.pilz.com</a> "
	Path: ServerStatus/BuildInfo/ManufacturerName		
ProductName	Numeric	2261	Product name ▶ Data type: Variant ▶ Access: Read ▶ Content: "PITreader"
	Path: Server/ServerStatus/BuildInfo/ProductName		
ProductUri	Numeric	2262	URI of the namespace for specific PITreader product data ▶ Data type: Variant ▶ Access: Read ▶ Content: "urn:Pilz:PITreader"
	Path: Server/ServerStatus/BuildInfo/ProductUri		
SoftwareVersion	Numeric	2264	Software version of the PITreader ▶ Data type: Variant ▶ Access: Read ▶ Content: Version details in the format <code>&lt;M&gt;. &lt;m&gt;. &lt;p&gt;</code> – M: Major version – m: Minor version – p: Patch version
	Path: Server/ServerStatus/BuildInfo/SoftwareVersion		

## 7.2 Namespace for generic product data

The PITreader OPC Server UA supports node identifiers (NodeId) specified by Pilz for generic product data.

### Node set namespace URI

urn:Pilz:Device

### Structure and content

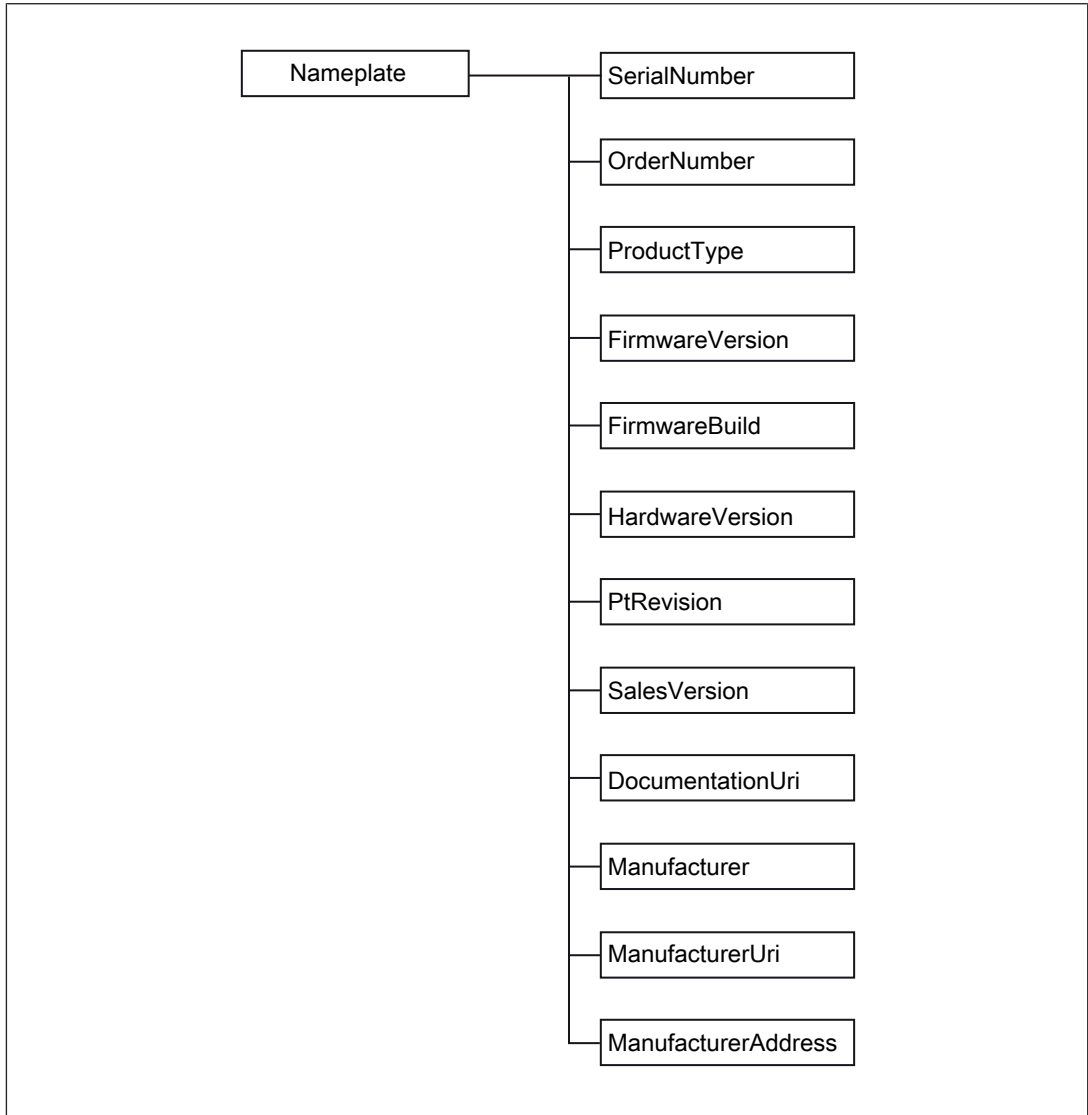


Fig.: Structure of the namespace for generic product data

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:Nameplate	Nameplate	Numeric	1001	Area with product data from the PITreader containing the PITreader OPC Server UA (basis node)
Path: Nameplate/				
1:SerialNumber	SerialNumber	Numeric	2001	Serial number of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: <Serial number> e.g.: 10000001
Path: Nameplate/SerialNumber				
1:OrderNumber	OrderNumber	Numeric	2002	Order number of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: <Order number> e.g.: "402255", "G1000020"
Path: Nameplate/OrderNumber				
1:ProductType	ProductType	Numeric	2003	Product name of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: <Product name> e.g.: PITreader, PITreader Gatebox
Path: Nameplate/ProductType				
1:FirmwareVersion	FirmwareVersion	Numeric	2004	Firmware version of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: Version details in the format <MM>.<mm>.<pp> – MM: Major version – mm: Minor version – pp: Patch version e.g.: 1.4.00
Path: Nameplate/FirmwareVersion				

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:FirmwareBuild	FirmwareBuild	Numeric	2005	Build version of the PITreader firmware ▶ Data type: String ▶ Access: Read ▶ Content: <10-digit display> e.g.: 2109291635
	Path: Nameplate/FirmwareBuild			
1:HardwareVersion	HardwareVersion	Numeric	2007	Hardware version of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: Version details in the format <MM>.<mm> – MM: Major version – mm: Minor version e.g.: 01.00
	Path: Nameplate/HardwareVersion			
1: PtRevision	PtRevision	Numeric	2008	[No content] ▶ Data type: String ▶ Access: Read ▶ Content: "" (blank)
	Path: Nameplate/PtRevision			
1: SalesVersion	SalesVersion	Numeric	2009	[No content] or sales version ▶ Data type: String ▶ Access: Read ▶ Content: "" (empty) or 2-digit sales version
	Path: Nameplate/SalesVersion			
1: DocumentationUri	DocumentationUri	Numeric	2010	Uri for Pilz operating manuals ▶ Data type: String ▶ Access: Read ▶ Content: https://www.pilz.com/manuals
	Path: Nameplate/DocumentationUri			

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1: Manufacturer	Manufacturer	Numeric	2011	Name of the device manufacturer ▶ Data type: String ▶ Access: Read ▶ Content: Pilz GmbH & Co. KG
1: ManufacturerUri	ManufacturerUri	Numeric	2012	Fully-qualified host name (FQDN) of the device manufacturer ▶ Data type: String ▶ Access: Read ▶ Content: pilz.com
1: ManufacturerAddress	ManufacturerAddress	Numeric	2013	Address of the device manufacturer ▶ Data type: String ▶ Access: Read ▶ Content: Felix-Wankel-Straße 2 73760 Ostfildern Germany



### 7.3 Namespace for generic network data

The PITreader OPC Server UA supports node identifiers (NodeId) specified by Pilz for generic network data.

