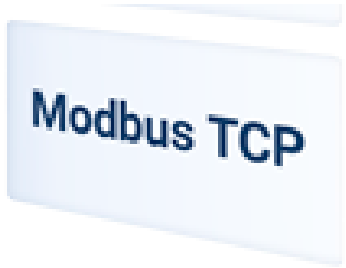
Version 2.0.1

WeighingExcellence

Connection via Modbus TCP

WTX120



Agenda :

1. Prerequisites
    1. Hardware
    2. Software
2. Step-by-Step
    1. Run Example Applications
    2. Programing own Window App Using the API
        1. Overview Structure & Communication Flow
        2. Code Example Using the API
        3. Change Settings of the WTX120
        4. Calibration
3. Outlook & Link Collection

1.1 Prerequisites – Hardware

- HBM WTX120 weighing terminal
- Supply voltage for WTX120 (12V-30V, DC)
- RJ45 Cable (“LAN” Cable)
- A weighing sensor, e.g. HBM PW6C
- Computer with LAN-port or which is connected to the same network as the WTX
- Visual Studio 2017 hardware requirements:
  - Min. 1.8 GHz processor (dual-core recommended)
  - Min. 2 GB RAM (4 GB recommended)
  - Around 20-50 GB hard disk space

1.2 Prerequisites – Software

- Windows operating system, min. Win7 SP1
  (for programming also macOS possible)
- Min. Visual Studio (VS) 2013
- .Net Version 4.5.2

1.2 VS Community License - Extract

“For organizations

An unlimited number of users within an organization can use Visual Studio Community for the following scenarios: in a classroom learning environment, for academic research, or ***for contributing to open source projects***

For all other usage scenarios:
In non-enterprise organizations, up to five users can use Visual Studio Community. In enterprise organizations (meaning those with >250 PCs or >$1 Million US Dollars in annual revenue)

For individuals

Any individual developer can use Visual Studio Community to create their own free or paid apps.”

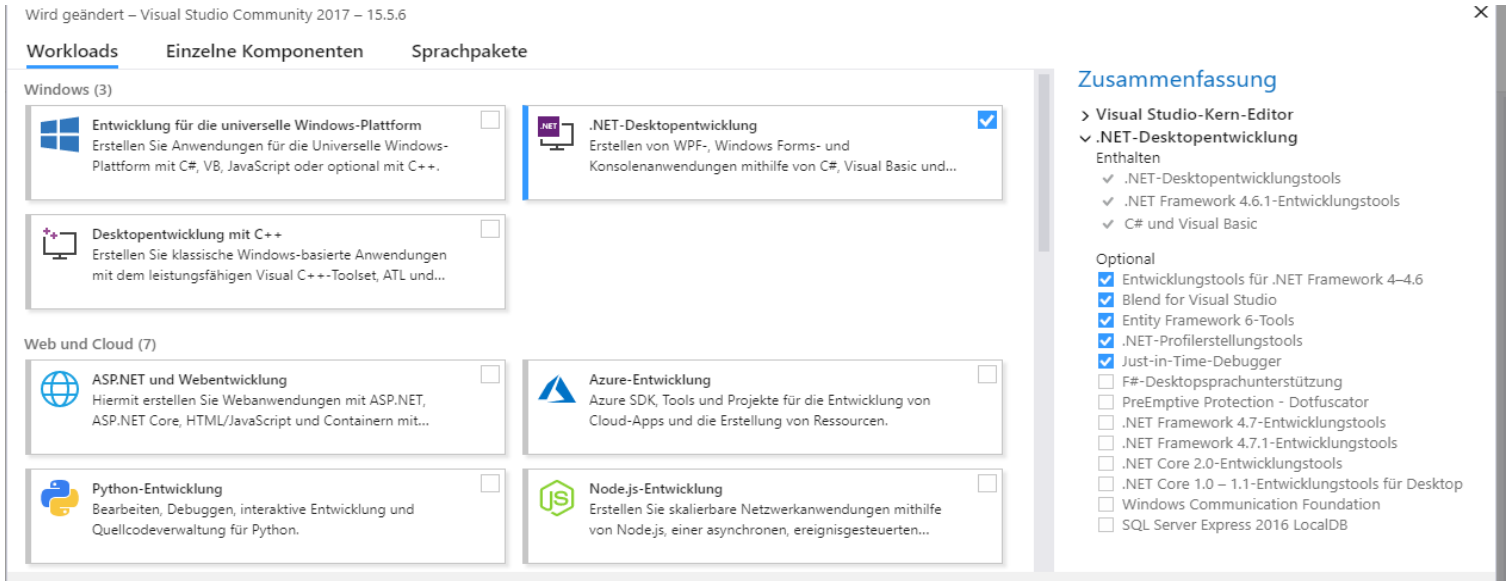
From https://www.visualstudio.com/vs/community/ (02/14/2018)

