

OneEye_UART_Oscilloscope_1 for KIT_AURIX_TC375_LK

Oscilloscope over UART using OneEye

AURIX™ TC3xx Microcontroller Training
V1.0.0



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Scope of work

Demonstrate how to implement the OneEye oscilloscope over the UART (USB) interface

After configuring the OneEye UART interface, a OneEye oscilloscope is created. The signals are updated and sampled every millisecond. OneEye is used to visualize the signal values.

Introduction

- › **OneEye** is a GUI that enables the creation of interactive Graphical User Interface. Graphical elements can be drag from a toolbox and drop onto the GUI. The behavior of the created GUI can be customized. Different communication interfaces like UART, Ethernet, CAN, DAS can be used to interact with the embedded system
- › **SyncProtocol / ProtocolBB** is a synchronous protocol that enables data streaming between the target microcontroller and OneEye. It enables to open multiple communication channels, provide packet acknowledge and packet checksum. Data are transported within a message with a message ID and a message payload. See the OneEye help for more information.

Single frame

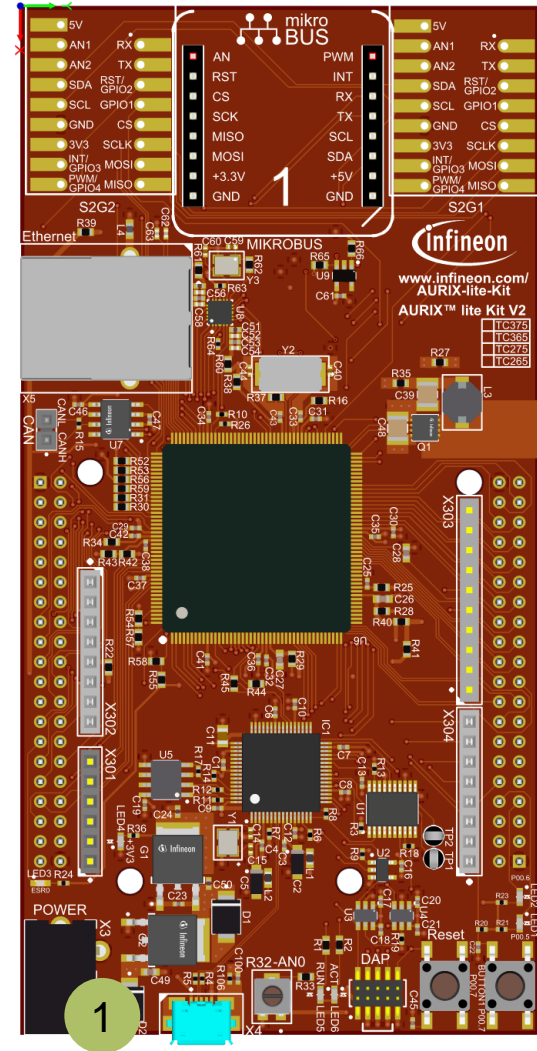
Offset	0	1	2	3
0	Start Byte	Sender	Receiver	Payload length
4	Flags (frameType=data)		Checksum payload	Checksum header
8	Message ID		(Reserved)	
12	Message length			
16	Message payload			
...	... (Message payload)			

- › **Note:** It is recommended to go through some of the **basic tutorials** listed in the help embedded in OneEye (Menu: Help -> OneEye help). This enables a quicker ramp-up in the OneEye concept and ensures a nice journey with OneEye

Hardware setup

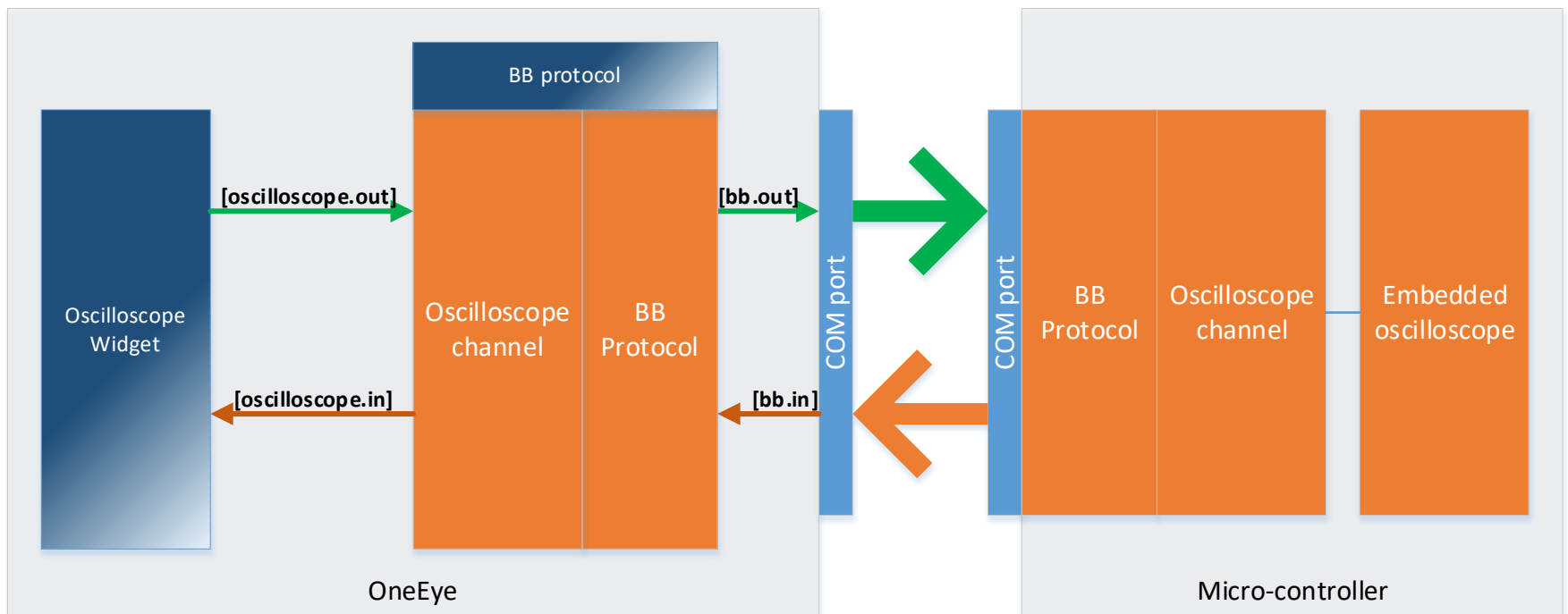
This code example has been developed for the board KIT_A2G_TC375_LITE.

The board should be connected to the PC through the USB port 1



Configuration overview

In this configuration an oscilloscope running on the microcontroller is connected to the COM port.
 In OneEye, two signals **bb.in** and **bb.out** are used to connect the COM port data stream to the BB protocol.
 The BB protocol is configured to open a channel reserved for the oscilloscope. This channel connects to the oscilloscope with the **oscilloscope.in** and **oscilloscope.out** signals.



Implementation - AURIX

Enabling the OneEye library

The OneEye library must be enabled by adding the following line to *lfx_Cfg.h*:
#define IFX_OE_AL_USE_AURIX_ILLD

Configuring the OneEye Oscilloscope

A OneEye oscilloscope (*lfx_Oe_Osci*) is an object that enable data sampling and provide triggering functionality.

The OneEye oscilloscope communication interface (*lfx_Oe_OsciBb*) enables streaming of data and control of the oscilloscope using the BB protocol (*lfx_Oe_SyncProtocol*).

The OneEye oscilloscope is initialized with *initOscilloscope()* / *lfx_Oe_Osci_init()*.

The ***autoAddChannels*** parameter enables to automatically add channels for each created oscilloscope signal.

The sample period (***samplePeriod***) is set to 1ms and provides OneEye information about sample timing.

The ***triggerMode*** is set to automatic, note that this value can be changed from the OneEye oscilloscope interface later.

The *lfx_oe_osci.h* file can be found in the Libraries\OneEye directory.

Adding signals to the oscilloscope

Oscilloscope signals are mainly pointers that the oscilloscope can use for data sampling. The signals are added using *lfx_Oe_Osci_addSignal()*. The function takes as parameter the signal **name** displayed by the oscilloscope, with an optional unit string in parenthesis, the signal **type** which informs the oscilloscope how to read the pointer value and a **source** pointer to the data. The last parameter corresponds to the **q format** used in case of fix point data, or 0 if not used.

Implementation - AURIX

Starting the oscilloscope

The oscilloscope is started with the function *lfx_Oe_Osci_start()*.

Configuring the signal generator

A signal generator is used to provide the user with some value to read / write. The signal generator does nothing more than incrementing two signals, *signalA* and *signalB*, stored in the structure *g_signalGenerator* up to a maximum value before resetting them.

The initialization of the signal generator is done with *initSignalGenerator()*.

