**TEConcept GmbH**
Wentzingerstr. 21
D-79106 Freiburg

Tel. +49 761 21443640
Fax +49 761 21443631
E-Mail: info@teconcept.de

# IO-Link-Control-Tool Quick Start Guide

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| Document ID | IO-Link-Control-Tool |
| Author | Franz-Otto Witte |
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| Status | Release |
| Version | V1.8 |

### 1.1.1 Contents

# References

| Ref No. | ID | Document Title | Date | Version |
|---|---|---|---|---|
| 1 | 10.002 | http://www.io-link.com/share/Downloads/Spec-Interface/IOL-Interface-Spec_10002_V112_Jul13.pdf | Jul 2013 | V1.1.2 |
| 2 | 10.012 | http://www.io-link.com/share/Downloads/Spec-IODD/IO_Device_Description_V1.1_Specification.zip | Aug. 2011 | V1.1 |
| 3 | | http://www.io-link.com/share/Downloads/Guide-IODD/IO-Device-Desc-Guideline_10022_V11.zip | July 2013 | V1.1 |
| 4 | | http://www.io-link.com/share/Downloads/Spec-IODD/IODD_V1.1_Checker_V1.1.1.0.zip | Feb 2013 | V1.1.1 |
| 5 | | IO-Link Test Specification | July 2014 | V1.1.2 |

# Version history

| Version | Date | Description | Status | Author |
|---|---|---|---|---|
| 1.0 | 2013-11-14 | Initial Version | Draft | OW |
| 1.1 | 2016-03-22 | Update and screen shots | | OW |
| 1.2 | 2016-06-21 | Version 2.0.0.0 update | A | PZ |
| 1.3 | 2016-10-14 | Version 2.1 update | A | OW |
| 1.4 | 2017-03-31 | Version 2.2 update (Added 4.2.1 Menu Representation) | A | PZ |
| 1.5 | 2017-04-07 | Settings description added | A | PZ |
| 1.6 | 2017-04-18 | DS Validity description | A | PZ |
| 1.7 | 2017-08-31 | Version >=3.0 changes/improvements | M, A | PZ |
| 1.8 | 2017-10-06 | Action log | A | PZ |
| Status: M = Modified, A= Added, D = Deleted | | | | |

# 2 Introduction to the IO-Link Control Tool

IO-Link devices /1/ provide various advantages over standard SIO-mode devices. One of the most prominent features is its ability to configure IO-Link devices remotely in an easy fashion.

The functionality of each IO-Link device is described in a formal way by means of the IO-Link Device Descriptor "IODD" file. An IODD is a well defined XML file. Its syntax and semantics is described in detail in the IO Device Description specification /2/. Examples can be found in the IO Device Description Guideline /3/. The syntactical correctness of the of the IODD files can be automatically checked by using the IODD checker tool /4/.

This document describes the IO-Link control tool "CT", a basic configuration tool for windows PCs (Win7 and newer) for IO-Link masters that are controlled by a serial protocol as defined in the IO-Link test specification /5-A4.4/ like the TEConcept IO-Link Masters. It supports a generic way of configuring IO-Link devices that are connected to IO-Link masters.

The serial communication protocol used to communicate between IO-Link masters and the control tool is designed in a generic way so that it can be used on a variety of serial communication interfaces.

Currently the following interfaces are supported:

- RS232 (serial interface )
- Ethernet
- USB
    - CAN (via USB-CAN adpter)
    - SPI (via Aardvark USB-SPI adapter)
    - SPI (via FTDI USB-SPI converter cable)

In addition to these simple communication interfaces the configuration may also be realized via a field-bus interface that is provided by the IO-Link master. The following mappings are planned:

- Profibus (DP)
- Ethercat
- ASI
- CIP (Ethernet – IP)
- OPC-UA

It should be mentioned that the configuration of the IO-Link devices may use the standard fieldbus mapping interface of the master. However this is not mandatory. Also setups where the IO-Link master offers a parallel path for configuration are supported.

Some IO-Link masters offer fieldbus interface focusing on process data exchange and a side path focusing on diagnosis and configuration via a second interface (USB or TCP/IP OPC-UA).

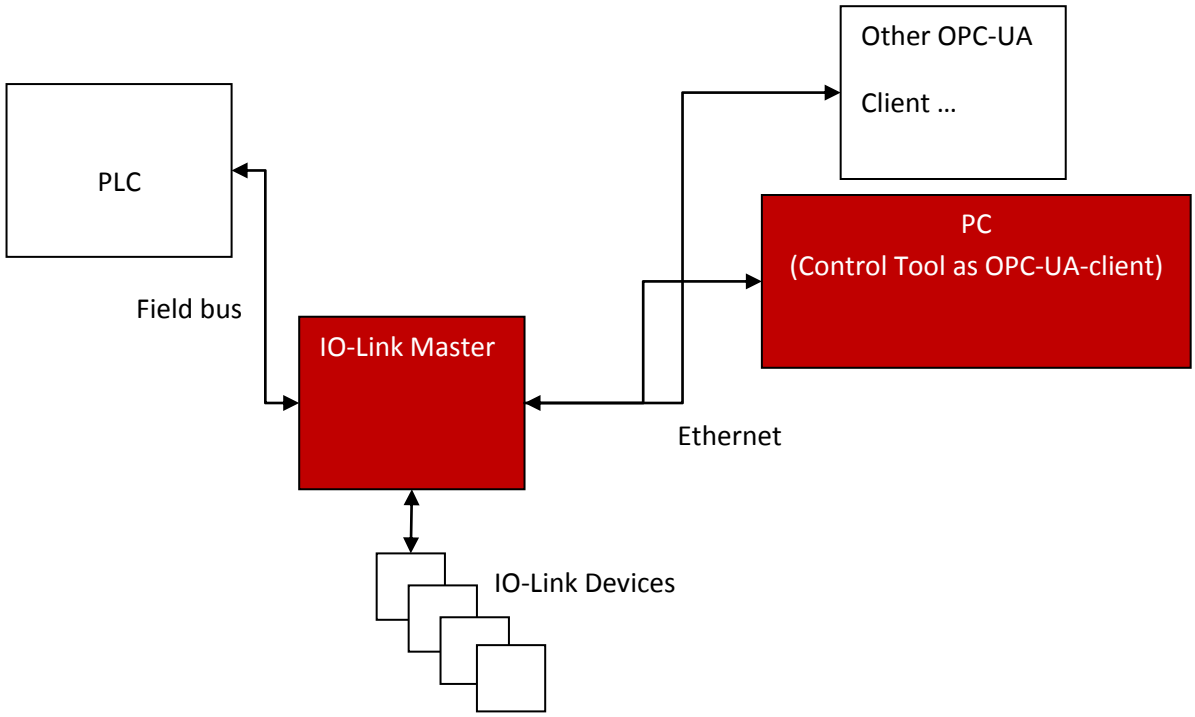



Figure 1 Control tool usage in a field bus environment

# 3 How to use the Control Tool

## 3.1 Connect the Master

After you start the control tool the following screen pops up:

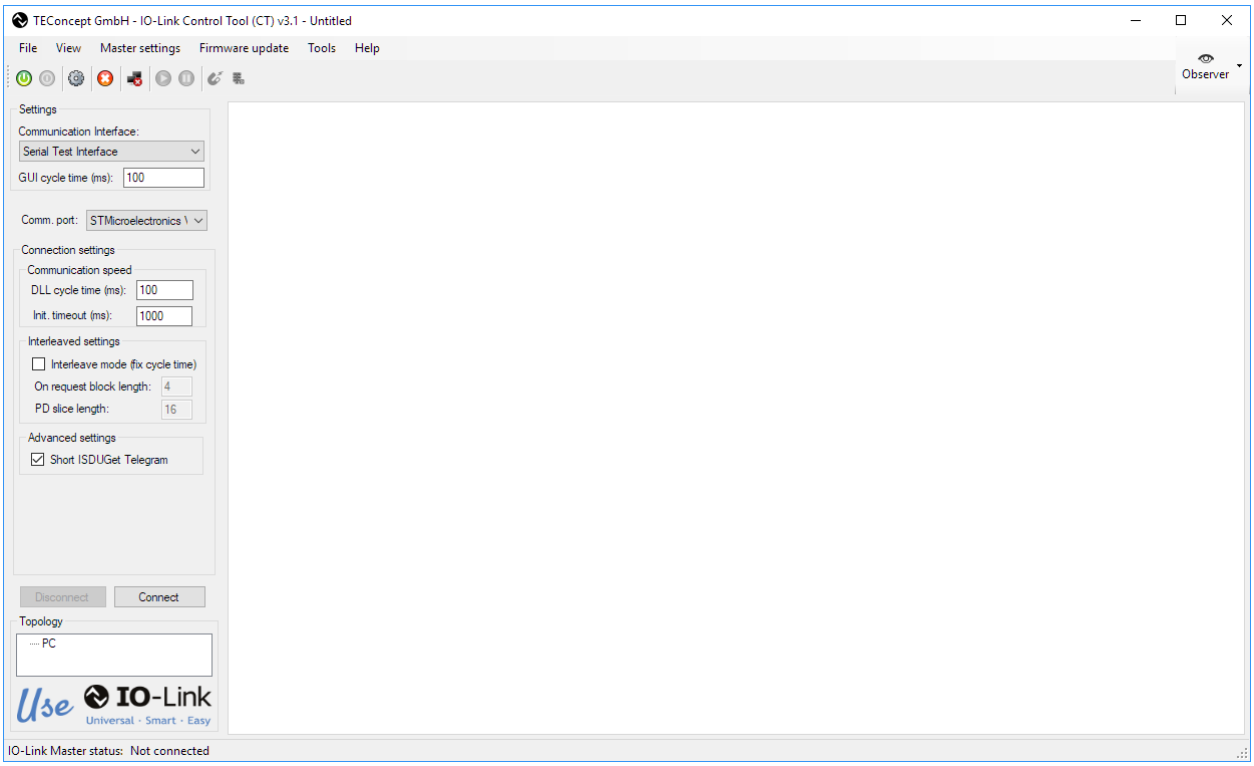



Figure 2 CT start screen

### 3.1.1 Communication Interfaces

From the Control Tool version 3.1 and above the communication interface has to be also selected. The Control Tool calls the communication functions defined in the highest abstraction layer of the communication hierarchy and because of this the communication can be extended with vendor specific communication protocols.

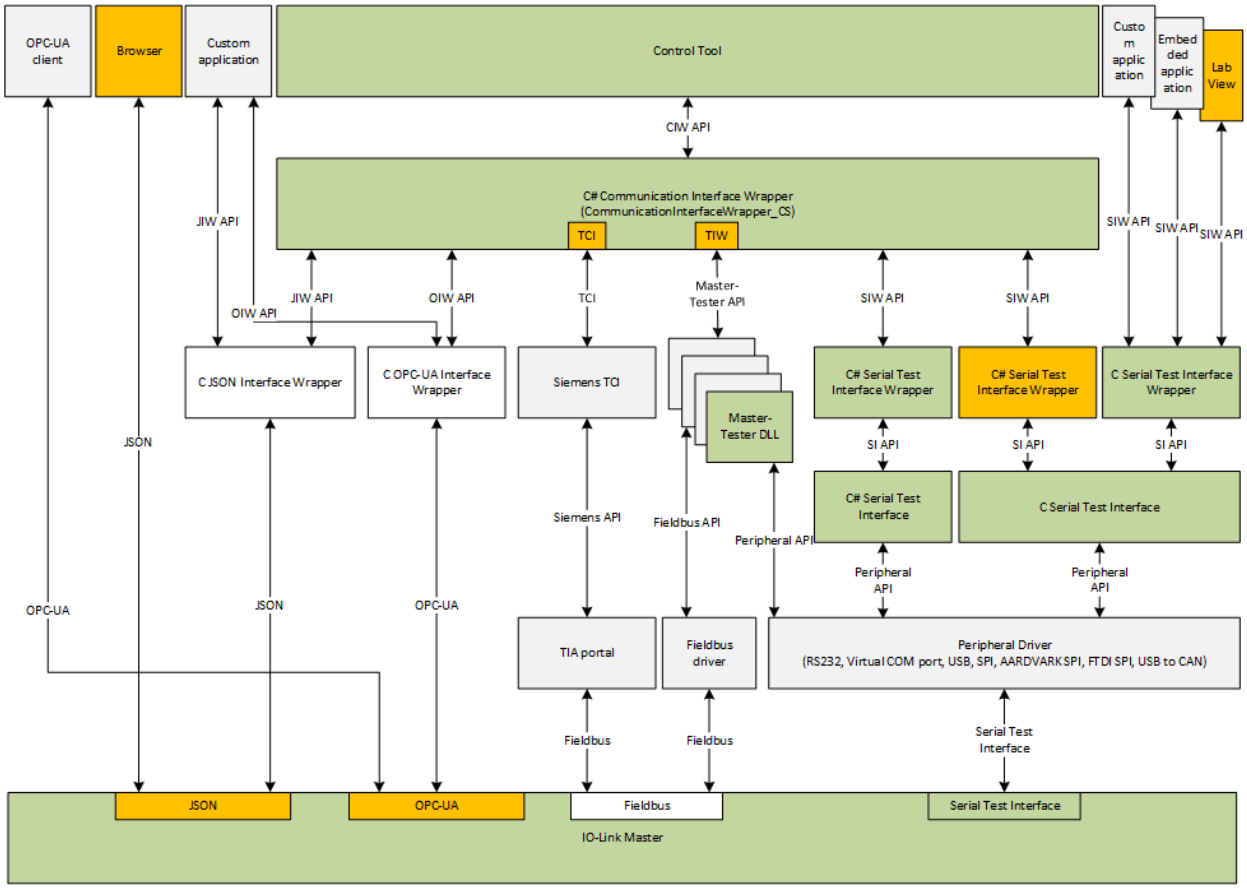



Figure 3 Control Tool Communication Interface Hierarchy

Note: the communication protocols marked with yellow are currently under development.

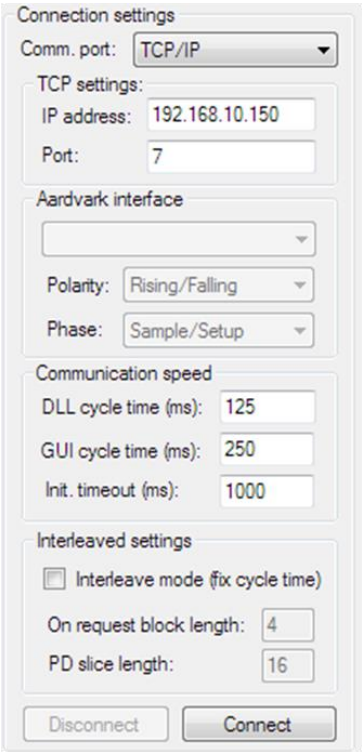
#### *3.1.1.1 Serial Test Interface*

The serial test interface communication type should be selected if the USB - Serial Test Interface communication protocol is used by the master and the Control Tool for communication.

