

# IO-Link CIP Integration

netPROXY System Development

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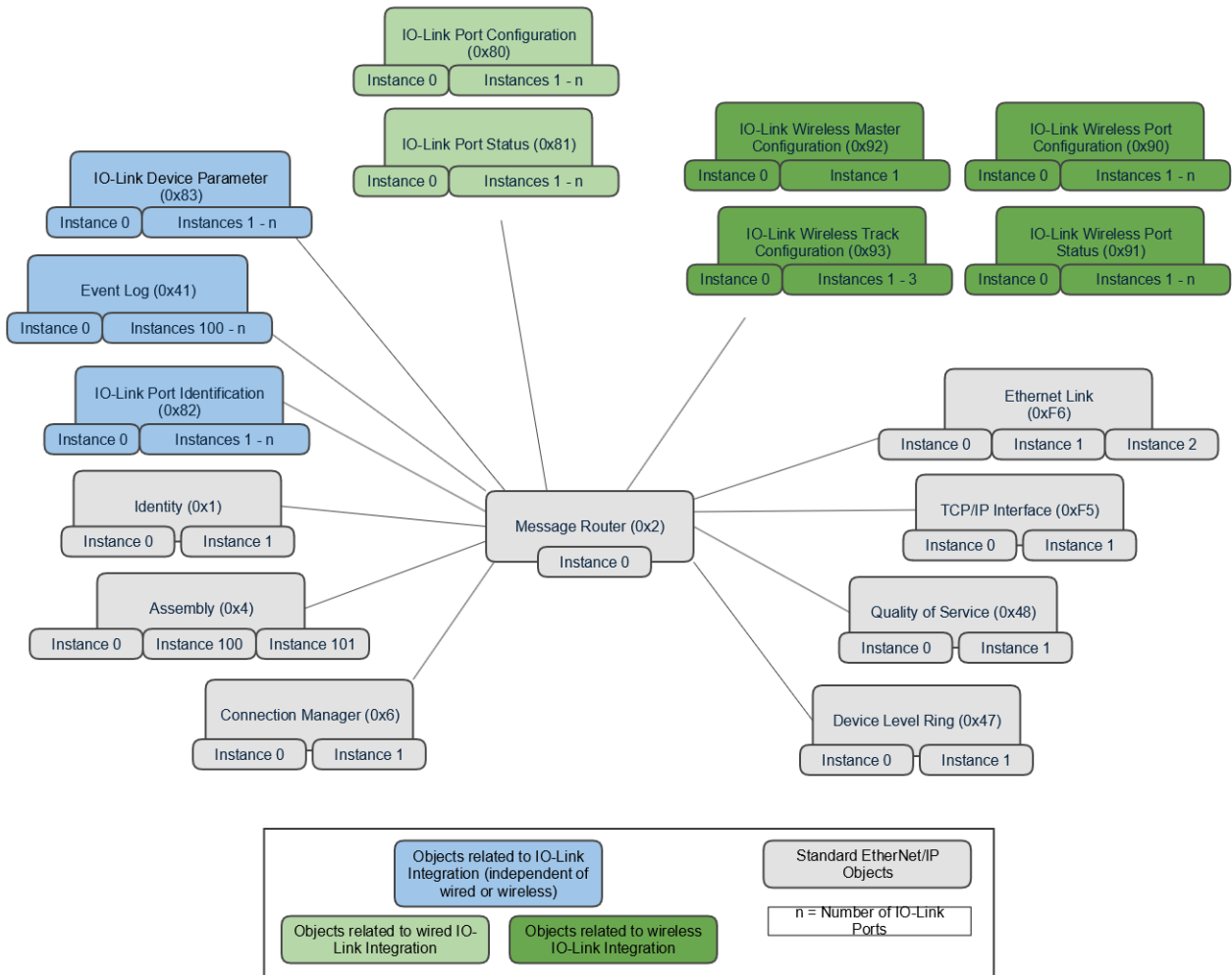
# 1 Introduction

There is no official specification available from ODVA for IO-Link Integration in CIP / EtherNet/IP at the time point of implementation.

The package supports the integration of IO-Link devices according to best practices for EtherNet/IP defined by Hilscher for EtherNet/IP devices.

## 2 IO-Link Extensions to the default EtherNet/IP object dictionary

The EtherNet/IP Slave to IO-Link Master Proxy package extends the CIP object dictionary by the following CIP objects:



### 2.1 Common IO-Link CIP objects

CIP Object	CIP Class ID	Description	Relation to netProxy world
IO-Link Port Identification Object (Class Code 0x82)(see page 14)	0x82 (vendor specific)	Type of IO-Link Ports	Interfaces with IO-Link Master - SMI - Port Identification

CIP Object	CIP Class ID	Description	Relation to netProxy world
<a href="#">IO-Link Device Parameter Object (Class Code 0x83)</a> (see page 15)	0x83 (vendor specific)	This object serves as interface to the IO-Link "On Request Data" services and therefore provides means to access the IO-Link device's object dictionary (iSDU) .	Interfaces with IO-Link Master - SMI - On Request Data Control and IO-Link Master - SMI - On Request Data Status
<a href="#">CIP Event Log Object (Class Code 0x41)</a> (see page 26)	0x41	The Event Log Object can be used to get information about IO-Link events.	Interfaces with IO-Link Master - SMI - Event Indication and IO-Link Master - SMI - Event Notification

## 2.2 Additional CIP objects for Wired IO-Link Integration

CIP Object	CIP Class ID	Description	Relation to netProxy world
<a href="#">IO-Link Port Configuration Object (Class Code 0x80)</a> (see page 20)	0x80 (vendor specific)	Configuration of the IO-Link Ports	Interfaces with IO-Link Master - SMI - Port Configuration
<a href="#">IO-Link Port Status Object (Class Code 0x81)</a> (see page 23)	0x81 (vendor specific)	Status of IO-Link Ports	Interfaces with IO-Link Master - SMI - Port Status



## 2.3 Additional CIP objects for Wireless IO-Link Integration

CIP Object	CIP Class ID	Description	Relation to netProxy world
<a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	0x90 (vendor specific)	Configuration of the wireless IO-Link Ports	Interfaces with IO-Link Master - SMI - W - Port Configuration
<a href="#">IO-Link Wireless Port Status Object (Class Code 0x91)</a> (see page 40)	0x91 (vendor specific)	Status of wireless IO-Link Ports	Interfaces with IO-Link Master - SMI - W - Port Status
<a href="#">IO-Link Wireless Master Configuration Object (Class Code 0x92)</a> (see page 45)	0x92 (vendor specific)	Configuration of the wireless IO-Link Master	Interfaces with IO-Link Master - SMI - W - Master Configuration

CIP Object	CIP Class ID	Description	Relation to netProxy world
<a href="#">IO-Link Wireless Track Configuration Object (Class Code 0x93)</a> (see page 47)	0x93 (vendor specific)	Track configuration of the wireless IO-Link	Interfaces with IO-Link Master - SMI - W - Track Configuration

## 2.4 Not supported CIP objects

Following CIP objects are not supported:

CIP Object	CIP Class ID	Description	Relation to netProxy world
<a href="#">Discrete Input Point Object (Class Code 0x08)</a> (see page 49)  Not implemented	0x08	The Discrete Input Point Object can be used to access the digital input data of the IO-Link device.	Interfaces with IO-Link Master - SMI - Output Process Data IQ and IO-Link Master - SMI - Input Process Data
<a href="#">Discrete Output Point Object (Class Code 0x09)</a> (see page 51)  Not implemented	0x09	The Discrete Output Point Object can be used to access the digital output data of the IO-Link device.	Interfaces with IO-Link Master - SMI - Output Process Data IQ and IO-Link Master - SMI - Output Process Data

## 3 I/O Connections and Cyclic Process Data

### 3.1 Supported assembly instances

The device firmware shall support the following assembly instances used to access the cyclic process data of the EtherNet/IP device.

