

User Manual

English



HBM Common API



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1 General

1.1 About this document

This document is a brief User's Manual, quick introduction to HBM Common API.

It describes key features and main workflows.

For a detailed description of all functions and properties, see the CHM-format help file that is provided together with this API.

For code examples and a quick demonstration of the API take a look at the provided Demo Project.

All code examples in this document are written in C#. They are for demonstration purposes only without warranty of any kind.

1.2 .NET Framework

The HBM Common API is written in C# and requires .NET Framework 4.0.

1.3 Installation

The HBM Common API is shipped as a single setup package.

This setup might be run by any user, though when run with administrator privileges it will also setup the Windows Firewall for the HBM Device Scan to work (see also below in this section).

By default the setup copies all files into a sub-directory "HBM\HBM Common API" within the public documents directory (i.e. for all local users) and makes it accessible via the Start Menu (Windows 7) or the Windows 8.x / Windows 10 Tiles Screen (All Apps section, group HBM). Notice that write-access is necessary for the demo-project to be buildable.

Here you'll find documentation, the API binaries (notice that some DLLs are dedicated to x86 or x64) and a C# demo project (could be built as x86 or Any CPU).

In the binaries directory there is a batch file to setup the Windows Firewall to allow the arrival of messages for the HBM Device Scan. On the developer PC these ports are opened when the setup is run with administrator privileges, otherwise this batch file needs to be run once with administrator privileges before the scan would work.

On systems using a different Firewall the ports need to be opened as done in the batch file.

Building the demo project with MS Visual Studio™ will copy all necessary DLLs into the bin directory using the Post-build event (x64 DLLs when using Any CPU configuration on a 64-bit Windows, otherwise x86 DLLs). The API Assemblies are all built in architecture Any CPU.

2 Developing with the Common API

2.1 Description

The Common API is a modular DAQ framework providing measurement functionalities for different device families in a unified, scalable and fast manner. It also includes a sensor API to work with custom sensors or with sensors from the HBM sensor database.

The Common API hides device family differences behind a common homogeneous interface and therefore reduces your need to rewrite code when switching from one hardware platform to another. You can reuse the same codebase.

2.2 Device families

The actual version of the Common API supports three different HBM device families:

Device Family name	Description
QuantumX / SomatXR	Universal data acquisition system
PMX	Industrial measuring amplifier system for testing and automation.
MGCplus	System for structural tests, durability testing and lab measurements.

2.3 Components

The API consist of a common part, which contains common functionalities shared across all devices, and device specific parts which are so unique to certain device families that they are implemented in the specialized device family driver.

All device family drivers are implemented as Plugins to the Common API. Therefore, the Common API can easily be extended by additional HBM device family drivers or even by 3rd party device family drivers.

The main assemblies of the API are:

Component	Description
Hbm.Api.Common	Main entry point for customer applications. Common functions, Object model, Base classes.
Hbm.Api.Scan	Contains the HBM device scan mechanism to detect devices within your network. Only used internally, should not be used directly by customer applications.
Hbm.Api.Utills	Utilities and helper functions.
Hbm.Api.SensorDB	Sensor database API
Hbm.Api.Logging	Logging API
Hbm.Api.QuantumX	QuantumX / SomatXR device family implementation.
Hbm.Api.Pmx	PMX device family implementation.
Hbm.Api.Mgc	MGC device family implementation.

From a high level perspective the Common API is built in 3 different layers as shown in Figure 1, whereby yellow represents HBM Common API components and blue parts are Non-HBM components like your Application on top of the API.