**Node set namespace URI**

urn:Pilz:Device:Network:eth0

**Structure and content**

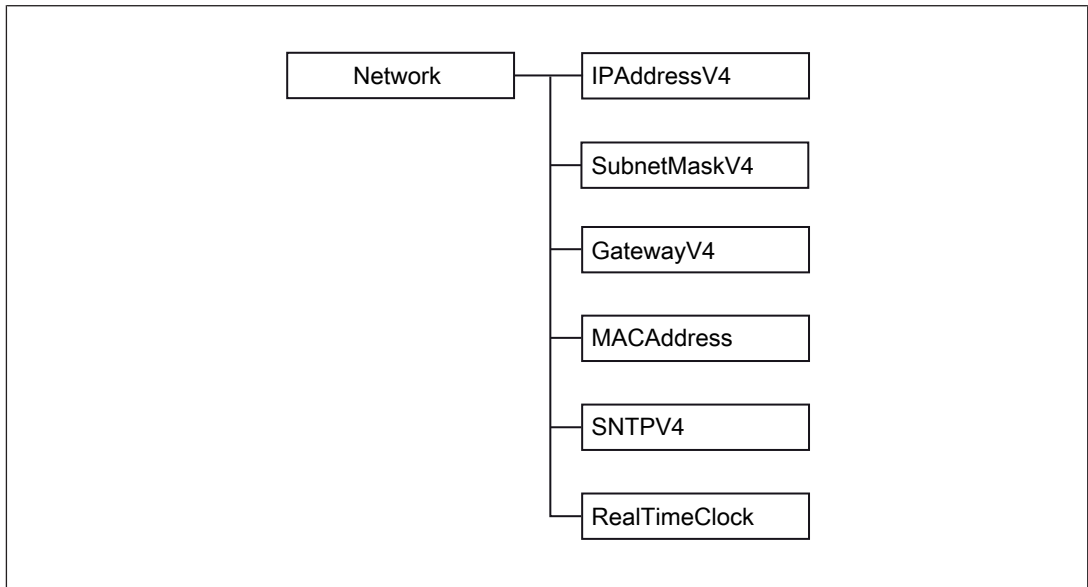


Fig.: Structure of the namespace for generic network data

BrowseName	DisplayName	NodeID		Meaning
		IdentifierType	Identifier	
1:Network	Network	Numeric	1001	Area with PITreader network data (basic node)
Path: Network/				
1:IPAddressV4	IPAddressV4	Numeric	2001	IP address (IPv4) of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: IP address in the format <n>.<n>.<n>.<n> e.g.: 192.168.0.12
Path: Network/IPAddressV4				

BrowseName	DisplayName	NodeID		Meaning
		IdentifierType	Identifier	
1:SubnetMaskV4	SubnetMaskV4	Numeric	2002	Subnet mask (IPv4) of the PITreader ▶ Data type: String ▶ Access: Read ▶ Content: Subnet mask in the format <n>.<n>.<n>.<n> e.g.: 255.255.255.0
	Path: Network/SubnetMaskV4			
1:GatewayV4	GatewayV4	Numeric	2003	IP address of the standard gateway of the PITreader (IPv4) ▶ Data type: String ▶ Access: Read ▶ Content: IP address in the format <n>.<n>.<n>.<n> e.g.: 0.0.0.0
	Path: Network/GatewayV4			
1:MACAddress	MACAddress	Numeric	2007	MAC address of the PITreader's network interface ▶ Data type: String ▶ Access: Read ▶ Content: MAC address in the format <nn>:<nn>:<nn>:<nn>:<nn>.<nn> e.g.: 9C:69:B4:50:00:01
	Path: Network/MACAddress			
1:SNTPV4	SNTPV4	Numeric	2009	IP address of the configured SNTP Server (IPv4) ▶ Data type: String ▶ Access: Read ▶ Content: IP address in the format <n>.<n>.<n>.<n> e.g.: 0.0.0.0
	Path: Network/SNTPV4			
1:RealTimeClock	RealTimeClock	Numeric	2010	Date and time of the device clock on the PITreader in UTC format ▶ Data type: DateTime ▶ Access: Read ▶ Content: Date and time in UTC format e.g.: 2021-01-31T12:00:00
	Path: Network/RealTimeClock			

## 7.4 Namespace for specific product data

The PITreader OPC Server UA supports node identifiers (NodeID) specified by Pilz for data from the PITreader.

### Node set namespace URI

urn:Pilz:PITreader

### Structure and content

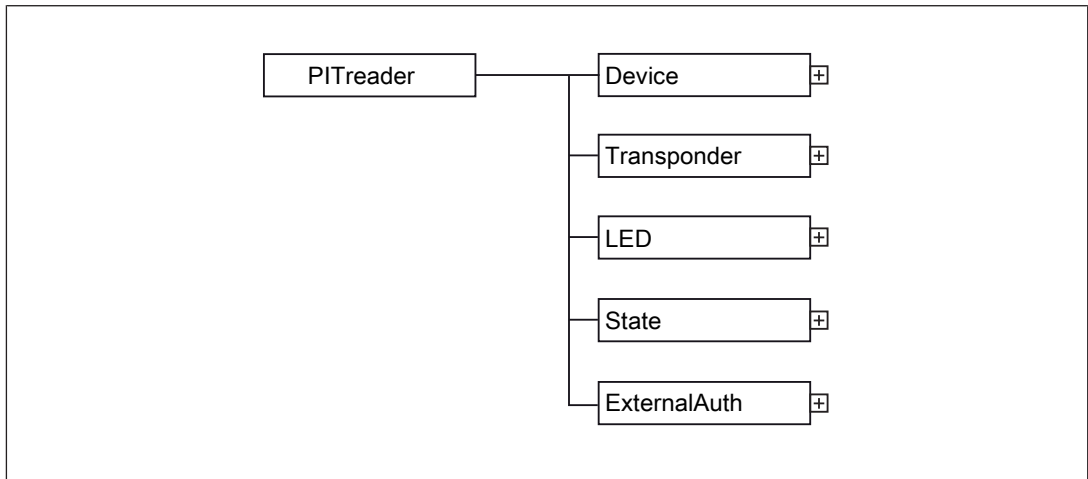





Fig.: Structure of the namespace for data from the PITreader

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:PITreader	PITreader	Numeric	1001	Area with data from the PITreader (basic node)
Path: PITreader/				
1:Device	Device	Numeric	1002	Area with device data ▶ NodeClass: Object (structure node) See <a href="#">PITreader/Device</a> [29]
Path: PITreader/Device/				
1:Transponder	Transponder	Numeric	1003	Area with transponder data ▶ NodeClass: Object (structure node) See <a href="#">PITreader/Transponder</a> [34]
Path: PITreader/Transponder/				