Instance	Name	Input / Output	Size, byte
100	Output Data (O2T, Consuming)	Input	$4 + 8(2 + 32) = 276$
101	Input Data (T2O, Producing)	Output	$4 + 8(2 + 32) = 276$

Additionally, there will be the assembly instances 193 and 192 to support Input Only and Listen Only connections. These assembly instances are used internally only and cannot be accessed from the network via CIP services (used internally to recognize Input or Listen Only connection). The supported assembly instances have the structure as defined below.

### 3.2 Output assembly instances

#### 3.2.1 Instance 100 - Output data, 276 bytes (O2T, Consuming)

Bytes	Data	Size, bytes	Link Path
0-275	Process Output Data	276	20 04 24 64 30 03

#### Process Output Data

Number of Bytes	4	34	34	...	34
Name	DO Status + DO Data	IO-Link Port 1: Output Enable + Data	IO-Link Port 2: Output Enable + Data	...	IO-Link Port 8: Output Enable + Data
npx-Mapping	Mapped to IO-Link Master - HIL - Digital Output Process Data	IO-Link Master - SMI - Output Process Data	IO-Link Master - SMI - Output Process Data	IO-Link Master - SMI - Output Process Data	IO-Link Master - SMI - Output Process Data

#### DO Status + DO Data (4 Bytes)

Byte	0	1	2	3
<b>Name</b>	DO Status	Reserved (set to 0)	DO Data	
<b>npx-Mapping</b>	Mapped to IO-Link Master - HIL - Digital Output Process Data - Element 1		Mapped to IO-Link Master - HIL - Digital Output Process Data - Element 0  <b>Note:</b> the content/behavior of this field depends on the configuration of IO-Link Master - HIL - Digital Output Process Data Mapping	

**IO-Link Port X: Control + Data (34 Bytes)**

Byte	0	1	2 - 33
<b>Name</b>	Output Enable	Reserved (set to 0)	Data
<b>npx-Mapping</b>	Mapped to IO-Link Master - SMI - Output Process Data - Element 1		Mapped to IO-Link Master - SMI - Output Process Data - Element 0

### 3.3 Input assembly instances

#### 3.3.1 Instance 101 - Input data 276 bytes (T2O, Producing)

Bytes	Data	Size, bytes	Link Path
0-275	Process Input Data	276	20 04 24 65 30 03

**Process Input Data**

Number of Bytes	4	34	34	...	34
<b>Name</b>	DI Status + DI Data	IO-Link Port 1: Input Data Status + Input Data	IO-Link Port 2: Input Data Status + Input Data	...	IO-Link Port 8: Input Data Status + Input Data

<b>npx-Mapping</b>	Mapped to IO-Link Master - HIL - Digital Input Process Data	Mapped to IO-Link Master - SMI - Input Process Data	Mapped to IO-Link Master - SMI - Input Process Data	Mapped to IO-Link Master - SMI - Input Process Data	Mapped to IO-Link Master - SMI - Input Process Data
--------------------	---	---	---	---	---

**DI Status + DI Data**

Byte	0	1	2	3
<b>Name</b>	DI Status	Reserved (set to 0)	DI Data	
<b>npx-Mapping</b>	Mapped to IO-Link Master - HIL - Digital Input Process Data - Element 1  0: invalid 1-255: valid		Mapped to IO-Link Master - HIL - Digital Input Process Data - Element 0	

**IO-Link Port X: Input Data Status + Input Data**

Byte	0	1	2 - 33																																					
<b>Name</b>	IOLink Data Status	Reserved (set to 0)	IOLink Data																																					
<b>npx-Mapping</b>	Mapped to IO-Link Master - SMI - Input Process Data - Element 1 (PQI)		Mapped to IO-Link Master - SMI - Input Process Data - Element 0																																					
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th colspan="8">Bit</th> </tr> <tr> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td>PQ</td> <td>DevEr</td> <td>DevCom</td> <td>Reserved</td> <td>IO-Link Event Available ★</td> <td>Reserved</td> <td>Reserved</td> <td>Reserved</td> </tr> <tr> <td colspan="4">IO-Link</td> <td colspan="4">EtherNet/IP Specific</td> </tr> </tbody> </table> <p>★: Note, this bit mirrors attribute 20 of the CIP Event Log object (0x41).</p>								Bit								7	6	5	4	3	2	1	0	PQ	DevEr	DevCom	Reserved	IO-Link Event Available ★	Reserved	Reserved	Reserved	IO-Link				EtherNet/IP Specific			
Bit																																								
7	6	5	4	3	2	1	0																																	
PQ	DevEr	DevCom	Reserved	IO-Link Event Available ★	Reserved	Reserved	Reserved																																	
IO-Link				EtherNet/IP Specific																																				

## 3.4 Configuration Assembly

### 3.4.1 Instance 102 - Configuration data 80 bytes

The device firmware supports the following configuration assembly instance used to configure the IO-Link communication parameters.

Instance	Name	Size, byte
102	IO-Link Port Configuration	Wired IO-Link: 8 x 10 = 80 Wireless IO-Link: 8 x 28 = 224

#### Wired IO-Link:

Byte Offset	Data	Size in bytes
0	Instance 1 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
10	Instance 2 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
20	Instance 3 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
30	Instance 4 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
40	Instance 5 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
50	Instance 6 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
60	Instance 7 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10
70	Instance 8 of IO-Link Port Configuration Object (Class Code 0x80)(see page 20)	10

#### Wireless IO-Link:

Byte Offset	Data	Size in bytes
0	Instance 1 of IO-Link Wireless Port Configuration Object (Class Code 0x90)(see page 34)	28
28	Instance 2 of IO-Link Wireless Port Configuration Object (Class Code 0x90)(see page 34)	28
56	Instance 3 of IO-Link Wireless Port Configuration Object (Class Code 0x90)(see page 34)	28

Byte Offset	Data	Size in bytes
84	Instance 4 of <a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	28
112	Instance 5 of <a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	28
140	Instance 6 of <a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	28
168	Instance 7 of <a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	28
196	Instance 8 of <a href="#">IO-Link Wireless Port Configuration Object (Class Code 0x90)</a> (see page 34)	28

### 3.5 Supported I/O Connections

The device shall support Exclusive Owner, Input Only and Listen Only connections. Exclusive Owner and Input Only connection can be configured to be multicast or point-to-point in the T->O direction. Listen Only connections are always multicast in the T->O direction. The device shall support the following connections.