Running the signal generator and the oscilloscope

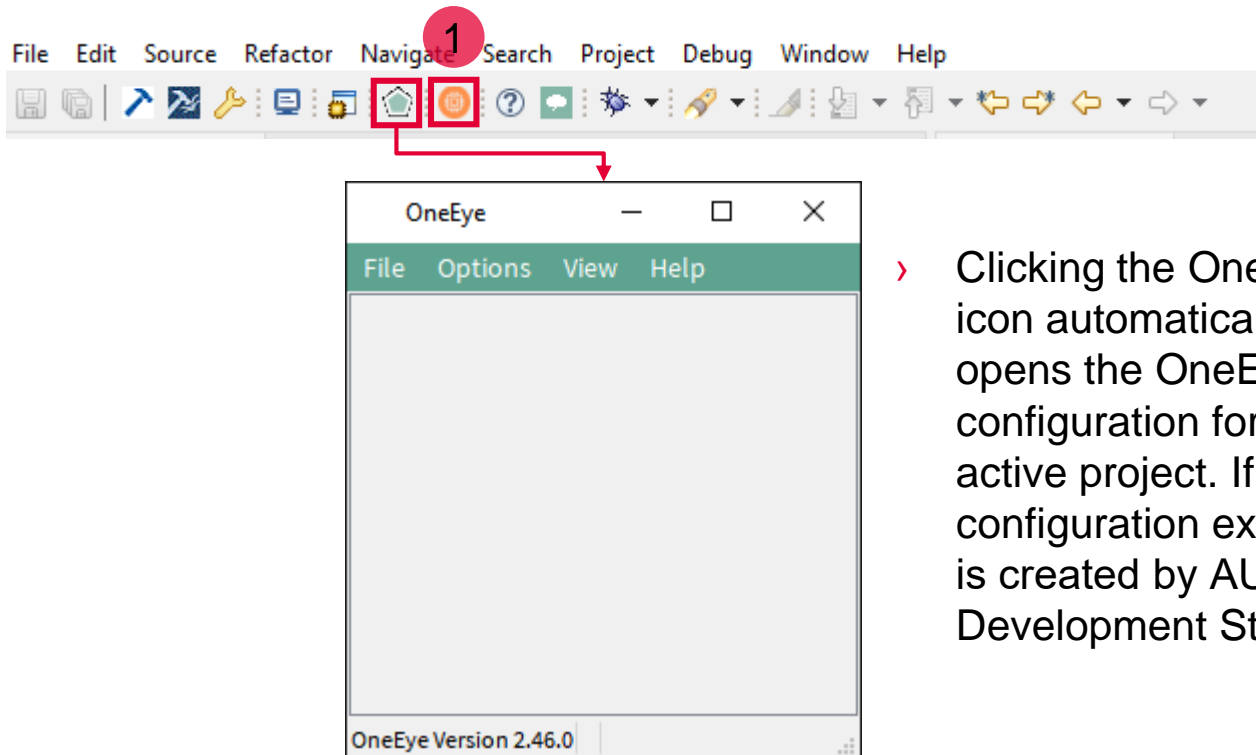
The signal generator is executed in the background loop every 1ms with *processSignalGenerator()*. To ensure the timing, a **deadline** variable is periodically updated with *lfx_Oe_Time_add()* to obtain the 1ms period.

The oscilloscope runs in the same background loop with *sampleOscilloscope() / lfx_Oe_Osci_step()*. This function handles the triggering and sampling of data.

Note: the call to *lfx_Oe_Osci_step()* can be moved to an interrupt service routine if required by the application use case.

Run and Test

- › After code compilation, flash the device using the Flash button **1** to ensure that the program is running on the device
- › For this training, the OneEye application is required for visualizing the values. OneEye can be opened inside the AURIX™ Development Studio using the following icon:



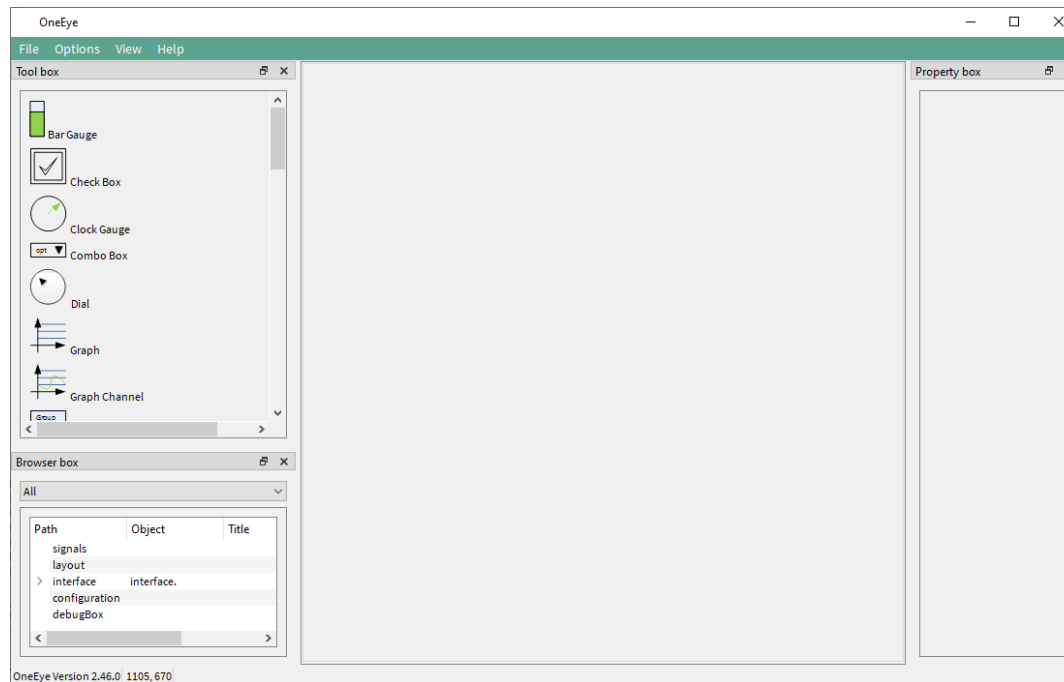
- › Clicking the OneEye icon automatically opens the OneEye configuration for the active project. If no configuration exists, it is created by AURIX™ Development Studio

Implementation - OneEye

In this training, the OneEye configuration is provided inside the Libraries folder. The following steps are needed to configure the oscilloscope from a brand-new configuration.

Setup OneEye for editing

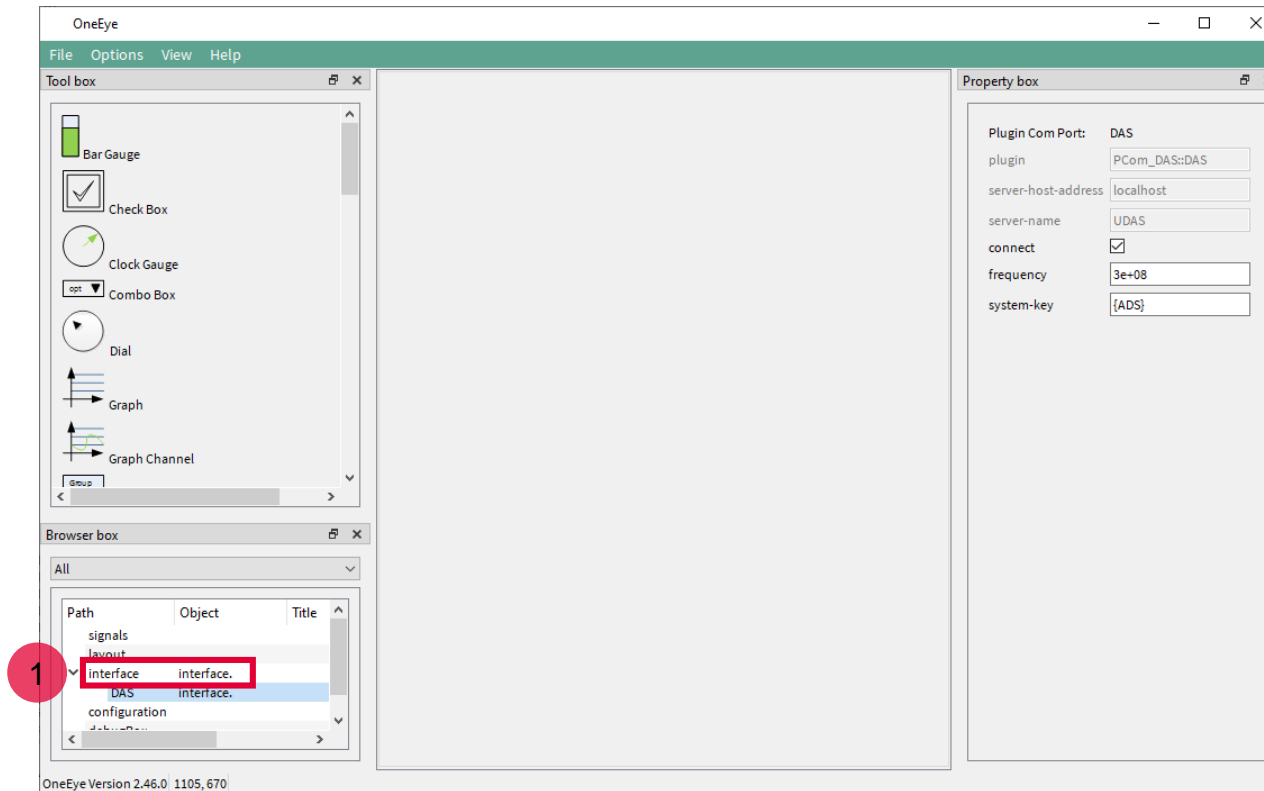
Select the OneEye menu **“Options -> Edit mode”** (if not already checked) to enable the edit mode. Select the OneEye menu **“View -> Browser box”**, **“View -> Property box”**, **“View -> Tool box”** (if not already checked) to display the browser, property box and tool box. Note that the box can be moved around.



Implementation - OneEye

Removing the default DAS interface

When the OneEye configuration is created by ADS, it is already setup with a DAS interface. Select the interface in the Browser box **1** and delete it with “right click and remove” as it is not required in this example.