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:LED	LED	Numeric	1004	Area for the device LED ▶ NodeClass: Object (structure node) See <a href="#">PITreader/LED</a>  40]
	Path: PITreader/LED/			
1:State	State	Numeric	1011	Area with device status data ▶ NodeClass: Object (structure node) See <a href="#">PITreader/State</a>  43]
	Path: PITreader/State/			
1:ExternalAuth	ExternalAuth	Numeric	1012	Area for "external" authentication mode: ▶ Read current information about the authentication status ▶ Define permissions for a transponder ▶ NodeClass: Object (structure node) See <a href="#">PITreader/ExternalAuth</a>  45]
	Path: PITreader/ExternalAuth/			

### 7.4.1 PITreader/Device

**Node set namespace URI**

urn:Pilz:PITreader

**Structure and content**

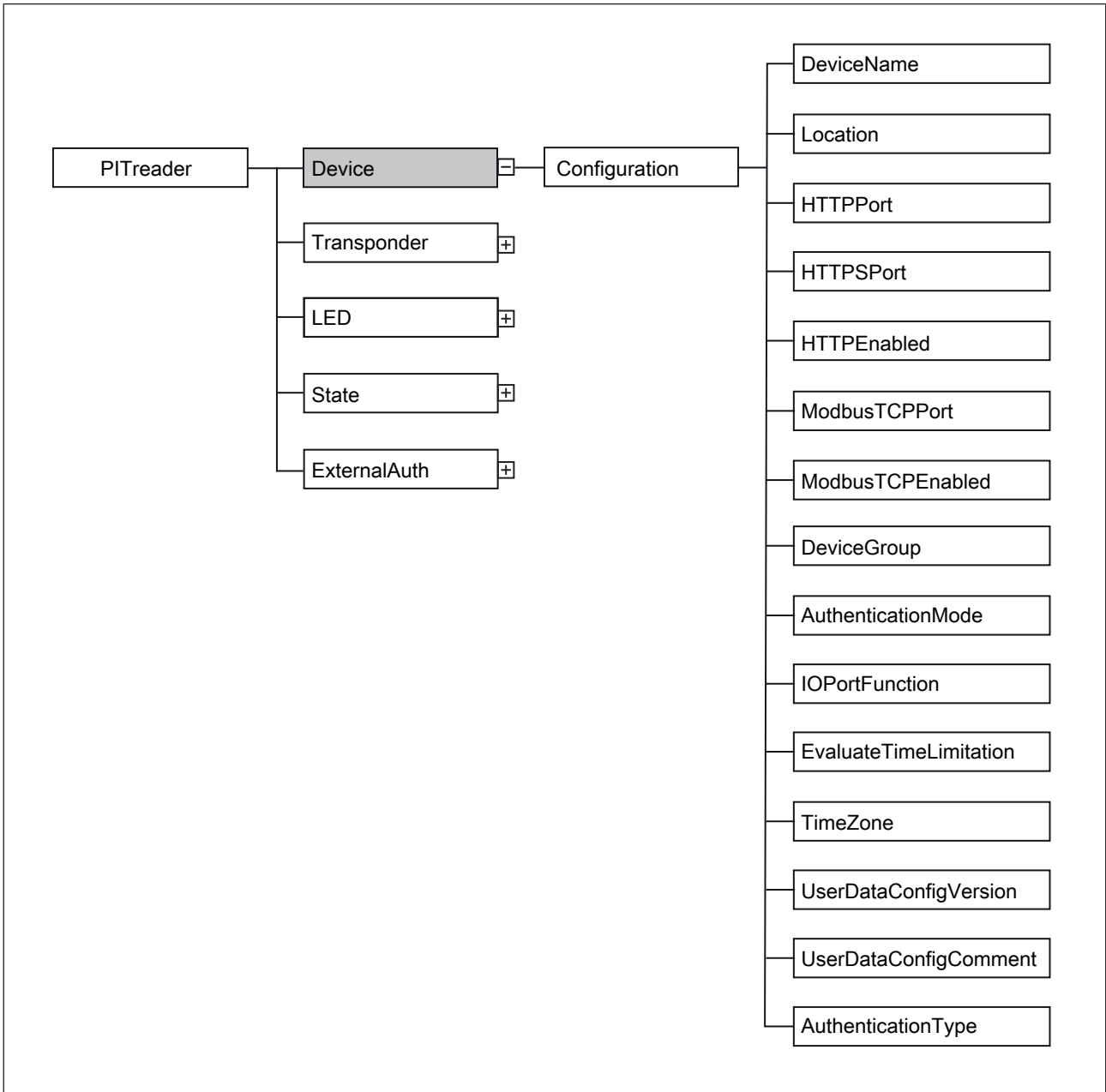


Fig.: PITreader/Device/ area

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:Device	Device	Numeric	1002	Area with device data ▶ NodeClass: Object (structure node)
Path: PITreader/Device/				
1:Configuration	Configuration	Numeric	1005	Area with configuration data of the PITreader ▶ NodeClass: Object (structure node)
Path: PITreader/Device/Configuration/				
1:DeviceName	DeviceName	Numeric	2003	Device name ▶ Data type: String ▶ Access: Read ▶ Content: <Host <i>name</i> >
Path: PITreader/Device/Configuration/DeviceName				
1:Location	Location	Numeric	2022	Location description ▶ Data type: String ▶ Access: Read ▶ Content: <Location <i>description</i> >
Path: PITreader/Device/Configuration/Location				
1:HTTPPort	HTTPPort	Numeric	2004	HTTP port number ▶ Data type: UInt16 ▶ Access: Read ▶ Content: <Port <i>number</i> > Standard port: 80
Path: PITreader/Device/Configuration/HTTPPort				
1:HTTPSPort	HTTPSPort	Numeric	2005	HTTPS port number ▶ Data type: UInt16 ▶ Access: Read ▶ Content: <Port <i>number</i> > Standard port: 443
Path: PITreader/Device/Configuration/HTTPSPort				

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:HTTPEnabled	HTTPEnabled	Numeric	2006	HTTP access
				▶ Data type: Boolean
				▶ Access: Read
				▶ Possible content:
		<b>Display</b>	<b>Meaning</b>	
		false		Not activated
		true		Activated
Path: PITreader/Device/Configuration/HTTPEnabled				
1:ModbusTCPPort	ModbusTCPPort	Numeric	2007	Modbus/TCP Slave port number
				▶ Data type: UInt16
Path: PITreader/Device/Configuration/ModbusTCPPort				
1:ModbusTCP Enabled	ModbusTCP Enabled	Numeric	2008	Modbus/TCP status of the PITreader
				▶ Data type: Boolean
				▶ Access: Read
				▶ Possible content:
		false		Modbus/TCP Slave not activated
		true		Modbus/TCP Slave activated
Path: PITreader/Device/Configuration/ModbusTCPEnabled				
1: DeviceGroup	DeviceGroup	Numeric	2009	Device's device group for authentication mode "1" (= transponder data)
				▶ Data type: UInt32
Path: PITreader/Device/Configuration/DeviceGroup				