Type - Name	O => T	T => O	Connection Path
Exclusive Owner - Status & Data	32-bit run/idle header	Modeless	20 04 24 66 2C 64 2C 65
Input Only - Status & Data	Heartbeat	Modeless	20 04 24 66 2C C1 2C 65
Listen Only - Status & Data	Heartbeat	Modeless	20 04 24 01 2C C0 2C 65

## 4 IO-Link Port Identification Object (Class Code 0x82)

The IO-Link Port Identification object can be used to gather information about IO-Link ports identification. Each instance of this objects addresses an IO-Link port of the IO-Link Master (CIP Instance 1 → IO-Link Port 1, CIP Instance 2 → IO-Link Port 2, etc.).

### 4.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	Number of available IO-Link Ports

### 4.2 Instance Attributes

Note: The instance attributes are related to IO-Link Master - SMI - Port Identification

Attribute	Name	N V	Access Rule	Data Type	Description
1	Port Type	V	Get	USINT	Indicates the type of port: <b>0:</b> Class A <b>1:</b> Class A with PortPowerOffOn support <b>2:</b> Class B <b>3:</b> FS_Port_A without OSSDe (safety) <b>4:</b> FS_Port_A with OSSDe (safety) <b>5:</b> FS_Port_B (safety) <b>6:</b> W_Master (wireless) <b>7-255:</b> Reserved

### 4.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single

## 5 IO-Link Device Parameter Object (Class Code 0x83)

The IO-Link Device Parameter Object can be used to access parameters of an IO-Link device via ISDU (Index Service Data Unit).

The object provides services that map CIP services to IO-Link services.

An IO-Link port is addressed by using the CIP Instance of the "IO-Link Device Parameter Object".







### 5.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1 (0x01)	Revision	Get	1
2 (0x02)	Max. Instance	Get	Number of available IO-Link Ports

### 5.2 Instance Attributes

Each CIP instance represents exactly one IO-Link port. The CIP instances itself do not support any attributes.

### 5.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
14 (0x0E)			Get Attribute Single
75 (0x4B)			Read ISDU (indexed service data unit)
76 (0x4C)			Write ISDU (indexed service data unit)

#### 5.3.1 Read iSDU

This service can be used to read parameters from an IO-Link device which is connected on a dedicated IO-Link port. The IO-Link port is addressed using the CIP instance number.

Addressing a CIP attribute is not required (as the IO-Link port is addressed by the CIP Instance). If the CIP service request path includes a CIP attribute, it will be ignored.

The service data includes the index and subindex values, which addresses the IO-Link object within the IO-Link device.

##### 5.3.1.1 Read iSDU Request

###### Read iSDU Service Request

Field	Type	Value	Description
<b>CIP Service</b>	-	75 (0x4B)	ISDU read service
<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the IO-Link Port the IO-Link device is connected to
<b>CIP Data</b>	UINT	Index	IO-Link iSDU Objekt Index
	USINT	Subindex	IO-Link iSDU Objekt Subindex

### 5.3.1.2 Read iSDU Response

✔ Positive Response (CIP Status in service response == 0)

Positive Read iSDU Service Response			
Field	Type	Value	Description
<b>CIP Service</b>	-	75 (0x4B)	ISDU read service
<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the IO-Link Port the IO-Link device is connected to
<b>CIP Data</b>	ARRAY of BYTE	iSDU Data	IO-Link object data retrieved from the IO-Link device Maximum number of bytes: 0 - 232

✘ Negative Response (CIP Status in service response != 0)

Positive Read iSDU Service Response			
Field	Type	Value	Description
<b>CIP Service</b>	-	75 (0x4B)	ISDU read service
<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the IO-Link Port the IO-Link device is connected to

<b>CIP Data</b>	UINT	For more informations please refer to table C.2 in IO-Link Interface Specification V1.1.2 from July 2013.	IO-Link Master Error
	USINT		IO-Link Device Error
	USINT		IO-Link Device Additional Error

## 5.3.2 Write iSDU

This service can be used to write parameters to an IO-Link device which is connected on a dedicated IO-Link port. The IO-Link port is addressed using the CIP instance number.

Addressing a CIP attribute is not required (as the IO-Link port is addressed by the CIP Instance). If the CIP service request path includes a CIP attribute, it will be ignored.

The service data includes the index and subindex values (which addresses the IO-Link object within the IO-Link device) and the actual data that shall be written to the IO-Link device's object.

### 5.3.2.1 Write iSDU Request

<b>Write iSDU Service Request</b>			
<b>Field</b>	<b>Type</b>	<b>Value</b>	<b>Description</b>
<b>CIP Service</b>	-	76 (0x4C)	ISDU write service
<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the IO-Link Port the IO-Link device is connected to
<b>CIP Data</b>	UINT	Index	IO-Link iSDU Objekt Index
	USINT	Subindex	IO-Link iSDU Objekt Subindex
	ARRAY of BYTE	Data	Data that shall be written to IO-Link device Maximum number of bytes: 0 - 232

### 5.3.2.2 Write iSDU Response

✔ Positive Response (CIP Status in service response == 0)

The positive response to this service does not hold any CIP data.

<b>Positive Write iSDU Service Response</b>			
<b>Field</b>	<b>Type</b>	<b>Value</b>	<b>Description</b>
<b>CIP Service</b>	-	76 (0x4C)	ISDU write service

<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the IO-Link Port the IO-Link device is connected to
<b>CIP Data</b>	The positive response to this service does not hold any CIP Data (Number of bytes: 0).		

 Negative Response (CIP Status in service response != 0)

Positive Write iSDU Service Response			
Field	Type	Value	Description
<b>CIP Service</b>	-	76 (0x4C)	iSDU write service
<b>CIP Class</b>	-	131 (0x83)	IO-Link Device Parameter Object
<b>CIP Instance</b>	-	1 ... Number of available IO-Link Ports	Addresses the actual IO-Link Port the IO-Link device is connected to
<b>CIP Data</b>	UINT	For more informations please refer to table C.2 in IO-Link Interface Specification V1.1.2 from July 2013.	IO-Link Master: Error code
	USINT		IO-Link Device: Error code
	USINT		IO-Link Device: Additional error code

### 5.3.3 CIP Error Codes

The following table provides a short summary of what CIP status code can be returned when accessing the "IO-Link Device Parameter Object" via a CIP service. The table does not claim to be complete.

CIP Status	Description
0 (0x00)	Success. Service was successfully performed.
5 (0x05)	Path destination unknown. Addressed CIP Class or CIP Instance is not known.
8 (0x08)	Service not supported. The requested service is not implemented or was not defined for this Object Class/Instance.
19 (0x13)	Not enough data. The service did not supply enough data to perform the specified operation.

<b>CIP Status</b>	<b>Description</b>
20 (0x14)	Attribute not supported. The attribute specified in the request is not supported.
21 (0x15)	Too much data. The service supplied more data than was expected.
30 (0x1E)	An embedded service resulted in an error. The IO-Link specific error codes within the CIP response data might provide more information about what went wrong.

## 6 IO-Link Port Configuration Object (Class Code 0x80)

The IO-Link Port Configuration Object can be used to configure the IO-Link Master's ports.

Each instance of this objects addresses an IO-Link port of the IO-Link Master (instance 1 → port 1, instance 2 → port 2, etc.).