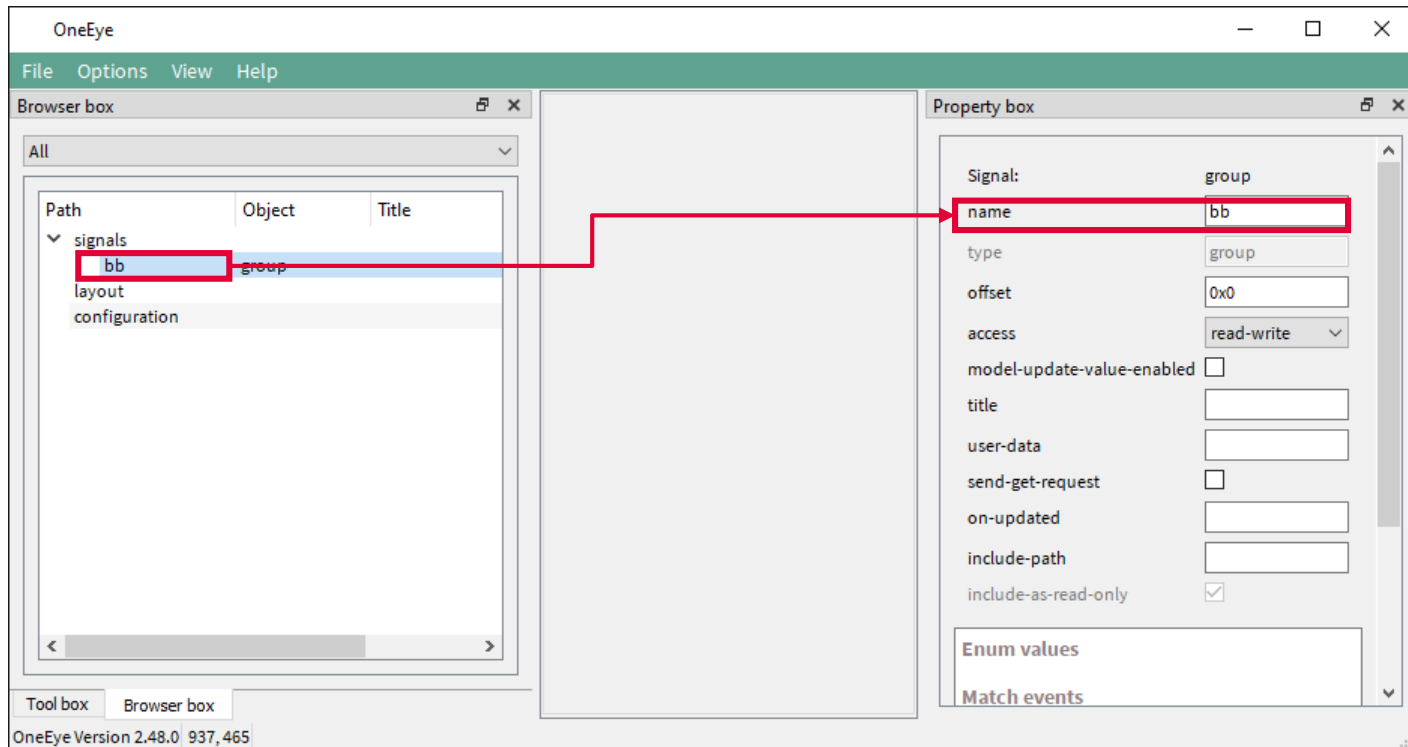


Implementation - OneEye

Configuring the UART interface: Signal creation

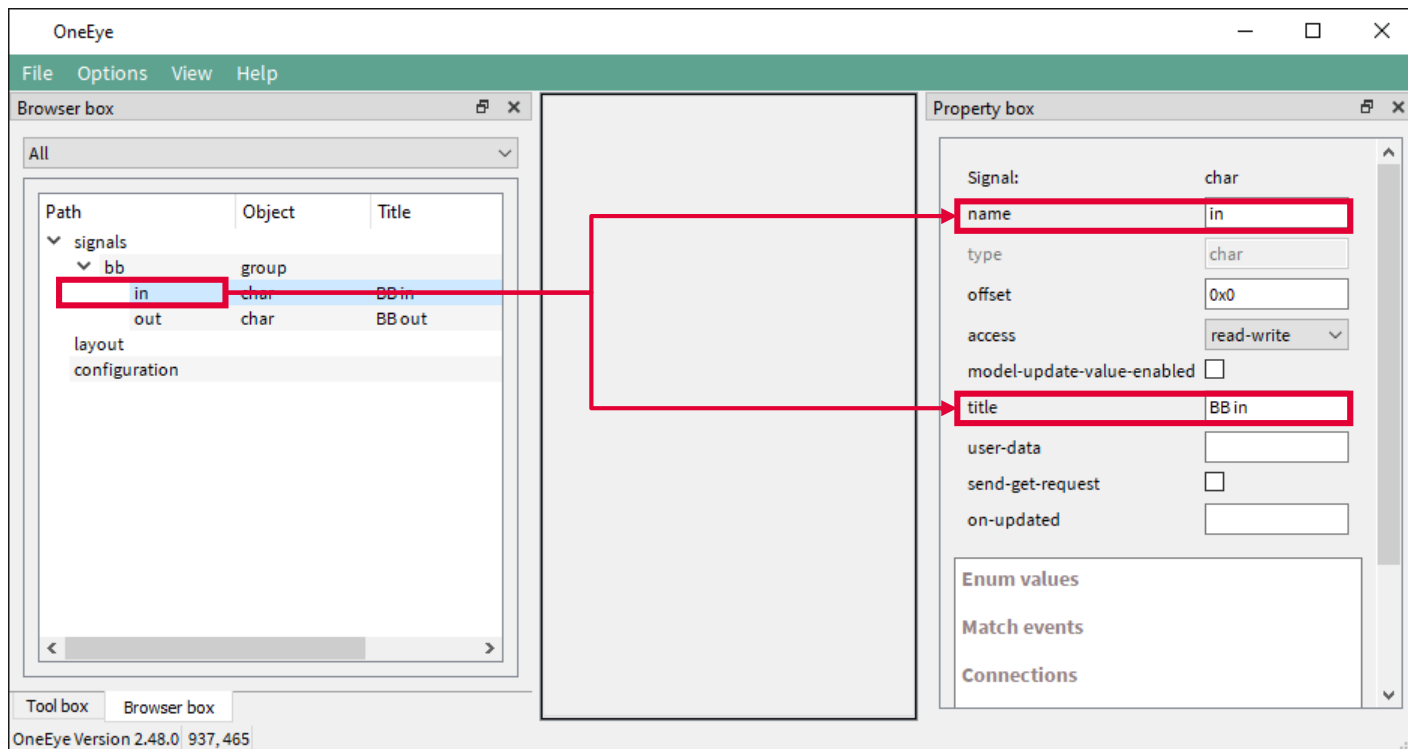
The first step is to create 2 signals to connect the received and transmit data over the UART.

Create a signal group and set its **name** property to **bb**.



Implementation - OneEye

Add two signals of type **char** into the **bb** group, name them **in** and **out**, and set their **title** property to respectively **BB in** and **BB out**.

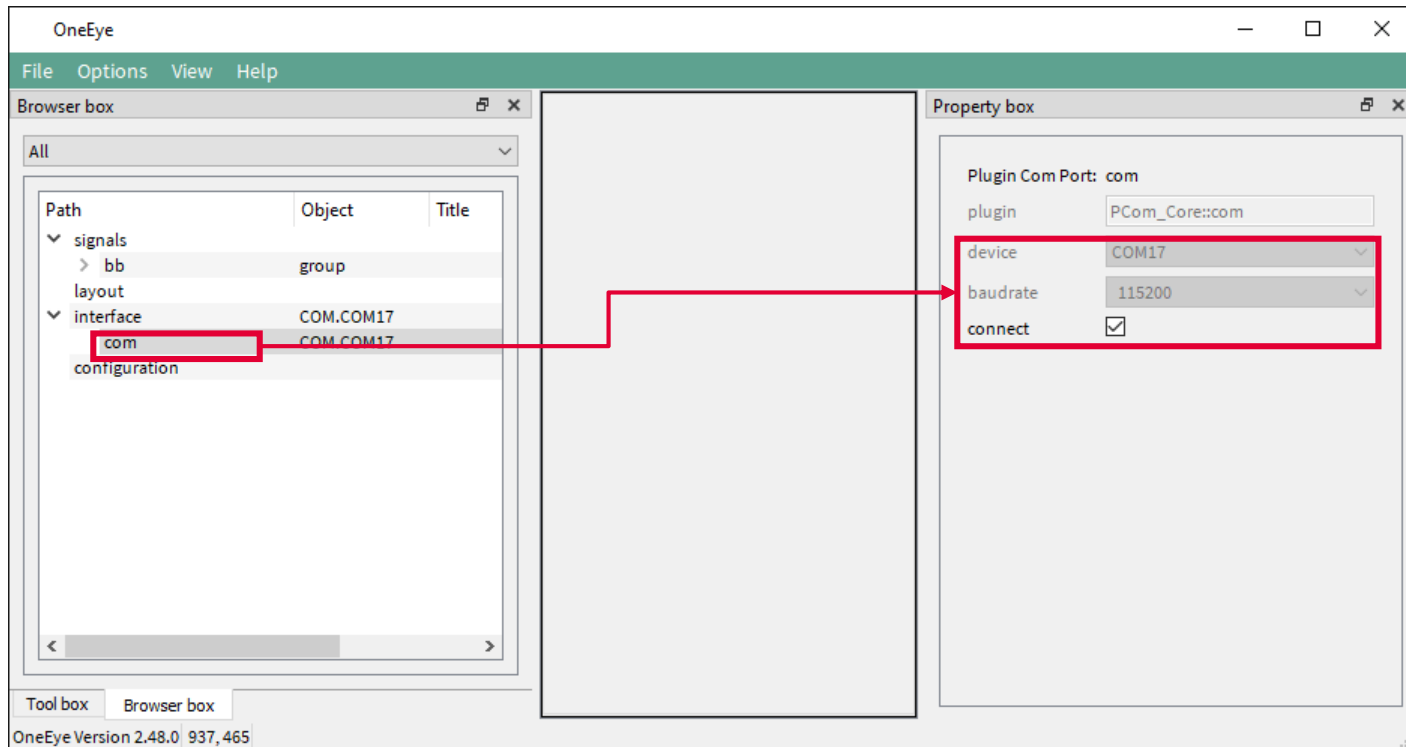


Implementation - OneEye

Configuring the UART interface: COM port

Right click in an empty area of the Browser box, and select **Add child -> Interface**. Then right click on the created interface and select **Add child -> com**. Select the **com** item and set its **device** property to the COM port connected to the AURIX board. Set the **baudrate** property to **115200** and click **connect**.