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:AuthenticationMode	AuthenticationMode	Numeric	2010	Authentication mode of the PITreader <ul style="list-style-type: none"> <li>▶ Data type: UInt32</li> <li>▶ Access: Read</li> <li>▶ Possible content:</li> </ul>	
				<b>Display</b>	<b>Meaning</b>
				0	External
				1	Transponder data
Path: PITreader/Device/Configuration/AuthenticationMode					
1:IOOutputFunction	IOOutputFunction	Numeric	2011	Function of the 24 V I/O port <ul style="list-style-type: none"> <li>▶ Data type: UInt32</li> <li>▶ Access: Read</li> <li>▶ Possible content:</li> </ul>	
				<b>Display</b>	<b>Meaning</b>
				0	No function
				1	Authentication status (output)
Path: PITreader/Device/Configuration/IOOutputFunction					
1:EvaluateTimeLimitation	EvaluateTimeLimitation	Numeric	2012	Indicates whether the validity period (start date "Valid from", end date "Valid to") is evaluated by the transponder <ul style="list-style-type: none"> <li>▶ Data type: Boolean</li> <li>▶ Access: Read</li> <li>▶ Possible content:</li> </ul>	
				<b>Display</b>	<b>Meaning</b>
				false	Evaluation not activated
				true	Evaluation activated
Path: PITreader/Device/Configuration/EvaluateTimeLimitation					
1:TimeZone	TimeZone	Numeric	2002	Current time zone <ul style="list-style-type: none"> <li>▶ Data type: String</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;Current time zone&gt;</li> </ul>	
				Path: PITreader/Device/Configuration/TimeZone	



BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1: UserDataConfig Version	UserDataConfig Version	Numeric	2023	Version of the user data configuration <ul style="list-style-type: none"> <li>▶ Data type: UInt32</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;Version number&gt;</li> </ul>	
				Path: PITreader/Device/Configuration/UserDataConfigVersion	
1: UserDataConfig Comment	UserDataConfig Comment	Numeric	2024	Comment regarding the version of the user data configuration <ul style="list-style-type: none"> <li>▶ Data type: String</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;Comment&gt;</li> </ul>	
				Path: PITreader/Device/Configuration/UserDataConfigComment	
1: AuthenticationType	AuthenticationType	Numeric	2059	Authentication type <ul style="list-style-type: none"> <li>▶ Data type: UInt32</li> <li>▶ Access: Read</li> <li>▶ Possible content:</li> </ul>	
				<b>Display</b>	<b>Meaning</b>
				0	Basic
				1	Single authentication
				2	2-person rule
Path: PITreader/Device/Configuration/AuthenticationType					