After 30 days you have to log in with a Microsoft account to unlock the test version

Everyone else needs another license!

2 Step-by-Step - Installation

- You can find all required links for downloads in the Link-Collection
- Install VS with .NET-Development extension or basic version and install required packages afterwards
- Download ModbusTCP_WTX from GitHub



Picture: VS Required Tools and Features

2 Step-by-Step - Connect WTX & Get Started

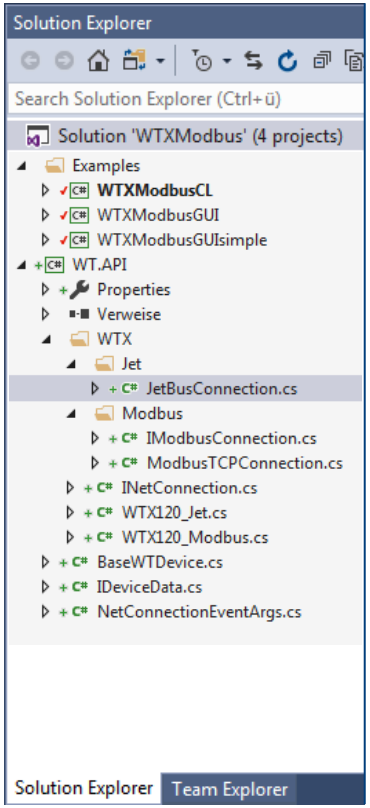
- Connect WTX120 with the same network as your PC
  Note: WTX does not support DHCP currently, only fixed IP

- Or connect directly to your PC, the IP-address in WTX must be the same, where the subnet-mask is 255, and different, where it is 0.

- Open WTXModbus.sln in the *WTXModbus* folder in the downloaded folder

  Note: You need internet access during the first build, because WTXModbus downloads 2 NuGet- packages one-time

- Project overview: 3 example applications: one command line application (CL), two graphic applications (GUI), and the API *WT.API*