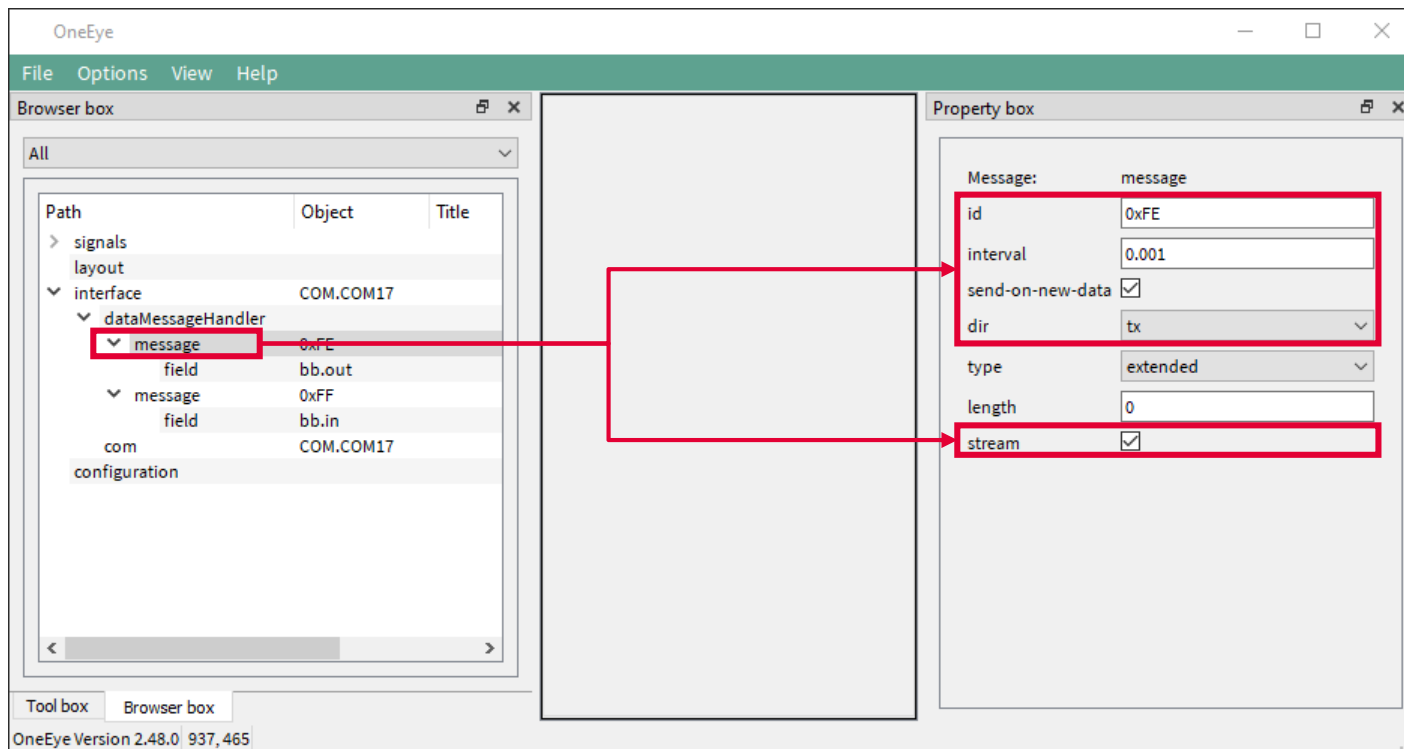
The COM port is now opened and ready for communication.



Implementation - OneEye

Configuring the UART interface: Transmit stream

Right click on the **interface** in the Browser box, and select **Add child -> dataMessageHandler**. Then right click on the created **dataMessageHandler** and select **Add child -> message** to create a message item. Configure the **message** with the **id=0xFE**, **interval=0.001**, **send-on-new-data** checked, **dir=tx**, **stream** checked.



The screenshot shows the OneEye software interface with the following configuration:

Property	Value
Message:	message
id	0xFE
interval	0.001
send-on-new-data	<input checked="" type="checkbox"/>
dir	tx
type	extended
length	0
stream	<input checked="" type="checkbox"/>

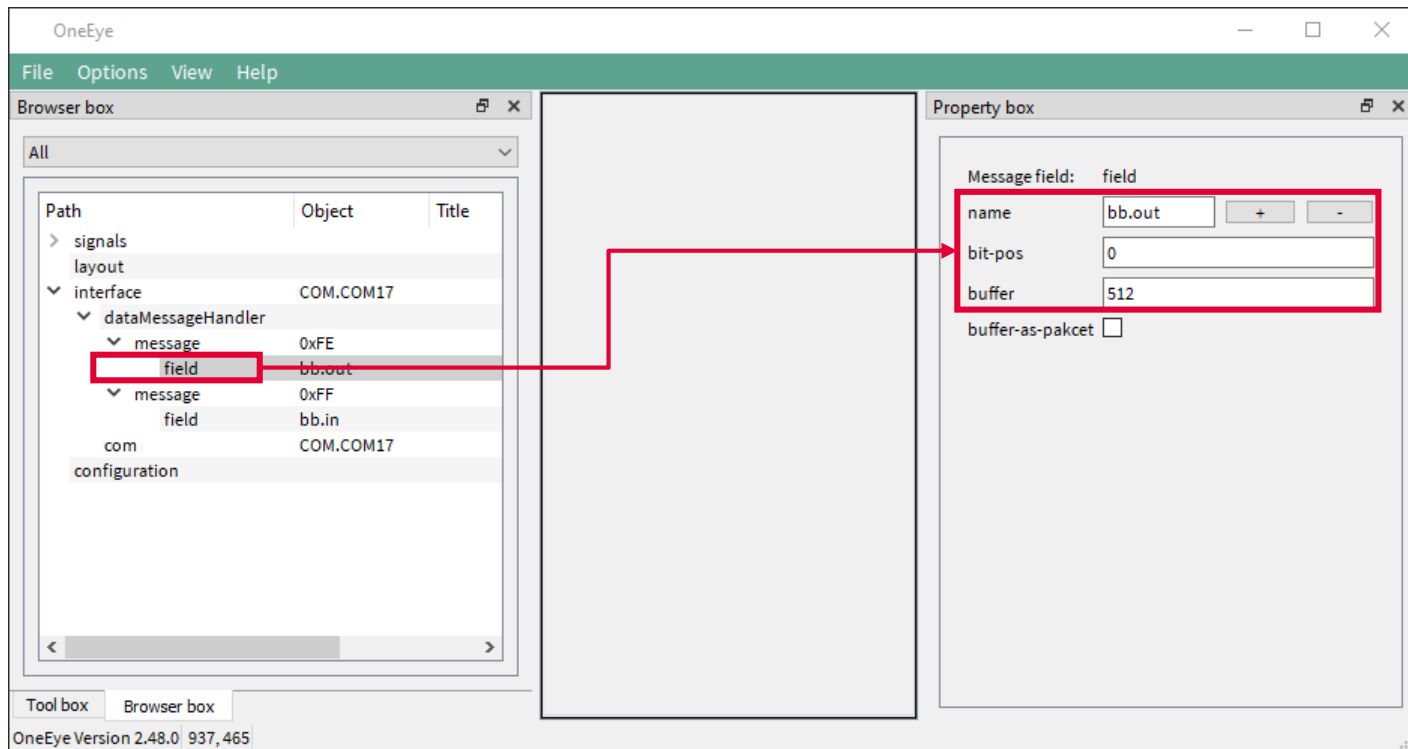
The Browser box shows the following tree structure:

- signals
 - layout
 - interface (COM.COM17)
 - dataMessageHandler
 - message (0xFE)
 - field (bb.out)
 - message (0xFF)
 - field (bb.in)
 - com (COM.COM17)
 - configuration

Implementation - OneEye

Right click on the **message**, and select **Add child -> field**.
Configure the field with **name=bb.out**, **bit-pos=0**, **buffer=512**.