The following protocols are defined here:

- Serial Port
- USB-CAN
- USB-SPI (Aardvark USB-SPI adapter or FTDI USB-SPI)
- Ethernet

If a new master is connected, a connection type needs to be selected initially. For this press the  Icon in the top menu. The following dialog becomes visible:



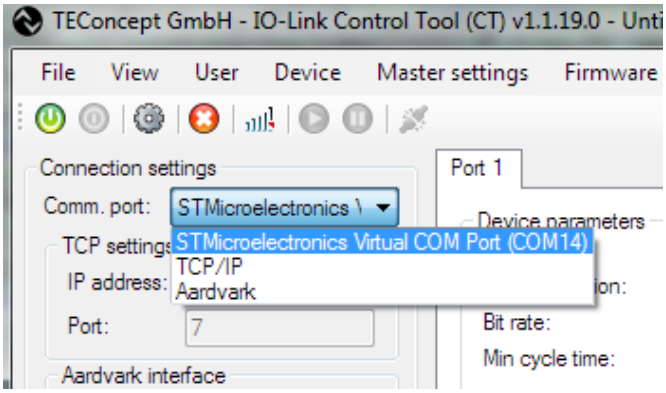




Figure 4 Connection Settings

Select the right communication interface in the drop down box. In case of a connected USB master a virtual com port from ST-Microelectronics should be listed.

In case of an Ethernet master you have to type the right IP-address. If you do not know the right IP-address of the master (for example if the IP address is assigned by an DHCP server) you can ask the control tool to discover the IO-Link master within the subnet covered by the DHCP server by selecting the item “discover masters on network” of the “Master settings” menu entry.

A checkbox in the connection panel is called “Interleave mode (fix cycle time). This box should only be selected for IO-Link masters that support the extended serial interface.

The extended serial interface uses a wrapper layer for the configuration protocol that uses fixed length transfers between master and control tool and it assures that process data of all devices are transferred at predictable time slots. Effectively the interleave mode enables short latency real time operation with a master, preferrably via an SPI interface. The interleave mode is applicable to SPI communication via

FTDI USB-SPI converter. The interleaved settings should stay disabled for standard for masters using the standard configuration protocol.

If everything is selected, press the "connect" button.

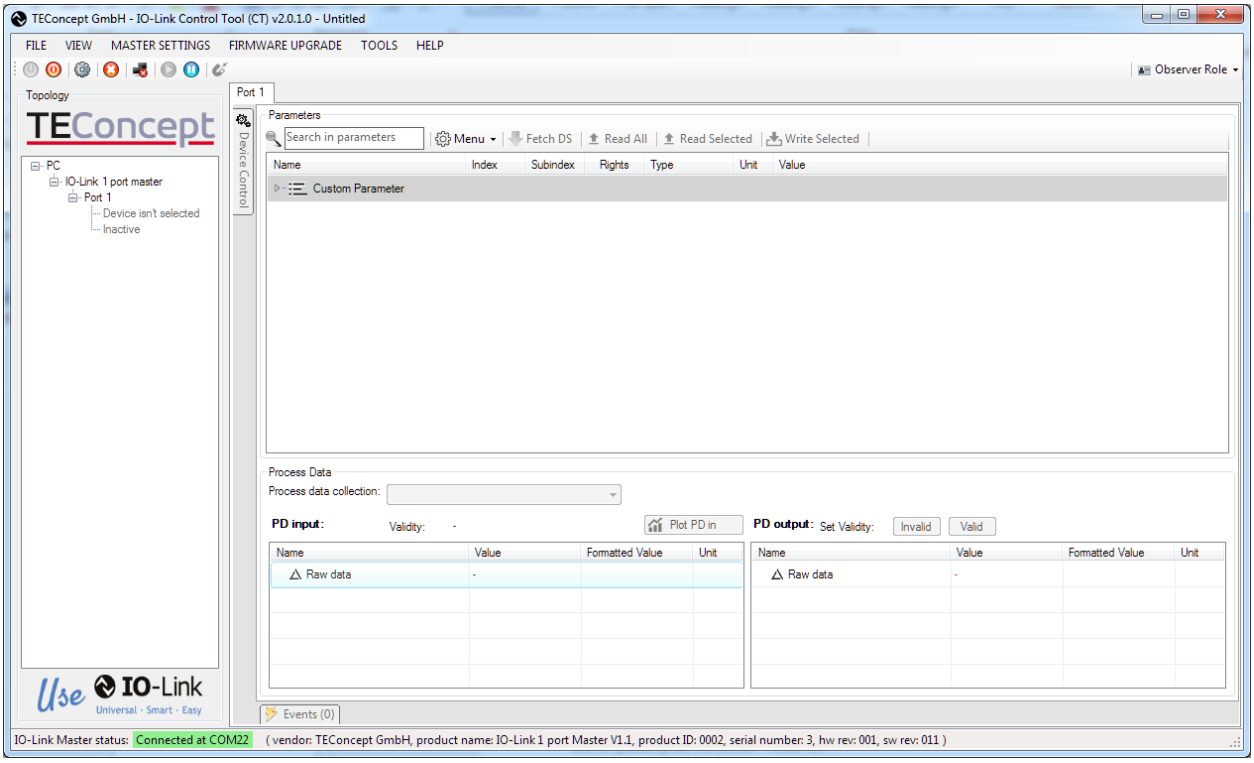


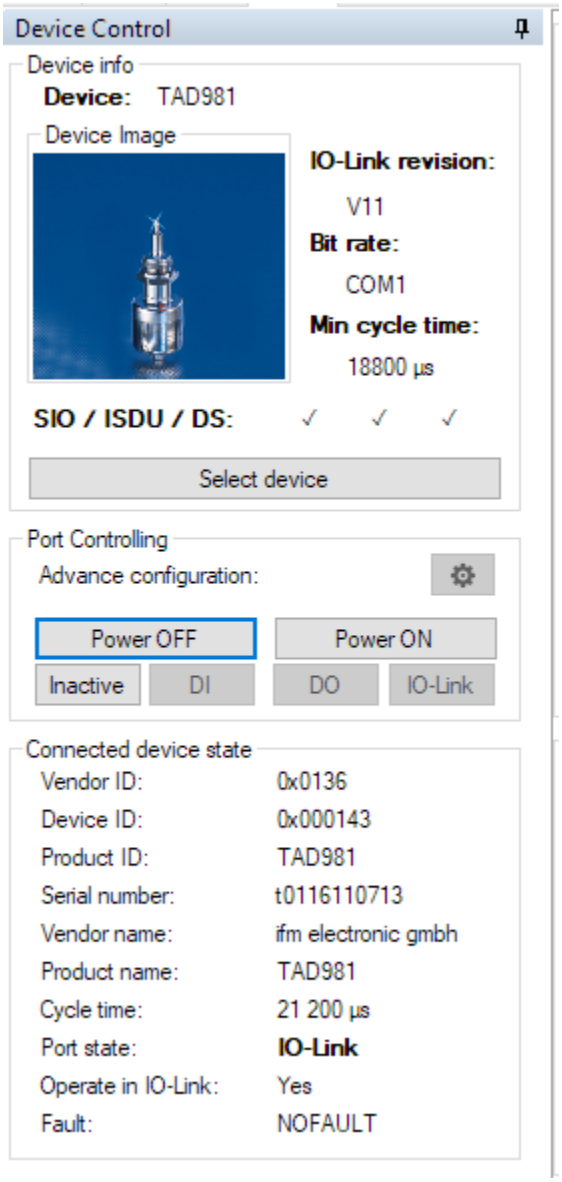

Figure 5 Master is connected

Now the master is connected. Please check the green text in the bottom status line. Here you also see the id as well as hardware and firmware versions of the connected master.

## 3.2 Connect the Device

The next step is to connect a device to the master. For this the “Device Control” tab has to be used. For masters that provide a power switch per device, the device power can be switched on or off by this panel.

The user can also select some operation modes in which he wants to utilize the device. The following picture shows the device control tab.


Device Control
Device info
Device: TAD981
Device Image
IO-Link revision:
V11
Bit rate:
COM1
Min cycle time:
18800 µs
SIO / ISDU / DS: ✓ ✓ ✓
Select device
Port Controlling
Advance configuration:
Power OFF
Power ON
Inactive
DI
DO
IO-Link
Connected device state
Vendor ID: 0x0136
Device ID: 0x000143
Product ID: TAD981
Serial number: t0116110713
Vendor name: ifm electronic gmbh
Product name: TAD981
Cycle time: 21 200 µs
Port state: IO-Link
Operate in IO-Link: Yes
Fault: NOFAULT

### 3.2.1 Operation without IODD

If you don't have an IODD of your device, simply press the "IO-Link" Button. The device will wake up and you see some information about the device in the information area under the "IO-Link" Button.

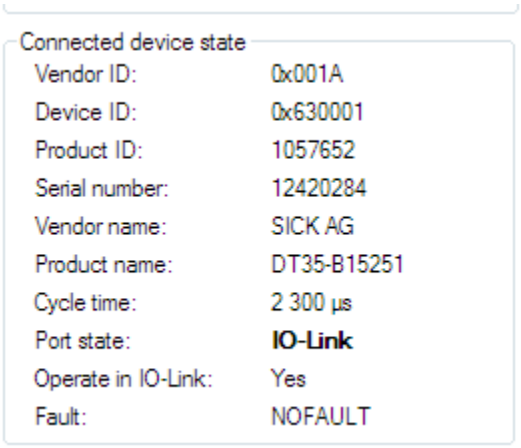



Figure 6 Device Information area

Without an IODD the tool will not know anything about the parameters of the device. If the user knows a particular indices of the connected device the custom parameter read and write option can be used.

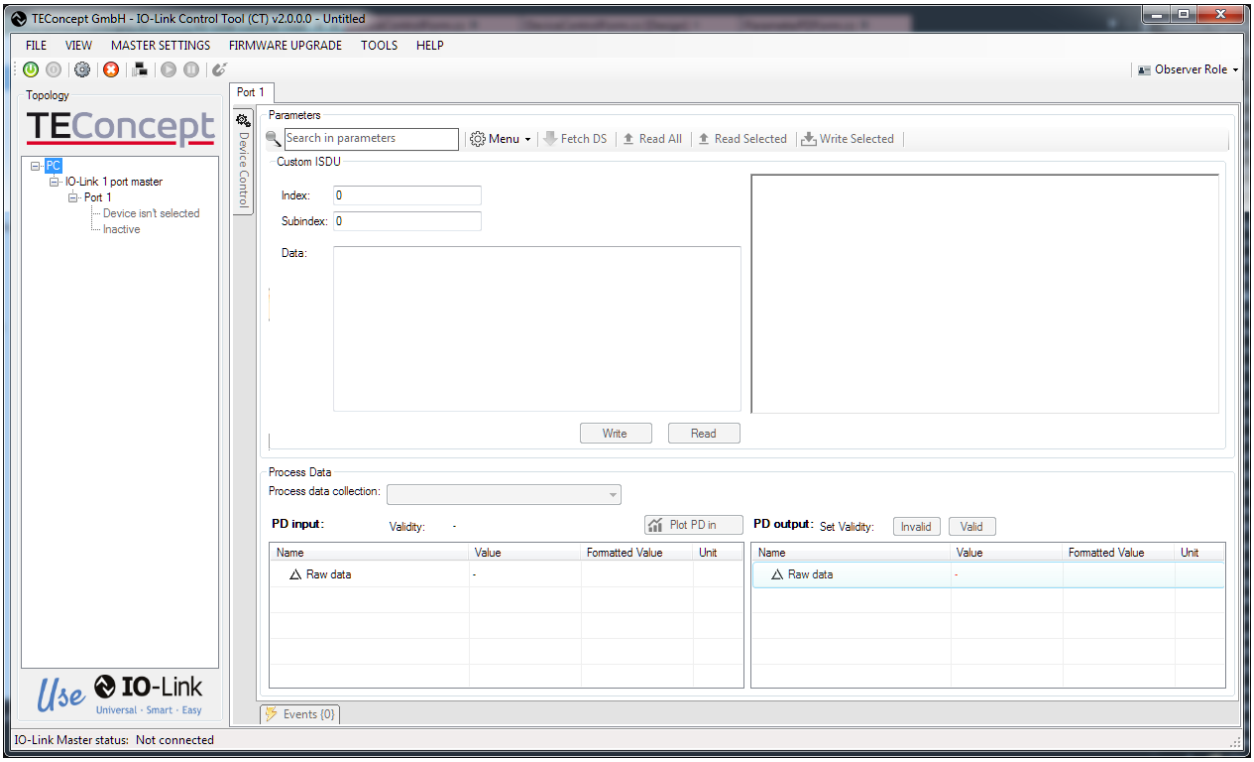



Figure 7 Read an ISDU index

### 3.2.2 Operation with IODD

If you have an IODD for your device, deactivate IO-Link communication (if active) and press "Select Device". A device selector dialog pops up.

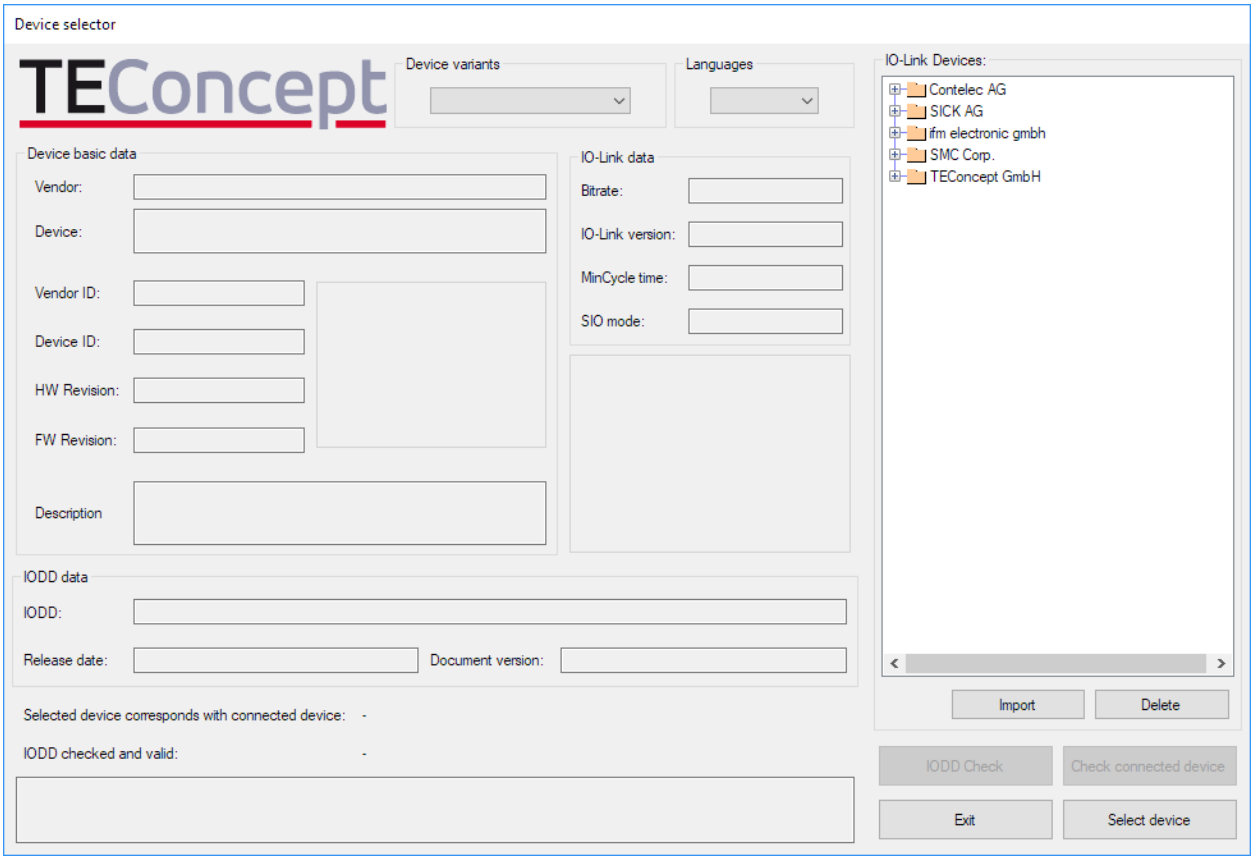
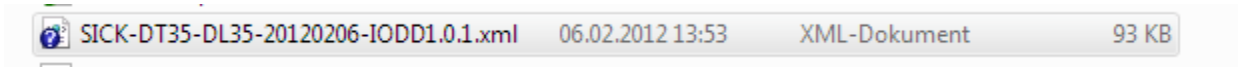



Figure 8 Device selector window

On the right side you can see a list of already known devices. If your device is not in that list, press "Import" and load the IO-Link xml-file of your device.