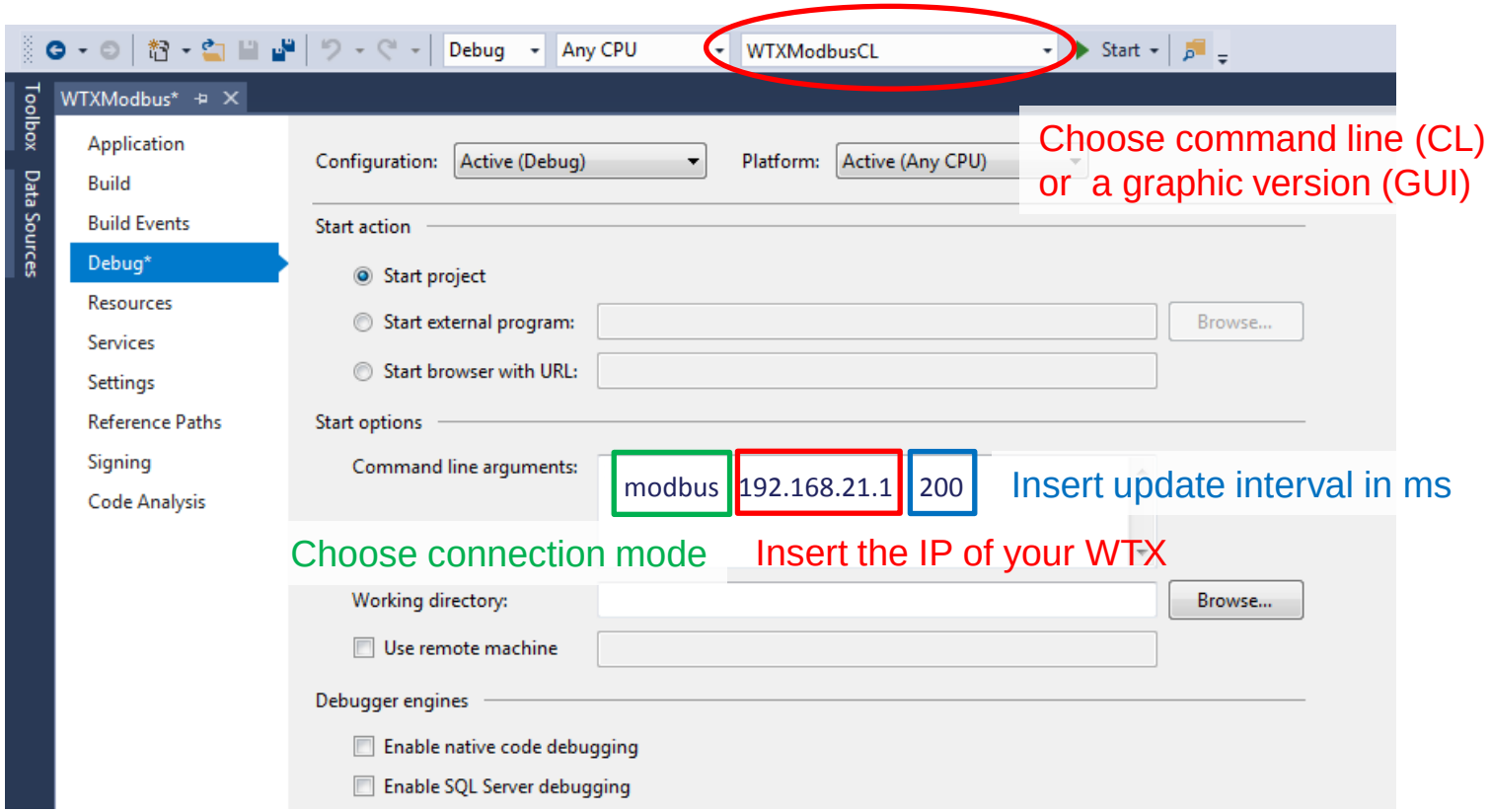


Picture: Project overview– Solution explorer

2.1 Step-by-Step - Example Application

- Start a demo example: Choose an app

  Note: If you choose WTXModbusCL, you have to set the IP in the VS project properties menu as an argument. Connection establishs automatically after start.

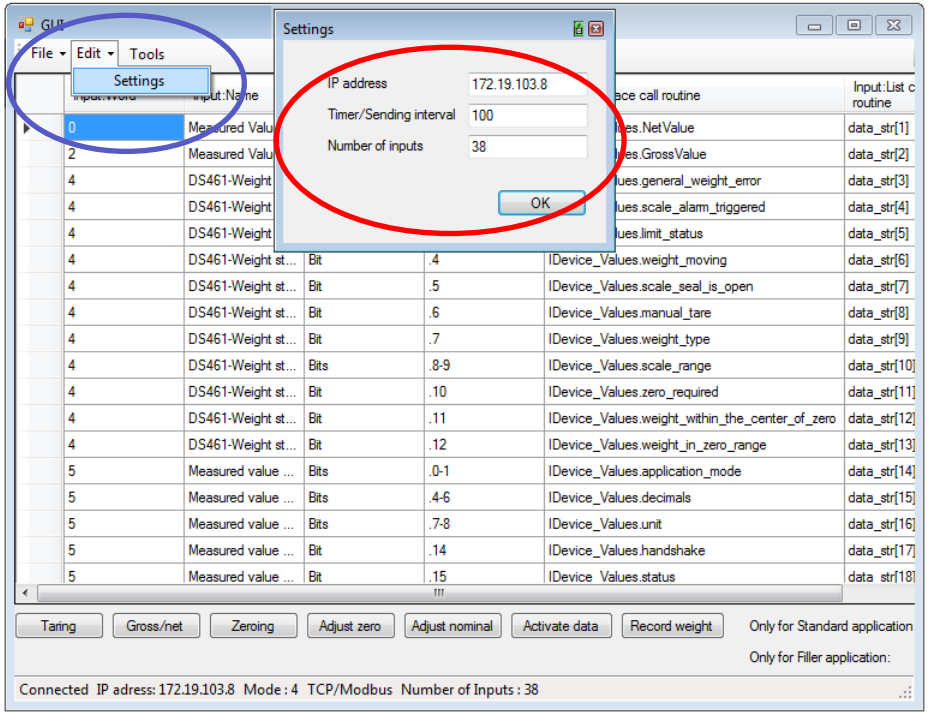


Picture: WTXModbusCL Project Menu (Project-> WTXModbusCL Properties… -> Debug)