## 7.4.2 PITreader/Transponder

### Node set namespace URI

urn:Pilz:PITreader

### Structure and content

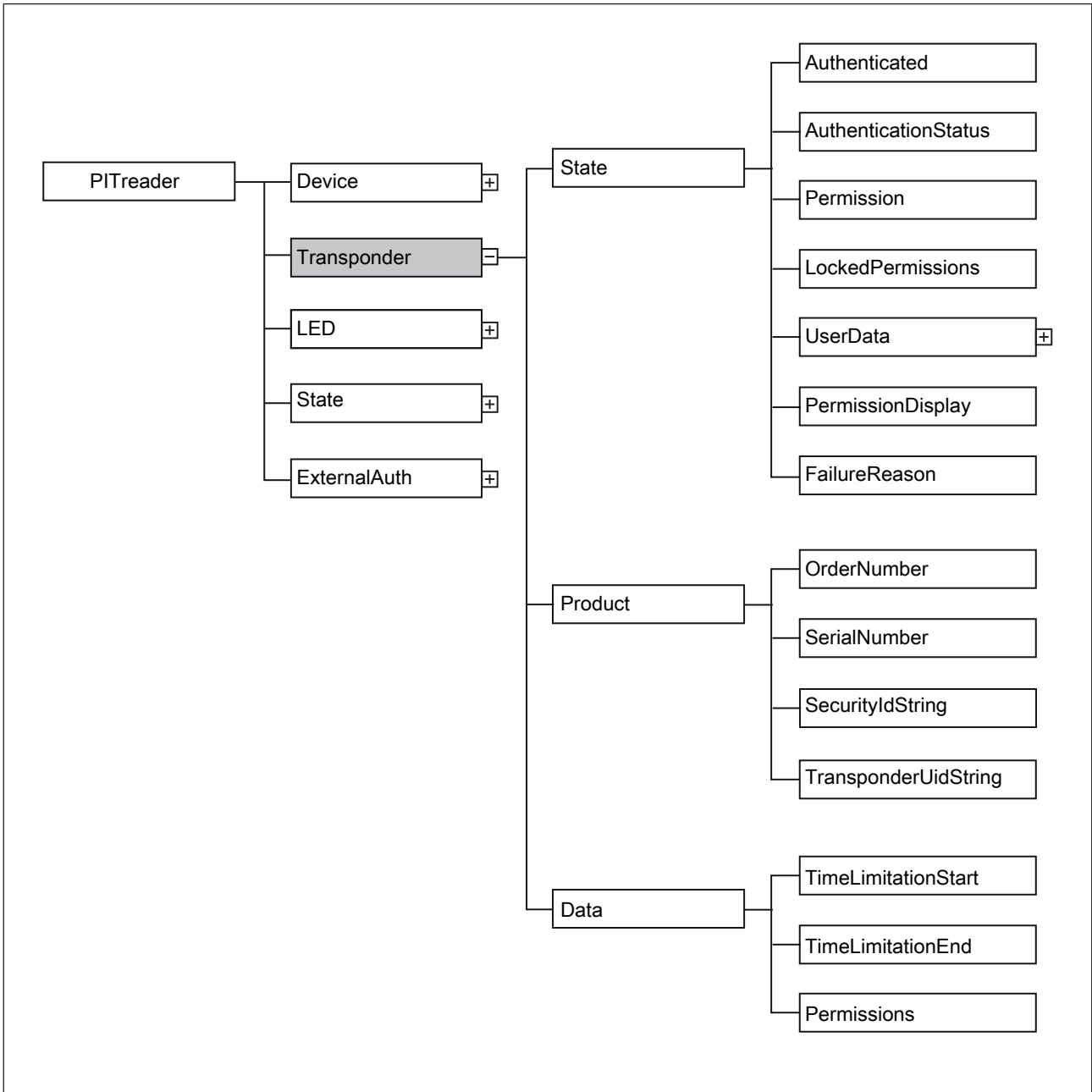



Fig.: PITreader/Transponder/ area

BrowseName	DisplayName	NodeID		Meaning								
		Identifier Type	Identifier									
1:Transponder	Transponder	Numeric	1003	Area with transponder data ▶ NodeClass: Object (structure node)								
Path: PITreader/Transponder												
1:State	State	Numeric	1006	Area with the status of transponder data ▶ NodeClass: Object (structure node)								
Path: PITreader/Transponder/State/												
1:Authenticated	Authenticated	Numeric	2013	Transponder's authentication status ▶ Data type: Boolean ▶ Access: Read ▶ Possible content:								
				<table border="1"> <thead> <tr> <th>Display</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>False</td> <td>Not authenticated</td> </tr> <tr> <td>True</td> <td>Authenticated</td> </tr> </tbody> </table>	Display	Meaning	False	Not authenticated	True	Authenticated		
Display	Meaning											
False	Not authenticated											
True	Authenticated											
Path: PITreader/Transponder/State/Authenticated												
1:Authentication Status	Authentication Status	Numeric	2016	Status of authentication process ▶ Data type: UInt32 ▶ Access: Read ▶ Possible content:								
				<table border="1"> <thead> <tr> <th>Display</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No transponder</td> </tr> <tr> <td>1</td> <td>Process completed</td> </tr> <tr> <td>2</td> <td>Waiting for external authentication</td> </tr> </tbody> </table>	Display	Meaning	0	No transponder	1	Process completed	2	Waiting for external authentication
Display	Meaning											
0	No transponder											
1	Process completed											
2	Waiting for external authentication											
Path: PITreader/Transponder/State/AuthenticationStatus												
1:Permission	Permission	Numeric	2017	Transponder's current, authenticated permission ▶ Data type: UInt32 ▶ Access: Read ▶ Content: <Hamming-coded permission>								
Path: PITreader/Transponder/State/Permission												

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:Locked Permissions	Locked Permissions	Numeric	2050	Changes to permissions are locked <ul style="list-style-type: none"> <li>▶ Data type: Boolean</li> <li>▶ Access: Read</li> <li>▶ Possible content:</li> </ul>	
				<b>Display</b>	<b>Meaning</b>
				false	Changes to permissions are not locked
				true	Changes to permissions are locked
Path: PITreader/Transponder/State/LockedPermissions					
1:UserData	UserData	Numeric	1013	Area with information regarding the user data configured by the user in the PITreader's user data configuration <ul style="list-style-type: none"> <li>▶ NodeClass: Object (structure node)</li> </ul> See <a href="#">Namespace for user data</a>  48]	
				Path: PITreader/Transponder/State/UserData/	
1:Permission Display	Permission Display	Numeric	2063	Transponder's current, authenticated permission <ul style="list-style-type: none"> <li>▶ Data type: Byte</li> <li>▶ Access: Read</li> <li>▶ Content: &lt;Integer value 0 ... 64&gt;</li> </ul>	
				Path: PITreader/Transponder/State/PermissionDisplay	

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:FailureReason	FailureReason	Numeric	2064	Error messages in the event of failed authentication ▶ Data type: UInt32 ▶ Access: Read ▶ Possible content:	
				<b>Display</b>	<b>Meaning</b>
				0	No error
				1	No transponder positioned
				2	Permission "0" The transponder has no permissions for device groups.
				3	The validity of the transponder is outside the validity period. (start date/end date)
				4	The transponder is included in the block list.
				5	No permission has been stored for the security ID yet. ("external" authentication mode)
				6	Authentication is locked by the 24 V I/O port.
				7	The "Single authentication" authentication type is configured and authentication is locked by another registered transponder.
8	The "2-person rule" authentication type is configured and a second transponder is required for authentication.				
Path: PITreader/Transponder/State/FailureReason					
1:Product	Product	Numeric	1007	Area with the transponder's product data ▶ NodeClass: Object (structure node)	
Path: PITreader/Transponder/Product/					
1:OrderNumber	OrderNumber	Numeric	2014	Order number of the transponder ▶ Data type: String ▶ Access: Read ▶ Content: <Order number>	
Path: PITreader/Transponder/Product/OrderNumber					

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:SerialNumber	SerialNumber	Numeric	2015	Transponder's serial number ▶ Data type: String ▶ Access: Read ▶ Content: <Serial number>
				Path: PITreader/Transponder/Product/SerialNumber
1:SecurityIdString	SecurityIdString	Numeric	2018	Transponder's security ID ▶ String data type ▶ Access: Read ▶ Content: <Security ID>
				Path: PITreader/Transponder/Product/SecurityIdString
1:TransponderUidString	TransponderUid-String	Numeric	2065	Transponder UID ▶ String data type ▶ Access: Read ▶ Content: <UID>
				Path: PITreader/Transponder/Product/TransponderUidString
1:Data	Data	Numeric	1008	Area with transponder data for validity period and permissions ▶ NodeClass: Object (structure node)
				Path: PITreader/Transponder/Data
1:TimeLimitationStart	TimeLimitationStart	Numeric	2051	Start date for validity of transponder ▶ Data type: DateTime ▶ Access: Read ▶ Content: <Start date> <ul style="list-style-type: none"> <li>– Example: 2020-01-31T12:00:00</li> <li>– If the start date is not configured: 01.01.2000</li> </ul>
				Path: PITreader/Transponder/Data/TimeLimitationStart

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:TimeLimitationEnd	TimeLimitationEnd	Numeric	2052	End date for validity of transponder ▶ Data type: DateTime ▶ Access: Read ▶ Content: <End date> – Example: 2020-01-31T12:00:00 – If the value is not configured: 01.01.2020
Path: PITreader/Transponder/Data/TimeLimitationEnd				
1:Permissions	Permissions	Numeric	2058	Permissions for device groups on the transponder ▶ Data type: Array of UInt32 (32 entries) ▶ Access: Read ▶ Content: <Permissions>
Path: PITreader/Transponder/Data/Permissions				