After the device is imported you can see it on the list. Select the device by opening the vendor folder and select the previously imported IODD. If the IODD is correct, information about the selected device is shown .

If multiple languages defined are defined in the IODD, language can be changed using the language selector combo-box. (Note: this feature only available from version 3.1 and above )

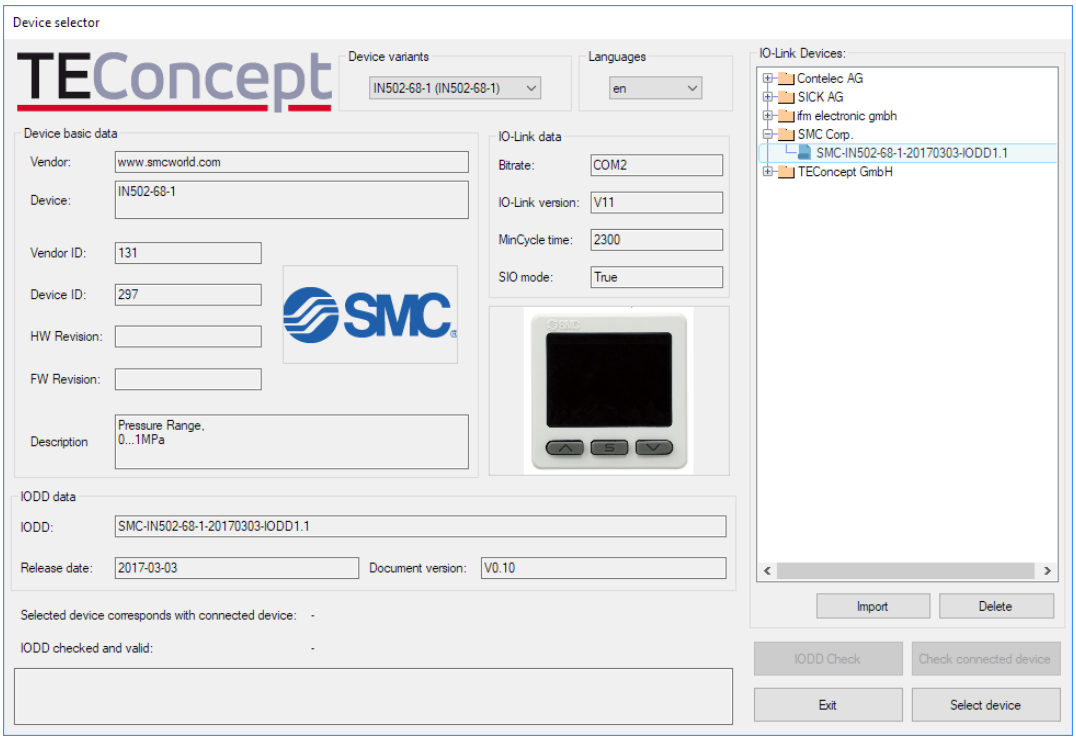



**Figure 9** **Device selector window with selected IODD**

If everything looks ok, press "Select device". The window closes and now your main window is equipped with all kind of information about the device.

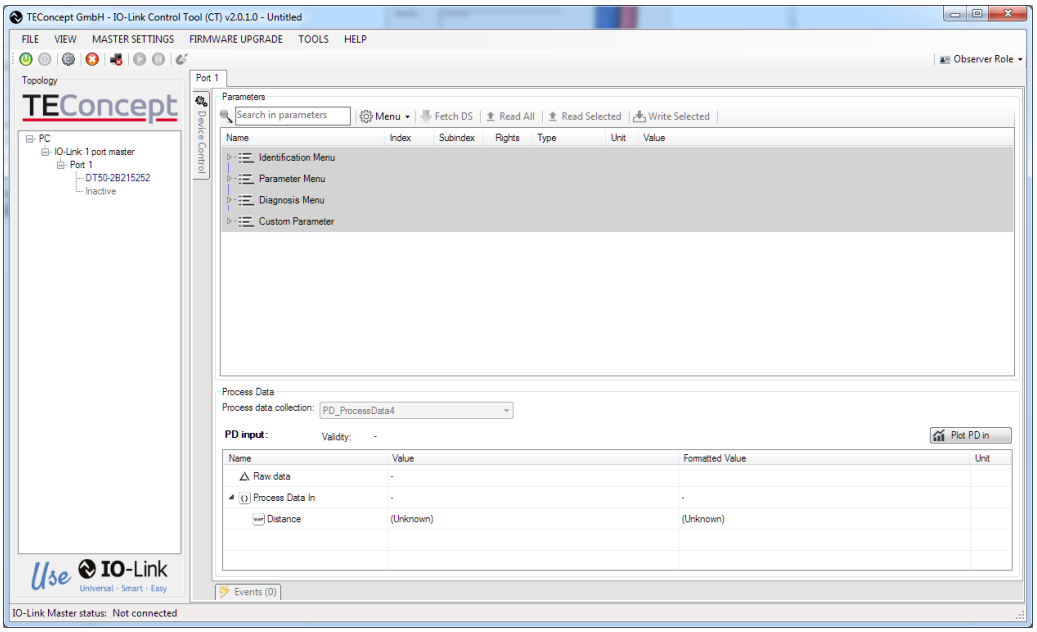


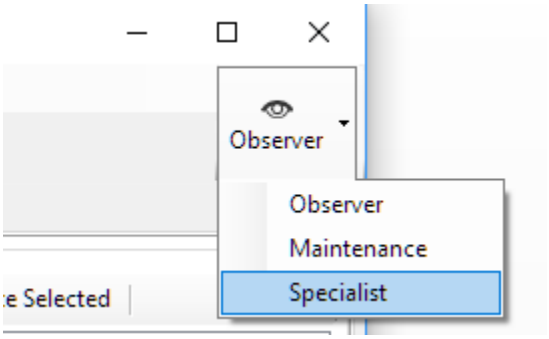

**Figure 10** **Main window of CT with Device Selected**

The parameters are shown in a menu structure as defined in the opened IODD and the user can choose which role want to use.

This procedure has to be done only once. If an IODD is imported into the control tool you only need to enable IO-Link communication. The master reads out the Vendor ID and the Device ID from the device and automatically selects the corresponding IODD from its internal data base.

### 3.2.3 The User Role Menu

On the right side of the top menu bar is is possible to select in which role a user wants to parameterize the connected device.




If the control tool is used in a configuration with user authentification, this menu will not be visible asthe user role will be specified by the log-in process.

# 4 Parameters

After version 2.0 of the Control Tool the parameter view has changed, and a feature that allows to check the integrity of the data storage memory is supported.

The default visualization format for the parameters is defined in the IODD.

## 4.1 Top Menu Strip

At the top of the “Parameters” group box the menu strip is located. In this group of controls the user can search for the a variable, apply various filters on the parameters, fetch the data storage information , Read selected or all parameters and write back certain parameters. The menu strip for parameters is shown in Figure 11 below.

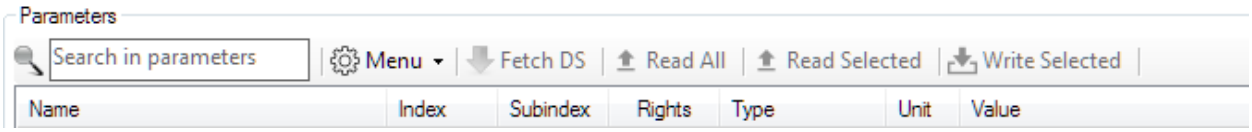



Figure 11 Parameter Strip Menu Layout

### 4.1.1 Search for certain Parameters

The user can search through the list of parameters by typing the search expression into the text box in the left side of the menu strip. The search function utilizes a text match algorithm that shows only parameters that match with the matched expression highlighted. The current search is executed only in expanded parameters, in collapsed parameter tabs the search won’t apply.

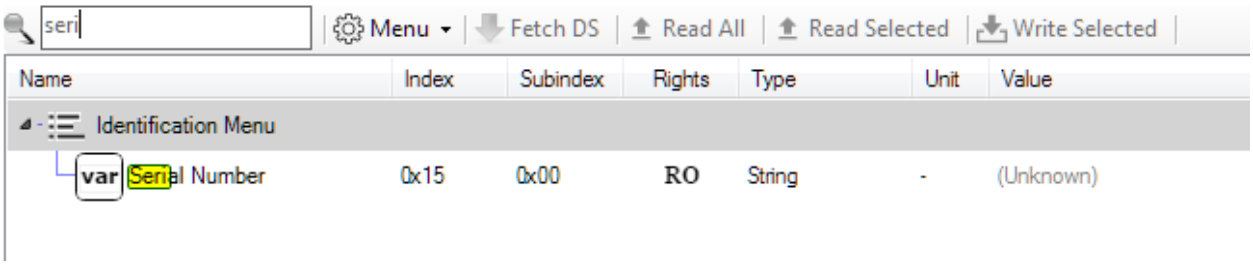



Figure 12 Parameter search result

The search function can be disabled by deleting the search text in the search text box.

### 4.1.2 Menu item

In the menu item the user has various option to customize the view of the parameters. The following picture shows the “Menu” options.

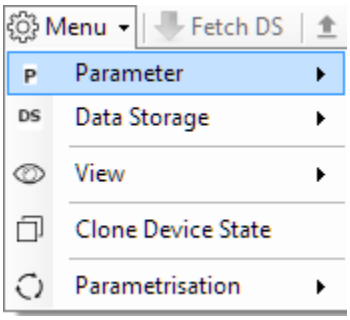



Figure 13 Submenu “Menu” of the Parameter Strip Box.

#### 4.1.2.1 Menu Items

Here is defined the options that can be applied on the parameter view.

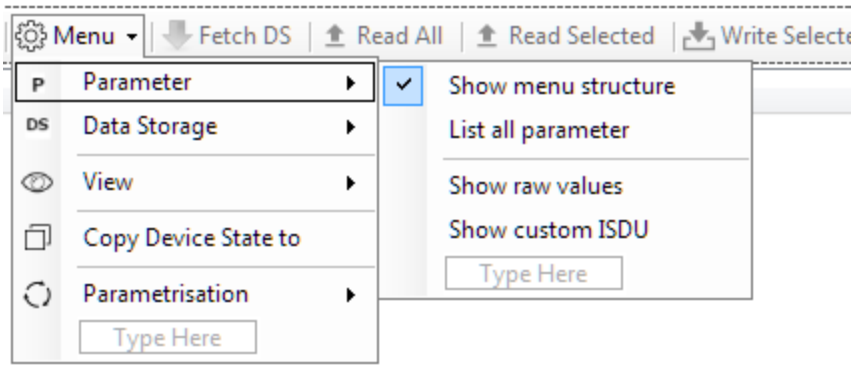



Figure 14 Menu item Parameters

The parameters are visualized through the menu structure as mentioned above. Here the user can select to see all the parameters that are defined in the IODD whether it is in the menu structure or not by enabling the “List all parameter” option. Alternatively the parameters are combined into expandable groups depending on structuring elements assigned to them in the IODD.

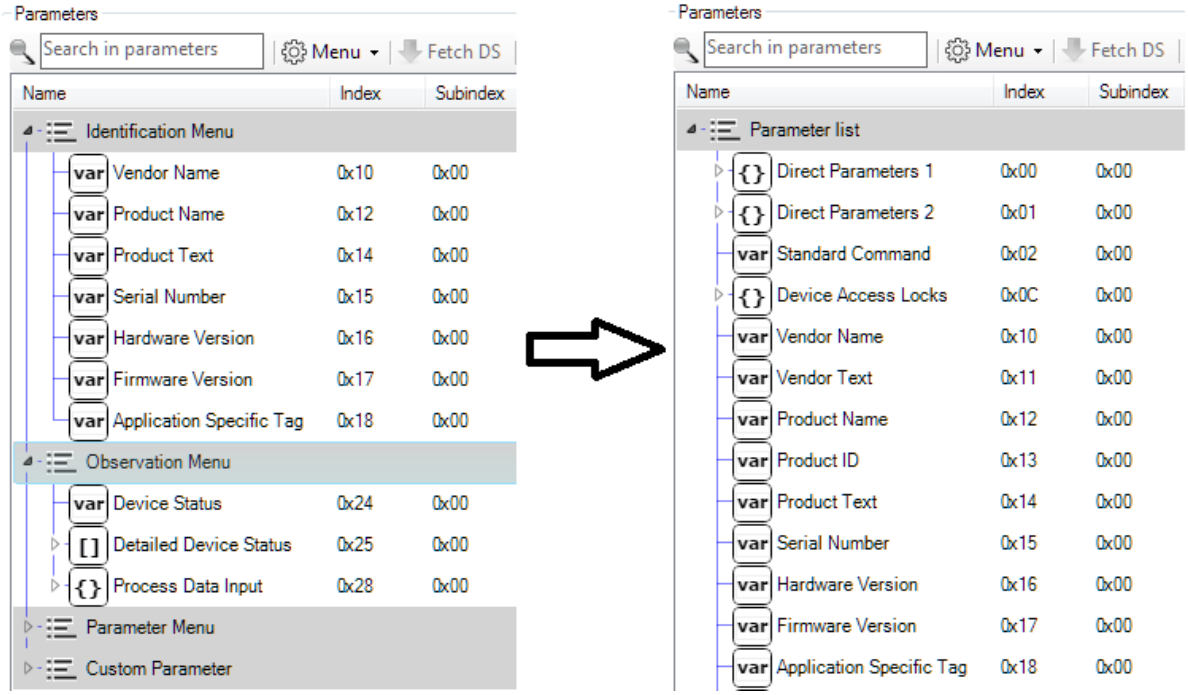



Figure 15 Parameter View options

If parameters are shown in groups, unit code and other menu structure specific settings are shown, that are not displayed in the unstructured “list all parameters” view.

If the “Show raw values” option is checked also a “Raw value” column appears as shown in the following picture.