### 6.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	Number of available IO-Link Ports

### 6.2 Instance Attributes









Note: The instance attributes are related to IO-Link Master - SMI - Port Configuration

Attribute	Name	N V	Access Rule	Data Type	Description
1	Port Mode	N V	Get/Set	USINT	<p>Operating mode of IO-Link port (pin 4)</p> <p><b>0 = Deactivated</b> - the port is inactive, L+ is turned off, Input and Output Process Data are 0</p> <p><b>1 = IOL Manual</b> - Target mode based on user defined configuration including validation of Vendor ID, Device ID, and Revision</p> <p><b>2 = IOL Autostart</b> - Target mode without configuration, Validation: No Device Check.</p> <p><b>3 = Digital Input</b> - all elements of port configuration are don't care except Input Data Lengths and Output Data Length</p> <p><b>4 = Digital Output</b> - all elements of port configuration are don't care except Input Data Lengths and Output Data Length</p>

Attribute	Name	N V	Access Rule	Data Type	Description								
2	Validation and Backup	N V	Get/Set	USINT	<p>Inspection level to be performed by the device and the Backup/Restore behavior</p> <p><b>0 = No Device Check</b>  <b>1 = Type compatible to Device V1.0</b>  <b>2 = Type compatible to Device V1.1</b>  <b>3 = Type compatible to Device V1.1, Backup and Restore</b>  <b>4 = Type compatible to Device V1.1, Restore only</b></p>								
3	IQ behavior	N V	Get/Set	USINT	<p>Behavior of the I/Q signal at Pin 2</p> <p><b>0 = Not Supported</b> - no validation of Vendor/Device ID's and serial number</p> <p><b>1 = Digital Input</b>  <b>2 = Digital Output</b>  <b>3 = Reserved for future use</b>  <b>4 = Reserved for future use</b>  <b>5 = Power 2</b> - Port is Class B</p>								
4	Port Cycle Time	N V	Get/Set	USINT	<p>Port cycle time expected by the SMI client</p> <p><b>0 = As Fast As Possible (default value)</b>  <b>1-255 = Time</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> </table> <p><b>Bit 0 - 5: Multiplier</b>  <b>Bit 6 - 7: Time Base</b>  <b>0: 0,1 ms → Calculation: Multiplier * Time Base</b>  <b>1: 0,4 ms → Calculation: 6,4 ms + Multiplier * Time Base</b>  <b>2: 1,6 ms → Calculation: 32,0 ms + Multiplier * Time Base</b>  <b>3: Reserved</b></p>	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0						
5	Vendor ID	N V	Get/Set	UINT	<p>Expected Vendor ID (handling according to "Validation and Backup")</p>								

Attribute	Name	N V	Access Rule	Data Type	Description
6	Device ID	N V	Get/Set	UDINT	Expected Device ID (handling according to "Validation and Backup")

### 6.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x10			Set Attribute Single
0x01			Get Attributes All
0x02			Set Attributes All

## 7 IO-Link Port Status Object (Class Code 0x81)

The IO-Link Port Status Object can be used to gather information about the status of the IO-Link Master's ports. Each instance of this objects addresses an IO-Link port of the IO-Link Master (CIP Instance 1 → IO-Link Port 1, CIP Instance 2 → IO-Link Port 2, etc.).

### 7.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	Number of available IO-Link Ports

### 7.2 Instance Attributes





Note: The instance attributes are related to IO-Link Master - SMI - Port Status.

Attribute	Name	N V	Access Rule	Data Type	Description
1	Port State Info	V	Get	USINT	<p>Current port state of IO-Link port</p> <p><b>Each possible value is defines as enumeration:</b></p> <p><b>0 = No Device</b> - No device connected to port or no communication with connected device</p> <p><b>1 = Deactivated</b> - Port is inactive</p> <p><b>2 = Port Diag</b> - Check of revision or compatibility failed</p> <p><b>3 = Preoperate</b> - Device is ready for communication</p> <p><b>4 = Operate</b> - Device is in communication</p> <p><b>5 = DI CQ</b> - Port is in Digital Input mode</p> <p><b>6 = DO CQ</b> - Port is in Digital Output mode</p> <p><b>7 = Reserved for IO-Link Safety</b></p> <p><b>8 = Reserved for IO-Link Safety</b></p> <p><b>254 = Port Power Off</b></p> <p><b>255 = Not Available</b> - The port is not available</p>

Attribute	Name	N V	Access Rule	Data Type	Description								
2	Port Quality Info	V	Get	USINT	<p>Status information of Process Data</p> <p><b>Description of binary coded content:</b></p> <table border="1" data-bbox="1034 539 1425 607"> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> </table> <p><b>Bit 0: 0 = Input Process data is valid, 1 = Input Process Data is not valid</b></p> <p><b>Bit 1: 0 = Output Process data is valid, 1 = Output Process Data is not valid</b></p> <p><b>Bit 2 to Bit 7: Reserved</b></p>	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0						
3	Revision	V	Get	USINT	<p>Revision ID of connected device</p> <p><b>0:</b> No device connected <b>Others:</b> Revision ID of connected device</p>								
4	Transmission Rate	V	Get	USINT	<p>Transmission rate of communication between port and connected device</p> <p><b>0:</b> No device connected <b>1:</b> COM1 (4,8 kbit/s) <b>2:</b> COM2 (38,4 kbit/s) <b>3:</b> COM3 (230,4 kbit/s)</p> <p><b>4 to 255:</b> Reserved for future use</p>								

Attribute	Name	N V	Access Rule	Data Type	Description								
5	Master Cycle time	V	Get	USINT	Cycle time of communication in <b>Operate</b> mode  <table border="1" style="margin-left: 20px;"> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> </table> <b>Bit 0 - 5:</b> Multiplier <b>Bit 6 - 7:</b> Time Base <b>0:</b> 0,1 ms → Calculation: Multiplier * Time Base <b>1:</b> 0,4 ms → Calculation: 6,4 ms + Multiplier * Time Base <b>2:</b> 1,6 ms → Calculation: 32,0 ms + Multiplier * Time Base <b>3:</b> Reserved	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0						
6	Input Data Length	V	Get	USINT	Real input data length of connected device in bytes								
7	Output Data Length	V	Get	USINT	Real output data length of connected device in bytes								
8	Vendor ID	V	Get	UINT	Vendor ID of connected device								
9	Device ID	V	Get	UDINT	Device ID of connected device								

### 7.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x01			Get Attributes All

## 8 CIP Event Log Object (Class Code 0x41)


The Event Log Object can be used to get information about IO-Link events.


This object is officially defined by the ODVA (see CIP Volume 1).

The following table shows the mapping of CIP instances to the IO-Link ports. (CIP instance 1 to 99 do not exist)

IO-Link Port	CIP Instance
1	100
2	101
3	102
4	103
...	...