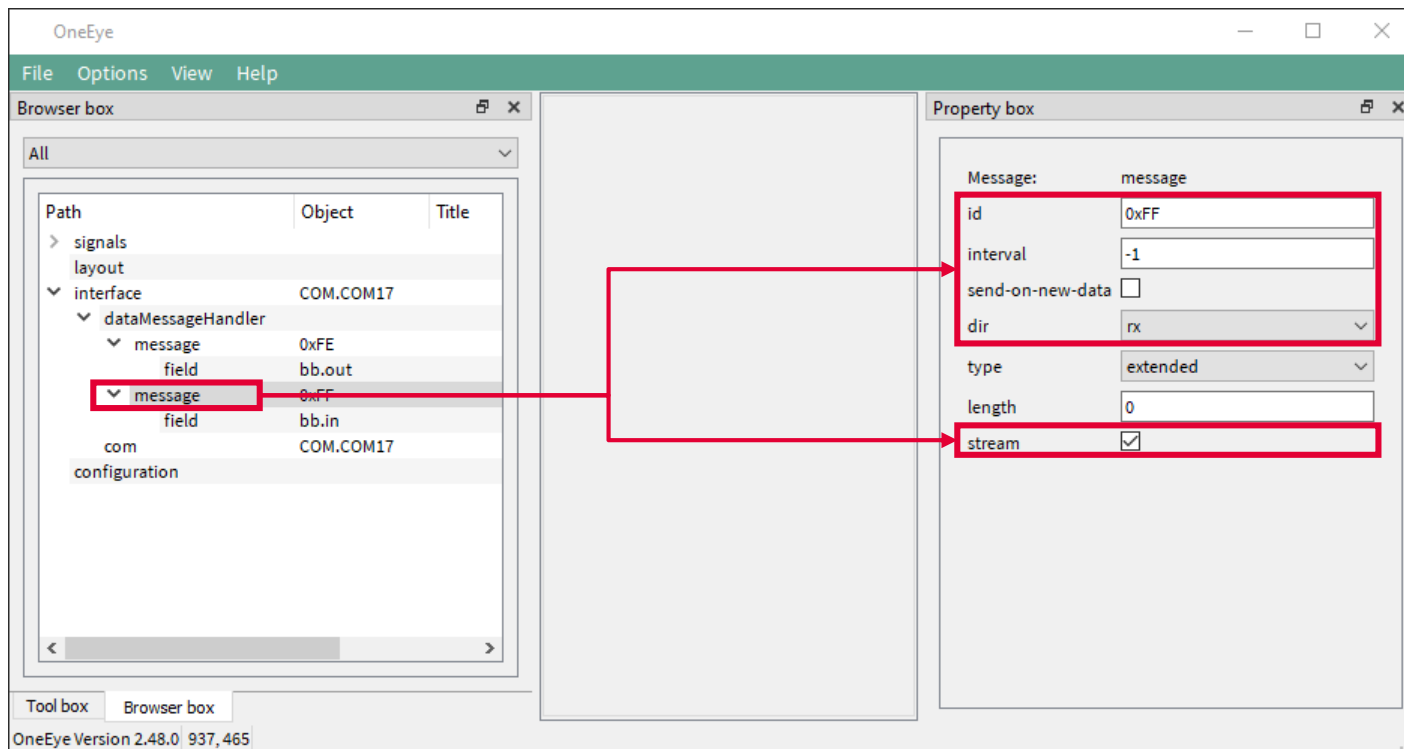
Now, data will be transmitted over the UART each time the **bb.out** signal is written with some data.



Implementation - OneEye

Configuring the UART interface: Receive stream

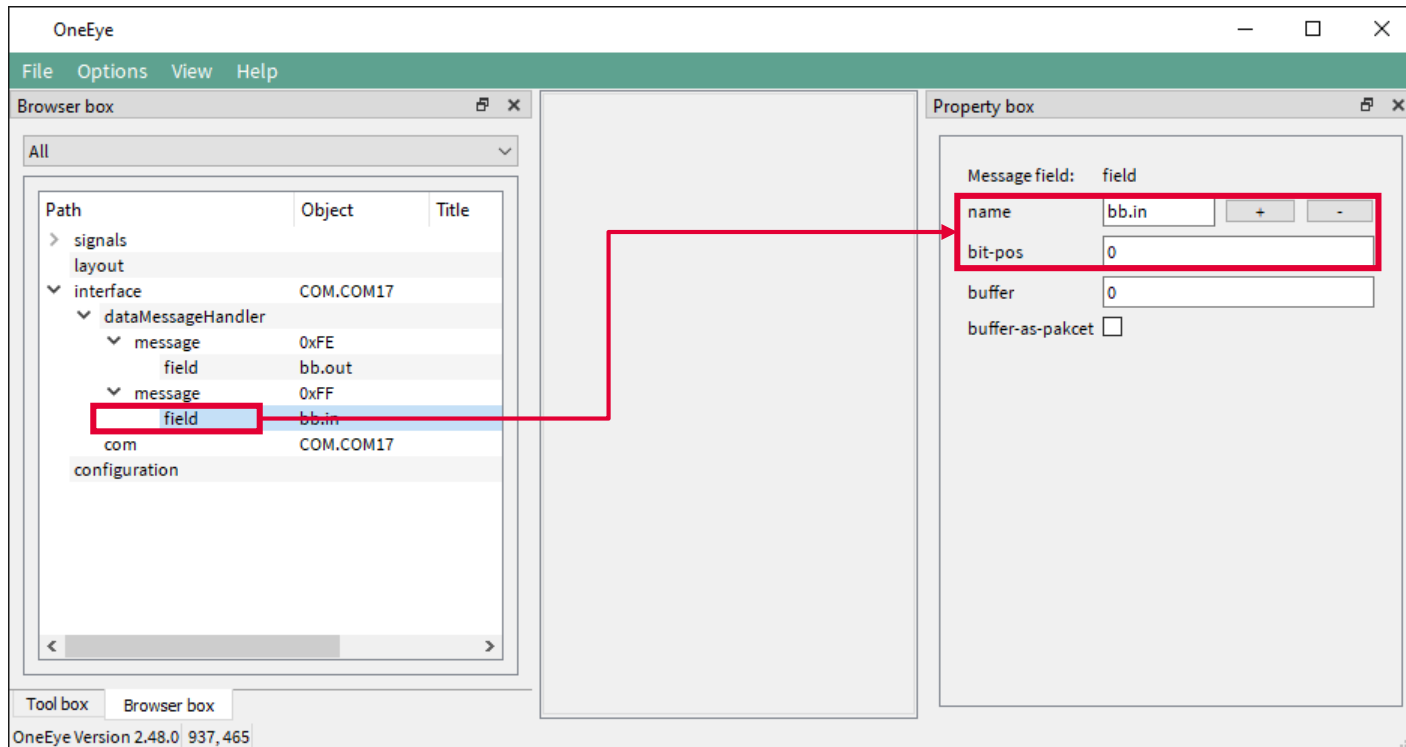
Right click on the **dataMessageHandler** and select **Add child -> message** to create a second message item. Configure the message with the **id=0xFF**, **interval=-1**, **dir=rx**, stream checked.



Implementation - OneEye

Right click on the **message**, and select **Add child -> field**.
Configure the field with **name=bb.in**, **bit-pos=0**.

Now each time data are received over the UART, the **bb.in** signal will be updated.

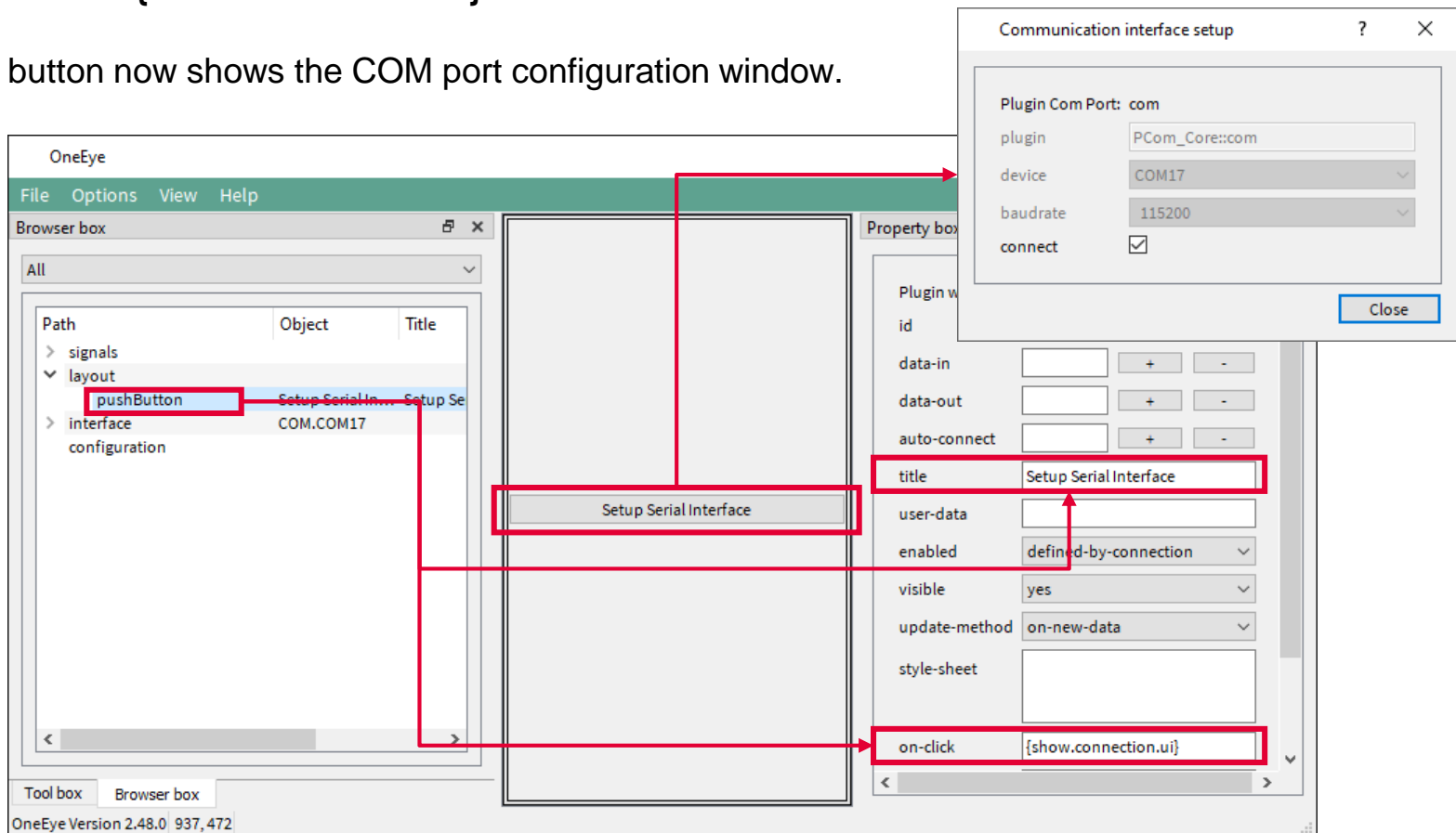


Implementation - OneEye

Configuring the UART interface: Push button

Drag and drop a **pushButton** widget from the toolbox onto the layout, configure it with **title=Setup Serial Interface**, **on-click={show.connection.ui}**.