- If a failure occurs during build, probably you have not installed all required VS packages

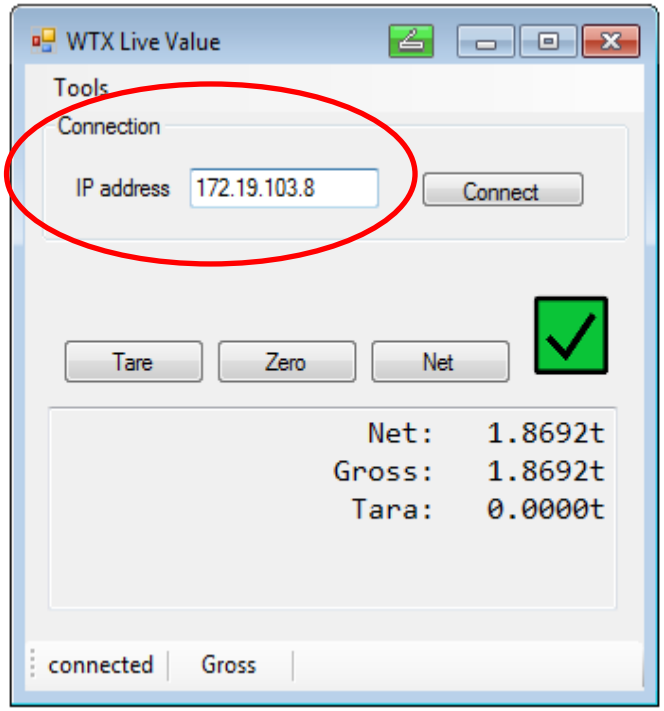
2.1 Step-by-Step - Example Application: GUIs

- GUI example apps can change their IP graphically, also during a run



Picture: Example User Interface "WTXModbus GUI"

WTXModbusGUI:
Start by clicking *File -> Start*



Picture: Example User Interface "WTXModbus GUIsimple"

WTXModbusGUIsimple:
Start by clicking *Connect*

2.2.1 Step-by-Step - Use the API: Overview Structure

communicates via Modbus/TCP protocol

<<interface>>
INetConnection

+Connect():void
+Write(…):void
+Read(…):void

implements

ModbusConnObj :
ModbusTCPConnection

+RaiseDataEvent :
event EventHandler
<NetConnectionEvent
Args<ushort[]>>

1 has

<<interface>>
IDeviceData

~NetValue:int
~GrossValue:int
~status:int
~handshake:int
….
~DataUpdateEvent:
event EventHandler

implements

WTXObj :
WTXModbus

-ModbusConnObj:
ModbusConnection

- ModbusTCPConnection uses an event handler to signalize that data has been read

- IDeviceData defines the properties (attributes) for values from the WTX device and an eventhandler to check if new data has been read and converted afterwards

2.2.1 Step-by-Step - Use the API: Overview Communication Flow (1)

Real World

API

3. Connect()

ModbusConnObj :
ModbusTCPConnection

+is_connected:bool
+IP_Adress:String

has

WTXObj : WTXModbus

-aTimer:Timer

+WTX120Modbus
(connection, timerInterval)

API

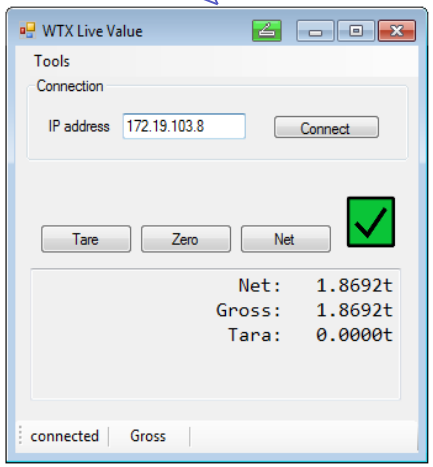
User Interface (Application)