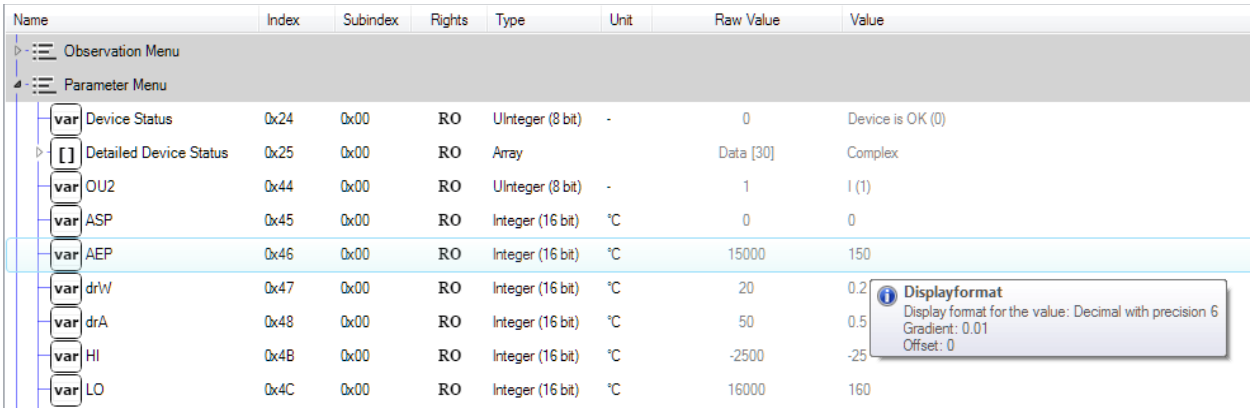



Figure 16 Raw value column

If the “Raw Value” column appears,it shows the value of the parameter without any display formatting – in that form in which the value is written or read out from the device.

In Figure 16 above for example the AEP parameter has a raw value of 15000 that corresponds to 150° in in interpreted from in the "Value" column by applying gradient, offset and unit information.

Hovering the cursor on the "Value" cells the tooltip will show the applied display format. If a display format is not specified in the IODD, the "Value" column will show the same as the "Raw Value" column.

If the "Show custom ISDU" option is checked it will bring back the a simple parameter read / write panel. This panel can be used to read or write particular indices by its index and subindex.

### 4.1.2.2 Data Storage

Here all options that can be applied to the data storage view can be handled. The following picture shows the data storage menu item.

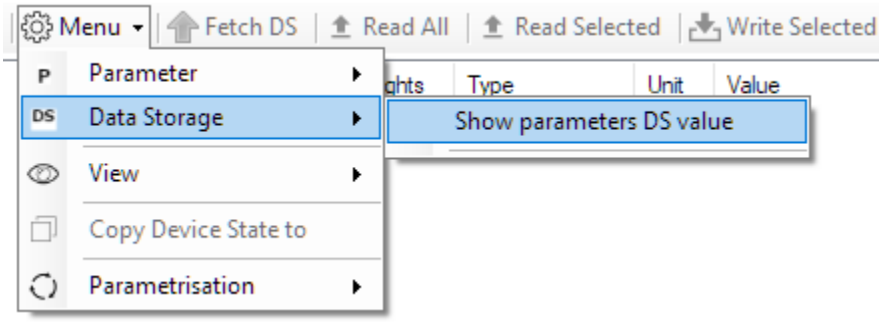



Figure 17 The Data Storage Menu Options

The first option "Show parameters DS value" adds a column that show the parameter's data storage value to the parameter view as shown in the following figure.

The following picture shows the view if the data storage view is added.


Figure 18 Data Storage Value Display

### 4.1.2.3 Menu-View

The following picture shows the view menu item.

The "Show tooltips" options is enabled by default. If the frequent occurrence of the tooltips becomes annoying to the user it can be disabled here.

#### 4.1.2.4 Menu - Clone device state

If the master has more than one port this function can be used to clone the device state (parameter values) from one port to another.

The following picture demonstrates when an 8-port master is connected and cloning the port is desired.

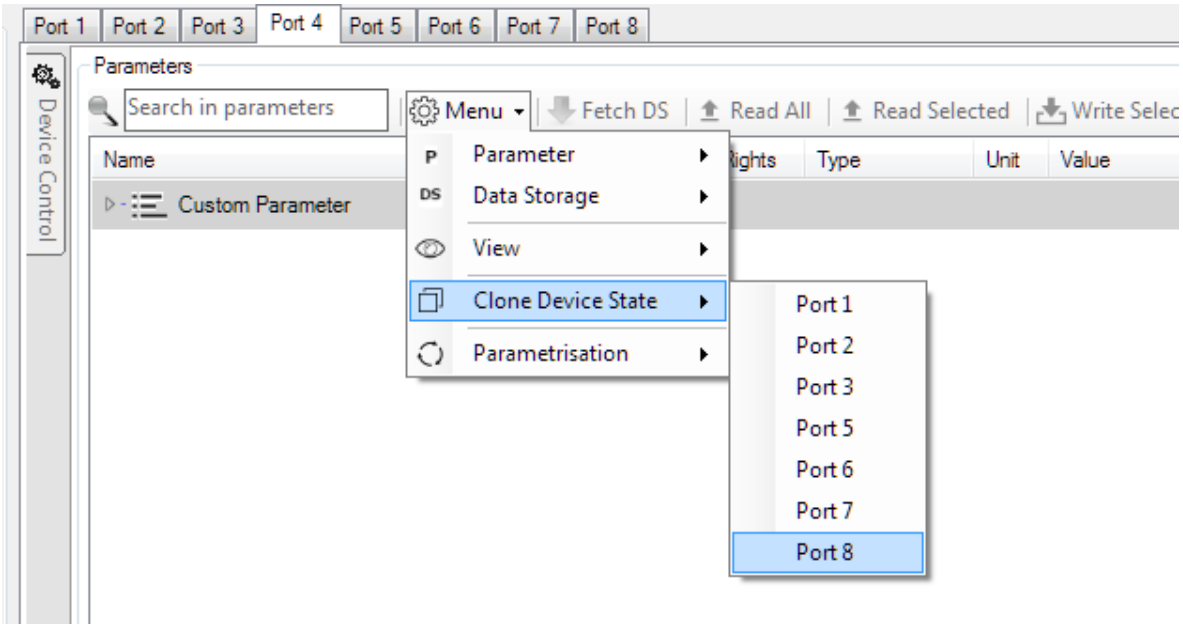



Figure 19 Cloning Device Configuration

The device state cloning function can only be used if all the parameters (readable) have up-to-date (green) values. This can be achieved easily by selecting the “Read All” Menu entry first.

#### 4.1.2.5 Online Parameterization

The parameterization option is disabled by default and can be only enabled if the device reaches the operating state. If the online option is enabled, changing the value of an parameter will automatically indicate a write request for the device with the new value.

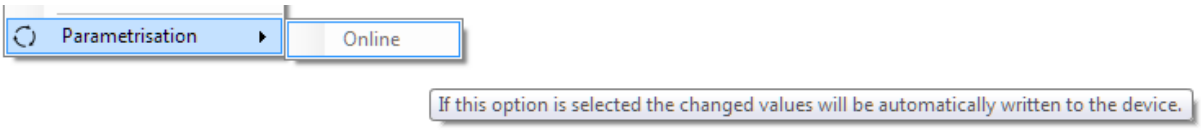
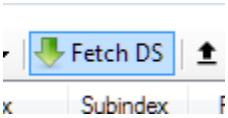



Figure 20 Parameterization in Online Mode

### 4.1.3 Fetch DS

This function does trigger a data storage download from the device to the master (and the control tool). The following picture shows the Fetch DS menu item.




This menu item will be only available to the user if the device is in operate state. If the following device configuration is not enabled a warning message will appear that the data storage mode isn't activated.

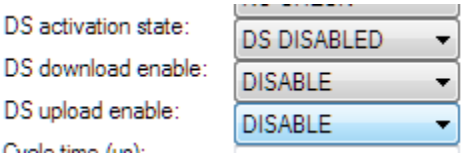



Figure 21 Data Storage operation modes

### 4.1.4 Read all / Read Selected / Write Selected

The following picture shows the read/write menu items in the parameters menu strip.

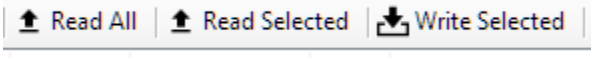



Figure 22 Read Write Items in Parameter Menu Strop

The "Read selected" and "Write Selected" functions will issue a read or write operation on the selected parameter(s). (Selection can be done by highlighting the desired parameters with the pointing device". The "Read All" function will read out all the readable parameters on the current view.

## 4.2 Using the parameter view

This section will demonstrate how to use the parameter view. The parameter view has 9 columns, 7 of them is visible by default:

| Column name | Description |
|---|---|
| **Name.** | The name of the parameter |
| **Index.** | The index of the parameter |
| **Sub index** | The sub index of the parameter, if the parameter is simple type this value is fixed to 0x00 (0). |
| **Rights** | The access rights of the parameter or restriction if it is added to the menu. (E.g.: observer role normally has a read restriction). |
| **Type** | Shows the variable's data type. |
| **Unit** | Displays unit of parameter if defined in the menu part of the IODD |
| **Value** | Show the formatted value of the parameter according to its definition in the menu part of the IODD |
| **Raw Value.** | Shows in the Menu/Parameter/Show parameter raw format (Hex value)<br>This column is not enabled by default. |
| **DS Value** | The value of the parameter as it is stored in the data storage. (Applicable only, if the corresponding parameter is listed in the index list of DS parameters)<br>This column is not enabled by default. |

(The columns can be reordered by selection the column and dropping in the desired position.

### 4.2.1 Menu Representation

The Control Tool with version number 2.2.6299 (and above) supports the full menu hierarchy. In the previous versions of the software the tool showed only the referenced parameters (variables) under the proper menu (Identification, Observation, Parameter and Diagnosis). The new Control Tool shows not only the referenced variables inside the menu but the defined sub-menus inside in it.

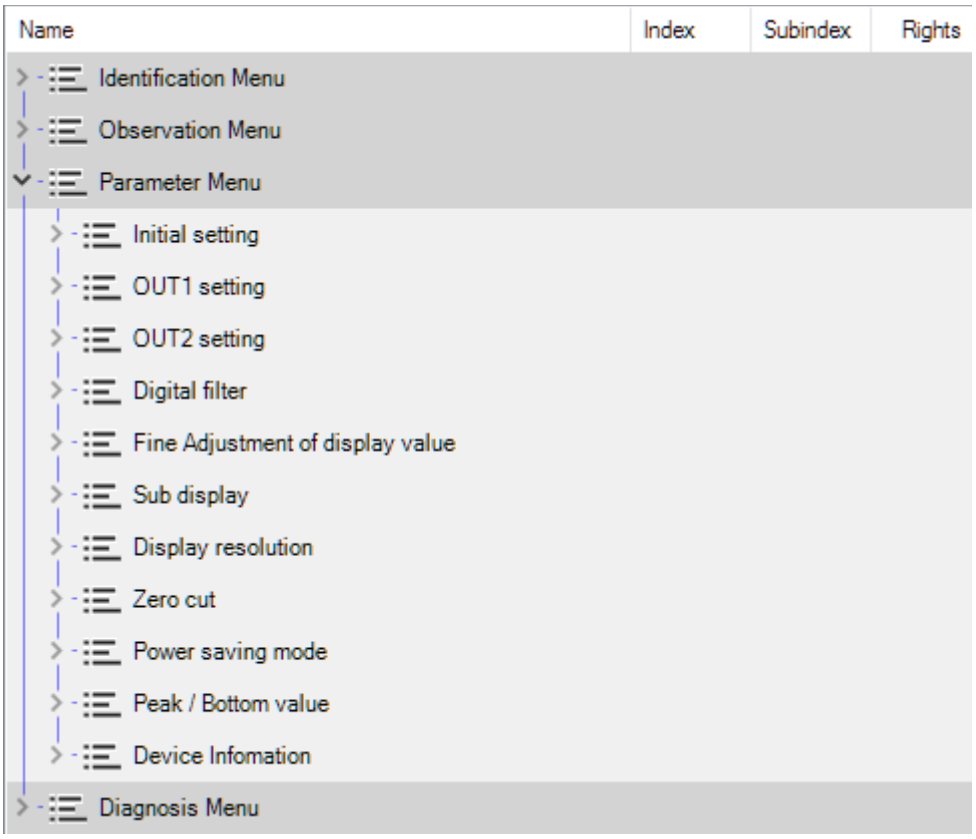
#### *4.2.1.1 Top-Level Menus*

The top-level menus are represented with dark grey background color and shows the four different menu: **Identification**, Observation, Parameter and Diagnosis.


Note: only the Identification top-level menu is mandatory the other menus may not appear depending on the IODD definition.

#### *4.2.1.2 Sub-Menus*

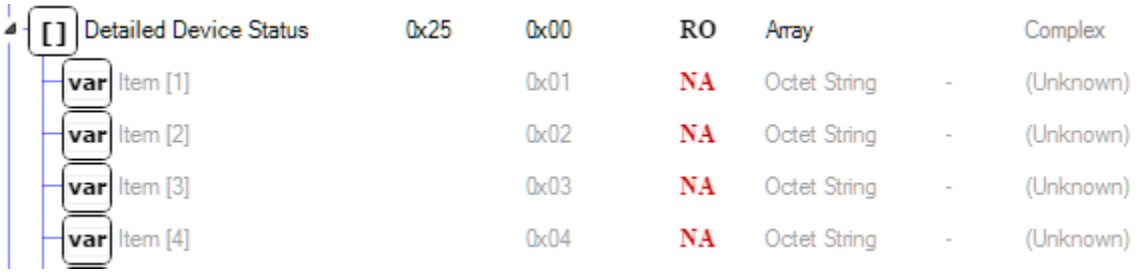
The sub-menus are represented with light grey color and shows the menus defined in the IODD.



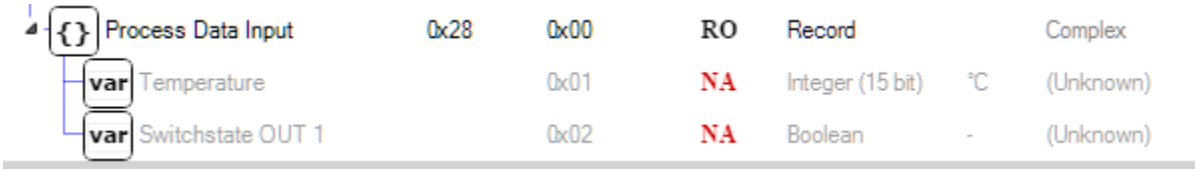

### 4.2.2 Parameter Representation

The parameters are separated to three category from their data type. The three main category are the following:

**Array** [] – The view can be expanded to show all array elements.



**Record** {} – The view can be expanded to show all record elements




**Simple type [var]** – not expandable.


#### 4.2.2.1 Access rights

There are four type of access rights:

- RW – marks the variable (or record item or array item) readable and writeable.
- RO – marks the variable (or record item or array item) only readable.
- WO – marks the variable (or record item or array item) only writeable.
- NA – marks an array item or record item as not available for read or write operation as an individual sub-index (see details below).

The tool uses the access right restriction defined in the menu collection of the IODD for each variable, if the menu item that defines the reference to the variable doesn't restricts the access right, the parameters access right will be shown.

***NA (not available)***: this attribute is used only when the variable is complex type and the variable's sub index support is set to false. That means the sub index can't be accessed individually, the whole variable that contains the record item or array item should be read or written.