### 8.1 Class Attributes

Attribute	Name	Access Rule	Data Type	Description	Value
1	Revision	Get			1
2	Max Instance	Get		Number of IO-Link Ports	
32	Time Format	Get	USINT	Data type code for time and/or date	0xCC = STIME 0xCF = DATE_AND_TIME   We only support STIME at the moment. Writing this attribute to any other value will be rejected with status "Invalid attribute value"

Attribute	Name	Access Rule	Data Type	Description	Value
33	Present Time	Get	Dependant on Attribute #32   Since only the STIME format is supported (see attribute 32), this attribute returns always 8 bytes (LWORD)	Default time value = zero for all data types	

## 8.2 Instance Attributes

Attribute	Name	Access Rule	N V	Data Type	Description of Attribute	Semantics of Value
2	State	Get	V	USINT	State of this instance	<b>0</b> = Nonexistent <b>1</b> = Stopped <b>2</b> = Empty <b>3</b> = Available <b>4</b> = Full/Overwrite <b>5</b> = Full/Halted <b>6 - 255</b> = Reserved  See also below state diagram.
9	Logged Data Configuration	Get, Set	N V	BYTE	Configures which data is stored in the event log.	Default = 0x00  <b>Bit 0: Time value</b> (data value defined by Time Format class attribute)  For more information see semantics of instances attributes below

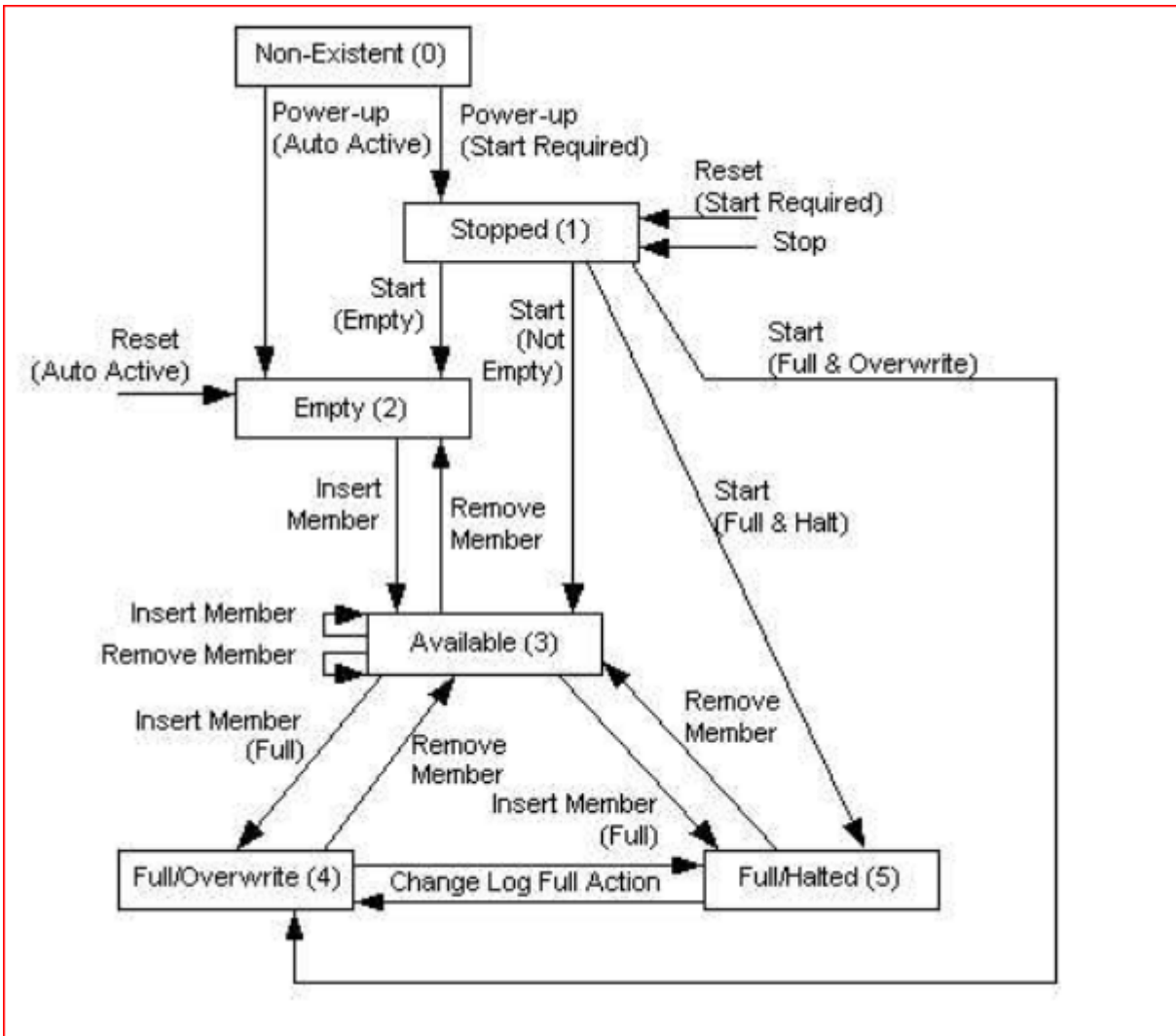
Attribute	Name	Access Rule	N V	Data Type	Description of Attribute	Semantics of Value
10	Log Full Action	Get, Set	N V	USINT	Configures the action to take when a new event is detected and the log is full.	<b>0</b> = Halt <b>1</b> = Scroll (Default) <b>2 - 255</b> = Reserved  For more information see semantics of instances attributes below
11	Duplicate Event Action	Get, Set	N V	USINT	Configures the action to take when a duplicate event is detected.	<b>0</b> = Ignore <b>1</b> = Add (Default) <b>2</b> = Overwrite <b>3 - 255</b> = Reserved  For more information see semantics of instances attributes below
12	Event/Data Log Maximum Size	Get	V	UDINT	The maximum number of allowable event/data log entries for the instance.	Default: 8
13	Event/Data Log Size	Get	V	UDINT	The current number of non-zero entries in an instance's event/data log.	Range: 0 to "Event List Size"
14	Event/Data Log	Get Get Member Remove Member	V	ARRAY of STRUCT	List of all events that have been logged	For more information see semantics of instances attributes below

Attribute	Name	Access Rule	N V	Data Type	Description of Attribute	Semantics of Value
19	Log Full	Get	V	BOOL	A flag which indicates if the Event Log is full. TRUE if Event Log Size = Event Log Maximum Size	<b>0</b> = Log not full <b>1</b> = Log full
20	Log Contains Entries	Get	V	BOOL	A flag which indicates that the Event Log is not empty (ie. at least one entry is present). This value is TRUE when the Event Log Size (attribute 13) is not equal to zero.	<b>0</b> = Log empty <b>1</b> = Log contains entries
21	Log Overrun	Get	V	BOOL	A flag which indicates that an overrun has occurred. This value is reset to zero (FALSE) when the attribute is read.	<b>0</b> = No Log Overrun <b>1</b> = Log Overrun
22	Sequential Event/ Data Access	Get	V	See Attribute 9	Provides a simple mechanism to access Event/ Data entry	For more information see semantics of instances attributes below

Attribute	Name	Access Rule	NV	Data Type	Description of Attribute	Semantics of Value									
24	Event Identifier Format	Get, Set	NV	USINT	Defines the format of the Event Identifier for the log entries	0 - 3 = Not supported <b>4</b> = 24 Bit Object Model Format 5 - 255 = Not supported  Format of 24 Bit Object Model Format:									
						<table border="1"> <thead> <tr> <th>Byte Offset</th> <th>Data Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>USINT</td> <td>8-bit Error/Event code comes from the IO Link EventQualifier</td> </tr> <tr> <td>1</td> <td>UINT</td> <td>16-bit Extended Error Code comes from the IO Link EventCode</td> </tr> </tbody> </table>	Byte Offset	Data Type	Description	0	USINT	8-bit Error/Event code comes from the IO Link EventQualifier	1	UINT	16-bit Extended Error Code comes from the IO Link EventCode
Byte Offset	Data Type	Description													
0	USINT	8-bit Error/Event code comes from the IO Link EventQualifier													
1	UINT	16-bit Extended Error Code comes from the IO Link EventCode													

### 8.2.1 Event/Data Log Instance Behavior

The following diagram illustrates the state behavior of one single Event Log instance.