1. *Create*

2. *Create*

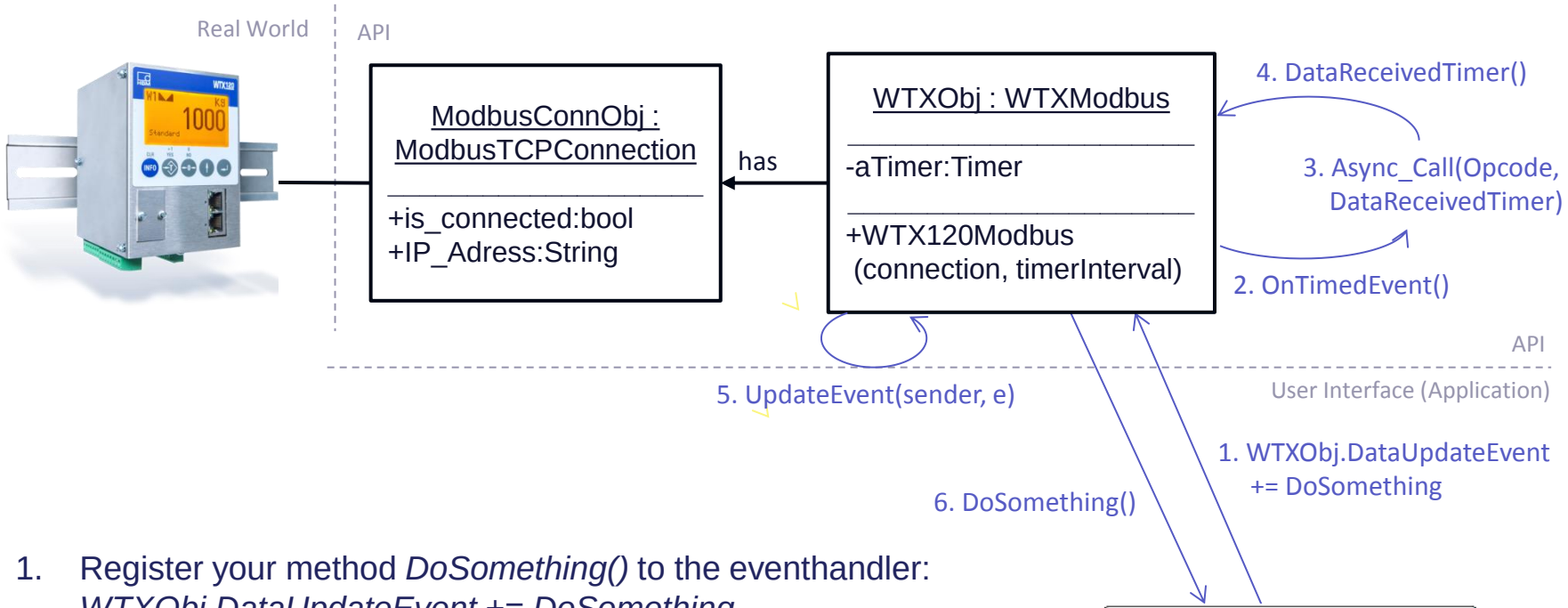
1. Create an object ModbusConnObj of class *ModbusTCPConnection* with an IP-address as a parameter
2. Create an object WTXObj of class *WTXModbus* with ModbusConnObj and a timer interval as a parameter
3. Call *Connect()* on ModbusConnObj

Note: Code example see slide 14



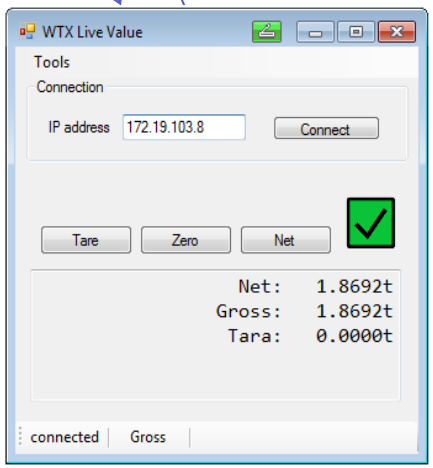
Picture: Example User Interface "WTXModbus GUIsimple"