The value of the parameter that is not available can be changed as well, just can't be read or write individually, the tool will always issue the request as a request for the whole variable (with sub index 0x00).

#### 4.2.2.2 Unit

If the menu contains a unit definition for the referenced variable than the unit code will be shown in this column.

#### 4.2.2.3 Value

Here is the formatted value is shown. This column only differs from the Raw Value column hat here the data is formatted according to the display format.

In this column the parameter's values are shown except if the parameter is a complex data type, because complex data types can become extremely large. In this case just the text "Complex" text is shown. The user has to expand the complex data row in order to see the values for all individual items.

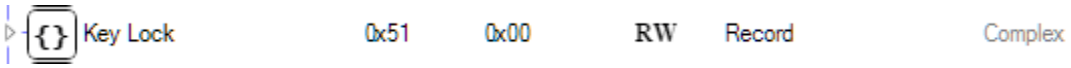



Figure 23 Visualization of a Record parameter

The coloring of the value field depends on the state of the parameter.

If the IODD is opened and the default values that are defined in the IODD are shown in gray color . If the variable doesn't have default values than the (Unknown) is shown the value is ***grayed*** out.

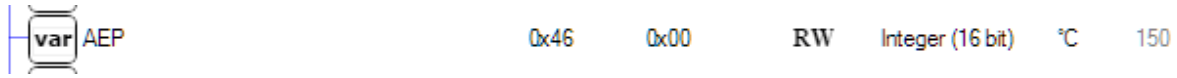



Figure 24 Visualization of a Parameter based on its IODD values

The value will have ***green*** color if it is "up to date", this means if the parameter is successfully read or write so the value is the same what is in the device.

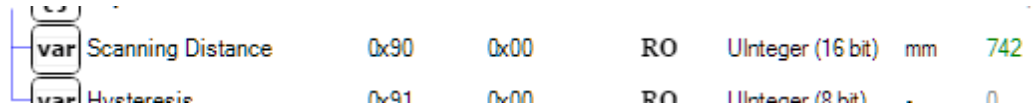



Figure 25 Visualization of a parameter after access on Device

The value will be ***red*** if the read or write operation returns with a negative response. If the user hovers the cursor in the value the error text will be shown.

The value will be ***blue*** if the value of the parameter is changed but was not written to the device yet.

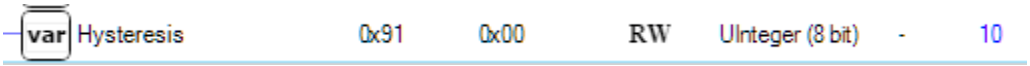



Figure 26 Visualization of a parameter that is changed in the CT but not updated on the device

#### 4.2.2.4 Raw Value

The "Raw Value" column holds an unformatted view of the parameter content. For record data types the difference Raw Value shows the complex data's byte array.

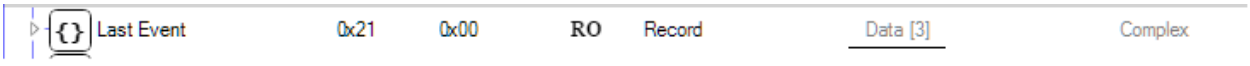
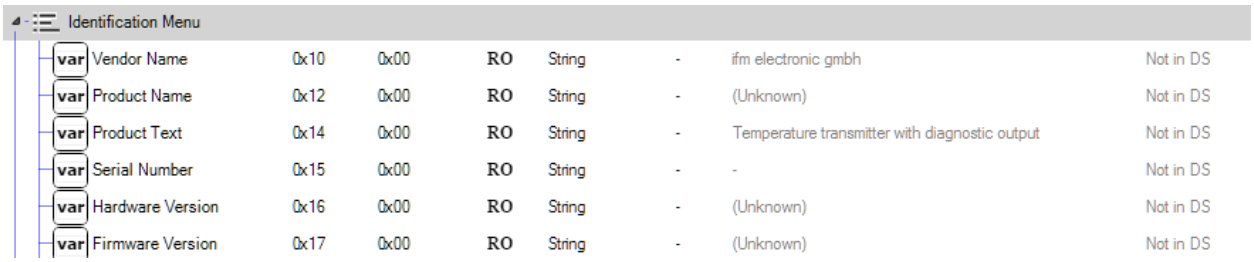



Figure 27 Raw Record (not expanded)

#### 4.2.2.5 DS value

In this column the data storage value is shown. If a parameter is not in the data storage index list or the parameter is excluded from the data storage the following note will be shown.



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Identification Menu | | | | | | | |
| var Vendor Name | 0x10 | 0x00 | RO | String | - | ifm electronic gmbh | Not in DS |
| var Product Name | 0x12 | 0x00 | RO | String | - | (Unknown) | Not in DS |
| var Product Text | 0x14 | 0x00 | RO | String | - | Temperature transmitter with diagnostic output | Not in DS |
| var Serial Number | 0x15 | 0x00 | RO | String | - | - | Not in DS |
| var Hardware Version | 0x16 | 0x00 | RO | String | - | (Unknown) | Not in DS |
| var Firmware Version | 0x17 | 0x00 | RO | String | - | (Unknown) | Not in DS |

**Figure 28** **DS value for Parameters that are not in the DS**

As mentioned above there are two different value formats for the data storage value.

## 4.3 Parameterization

The following example demonstrates the use of the parameter view. The following picture is the state of the device if the IODD is imported.

| Name | Index | Subindex | Rights | Type | Unit | Value |
|---|---|---|---|---|---|---|
| Identification Menu | | | | | | |
| var Vendor Name | 0x10 | 0x00 | RO | String | - | SICK AG |
| var Product Name | 0x12 | 0x00 | RO | String | - | WTB18C-3P2434 |
| var Serial Number | 0x15 | 0x00 | RO | String | - | (Unknown) |
| var Hardware Version | 0x16 | 0x00 | RO | String | - | 1.30 |
| var Firmware Version | 0x17 | 0x00 | RO | String | - | 1.47 |
| var Application Specific Name | 0x18 | 0x00 | RW | String | - | Sensor Intelligence. |
| Observation Menu | | | | | | |
| {} Process Data Input | 0x28 | 0x00 | RO | Record | | Complex |
| var Quality | 0xE1 | 0x00 | RO | UInteger (8 bit) | - | Excellent (5) |
| {} OES3 Status | 0xE2 | 0x00 | RO | Record | | Complex |
| Parameter Menu | | | | | | |
| {} Key Lock | 0x51 | 0x00 | RO | Record | | Complex |
| var Scanning Distance | 0x90 | 0x00 | RO | UInteger (16 bit) | mm | 200 |
| var Hysteresis | 0x91 | 0x00 | RO | UInteger (8 bit) | - | 0 |

Figure 29 Parameter view example (grouped)

The parameter values are grayed out if the IODD is imported, there are two kinds of data shown in the default state:

- Default value – contains the defined default value of the IODD, this value may not be the current value in the device and for that reason it is grayed out.
- (Unknown) – the value was never read out and modified and has no default value in the IODD.

With double clicking on the value that you want to modify a line editor is displayed and new values can be entered. The editor is shown in the following picture.

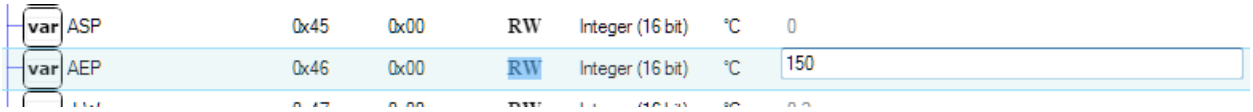



Figure 30 Editing a parameter value by a line editor

After editing. the value will be checked against the type and rules defined in the IODD the new value will be assigned to the variable. If the value is not sent to the device it will be indicated by a blue color code.

If the variable that the user want to add new value has defined single values or value ranges which limits the input values the following editor will occur.

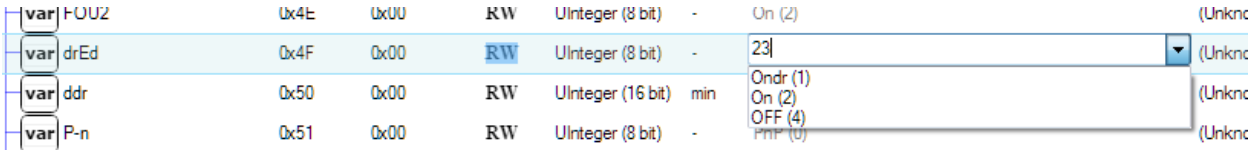



Figure 31 Editing a parameter with value ranges or single values

As seen in the Figure above there are three defined ***SingleValues*** for the "drEd" parameter that can be selected. Additionally it is possible to input a custom value as seen on the picture. This allows it to add change parameters that have both single values and value range in their definition.

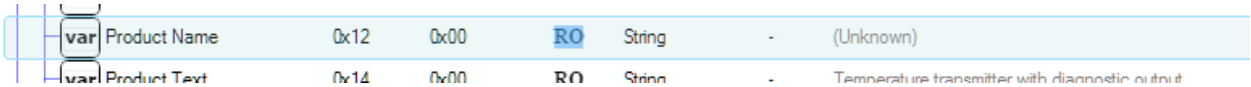
### 4.3.1 Reading or Writing the parameter(s)

The user can select any combinations of the parameters by selecting it and pressing the read or write selected buttons. The read all button will read out all the parameters that has read access.

The parameterization if more than one parameter is selected and the ***Block Parameterization*** is supported by the device will *always* read or write the selected parameters as a block.

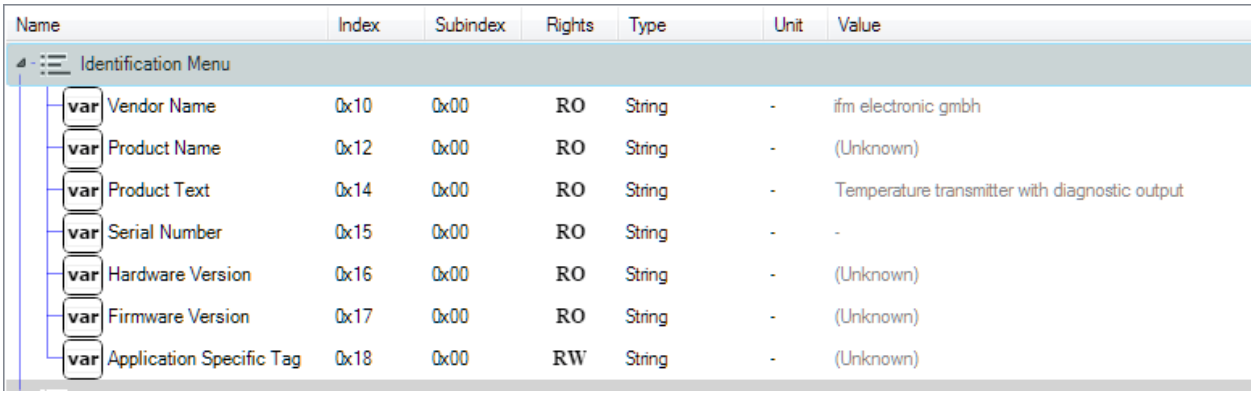
#### *4.3.1.1 Single parameter read / write*

The following picture demonstrates if a single parameter is selected for a read or write operation.




#### *4.3.1.2 Entire menu read / write*

It is possible to read or write a whole menu by selecting the menu row on the list view as seen in the picture.



#### *4.3.1.3 Multiple parameters read / write:*

It is also possible to select arbitrary parameters, just like shown in the following picture.

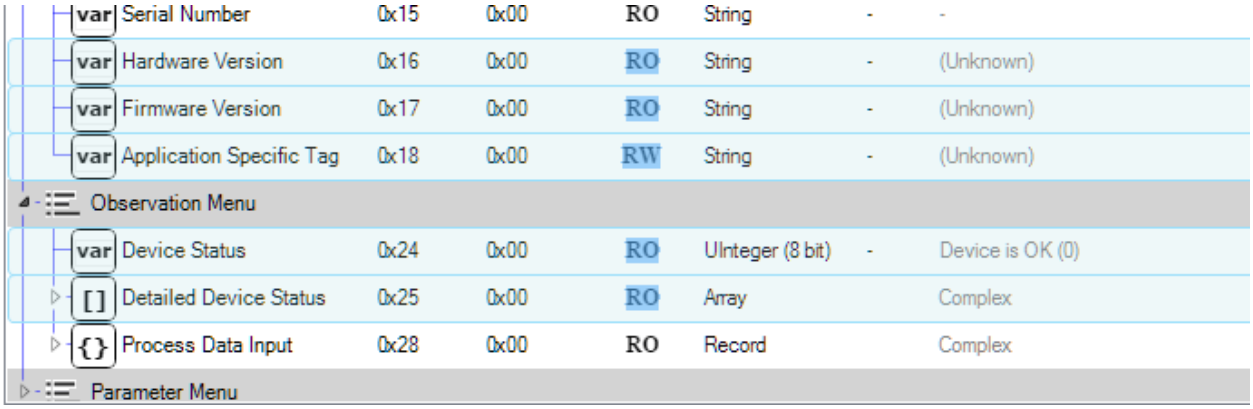
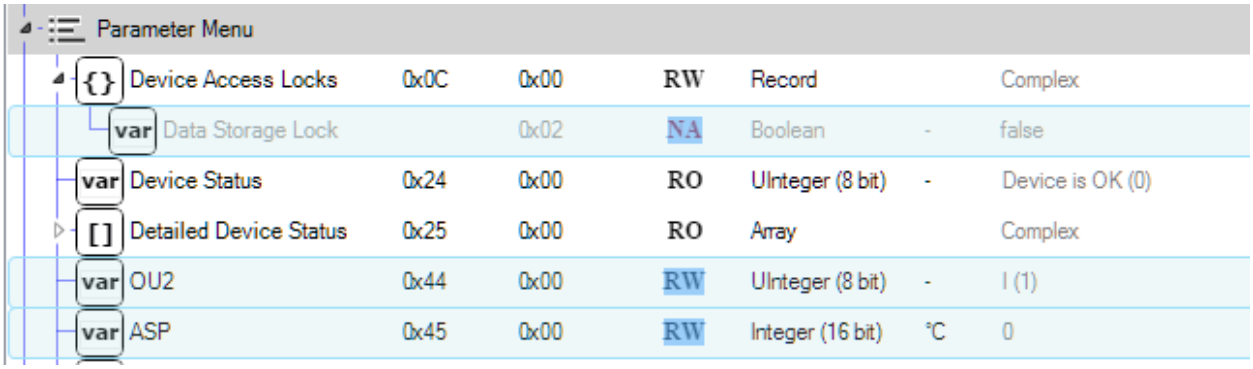



Figure 32 Selecting arbitrary parameters

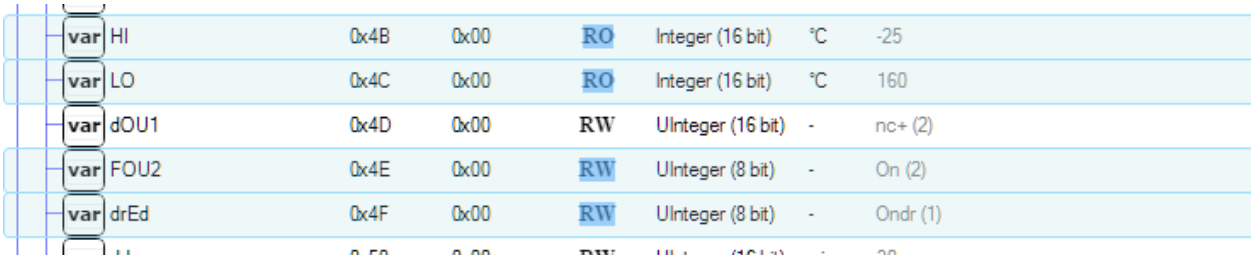
#### *4.3.1.4 Record item and variable read / write*

It is also possible to select a record item and a variable as shown in the picture following figure. This cab be achieved by clicking on the parameter with the CRTL key pressed.