## 8.2.2 Semantics of Instance Attributes

### 8.2.2.1 Attribute #9 - Logged Data Configuration

Defines the **information to be stored in the Event/Data Log** (Attribute 14).

The logged data always **begins** with the **Event Identifier** (format defined in Attribute 24), and **may be followed** by an **optional time stamp block**.

The time stamp block appears in the Event/Data Log **if bit 0 is set in Attribute #9**.

### 8.2.2.2 Attribute #10 - Log Full Action

Defines the action to take when a new event is detected and the event log is full. Options include scroll and halt.

The scroll selection causes new event log entries to overwrite the oldest entries when the event log is full.

The halt selection causes all new event log entries to be lost when the event log is full.

### 8.2.2.3 Attribute #11 - Duplicate Event Action

Defines the action to take when a duplicate event is detected. Options include **ignore**, **add**, and **overwrite**. The **ignore** option causes event entries of the same Event Identifier to be discarded. The **overwrite** option causes event entries of the same event to overwrite the previous entry of that event. The **add** to log option allows the same event to be placed in the log each time it occurs.

### 8.2.2.4 Attribute #14 - Event/Data Log

This attribute is the event/data log for the instance. New events are added to the end of the log, subject to overriding behavior specified by the Log Full Action and Duplicate Event Action attributes.

Information contained in the event/data log depends upon its configuration.

An entry whose value is all zero is defined to be a null entry containing no useful data.

This attribute is a single dimension array of entries. The maximum size of the array is given by attribute #12 (Event/Data Log Maximum Size).

The present number of entries is given by attribute #13 (Event/Data Log Size).

The form of each entry is determined by the combination of the Event Identifier Format (attribute #24) in conjunction with optional data selected by the Logged Data Configuration (attribute #9).

The table below shows the structure of a logged event entry.

Field Name	Available in single entry	Where enabled	Where Format Defined
Event Identifier	Always	No need to be enables, as it is always present	Event Identifier Format (Instance Attribute 24)
Time Stamp	Optional	Can be enables using "Logged Data Configuration" (Instance Attribute 9), Bit 0	Time Format (Class Attribute 32)

### 8.2.2.5 Attribute #22 - Sequential Event/Data Access











The Sequential Event/Data Access attribute provides the means for simple sequential access to members of the Event/Data Log.

The form of the data in this attribute is identical to the form of the data contained within individual member(s) of the Event/Data Log (attribute #14).

The **Get\_Attribute\_Single** service, when directed to the Sequential Event/Data Access attribute, will return the contents of the oldest Event/Data Log entry (attribute 14) and will remove that entry from the list afterwards.

Note: Reading attribute 22 using the **Get\_Attribute\_Single** service is the same as sending the **Remove\_Member** service (0x1B) to instance attribute #14 and addressing member 1.

### 8.3 Supported services

Service Code	Supported on		Service Name	Service Description
	Class Level	Instance Level		
0x05			Reset	<p>Provides one of the types of reset for the object as described below.</p> <p>Type 0: Return all attributes to the power up values. (This is the default if the type parameter is omitted.)</p> <p>Type 1: Return as closely as possible to the out-of-box configuration.</p>
0x0E			Get Attribute Single	Returns the contents of the specified attribute.
0x10			Set Attribute Single	Sets the contents of the specified attribute.
0x18			Get Member	<p>This service can be directed to instance attribute 14 only.</p> <p>Returns the contents of a single member (Event/Data Log entry).</p>
0x1B			Remove Member	<p>This service can be directed to instance attribute 14 only.</p> <p>Returns the contents of a single member (Event/Data Log entry) and removes that member from the list.</p>

## 9 IO-Link Wireless Port Configuration Object (Class Code 0x90)

The IO-Link Wireless Port Configuration Object can be used to configure the wireless IO-Link Master's ports. Each instance of this objects addresses an IO-Link port of the wireless IO-Link Master (instance 1 → port 1, instance 2 → port 2, etc.).

### 9.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	Number of available IO-Link Ports

### 9.2 Instance Attributes

Note: The instance attributes are related to IO-Link Master - SMI - W - Port Configuration

Attribute	Name	N V	Access Rule	Data Type	Description
1	Port Mode	N V	Get/Set	USINT	<p>Operating mode of IO-Link port</p> <p><b>Each possible value is defined as enumeration:</b></p> <p><b>0 = Deactivated</b> - the port is inactive, Input and Output Process Data are 0</p> <p><b>1 = Cyclic</b></p> <p><b>2 = Roaming</b></p> <p><b>3-255 = Reserved</b></p>

Attribute	Name	N V	Access Rule	Data Type	Description
2	Validation and Backup	N V	Get/Set	USINT	<p>Inspection level to be performed by the device and the Backup/Restore behavior</p> <p><b><i>Each possible value is defined as enumeration:</i></b></p> <p><b>0 = No Device Check</b>  <b>1-4 = Reserved (Used by IOL wired Master)</b>  <b>5 = Type compare*, no Backup/Restore</b>  <b>6 = Type compare*, Backup only</b>  <b>7 = Type compare*, Restore only</b>  <b>8 = Type compare*, Backup and Restore</b>  <b>9 = No type compare*, no Backup/Restore</b>  <b>10 = No type compare*, Backup only</b>  <b>11 = No type compare*, Restore only</b>  <b>12 = No type compare*, Backup and Restore</b>  <b>13-255 = Reserved</b></p> <p><b>*Type compare means compare DeviceID and VendorID from the configuration object with the real device values.</b></p>
3	Reserved	N V	Get/Set	USINT	









Attribute	Name	N V	Access Rule	Data Type	Description																													
4	Port Cycle Time	N V	Get/Set	USINT	<p>Sets up the cycle time of a W-Port of the W-Master.</p> <p>The cycle time is encoded using "Time Base" and "Multiplier" values:</p> <table border="1" data-bbox="890 571 1425 1628"> <thead> <tr> <th></th> <th colspan="2">Time Base</th> <th colspan="5">Multiplier</th> <th></th> <th rowspan="2">R e s u l t i n g C y c l e t i m e</th> </tr> <tr> <th>B i t</th> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td></td> <td>00: -</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>fr e e- r u n n i n g m o d e</td> </tr> </tbody> </table>		Time Base		Multiplier						R e s u l t i n g C y c l e t i m e	B i t	7	6	5	4	3	2	1	0		00: -		-						fr e e- r u n n i n g m o d e
	Time Base		Multiplier						R e s u l t i n g C y c l e t i m e																									
B i t	7	6	5	4	3	2	1	0																										
	00: -		-						fr e e- r u n n i n g m o d e																									

Attribute	Name	N V	Access Rule	Data Type	Description									
					Time Base	Multiplier							R e s u l t i n g C y c l e t i m e	
					B i t	7	6	5	4	3	2	1	0	
						01: 5ms			1..63 as multiplier (Note)					5. .. 3 1 5 ms (T i m e B a s e * M u l t i p l i e r)
						10..1 1: reser ved			reserved					re s e r v e d