2.2.1 Step-by-Step - Use the API: Overview Communication Flow (2)



1. Register your method *DoSomething()* to the eventhandler: *WTXObj.DataUpdateEvent += DoSomething*
2. *aTimer* calls periodically *Async_Call()*
3. The method *Async_Call()* updates the values in *WTXObj* via *ModbusConnObj* 's method *Read()*
4. *DataRecievedTimer()* in *WTXObj* is executed as soon as the values are up-to-date
5. The data is called up after *.Invoke()* in WTX120Modbus within method *UpdateEvent()* and fetched
6. *DoSomething()* is executed.

Steps 3-6 are repeated periodically.



Picture: Example User Interface "WTXModbus GUIsimple"

2.2.2 Step-by-Step - Use the API: Create your own Application

For GUI

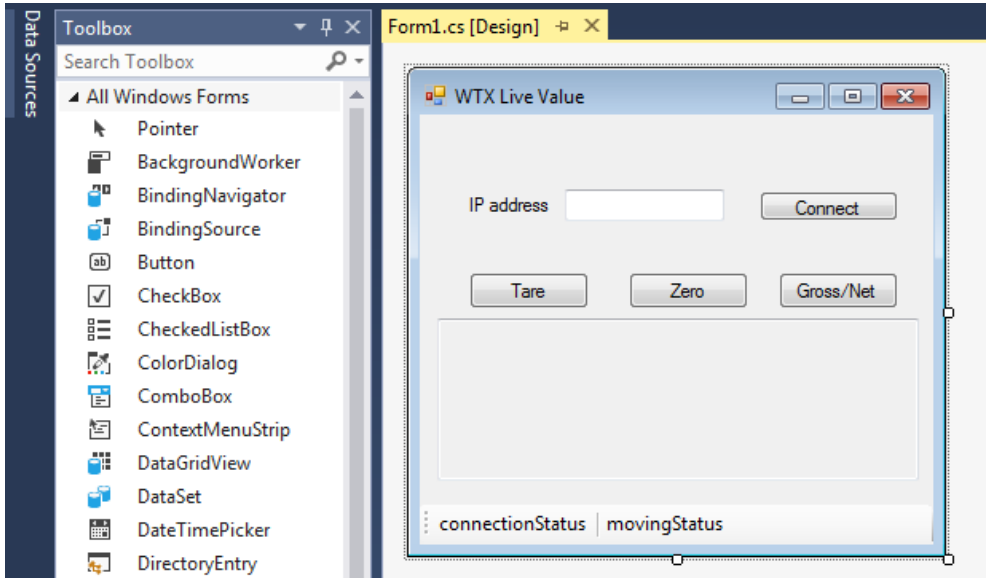
- Add a new *Windows Forms App* project to the Solution
- Use the VS Toolbox to create a display window (drag & drop)
- Double-click on buttons or timer to create empty methods in code
- Use F7 to switch to the programming view

For CL

- Use *Console App* project

For both

- Use methods as mentioned on the previous slides to create your program



Picture: VS Toolbox with an Example Window

2.2.2 Step-by-Step - Use the API: Code Example (1)

Code Example

```
using Hbm.Devices.WTXModbus; // 1)
using WTXModbus;

namespace CodeExample
{
   public class ClassExample
   {
      private ModbusTCPConnection ModbusObj;
      private WTXModbus WTXObj;

      public ClassExample()
      {
         int interval=1000;
         ModbusObj = new ModbusTCP(IPAddress);     // 2) 3)
         WTXObj = new WTXModbus(ModbusObj, interval);
         WTXObj.getConnection.Connect();           // 4)
         // equal to  ModbusObj.Connect();
         ModbusObj.DataUpdateEvent += DoSomething; // 5)
      }

      private void DoSomething(object sender,       // 6)
            NetConnectionEventArgs<ushort[]> e)
      {
         //Print Values on Console
         Console.WriteLine(WTXObj.NetValue);       // 7)
         Console.WriteLine(WTXObj.GrossValue);
      }
   }
}
```

Description

1) Required imports

2) *IPAddress* is a string like “192.168.21.1” and *interval* is in milliseconds

3) Create an object of *ModbusTCPConnection* with an IP address of the WTX device and an object of *WTX120Modbus* with the created *ModbusTCPConnection* object and a timer interval

4) Connect your device

5) Add your method *DoSomething ()* to the Eventhandler *DataUpdateEvent*

6) The method is called from the API once the data is read from your WTX device and stored in *WTXObj*

7) Here *DoSomething* updates the console with the newly arrived net and gross values. Write your specific code here!