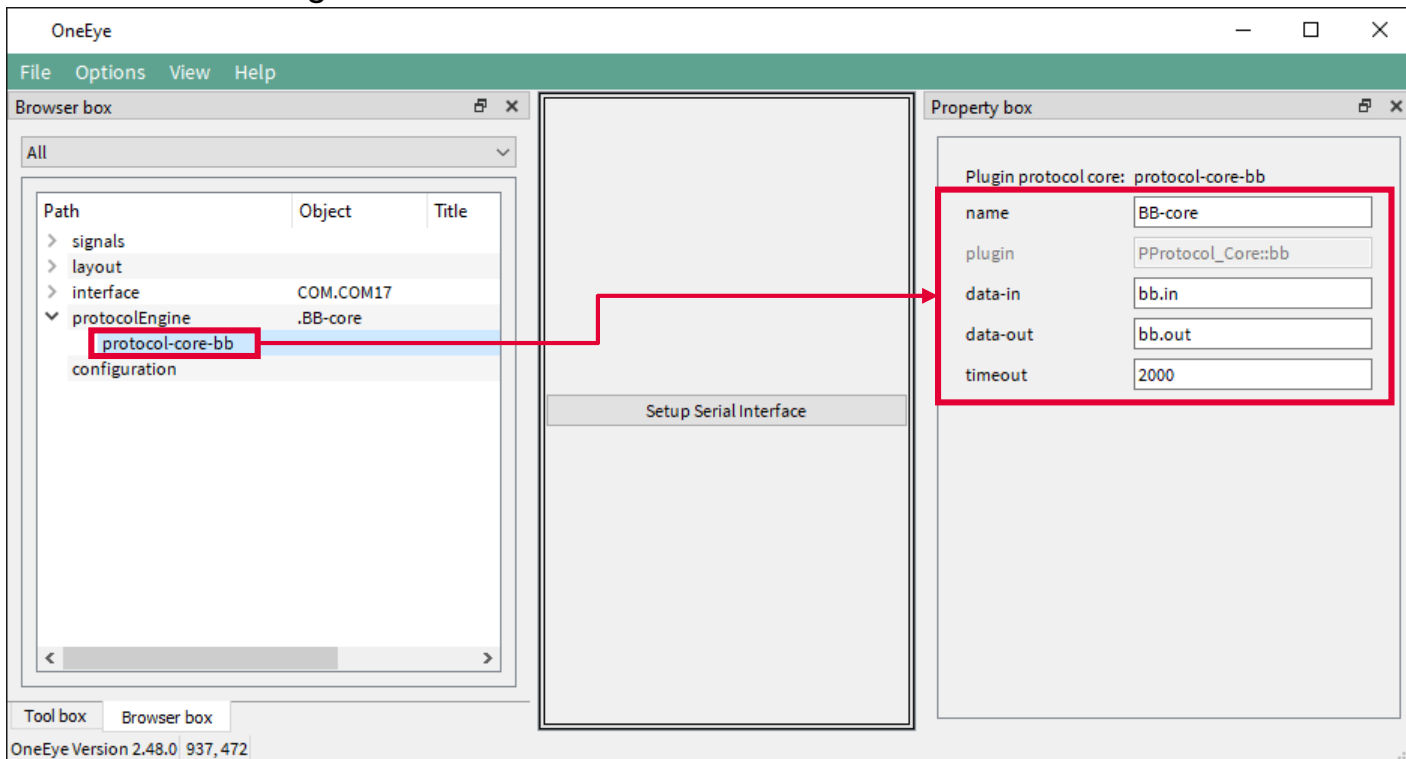
Clicking the button now shows the COM port configuration window.



Implementation - OneEye

Configuring the BB protocol

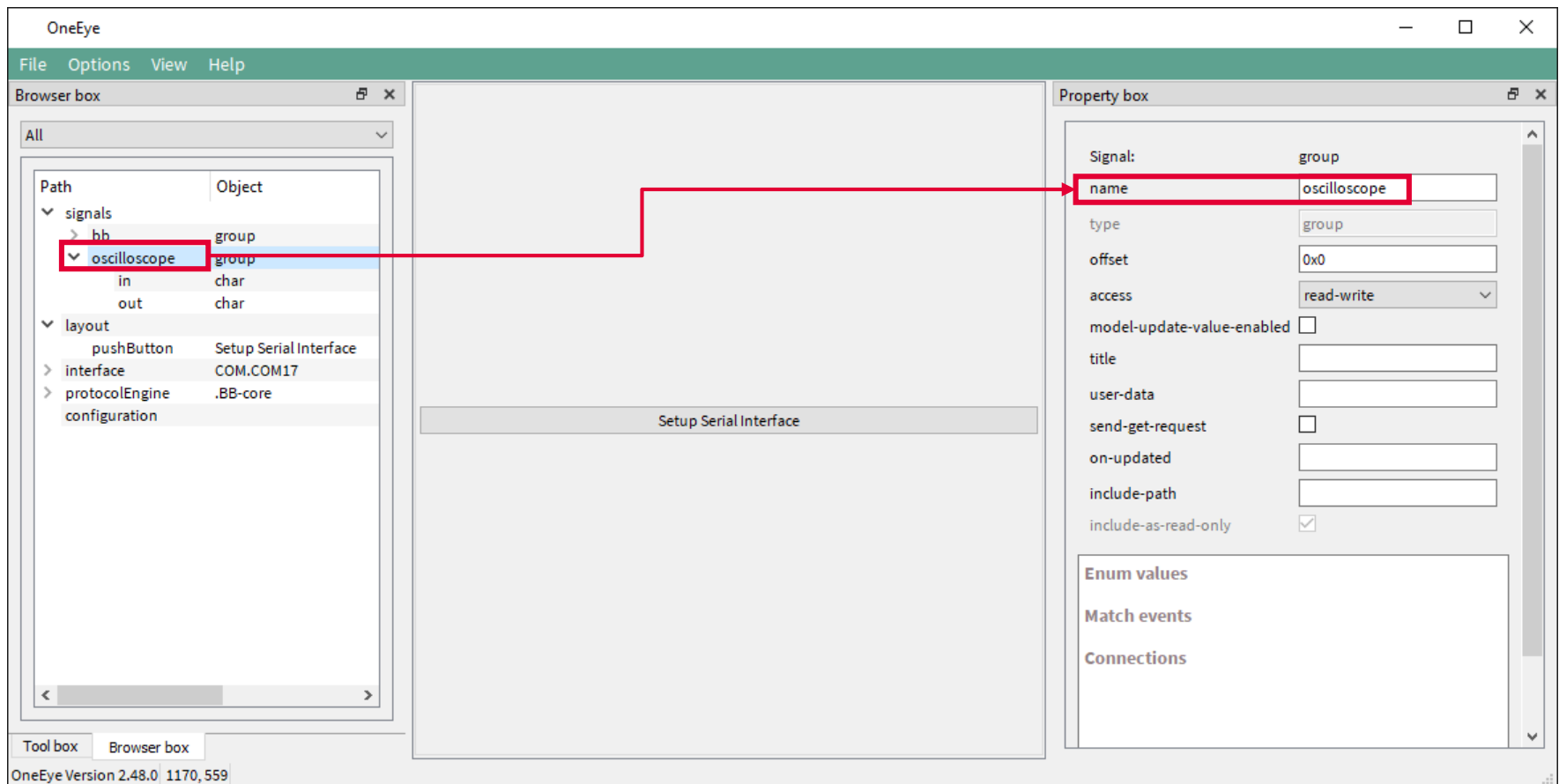
Right click in an empty area of the Browser box, and select **Add child -> protocolEngine**. Then right click on the created **protocolEngine** and select **Add child -> protocol-core-bb**. Connect the BB protocol stream to the **bb.in** and **bb.out** signals by setting respectively the **data-in** and **data-out** properties. Set the **name** property to **BB-core**. And set the **timeout** to **2000** ms so that frames are dropped after 2 seconds in case the microcontroller is not answering.



Implementation - OneEye

Configuring the Oscilloscope: signals creation

Create a signal group and set its **name** property to **oscilloscope**.