Attribute	Name	N V	Access Rule	Data Type	Description
					<p><b>Note:</b> for W-Devices and W-Bridges the minimum possible transmission time is 5 ms.</p> <p><b>Note:</b> When the free-running mode is chosen with a time base of 0, the W-Master Stack will automatically configure the Master cycle time to be the Minimum Master cycle time based on the PD Segmentation length, Slot Type and Max Retry configurations.</p>
5	Vendor ID	N V	Get/Set	UINT	Expected Vendor ID (handling according to Validation Level)
6	Device ID	N V	Get/Set	UDINT	Expected Device ID (handling according to Validation Level)
7	Slot	N V	Get/Set	USINT	Wireless slot number to be used for the port
8	Track	N V	Get/Set	USINT	Wireless track number to be used for the port
9	Device TX Power	N V	Get/Set	USINT	This parameter contains the transmit power level of the W-Device
10	Max Retry	N V	Get/Set	USINT	Maximum number of retries for a transmission in OPERATE mode
11	IMA Time	N V	Get/Set	UINT	Requested IMA time for the OPERATE mode
12	Slot Type	N V	Get/Set	USINT	<p><b>0 = Single slot</b>  <b>1 = Double slot</b></p>
13	Low Power Device	N V	Get/Set	USINT	<p>Is the connected W-Device low power or not</p> <p><b>0x00 = Not Low Power</b>  <b>0x01 = Low Power</b></p>
14	Max PD Segment Length	N V	Get/Set	USINT	This parameter contains the maximum segment length of the PDOOut data to the Message handler to distribute PDOOut Data within multiple W-Cycles.

Attribute	Name	N V	Access Rule	Data Type	Description
15	Unique ID	N V	Get/Set	USINT[9]	UniqueID of the W-Device (9 Bytes)

### 9.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x10			Set Attribute Single
0x01			Get Attributes All
0x02			Set Attributes All

## 10 IO-Link Wireless Port Status Object (Class Code 0x91)

The IO-Link Wireless Port Status Object can be used to gather information about the status of the wireless IO-Link Master's ports.

Each instance of this objects addresses an IO-Link port of the wireless IO-Link Master (CIP Instance 1 → IO-Link Port 1, CIP Instance 2 → IO-Link Port 2, etc.).

### 10.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	Number of available IO-Link Ports

### 10.2 Instance Attributes

Note: The instance attributes are related to IO-Link Master - SMI - W - Port Status.




Attribute	Name	N V	Access Rule	Data Type	Description
1	Port State Info	V	Get	USINT	<p>Current port state of IO-Link port</p> <p><b>Each possible value is defines as enumeration:</b></p> <p><b>0 = Pairing success</b>  <b>1 = Pairing timeout</b>  <b>2 = Pairing wrong slot type</b>  <b>3 = Inactive</b>  <b>4 = Port ready</b>  <b>5 = Communication ready</b>  <b>6 = Operate</b>  <b>7 = Communication lost</b>  <b>8 = Revision fault</b>  <b>9 = Compatibility fault</b>  <b>10 = Serial number fault</b>  <b>11 = Process data fault</b>  <b>12 = Cycle time fault</b>  <b>13-255 = Reserved</b></p>

Attribute	Name	N V	Access Rule	Data Type	Description								
2	Port Quality Info	V	Get	USINT	<p>Status information of Process Data</p> <p><b>Description of binary coded content:</b></p> <table border="1"> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> </table> <p><b>Bit 0: 0 = Input Process data is valid, 1 = Input Process Data is not valid</b></p> <p><b>Bit 1: 0 = Output Process data is valid, 1 = Output Process Data is not valid</b></p> <p><b>Bit 2 to Bit 7: Reserved</b></p>	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0						
3	Revision ID	V	Get	USINT	<p>Revision ID of connected device</p> <p><b>0:</b> No device connected <b>Others:</b> Revision ID of connected device</p>								
4	Reserved	V	Get	USINT	<p>Transmission rate of communication between port and connected device</p> <p><b>0:</b> No device connected <b>1:</b> COM1 (4,8 kbit/s) <b>2:</b> COM2 (38,4 kbit/s) <b>3:</b> COM3 (230,4 kbit/s)</p> <p><b>4 to 255:</b> Reserved for future use</p>								

Attribute	Name	N V	Access Rule	Data Type	Description																																												
5	Port Cycle time	V	Get	USINT	<p>Actual cycle time of a W-Port of the W-Master. The cycle time is encoded using "Time Base" and "Multiplier" values:</p> <table border="1"> <thead> <tr> <th></th> <th>Time Base</th> <th>Multiplier</th> <th>R e s u l t i n g C y c l e t i m e</th> </tr> </thead> <tbody> <tr> <td><b>B i t</b></td> <td><b>7</b></td> <td><b>6</b></td> <td><b>5</b></td> <td><b>4</b></td> <td><b>3</b></td> <td><b>2</b></td> <td><b>1</b></td> <td><b>0</b></td> <td></td> </tr> <tr> <td></td> <td>00: -</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>fr e e- r u n n i n g m o d e</td> </tr> <tr> <td></td> <td>01: 5ms</td> <td>1..63 as multiplier (Note)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>10..1 1: reser ved</td> <td>reserved</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>re s er v e d</td> </tr> </tbody> </table>		Time Base	Multiplier	R e s u l t i n g C y c l e t i m e	<b>B i t</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>			00: -								fr e e- r u n n i n g m o d e		01: 5ms	1..63 as multiplier (Note)									10..1 1: reser ved	reserved							re s er v e d
	Time Base	Multiplier	R e s u l t i n g C y c l e t i m e																																														
<b>B i t</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>																																									
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	01: 5ms	1..63 as multiplier (Note)																																															
	10..1 1: reser ved	reserved							re s er v e d																																								

Attribute	Name	N V	Access Rule	Data Type	Description
					<p><b>Note:</b> for W-Devices and W-Bridges the minimum possible transmission time is 5 ms.</p> <p><b>Note:</b> When the free-running mode is chosen with a time base of 0, the W-Master Stack will automatically configure the Master cycle time to be the Minimum Master cycle time based on the PD Segmentation length, Slot Type and Max Retry configurations.</p>
6	Input Data Length	V	Get	USINT	Real input data length of connected device in bytes
7	Output Data Length	V	Get	USINT	Real output data length of connected device in bytes
8	Vendor ID	V	Get	UINT	Vendor ID of connected device
9	Device ID	V	Get	UDINT	Device ID of connected device
10	Signal Quality	V	Get	USINT	<p>Statistical data about the reliability of the radio transmission for this W-Device.</p> <p>The LinkQuality indicates the Packet Error Rate for singular W-Sub Cycle:</p> $PER_{W-Sub\ Cycle} = 10^{-LinkQuality}$ <p>presented is a single octet variable in a Q notation of Q(4,4):</p> <ul style="list-style-type: none"> <li>• Bit 0..3: Quantity</li> <li>• Bit 4..7: Integer</li> </ul> <p>For example:</p> <p>Aa value of LinkQuality=0x38 represents a singular W-Sub Cycle PER of <math>10^{-3.5}</math></p> <p>For A 5 milliseconds W-Cycle that consists of 3 W-Sub Cycles, this value represents a PER of</p> $(10^{-3.5})^3 = 10^{-10.5}$

### 10.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x01			Get Attributes All

## 11 IO-Link Wireless Master Configuration Object (Class Code 0x92)

The IO-Link Wireless Master Configuration Object can be used to set the general configuration of the IO-Link Wireless Master.