### 7.4.3 PITreader/LED

**Node set namespace URI**

urn:Pilz:PITreader

**Structure and content**

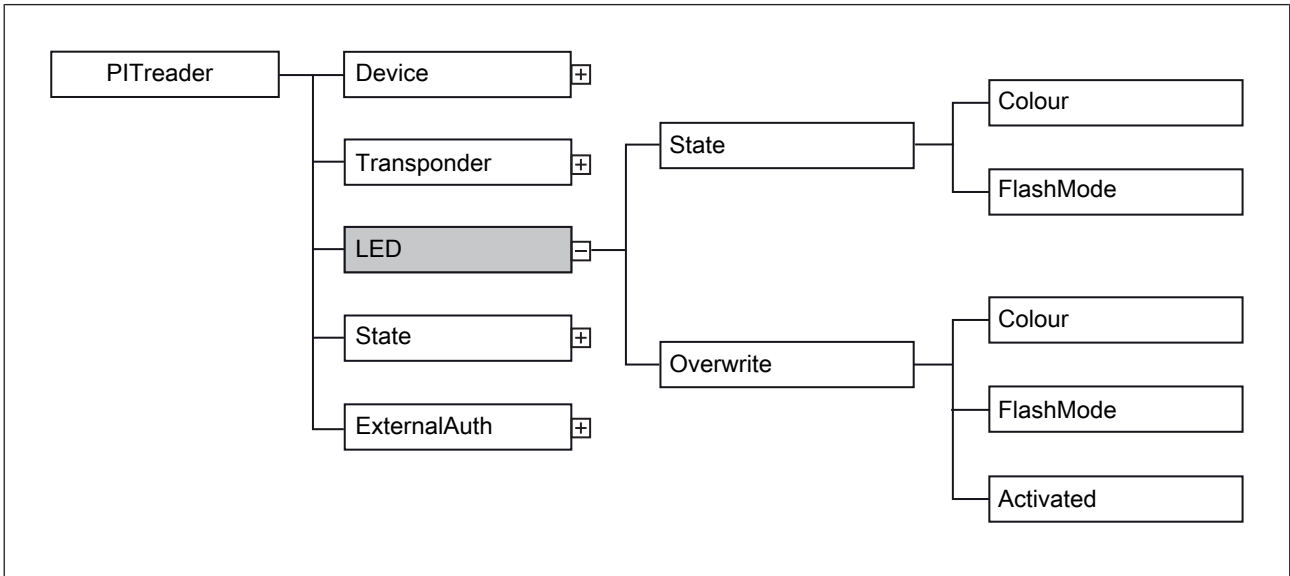


Fig.: Area PITreader/ LED/

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:LED	LED	Numeric	1004	Area for the device LED ▶ NodeClass: Object (structure node)
Path: PITreader/LED/				
1:State	State	Numeric	1009	Area containing information on the current LED status ▶ NodeClass: Object (structure node)
Path: PITreader/LED/State/				



BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:Colour	Colour	Numeric	2053	Current LED colour	
				▶ Data type: UInt32	
				▶ Access: Read	
				▶ Possible content:	
				<b>Display</b>	<b>Meaning</b>
				0	Switched off
				1	Blue
2	Yellow				
3	Red				
4	Green				
Path: PITreader/LED/State/Colour					
1:FlashMode	FlashMode	Numeric	2054	Current LED flash mode	
				▶ Data type: UInt32	
				▶ Access: Read	
				▶ Possible content:	
<b>Display</b>	<b>Meaning</b>				
0	Static LED mode				
1	Flash mode (approx. 1 Hz)				
Path: PITreader/LED/State/FlashMode					
1:Overwrite	Overwrite	Numeric	1010	Area for overwriting the current LED settings (structure node)	
Path: PITreader//LED/Overwrite/					
1:Colour	Colour	Numeric	2055	Target colour of device LED	
				▶ Data type: UInt32	
				▶ Access: Read/Write	
				▶ Possible value:	
				<b>Display</b>	<b>Meaning</b>
				0	Switch off
1	Blue				
2	Yellow				
3	Red				
4	Green				
Path: PITreader/LED/Overwrite/Colour					

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:FlashMode	FlashMode	Numeric	2056	Target flash mode of device LED ▶ Data type: Boolean ▶ Access: Read/Write ▶ Possible value:	
				<b>Display</b>	<b>Meaning</b>
				0	Static LED mode
				1	Flash mode (approx. 1 Hz)
Path: PITreader/LED/Overwrite/FlashMode					
1:Activated	Activated	Numeric	2057	Overwrite current LED status with target values activated ▶ Data type: Boolean ▶ Access: Read/Write ▶ Possible value:	
				<b>Display</b>	<b>Meaning</b>
				False	Overwrite not activated
				True	Overwrite activated
Path: PITreader/PITreader/LED/Overwrite/Activated					

### 7.4.4 PITreader/State

**Node set namespace URI**

urn:Pilz:PITreader

**Structure and content**

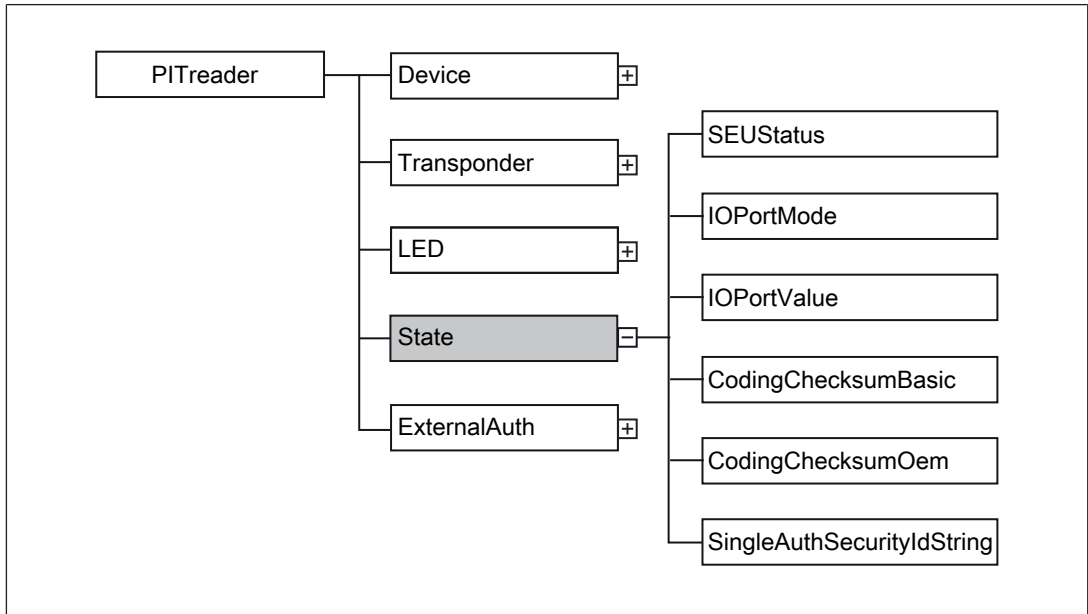


Fig.: Area PITreader/State/

BrowseName	DisplayName	NodeID		Meaning						
		Identifier Type	Identifier							
1:State	State	Numeric	1011	Area with device status data ▶ NodeClass: Object (structure node)						
Path: PITreader/State/										
1:SEUStatus	SEUStatus	Numeric	2001	Status of the connection between PIT m4SEU and PITreader ▶ Data type: Boolean ▶ Access: Read ▶ Possible content:						
				<table border="1"> <thead> <tr> <th>Display</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>False</td> <td>No active connection</td> </tr> <tr> <td>True</td> <td>Active connection</td> </tr> </tbody> </table>	Display	Meaning	False	No active connection	True	Active connection
Display	Meaning									
False	No active connection									
True	Active connection									
	Path: PITreader/State/SEUStatus									