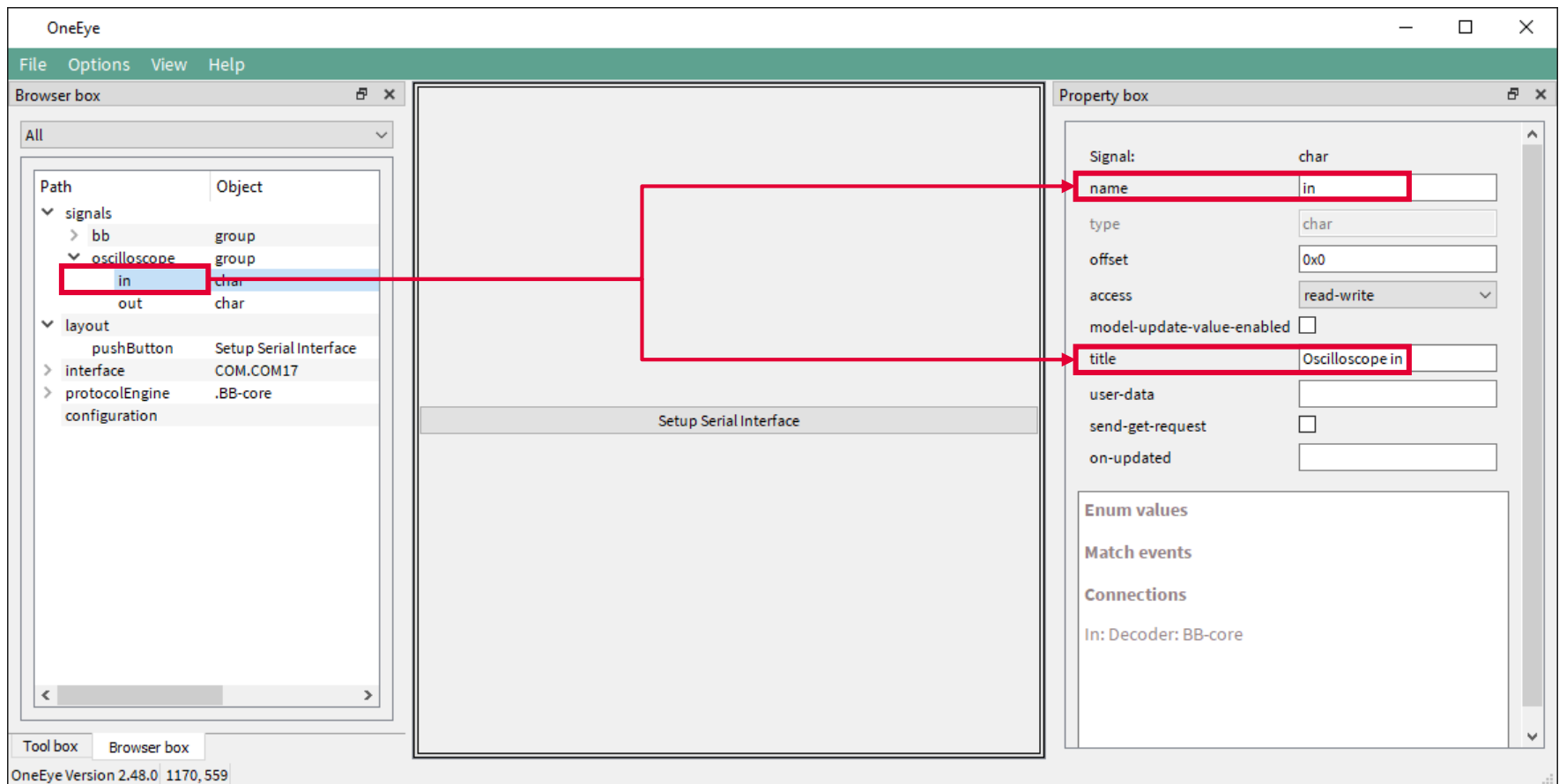


The screenshot shows the OneEye software interface with the following components:

- Browser box:** A tree view on the left showing a hierarchy of objects. The 'signals' folder is expanded, and the 'oscilloscope' group is selected and highlighted with a red box. A red arrow points from this box to the 'name' property in the Property box.
- Property box:** A panel on the right showing the configuration for the selected 'oscilloscope' group. The 'name' property is set to 'oscilloscope' and is highlighted with a red box. Other properties include 'type' (group), 'offset' (0x0), 'access' (read-write), and 'include-as-read-only' (checked).
- Central Canvas:** A large area in the middle showing a 'Setup Serial Interface' component.
- Footer:** The text 'OneEye Version 2.48.0 1170, 559' is visible at the bottom left.

Implementation - OneEye

Add two signals of type **char** into the **oscilloscope** group, name them **in** and **out**, and set their **title** property to respectively **Oscilloscope in** and **Oscilloscope out**.



The screenshot shows the OneEye software interface with the following components:

- Browser box:** A tree view on the left showing the project structure. The 'signals' folder is expanded, and the 'oscilloscope' group is selected. Two signals, 'in' and 'out', are listed under 'oscilloscope', both of type 'char'. The 'in' signal is highlighted with a red box.
- Property box:** A panel on the right showing the properties for the selected signal. The 'Signal:' dropdown is set to 'char'. The 'name' property is set to 'in' (highlighted with a red box). The 'type' is 'char', 'offset' is '0x0', and 'access' is 'read-write'. The 'title' property is set to 'Oscilloscope in' (highlighted with a red box).
- Central Canvas:** A large empty area in the center, with a grey bar at the bottom labeled 'Setup Serial Interface'. Red lines connect the 'in' signal in the browser box to the 'name' and 'title' fields in the property box.

At the bottom left, the status bar indicates 'OneEye Version 2.48.0 1170, 559'.

Implementation - OneEye

Create the oscilloscope widget

Drag and drop an **oscilloscope** widget from the toolbox onto the layout, set the oscilloscope properties **data-in** and **data-out** to respectively **oscilloscope.in** and **oscilloscope.out**. Set the **protocol-type** property to **ProtocolBB**. Set the **unit-x** property to **s**.

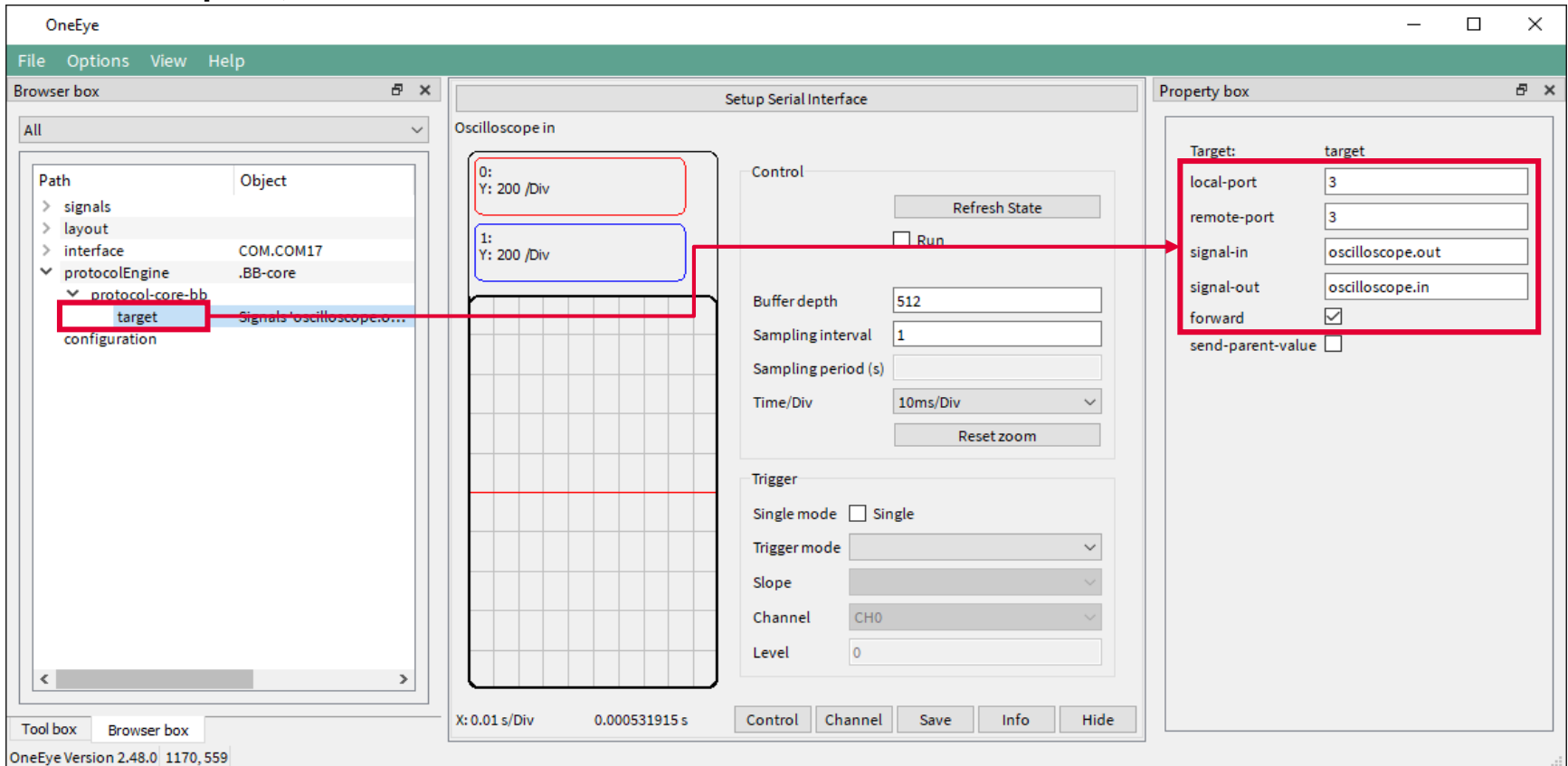
The screenshot shows the OneEye software interface with the following components and configurations:

- Browser box:** Shows a tree view of objects. The **oscilloscope** widget is highlighted in red.
- Setup Serial Interface:** A window titled "Oscilloscope in" showing a grid with two signals:
 - 0: Signal A (V) with Y: 200 (V)/Div and Value: 865 (V)
 - 1: Signal B with Y: 200 /Div and Value: 088
- Property box:** Shows the configuration for the **oscilloscope** widget. The following properties are highlighted in red:
 - data-in:** oscilloscope.in
 - data-out:** oscilloscope.out
 - protocol-type:** ProtocolBB
 - unit-x:** s

Implementation - OneEye

Connect the oscilloscope widget to the BB protocol

Right click on the **protocol-core-bb** and select **Add child -> target**. Select the **target** item and set **local-port** and **remote-port** to **3** to match the AURIX settings, **set signal-in=oscilloscope.out, signal-out=oscilloscope.in, forward=checked**.