See next slide for another example of *DoSomething*

2.2.2 Step-by-Step - Use the API: Code Example (2)

Code Example

```
…
    ModbusObj.DataUpdateEvent += ValuesOnConsole;
}

private void ValuesOnConsole(object sender,
   NetConnectionEventArgs<ushort[]> e)
{
   Console.WriteLine("Some example values from WTX:");
   // To print the net value as a string:
   Console.WriteLine(WTXObj.NetValueString);
   // To print the gross value as a string:
   Console.WriteLine(WTXObj.GrossValueString);
   // To print the limit status as a string:
   Console.WriteLine(WTXObj.limitStatusString);

   // As ushort or integer values:
   Console.WriteLine(WTXObj.NetValue);
   Console.WriteLine(WTXObj.GrossValue);
   Console.WriteLine(WTXObj.limitStatus);
}
```

Description

ValuesOnConsole() updates the console with the newly arrived values from your WTX device

The values like *WTX120.NetValue* and *WTX120.GrossValue* have *ushort* as type. To convert them to strings there are properties available WTX120.**PropertyName**String like WTX120.NetValueString

2.2.3 Step-by-Step: Writing into the WTX120 device

- Establish a connection
- Call *WTXObj.Async_Call(OpCode, CallbackMethod)*
- The callback method is called once the writing is completed to the WTX120. Choose the content by yourself.
- Choose the function with OpCode according to the table on the right.

Code Example

```
private void buttonTare_Clicked(object sender,
EventArgs e)
{
    WTX_obj.AsyncCall(0x1, WriteDataReceived);
}

private void WriteDataReceived(IDeviceValues_obj)
{
    textBoxAusgabe.Text = “Write executed”;
}
```

OpCode	Meaning
0x1	Taring
0x2	Switch Gross / NET
0x40	Zeroing
0x80	Adjust zero
0x100	Adjust nominal
0x800	Activate data
0x1000	Manual taring
0x4000	Weight storage
(For more see WTX manual, chapter PLC link)	

2.2.4 Step-by-Step: Calibration

There are two possibilities:

- Calculate the values for a dead load and a nominal load in a ratio in mV/V and write in into the WTX registers
  - Call *WTXObj.Calculate(preload, capacity)* on your WTX120 object with preload and capacity as double in mV/V
- Calibration with a reference weight
  - Call *WTXObj.MeasureZero()* with unloaded scale
  - Calculate a normalized weight by

    $weight_{in\_current\_unit} * 10^{WTXObj.decimals}$
  - Call *WTXObj.Calibrate(normalizedWeight)* with *normalizedWeight*

Code Example

```
// Unload scale

WTXObj.MeasureZero();

// put reference weight e.g. 2kg on the scale. WTX display shows weights in kg (WTXObj.unit=0)

Int weight = 2;
Int normalizedWeight = weight * Math.pow(10, WTXObj.decimals);
WTXObj.Calibrate(normalizedWeight);
```

3 Outlook

- If you want to implement an own application, it is recommended to be guided by the interfaces *IDeviceData*and *IModbusTCPConnection*. The latter represents the connection with TCP/Modbus to the WTX and *IDeviceData* represents the available values, which can be called via the interface from your application.

- For more details or functions have a look at the WTX120 manual or at the example app descriptions (coming soon)

- An API with Jetbus and Modbus together is in work to get more information from the WTX as well as easy and similar access to the WTX

3 Link Collection

- WTX120 Website:
  https://www.hbm.com/en/6304/wtx120-industrial-and-legal-for-trade-weighing-terminal/
- WTX120 Manual:
  https://www.hbm.com/fileadmin/mediapool/hbmdoc/technical/a4500.pdf
- ModbusTCP API on Github: *(currently unofficial)*
  https://github.com/FelixHuettlatHBM/ModbusTCP_WTX
- Microsoft Visual Studio:
  https://www.visualstudio.com/vs/

www.hbm.com