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:IOPortMode	IOPortMode	Numeric	2025	Mode of configurable 24 V I/O port ▶ Data type: String ▶ Access: Read ▶ Possible content:	
				<b>Display</b>	<b>Meaning</b>
				Input	Configuration as input
				Output	Configuration as output
Path: PITreader/State/ IOPortMode					
1:IOPortValue	IOPortValue	Numeric	2026	Status of the 24 V I/O port ▶ Data type: UInt32 ▶ Access: Read ▶ Possible content:	
				<b>Display</b>	<b>Meaning</b>
				0	Off (low)
				1	On (high)
Path: PITreader/State/IOPortValue					
1:CodingChecksum Basic	CodingChecksum Basic	Numeric	2060	Check sum for basic coding ▶ Data type: Array of Byte (16 entries) ▶ Access: Read ▶ Content: <Check sums>	
				Path: PITreader/State/CodingChecksumBasic	
1:CodingChecksum Oem	CodingChecksum Oem	Numeric	2061	Check sum for OEM coding ▶ Data type: Array of Byte (16 entries) ▶ Access: Read ▶ Content: <Check sums>	
				Path: PITreader/State/CodingChecksumOem	
1:SingleAuth SecurityIdString	SingleAuth SecurityIdString	Numeric	2062	Security-ID, which is currently locked by the device in "Single authentication" authentication type ▶ Data type: Byte ▶ Access: Read ▶ Content: <Security ID>	
				Path: PITreader/State/SingleAuthSecurityIdString	

### 7.4.5 PITreader/ExternalAuth

**Node set namespace URI**

urn:Pilz:PITreader

**Structure and content**

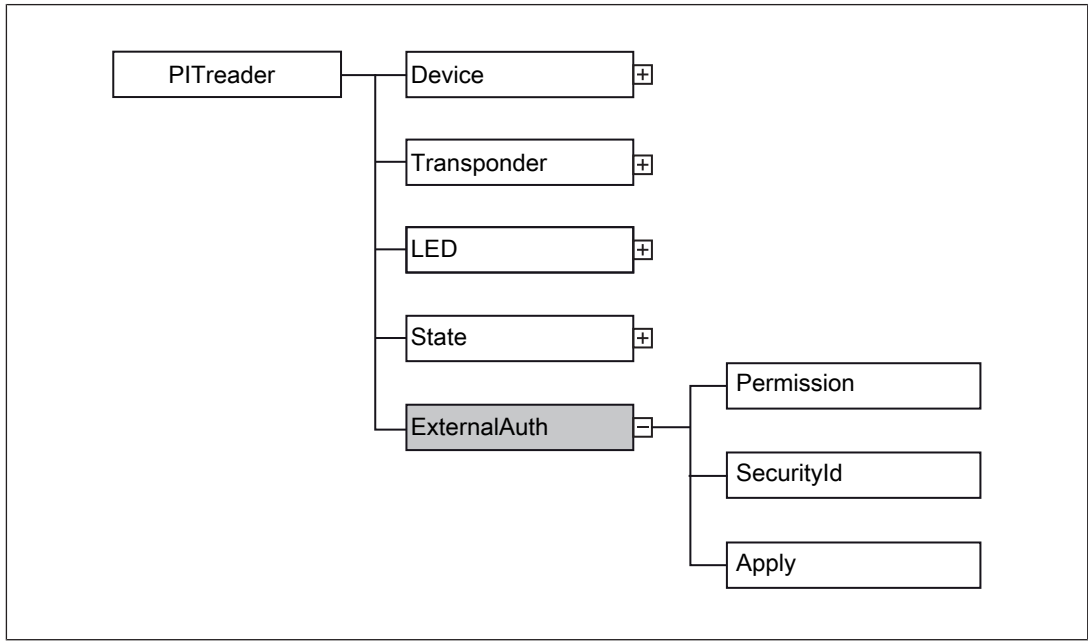


Fig.: Area PITreader/ExternalAuth/

BrowseName	DisplayName	NodeID		Meaning
		Identifier Type	Identifier	
1:ExternalAuth	ExternalAuth	Numeric	1012	Area for "external" authentication mode: <ul style="list-style-type: none"> <li>▶ Read current information about the authentication status</li> <li>▶ Define permissions for a transponder</li> <li>▶ NodeClass: Object (structure node)</li> </ul>
Path: PITreader/ExternalAuth/				

BrowseName	DisplayName	NodeID		Meaning	
		Identifier Type	Identifier		
1:Permission	Permission	Numeric	2019	Hamming permission for transponder with the stated security ID <ul style="list-style-type: none"> <li>▶ Data type: UInt32</li> <li>▶ Access: Read/Write</li> <li>▶ Content:                             <ul style="list-style-type: none"> <li>– Read access: &lt;Authenticated permission&gt;</li> <li>– Write access: &lt;Permission that is to be defined for the transponder&gt;</li> </ul> </li> </ul> Note for write access: Permission can only be configured for the transponder that is currently in the PITreader and has been identified via the relevant security ID.	
				Path: PITreader/ExternalAuth/Permission	
1:SecurityId	SecurityId	Numeric	2020	Security ID for the defined permission <ul style="list-style-type: none"> <li>▶ Data type: String</li> <li>▶ Access: Read/Write</li> <li>▶ Content:                             <ul style="list-style-type: none"> <li>– Read access: &lt;Security ID&gt;</li> <li>– Write access: &lt; Security ID, for which external authentication is to be defined&gt;</li> </ul> </li> </ul>	
				Path: PITreader/ExternalAuth/SecurityId	
1:Apply	Apply	Numeric	2021	Apply configuration (see [1]) <ul style="list-style-type: none"> <li>▶ Data type: Boolean</li> <li>▶ Access: Read/Write</li> <li>▶ Possible content:</li> </ul>	
				<b>Input</b>	<b>Meaning</b>
				false	Do not apply
				true	Apply
Path: PITreader/ExternalAuth/Apply					

**[1] Procedure: Apply configuration**

The configuration is only applied correctly if the variables are written sequentially. Keep to the following step sequence:

1. Configure permission  
Write the Hamming-coded permission in the "Permission" variable.
2. Configure security ID  
Write the security ID in the "SecurityId" variable.
3. Wait for execution end  
Ensure that both write commands are executed and ended!
4. Apply configuration  
Set the "Apply" variable to "true".



**NOTICE**

**Correct application of the configuration**

The configuration is only applied correctly if the variables "Permission", "SecurityId" and "Apply" are written sequentially.

Ensure that the variables are not written simultaneously. Follow the documented step sequence.

These steps must be repeated each time "Permission" and/or "SecurityId" is changed.

Permission can only ever be set for the transponder that is currently in the PITreader (identified via the relevant security ID).

## 7.5 Namespace for user data

The PITreader OPC Server UA supports an area specified by Pilz containing information regarding the user data configured by the user in the PITreader's user data configuration.

The basic node is in the namespace for specific product data (see [PITreader/Transponder](#) [34] under the NodeID with the identifier 1013 – UserData).