### 4.3.2 Grouped Parameter read/write access

The tool will sort the selected parameters according to the read or write access and the operation. Look on the following example.



| | | | | | | |
|---|---|---|---|---|---|---|
| var HI | 0x4B | 0x00 | RO | Integer (16 bit) | °C | -25 |
| var LO | 0x4C | 0x00 | RO | Integer (16 bit) | °C | 160 |
| var dOU1 | 0x4D | 0x00 | RW | UInteger (16 bit) | - | nc+ (2) |
| var FOU2 | 0x4E | 0x00 | RW | UInteger (8 bit) | - | On (2) |
| var drEd | 0x4F | 0x00 | RW | UInteger (8 bit) | - | Ondr (1) |

There are four parameter selected for ***Write*** operation, as seen on the picture and two of them only have read permission. In this case the tool “deselects” these parameters and the write request only occurs for the two parameters with the write rights. A similar mechanism is supported for ***Read only*** parameter as well.

# 5 Data storage

With the ”Fetch DS” option the user can receive the data storage content. As above mentioned the parameters that aren’t part of the data storage marked as “Not in DS” text. After receiving, the data storage content of values will be shown in the parameters.

| Name | Index | Subindex | Rights | Type | Unit | Value | Data Storage Value |
|---|---|---|---|---|---|---|---|
| var Bit filter for switching output(s) | 0x42 | 0x00 | RW | UInteger (8 bit) | - | (Unknown) | 1 |
| var Averaging for analog output | 0x43 | 0x00 | RW | UInteger (8 bit) | - | (Unknown) | 2 |
| var Display | 0x48 | 0x00 | RW | UInteger (8 bit) | - | (Unknown) | 0 |
| var User level for display | 0x49 | 0x00 | RW | UInteger (8 bit) | - | (Unknown) | 1 |
| var Qa Operation mode | 0x4B | 0x00 | RW | UInteger (8 bit) | - | Distance (0) | 1 |
| var Qa near | 0x4F | 0x00 | RW | UInteger (16 bit) | mm | 200 | 250 |
| var Qa far | 0x50 | 0x00 | RW | UInteger (16 bit) | mm | 30000 | 400 |
| var Keylock | 0x51 | 0x00 | RW | UInteger (8 bit) | - | Unlocked (0) | 0 |

Figure 33 Data storage view

Note: This applies only if the link between a data storage value and a parameter is made explicit in the IODD.

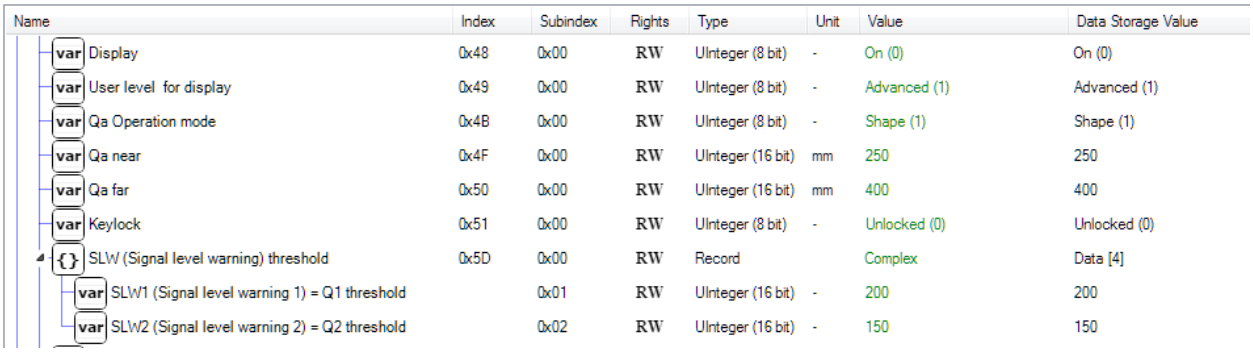
## 5.1 Value format

By default the data storage value is shown according to the data type of the parameter, display format, unit code, offset and gradient are ignored to enable formatting use the Menu/Data storage/Value Format/Formatted option.

**Note: in this demonstration the formatted data storage values are used**

## 5.2 Value state

After setting the “Formatted (Parsed)” value format and reading out the parameters the following view is shown.



| Name | Index | Subindex | Rights | Type | Unit | Value | Data Storage Value |
|---|---|---|---|---|---|---|---|
| var Display | 0x48 | 0x00 | RW | UInteger (8 bit) | - | On (0) | On (0) |
| var User level for display | 0x49 | 0x00 | RW | UInteger (8 bit) | - | Advanced (1) | Advanced (1) |
| var Qa Operation mode | 0x4B | 0x00 | RW | UInteger (8 bit) | - | Shape (1) | Shape (1) |
| var Qa near | 0x4F | 0x00 | RW | UInteger (16 bit) | mm | 250 | 250 |
| var Qa far | 0x50 | 0x00 | RW | UInteger (16 bit) | mm | 400 | 400 |
| var Keylock | 0x51 | 0x00 | RW | UInteger (8 bit) | - | Unlocked (0) | Unlocked (0) |
| {} SLW (Signal level warning) threshold | 0x5D | 0x00 | RW | Record | | Complex | Data [4] |
| var SLW1 (Signal level warning 1) = Q1 threshold | | 0x01 | RW | UInteger (16 bit) | - | 200 | 200 |
| var SLW2 (Signal level warning 2) = Q2 threshold | | 0x02 | RW | UInteger (16 bit) | - | 150 | 150 |

There are three states of data storage values:

- Marked as BLACK (up to date) – the data storage value of the parameter is equal to the value that is in the device.

Note: if the value is changed but isn’t written to the device (the parameter value is blue) the data storage value will be marked still as up to date because the changed value was never written to the device.

- Marked as RED (needs update) – The data storage value is changed in the device but the data storage was not fetched by DS-upload.

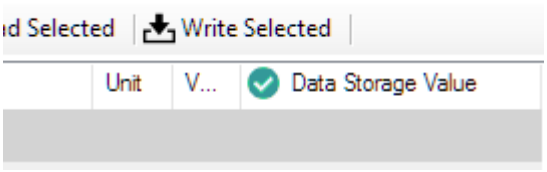
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| var Qa near | 0x4F | 0x00 | RW | UInteger (16 bit) | mm | 400 | 250 |

Note: The "Qa near" parameters value was changed from 250 to 400 and was written to the device but data storage was not fetched and stored in the master.

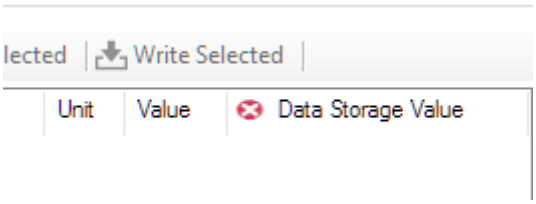
## 5.3 Data Storage Validity

The Control Tool from version 2.3 (and above) are able to show the data storage validity flag from the master (whether the content of the master’s data storage is valid or not). When the software connects to the selected master it will automatically read out the data storage validity flag and if the flag is valid the data storage content from the master as well.

The following picture shows the state where the Data Storage on the master is valid:




The image below shows the invalid state of the master's data storage.



# 6 Copy device state

It is also possible to copy a device state (the parameters current values) to an identical device that is connected to a second port of the master. The following sequence demonstrates the usage of the copy function.

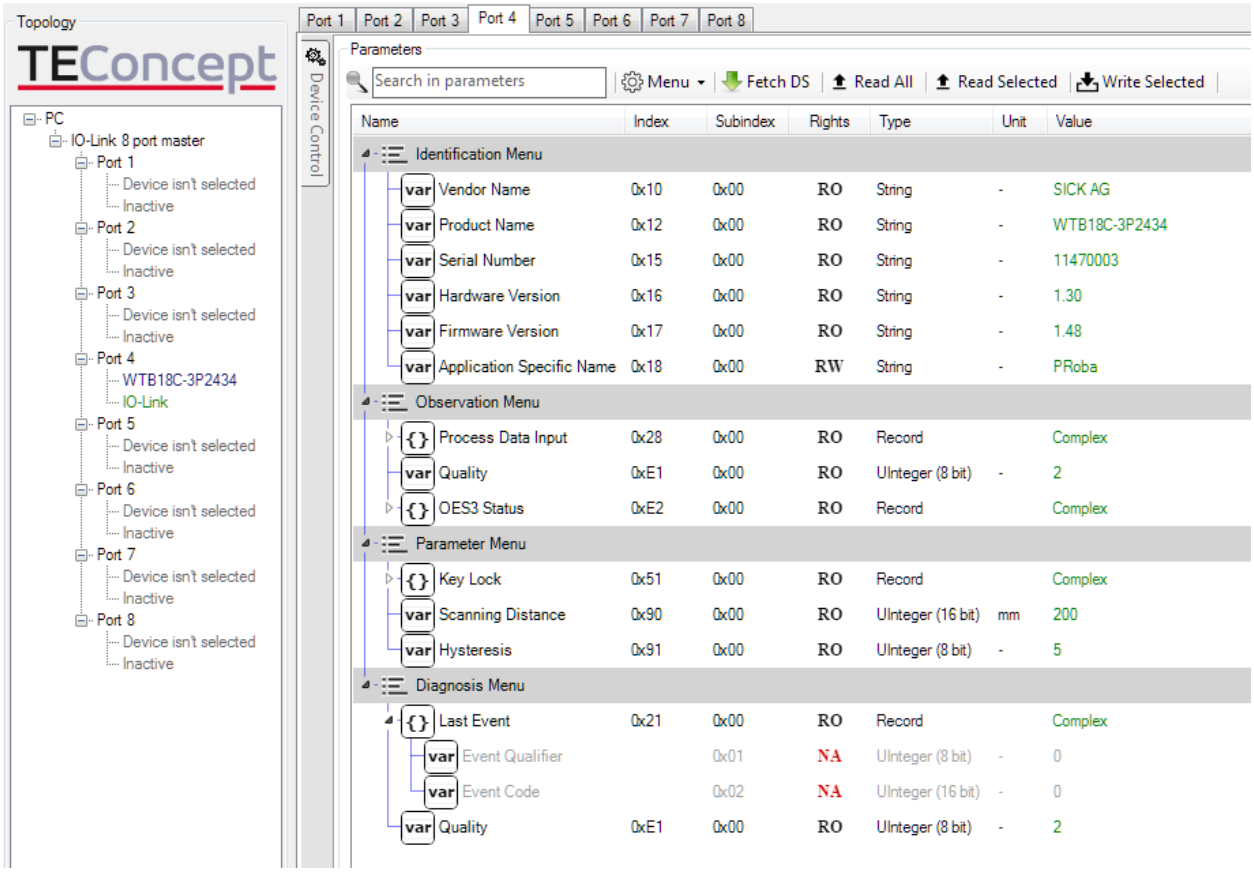
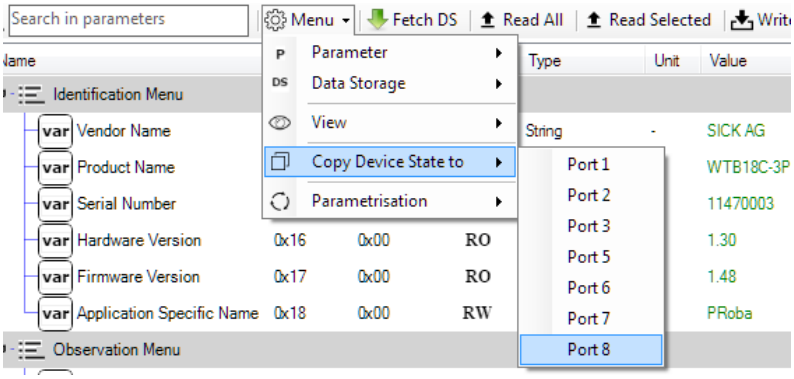



Figure 34 Parameter set for cloning

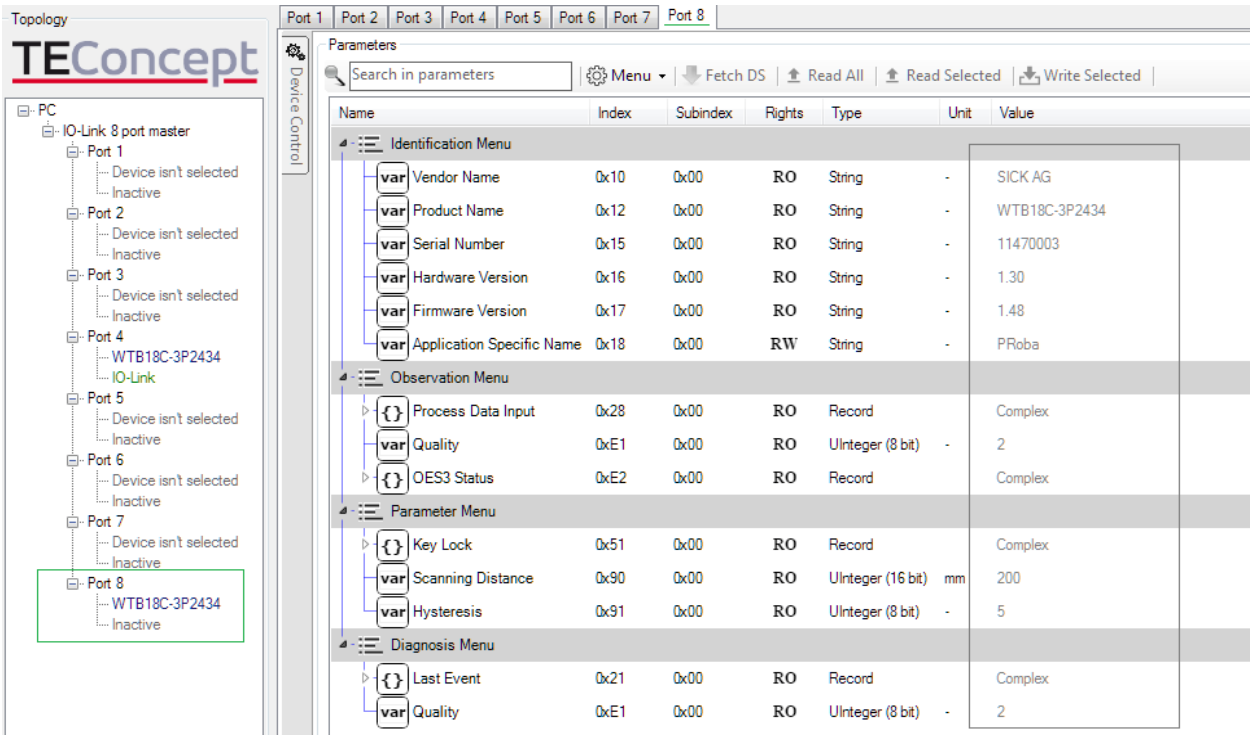
As seen on the picture all *readable* parameter must be “up-to-date” (marked as green) to allow copying the device state from this port to another port.