The screenshot shows the OneEye software interface with three main panels: Browser box, Setup Serial Interface, and Property box.

- Browser box:** Shows a tree view of the project structure. The **target** item under **protocol-core-bb** is selected and highlighted with a red box.
- Setup Serial Interface:** Shows the configuration for the selected **target**. The **Oscilloscope in** section is visible, with two channels (0 and 1) highlighted by red and blue boxes respectively. The **Control** section includes a **Run** button and a **Refresh State** button. The **Trigger** section includes **Single mode**, **Trigger mode**, **Slope**, **Channel**, and **Level** settings.
- Property box:** Shows the configuration for the **target**. The **local-port** and **remote-port** are set to **3**. The **signal-in** is set to **oscilloscope.out** and the **signal-out** is set to **oscilloscope.in**. The **forward** checkbox is checked.

Red arrows indicate the connection between the **target** in the Browser box, the **Oscilloscope in** section in the Setup Serial Interface, and the **Property box**.

OneEye Version 2.48.0 1170, 559

Implementation - OneEye

Test the oscilloscope

The oscilloscope Control tab provides configuration for the trigger and information about the oscilloscope state (armed, triggered, uploading).

Click on the **Control** button **1** and the **Refresh State** button to retrieve the oscilloscope settings (channels, timings, ...).

The screenshot displays the OneEye software interface. The main window is titled "OneEye" and contains several panels:

- Tool box:** Contains various components like Label, Line Edit, Logger, Logger Channel, Mux-Demux, Named Pipe Client, Named Pipe Server, Oscilloscope, and Oscilloscope Channel.
- Browser box:** Shows a tree view of the project structure, including "signals" and "bb" sub-items.
- Setup Serial Interface:** A central panel with a grid for the oscilloscope display. Below the grid, the "Control" tab is active, showing settings for Buffer depth (512), Sampling interval (1), Sampling period (0.01), and Time/Div (1s/Div). The "Refresh State" button is highlighted with a red box. Below the "Control" tab, the "Trigger" section is visible, showing settings for Single mode, Trigger mode (Automatic), Slope (Rising edge), Channel (CH0: Signal A (V)), and Level (0).
- Property box:** Located on the right, it shows configuration for the target, including local-port (3), remote-port (3), signal-in (oscilloscope.out), signal-out (oscilloscope.in), forward (checked), and send-parent-value (unchecked).

At the bottom of the interface, there are buttons for "Control", "Channel", "Save", "Info", and "Hide". The "Control" button is highlighted with a red box and a red circle containing the number "1".

OneEye Version 2.48.0 1310, 645

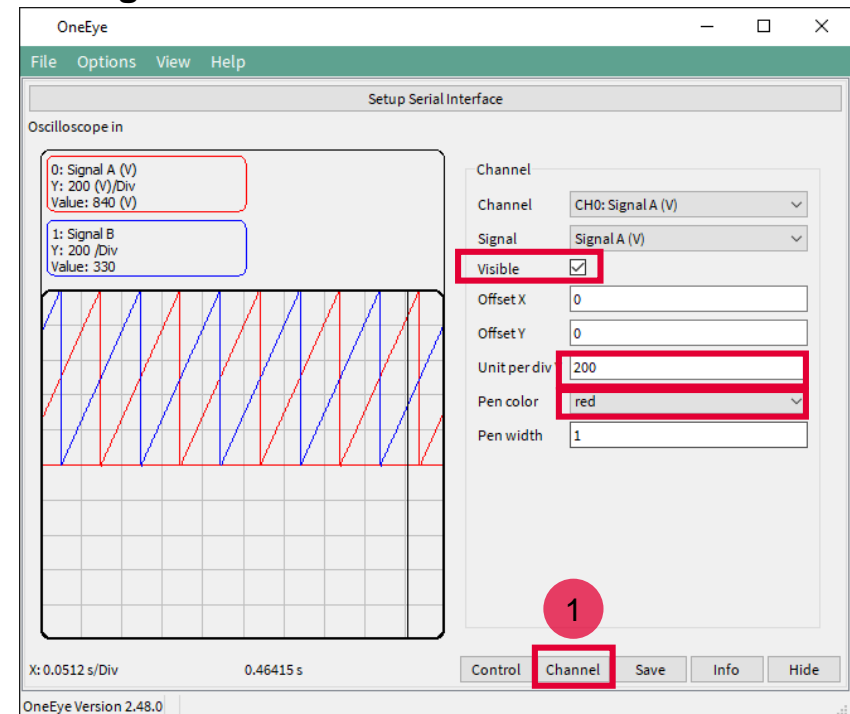
Implementation - OneEye

Test the oscilloscope

In the oscilloscope Channel tab, click on the Channel button **1** and check the **visible** check box for both **CH0: Signal A** and **CH1: Signal B** to display the two channels.

Set the **Unit per div Y** to **200** for both **CH0: Signal A** and **CH1: Signal B**.

Select the **Pen color red** for **CH0: Signal A** and **blue** for **CH1: Signal B**.



Implementation - OneEye

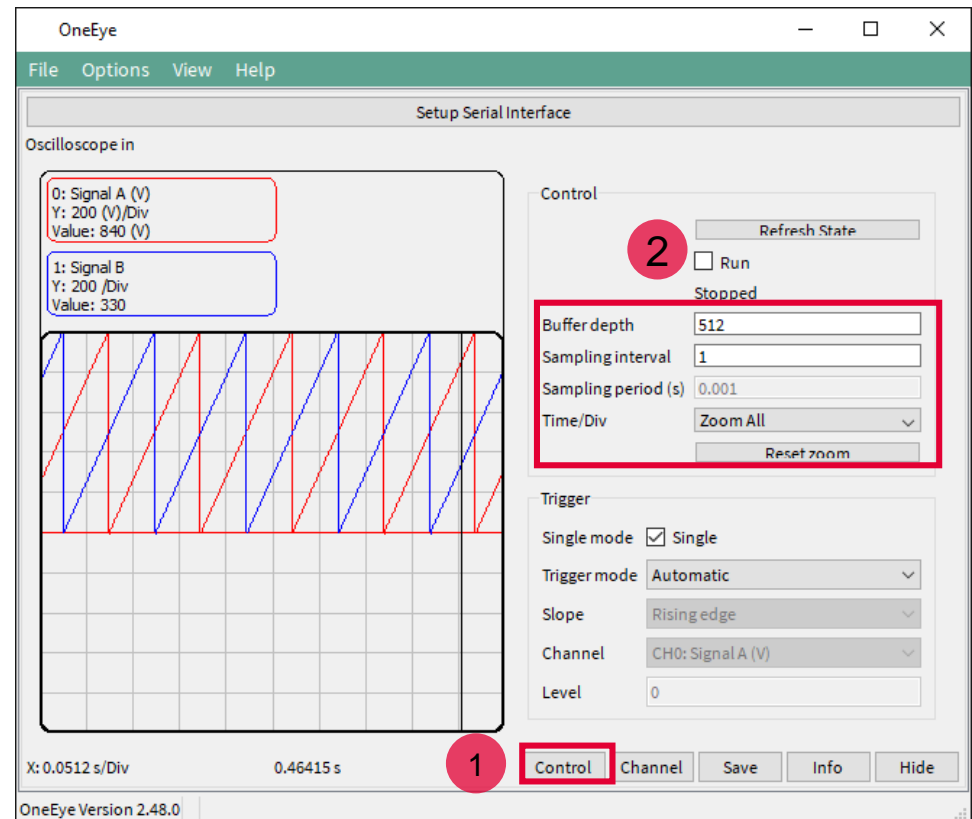
Test the oscilloscope

Click on the Control button **1**, check the run button **2**, the values for **signalA** and **signalB** should be updating in the oscilloscope.

Set the **Time/Div** value to **Zoom All** to configure the horizontal scale to use the full screen of the oscilloscope window.

The **Buffer depth** configures the oscilloscope buffer depth, here 512 points are used to fill the buffer. This value can be changed within the limit set by the software.

The **Sampling interval** provides the information whether to sample at each interval (1) or not (>1) to the oscilloscope.



Implementation - OneEye

Advanced options

Advanced configuration can be added to the file *Ifx_Cfg.h* or *ifx_oe_cfg.h* to tune the oscilloscope capabilities, this includes:

- › ***IFX_CFG_OE_OSCI_MAX_NUM_OF_SIGNALS***: the maximum number of signals that can be declared by the user
- › ***IFX_CFG_OE_OSCI_MAX_NUM_OF_CHANNELS***: the maximum number of channels that can be buffered
- › ***IFX_CFG_OE_OSCI_NUM_OF_SAMPLES***: the maximum number of sample per channel

Note: the memory used by the oscilloscope is mainly defined by

IFX_CFG_OE_OSCI_MAX_NUM_OF_CHANNELS * IFX_CFG_OE_OSCI_NUM_OF_SAMPLES * 4

Default values for the above mentioned macros are provided in *ifx_oe_oscicfg.h* under Library/OneEye.

References



- › AURIX™ Development Studio is available online:
- › <https://www.infineon.com/aurixdevelopmentstudio>
- › Use the „*Import...*“ function to get access to more code examples.



- › More code examples can be found on the GIT repository:
- › https://github.com/Infineon/AURIX_code_examples



- › For additional trainings, visit our webpage:
- › <https://www.infineon.com/aurix-expert-training>



- › For questions and support, use the AURIX™ Forum:
- › <https://www.infineonforums.com/forums/13-Aurix-Forum>

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Document reference

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_KIT_TC375_LK

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