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	1









### 11.1 Instance Attributes

Note: The instance attributes are related to IO-Link Master - SMI - W - Master Configuration.

Attribute	Name	N V	Access Rule	Data Type	Description
1	Master ID	N V	Get/Set	USINT	Master identifier according to IOLW specification  Value range: 1 - 29
2	Advanced Connectivity	N V	Get/Set	USINT	Enable different wireless functionalities:  <b>Bit 0 = AHT (0 = disable / 1 = enable)</b> <b>Bit 4 = Reconnect (0 = disable / 1 = enable)</b> <b>Bits 2 - 7 = Reserved</b>
3	Black List	N V	Get/Set	USINT[10]	Black list frequency channels. Bitwise coded 1 MHz channels 1-80, when 1 & 80 must be blacklisted.  Value range: 0x0000 0000 0000 0000 0000 - 0x7FFF FFFF FFFF FFFF

Attribute	Name	N V	Access Rule	Data Type	Description
4	Pairing Timeout	N V	Get/Set	UINT	Timeout for pairing by BUTTON / UUID in seconds.  Value range: 0x0005 - 0xFFFF

## 11.2 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x10			Set Attribute Single
0x01			Get Attributes All
0x02			Set Attributes All

## 12 IO-Link Wireless Track Configuration Object (Class Code 0x93)

The IO-Link Wireless Track Configuration Object holds the configuration of certain IO-Link Wireless Master Tracks. Each instance of this objects addresses a track of the wireless IO-Link Master (instance 1 → port 1, instance 2 → port 2, etc.).

### 12.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	3









### 12.2 Instance Attributes

**Note:** The instance attributes are related to IO-Link Master - SMI - W - Track Configuration

**⚠ Note :** The following instance attributes are only settable via the CIP service Set\_Attribute\_All (0x02). They cannot be set individually using a Set\_Attribute\_Single request.

Attribute	Name	N V	Access Rule	Data Type	Description
1	Track Mode	N V	Get/Set All	USINT	<p>Operating mode of wireless track</p> <p><b>Each possible value is defined as enumeration:</b></p> <p><b>0 = Stop:</b> track is inactive</p> <p><b>1 = Cyclic:</b> track is in cyclic only mode and can't perform service operations</p> <p><b>2 = Service:</b> track is in service mode, meaning, cyclic mode that can perform service operations like scan/pair</p> <p><b>3 = Roaming</b></p> <p><b>4 = Auto</b></p> <p><b>NOTE: Only 1 track can be in Roaming or Service mode.</b></p>
2	TX Power	N V	Get/Set All	USINT	<p>Transmission power</p> <p>Value range: 0x01 - 0x1F</p>

## 12.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x10			Set Attribute Single
0x01			Get Attributes All
0x02			Set Attributes All

## 13 Discrete Input Point Object (Class Code 0x08)

The Discrete Input Point Object can be used to access the digital input data of the IO-Link device. This object is officially defined by the ODVA (see CIP Volume 1).


### 13.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	2 x Number of IO-Link Ports

### 13.2 Instance Attributes

Attribute	Name	NV	Access Rule	Data Type	Description
3	Value	V	Get	BOOL (1 byte)	Input point value 0 = off 1 = on

### 13.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single

### 13.4 Relationship of CIP instances and digital input data of IO-Link ports

Each IO-Link Port is mapped to 2 CIP instances of the Discrete Input Point Object. Therefore, the maximum number of CIP instances is (2 x "Number of IO-Link Ports").

In general, there are 2 digital inputs possible for an IO-Link port: the C/Q pin (pin 4) and the I/Q pin (pin 2). Each pin is mapped to exactly one CIP instances.

	IO-Link Port 1		IO-Link Port 2		IO-Link Port 3		...	IO-Link Port n	
<b>CIP Instance</b> <sup>1) 2)</sup>	1	2	3	4	5	6	...	2n-1	2n

IO-Link Pin	C/Q	I/Q	C/Q	I/Q	C/Q	I/Q	...	C/Q	I/Q
<p>1) For C/Q instances (1, 3, 5, etc.): the instance can only be accessed when the IO-Link "port mode" is configured to <b>3 = Digital Input</b> (see <a href="#">IO-Link Port Configuration Object (Class Code 0x80)</a>(see page 20)). If it is not configured for "DI" all service addressing that instance will be rejected with general status 0x0C (Object state conflict).</p> <p>2) For I/Q instances: the instance can only be accessed when the I/Q pin is available (IO-Link class A device and I/Q pin is connected) and the "IQ behavior" is configured to <b>1 = Digital Input</b> (see <a href="#">IO-Link Port Configuration Object (Class Code 0x80)</a>(see page 20)). If it is not configured for "DI", all service addressing that instance will be rejected with general status 0x0C (Object state conflict).</p>									

## 14 Discrete Output Point Object (Class Code 0x09)

The Discrete Output Point Object can be used to access the digital output data of the IO-Link device. This object is officially defined by the ODVA (see CIP Volume 1).





### 14.1 Class Attributes

Attribute	Name	Access from EtherNet/IP Network	Value
1	Revision	Get	1
2	Max Instance	Get	2 x Number of IO-Link Ports

### 14.2 Instance Attributes

Attribute	Name	NV	Access Rule	Data Type	Description
3	Value	V	Get	BOOL (1 byte)	Input point value 0 = off 1 = on

### 14.3 Supported services

Service Code	Supported on		Service Name
	Class Level	Instance Level	
0x0E			Get Attribute Single
0x10			Set Attribute Single

### 14.4 Relationship of CIP instances and digital output data of IO-Link ports

Each IO-Link Port is mapped to 2 CIP instances of the Discrete Output Point Object. Therefore, the maximum number of CIP instances is (2 x "Number of IO-Link Ports").

In general, there are 2 digital outputs possible for an IO-Link port: the C/Q pin (pin 4) and the I/Q pin (pin 2). Each pin is mapped to exactly one CIP instances.

	IO-Link Port 1	IO-Link Port 2	IO-Link Port 3	...	IO-Link Port n
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<b>CIP Instance</b> <sup>1) 2)</sup>	1	2	3	4	5	6	...	2n-1	2n
<b>IO-Link Pin</b>	C/Q	I/Q	C/Q	I/Q	C/Q	I/Q	...	C/Q	I/Q

1) For C/Q instances (1, 3, 5, etc.): the instance can only be accessed when the IO-Link "port mode" is configured to **4 = Digital Output** (see [IO-Link Port Configuration Object \(Class Code 0x80\)](#)(see page 20)). If it is not configured for "DO" all service addressing that instance will be rejected with general status 0x0C (Object state conflict).

2) For I/Q instances: the instance can only be accessed when the I/Q pin is available (IO-Link class A device and I/Q pin is connected) and the "IQ behavior" is configured to **2 = Digital Output** (see [IO-Link Port Configuration Object \(Class Code 0x80\)](#)(see page 20)). If it is not configured for "DO", all service addressing that instance will be rejected with general status 0x0C (Object state conflict).