Search in parameters
Menu
Fetch DS
Read All
Read Selected
Parameter
Data Storage
View
Copy Device State to
Parametrisation
Port 1
Port 2
Port 3
Port 5
Port 6
Port 7
Port 8
Type
Unit
Value
Identification Menu
Vendor Name
String
SICK AG
Product Name
WTB18C-3P
Serial Number
11470003
Hardware Version
0x16
0x00
RO
1.30
Firmware Version
0x17
0x00
RO
1.48
Application Specific Name
0x18
0x00
RW
PRoba
Observation Menu

Cloning goes always from the selected port (here “Port 4” the copy function will clone that device state – parameter state – ***to*** the chosen “Port 8”.

## 6.1 Successful copy

The following picture shows the port state after the device state was copied – successfully.




After a successful copy the new parameter values appear on the desired port, however, all its values are grayed out.

## 6.2 Errors during the copying

Various errors can occur if the device state is being cloned.

### 6.2.1 Not all readable parameter has value

In the released version 2.0.0.0 the device state can only copied if all readable parameters are “up-to-date” (marked as green). [1] The following error window pops up, if not all parameter has value.

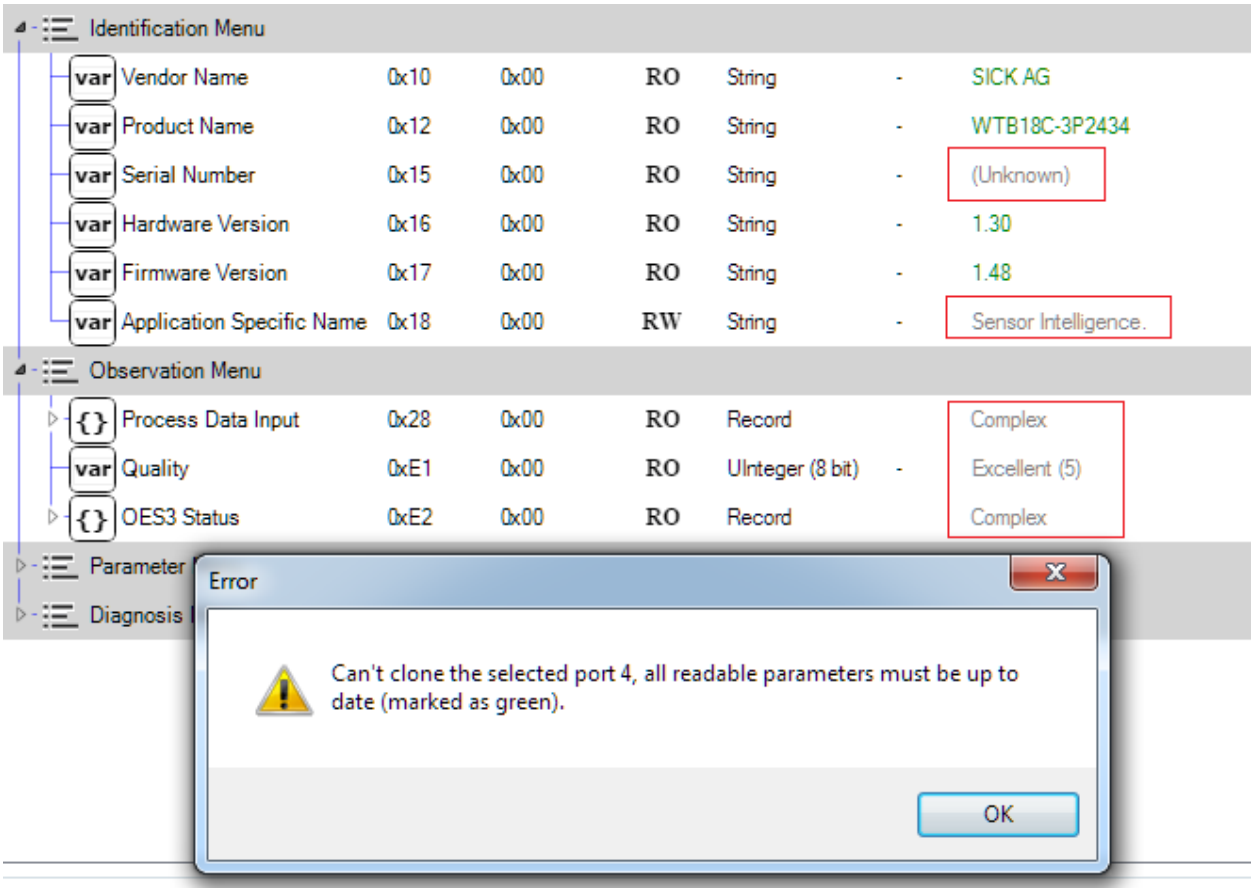



Figure 35 Cloning error if not all parameters are up to date

### 6.2.2 Port is in operate state

It is also not possible to copy a device state ***to*** a port that is in OPERATING state, the port that “receives” the device state must be in inactive state.

The following picture demonstrates the error message that appears.

[1] This may change in future releases of the CT

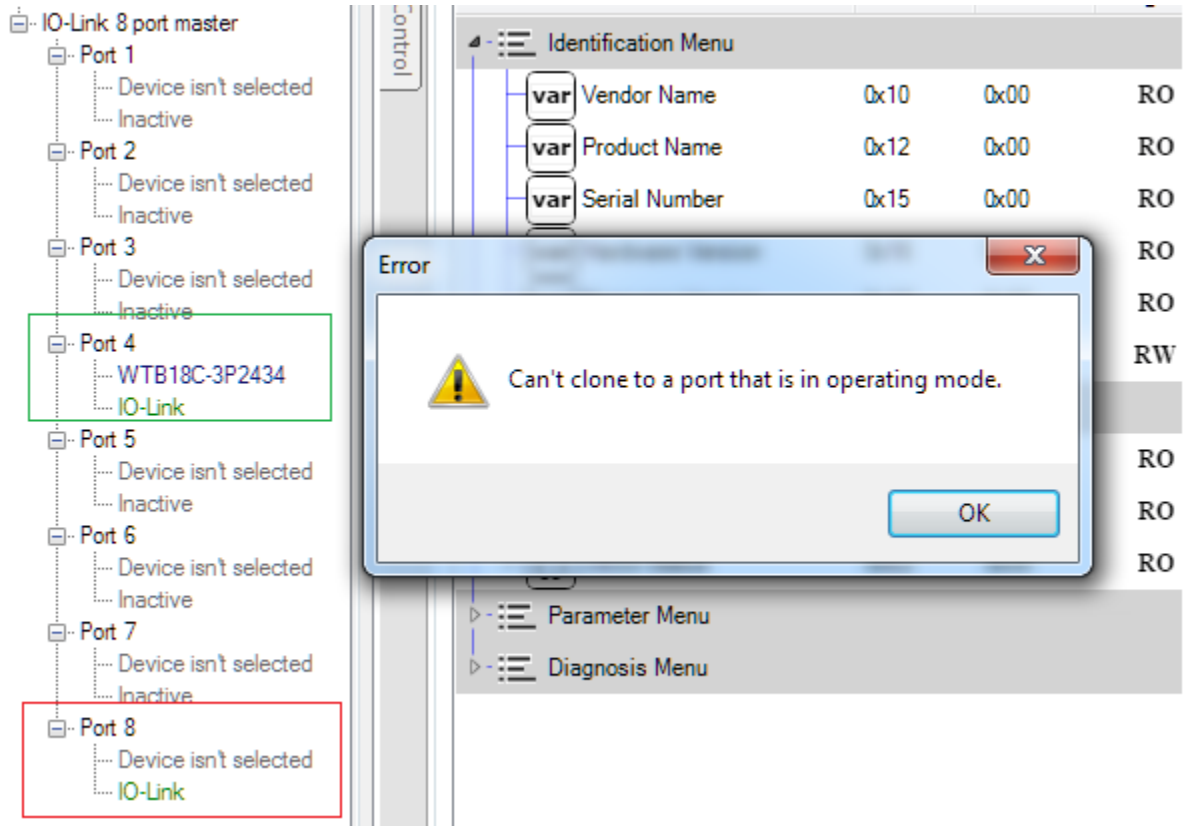
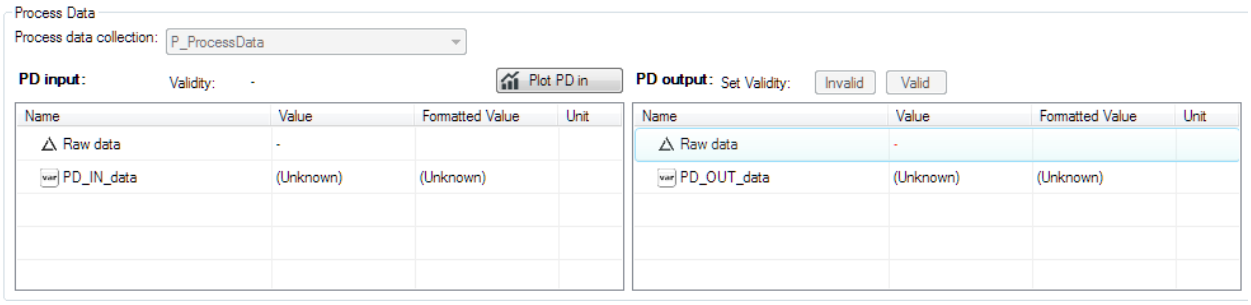



Figure 36 Cloning Error for active target port

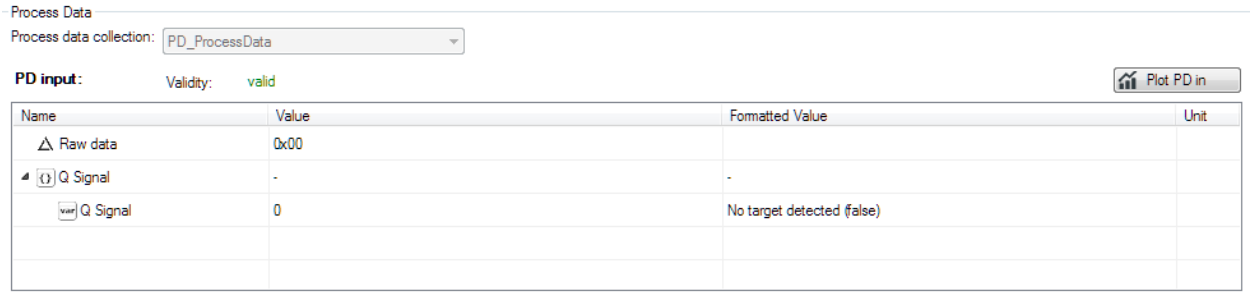
As seen on the picture above the 8th port is in IO-Link state, in this case the copying the device state from port 4 can't be done.

# 7 Process data view

For the application version 2.0.0.0 and later the process data view is modified.




## 7.1 Process data in layout




### 7.1.1 Process data collection

In the process data in group box the “Process data collection” field the current selected process data interpretation is used in accordance with the value if the process data collection in the IODD has more than one process data interpretation.

This field isn’t changeable manually by the user directly. The user has to modify the corresponding parameter (condition variable) which is responsible to change between the process data elements. For more please refer to the IODD Device Description specification paragraph 7.5.5.

### 7.1.2 Validity

The validity label at the process data in status flag shows whether the process data in is valid or not.

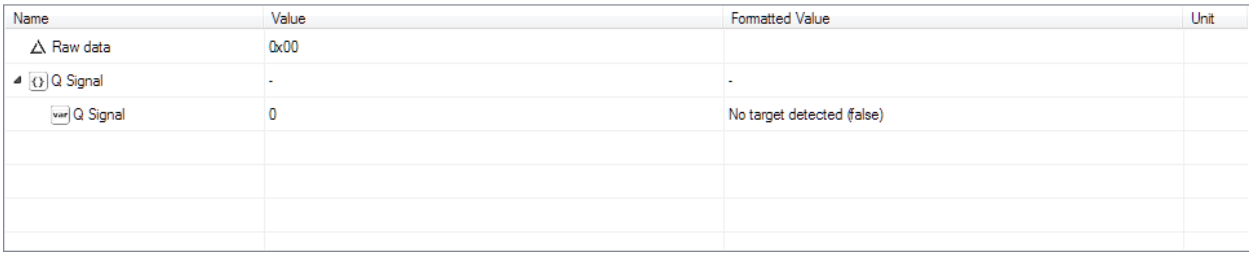
### 7.1.3 Process data in list view

The actual process data in view contains the following columns:

- Name – the name of the process data.
- Value – raw value of the incoming process data.

- Formatted Value – the formatted raw value according to the process data definition of the IODD.

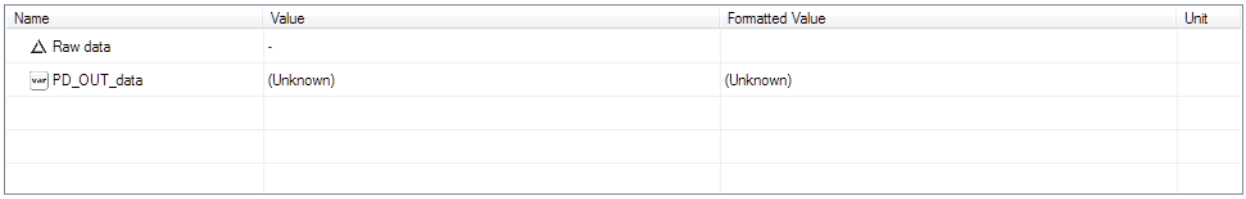
The following picture shows the process data in view:




The “Raw data” row is always present (if the device has process data in) and shows the raw incoming process data in hexadecimal format.

In the example above, the “Q Signal” refers to the process data name according to the IODD. In the “Value” column the raw process data is shown according to the type of the process data in. In the “Formatted Value” column the displayed value is shown according to the gradient, offset and unit of the process data defined in the IODD.

## 7.2 Process data out layout



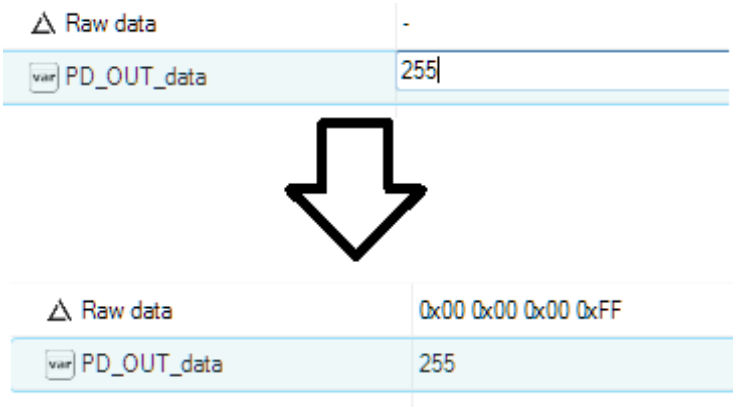

### 7.2.1 Set Validity

Sets the process data out status flag to valid or invalid.