### Node set namespace URI

urn:Pilz:PITreader:UserData

### Structure and content

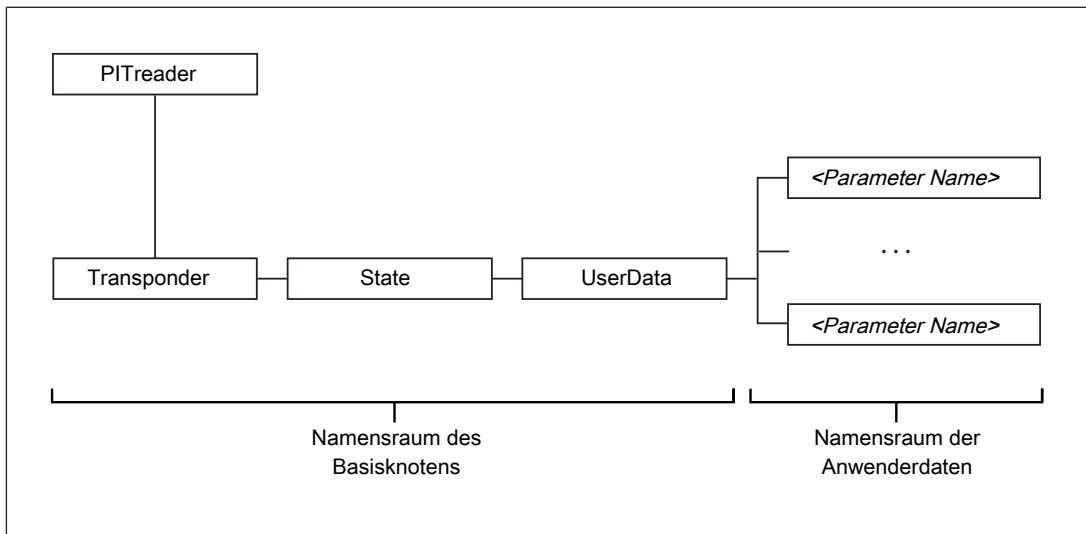


Fig.: Structure of the namespace for user data



### INFORMATION

Please note that the basic node and user data are in different namespaces.

Namespace URI of namespaces:

- Namespace of base node: urn:Pilz:PITreader
- Namespace of user data: urn:Pilz:PITreader:UserData

All the parameters from the user data configuration are listed as separate nodes in the namespace for user data.



BrowseName	DisplayName	NodeID		Meaning																				
		Identifier Type	Identifier																					
1:<Parameter Name> [. . .]	<Parameter Name> [. . .]	Numeric	1 ... .. 65535	User data in accordance with the parameters in the user data configuration (see [1]) ▶ Access: Read ▶ Data type assignment:																				
				<table border="1"> <thead> <tr> <th>User data</th> <th>OPC UA</th> </tr> </thead> <tbody> <tr> <td>STRING (ID 1)</td> <td>String</td> </tr> <tr> <td>INT8U (ID 10)</td> <td>Byte</td> </tr> <tr> <td>INT8S (ID 11)</td> <td>SByte</td> </tr> <tr> <td>INT16U (ID 12)</td> <td>UInt16</td> </tr> <tr> <td>INT16S (ID 13)</td> <td>Int16</td> </tr> <tr> <td>INT32U (ID 14)</td> <td>UInt32</td> </tr> <tr> <td>INT32S (ID 15)</td> <td>Int32</td> </tr> <tr> <td>DATETIME (ID 20)</td> <td>DateTime in UTC format</td> </tr> <tr> <td>PERMISSION (ID 30)</td> <td>UInt32 (Hamming-coded)</td> </tr> </tbody> </table>	User data	OPC UA	STRING (ID 1)	String	INT8U (ID 10)	Byte	INT8S (ID 11)	SByte	INT16U (ID 12)	UInt16	INT16S (ID 13)	Int16	INT32U (ID 14)	UInt32	INT32S (ID 15)	Int32	DATETIME (ID 20)	DateTime in UTC format	PERMISSION (ID 30)	UInt32 (Hamming-coded)
User data	OPC UA																							
STRING (ID 1)	String																							
INT8U (ID 10)	Byte																							
INT8S (ID 11)	SByte																							
INT16U (ID 12)	UInt16																							
INT16S (ID 13)	Int16																							
INT32U (ID 14)	UInt32																							
INT32S (ID 15)	Int32																							
DATETIME (ID 20)	DateTime in UTC format																							
PERMISSION (ID 30)	UInt32 (Hamming-coded)																							
Path: PITreader/Transponder/State/UserData/<Parameter Name>																								

[1]

Note:

- ▶ The NodeID in the namespace corresponds to the parameter ID from the user data configuration (1 ... 65535); i.e. the identifier is identical to the ID of the parameter displayed in the web application.
- ▶ The DisplayName in the namespace corresponds to the name of the parameter in the user data configuration.



**NOTICE**

**Change to the user data configuration**

Changes to the user data configuration are not applied in the namespace until the device is restarted.

To restart, switch the device's voltage supply off and then on again.

**Example view in the OPC UA Client UaExpert®**

The example shows a node in the namespace for user data with a parameter:

- ▶ ID: 1
- ▶ Name: Permission
- ▶ Type: 30 (PERMISSION)

Attributes	
Attribute	Value
▼ NodeId	ns=5;i=1
NamespaceIndex	5
IdentifierType	Numeric
Identifier	1
NodeClass	Variable
BrowseName	5, "Permission"
DisplayName	"" , "Permission"
Description	"" , "Permission"
WriteMask	0
UserWriteMask	0
RolePermissions	BadAttributeIdInvalid (0x80350000)
UserRolePermissions	BadAttributeIdInvalid (0x80350000)
AccessRestrictions	BadAttributeIdInvalid (0x80350000)
> Value	
▼ DataType	
NamespaceIndex	0
IdentifierType	Numeric
Identifier	7 [UInt32]
ValueRank	-1 (Scalar)
ArrayDimensions	UInt32 Array[-1]
AccessLevel	CurrentRead
UserAccessLevel	CurrentRead

# Support

Technical support is available from Pilz round the clock.

## Americas

### Brazil

+55 11 97569-2804

### Canada

+1 888 315 7459

### Mexico

+52 55 5572 1300

### USA (toll-free)

+1 877-PILZUSA (745-9872)

## Asia

### China

+86 21 60880878-216

### Japan

+81 45 471-2281

### South Korea

+82 31 778 3300

## Australia and Oceania

### Australia

+61 3 95600621

### New Zealand

+64 9 6345350

## Europe

### Austria

+43 1 7986263-0

### Belgium, Luxembourg

+32 9 3217570

### France

+33 3 88104003

### Germany

+49 711 3409-444

### Ireland

+353 21 4804983

### Italy, Malta

+39 0362 1826711

## Scandinavia

+45 74436332

## Spain

+34 938497433

## Switzerland

+41 62 88979-32

## The Netherlands

+31 347 320477

## Turkey

+90 216 5775552

## United Kingdom

+44 1536 462203

**You can reach our  
international hotline on:**

+49 711 3409-222

[support@pilz.com](mailto:support@pilz.com)

Pilz develops environmentally-friendly products using ecological materials and energy-saving technologies. Offices and production facilities are ecologically designed, environmentally-aware and energy-saving. So Pilz offers sustainability, plus the security of using energy-efficient products and environmentally-friendly solutions.



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Headquarters: Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany  
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: [info@pilz.com](mailto:info@pilz.com), Internet: [www.pilz.com](http://www.pilz.com)

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