### 7.2.2 Process data out list view

The process data out value entering can be done in the same as for parameterization, except there is an option to set a raw process data out stream.

Entering a value in the value or formatted value column is done in the following way:



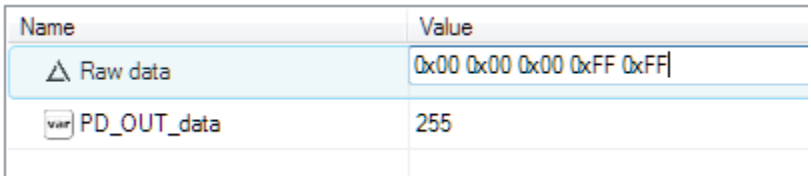

Entering a value on the process data fields will automatically set the raw process data out data, the raw process data out data is always what the master send to the device.

**Note:** by entering either the "Value" or "Formatted Value" value the tool will check if it is *fits* to the data type of the defined process data out element in the IODD.

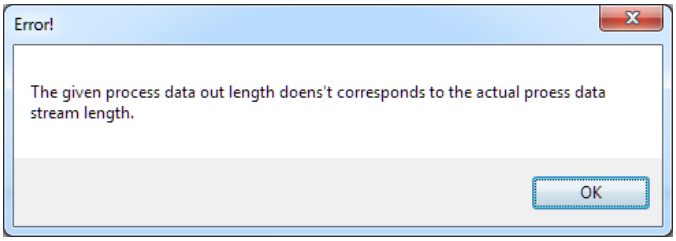
The user has the option to set the *raw* process data out, if the raw process data out is entered the tool will also check if it fits to the data type of the process data out element but if it fails the check the user gets a warning but the raw value will be set as process data out data.

The following example shows if the raw data is entered and it isn't fit to the process data out element defined in the IODD.

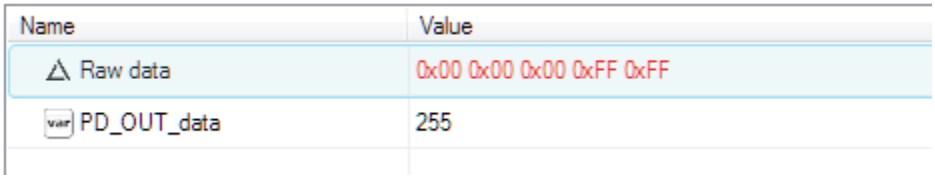
- IODD with 4 byte process data out, defined as unsigned integer.
- Raw process data out is entered with 5 byte length.




The following picture shows the message that occurs when the tool validates the raw data input.

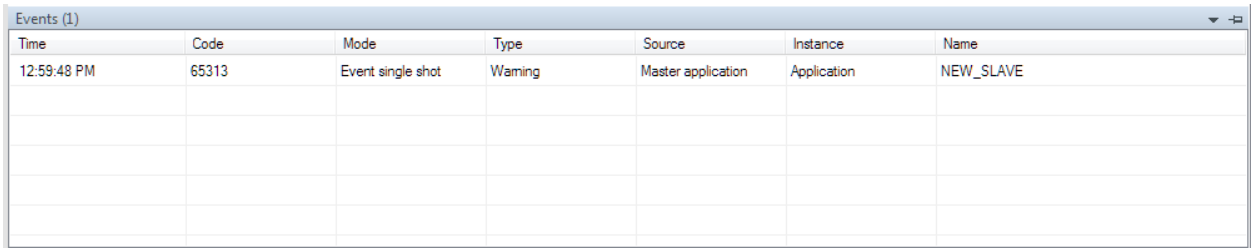


The process data out will be set but marked as red, but the process data out element from the IODD will not contain the value, because isn't fit to the 4 byte element.

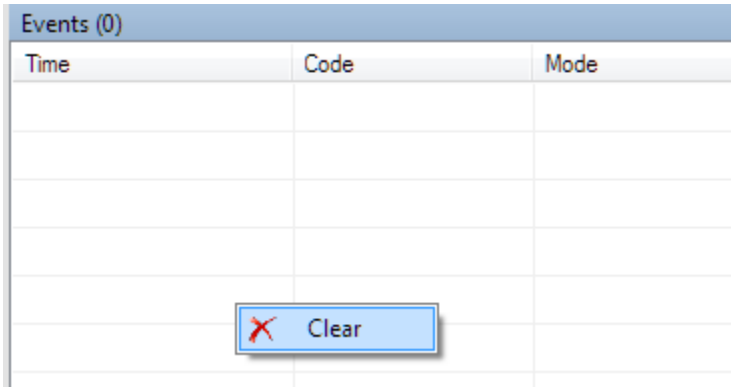


# 8 Events

The events are shown in a separate panel in the bottom of every port. The counter in the right of the label show the occurred events. By hovering the mouse in the tab the events panel will appear.

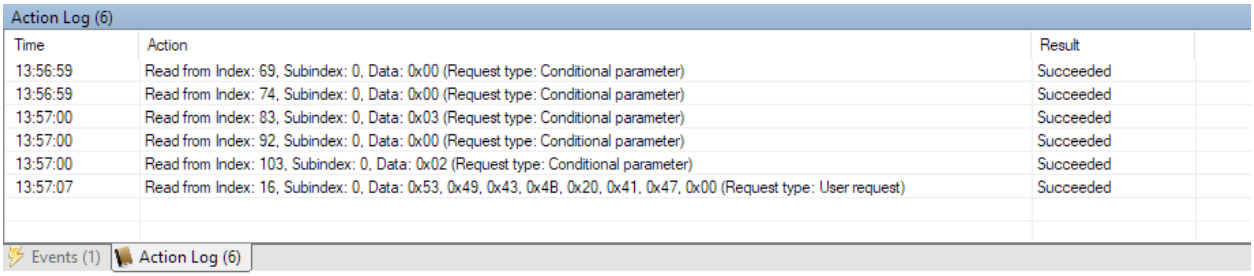




By right clicking on the listed events the delete option will appear, which deletes all the occurred events.




# 9 Action Log

In the Control Tool version 3.1 and above the animations used for feedback to the user about the ISDU request result is replaced with the action log. The action log gives a detailed explanation about the data sent to / received from the device and what background operations were issued.

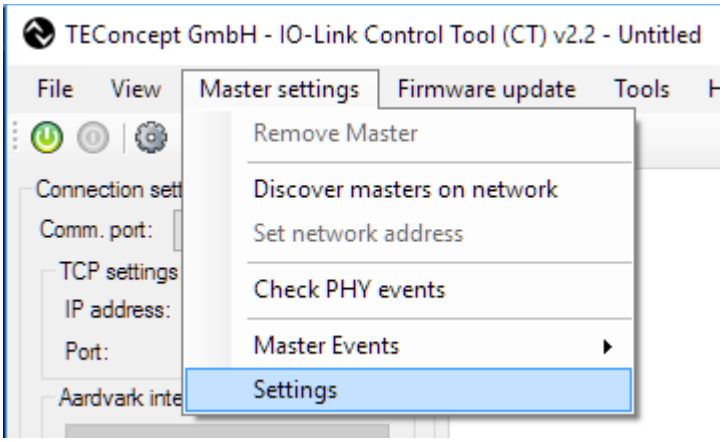


As shown in the picture the Control Tool read (automatically) the parameters which are used as condition elements for the process data and menu structure.

The last action is an ISDU request issued by the user.

# 10 Settings

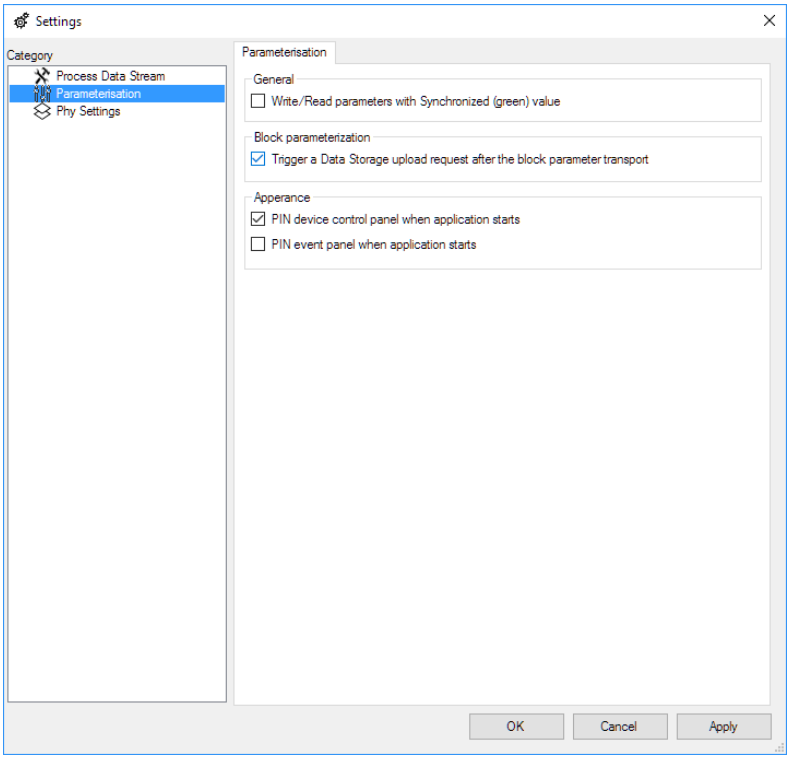
Various advanced settings are available to the user to configure the Control Tool. These settings are located in the Master settings/Settings window.




Clicking on the settings menu item will open the settings window.

## 10.1 Parameterization

The following window shows the settings listed in the Parameterization menu option.




The following settings can be applied:

**Write/Read parameters with Synchronized value**

The tool tries to eliminate unnecessary read or write operations, if a parameter's value is marked as green the value is in line with the value currently stored in the device so for example writing the same value to the device is an unnecessary operation. However for some parameters such as the system command writing the same value can have different meaning, for example the unlocking sequence during the firmware download where multiple system command shall be transferred sequentially. By checking this option the tool will allow the read and write operation any time.

**Block Parameterization – Trigger a Data Storage upload request**

The block parameter transport in download direction can end with two different system command:

1. **ParamDownloadEnd**
2. **ParamDownloadStore**

By default the Control Tool issues the *ParamDownloadEnd* system command at the end of the block transmission, if the user wants to trigger a data storage upload request at the end of the block parameter it can be done by checking this setting and the Control Tool will send the ParamDownloadStore at the end of the block parameter transition.

**Apperance**

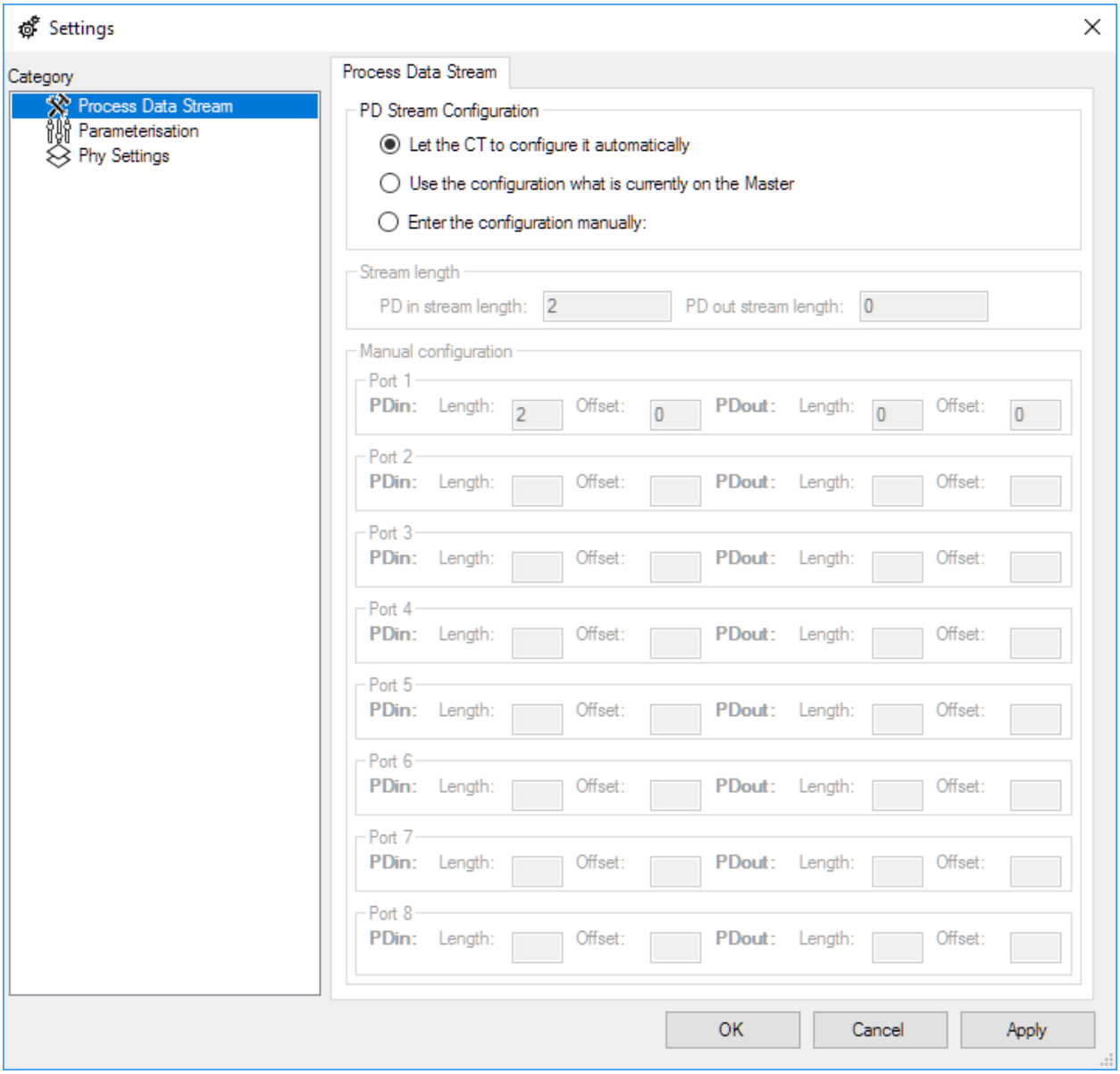
Here the two panel Events and Device Control can be forced to be pinned as soon as the application starts so there is no need to manually pin the panels which are used by the user.

## 10.2 Phy Settings

Related to maxim 8 port master.

## 10.3 Process Data Stream

In this option the process data stream can be configured, the following picture shows the options.




There is three different configuration:

**Let the CT (Control Tool) configure it automatically**

The control tool will automatically increase the offsets in the stream according to the process data in and process data out length of the device.

For example: if one device in port 1 is in operating mode and has a 2 byte length process data in, the offset inside of the stream is 0. A Second device in the port 2 is switched on with 1 byte process data length the control tool will put the offset of the second port to 2, so the whole process data stream will contain 3 bytes where the first two (starting from offset 0) are belong to the first port and the byte from offset 2 will belong to the second port.

**Use the configuration what is currently on the master**

This option will use the stored process data stream configuration in the master.

**Enter the configuration manually**

This option gives the user the ability to configure the process data stream manually, where the process data for each port starts and what is the length of it.

Important note that the stream doesn't allow

# 11 List of Figures