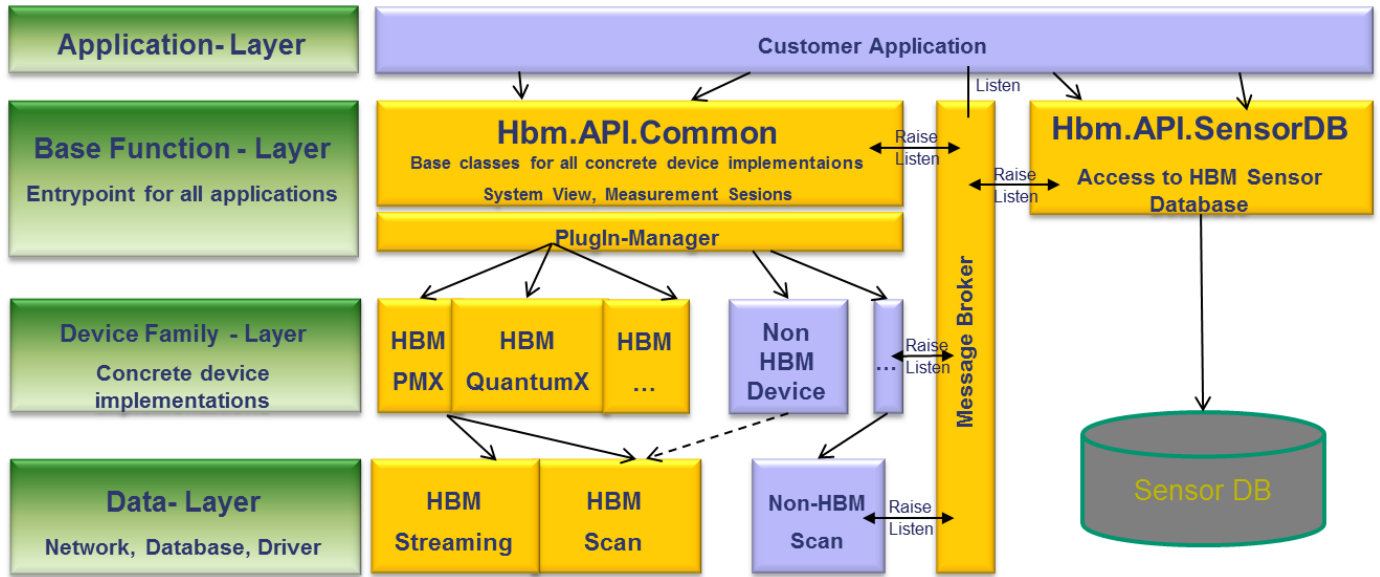


Figure 1 : High Level System Architecture

Assembly Hbm.Api.Common contains the most important classes DaqEnvironment and DaqMeasurement as well as the general object model in namespace Hbm.Api.Common.Entities.

Class	Description
DaqEnvironment	<p>Represents the entire system with all contained devices. Implemented as Singleton, thereby you need to call DaqEnvironment.GetInstance() to obtain an object reference. The first time an instance is created all available concrete device family implementations are enumerated (Plugins) and a scan is initiated.</p> <p>Call DaqEnvironment.GetInstance() as early as possible in your application to ensure that you get a filled result list when calling Scan().</p> <p>Allows the following tasks: Scan network for devices Connect to devices Disconnect from devices</p>
DaqMeasurement	<p>Manages and represents data acquisition sessions.</p> <p>Use this class to execute and run a continuous measurement.</p> <p>Allows the following tasks: Register signals for a measurement session Remove signals from a measurement session Start DAQ session Stop DAQ session Distribute measurement values to registered signals</p>

2.4 Thread safety

All components of the API are designed for parallel access and therefore all functions where thread safety is needed are secured against simultaneous access from different threads.

2.5 Object model

The object model in assembly Hbm.Api.Common supports normal devices as well as streaming devices. Concrete implementations of a device, such as QuantumX / SomatXR, MGC or PMX, implements and fulfils this object model. Each Plugin device driver can also extend this model, but as a minimum this model is shared among all devices.

In most cases it's sufficient to operate on functions and properties of the general class Device. Only if you need to use special device family specific functions, you need to cast to this concrete device implementation and then use these additional features.

The properties of a device are filled with actual values during the connect process. That means that after a successful connect to a device you can explore all properties of that device.

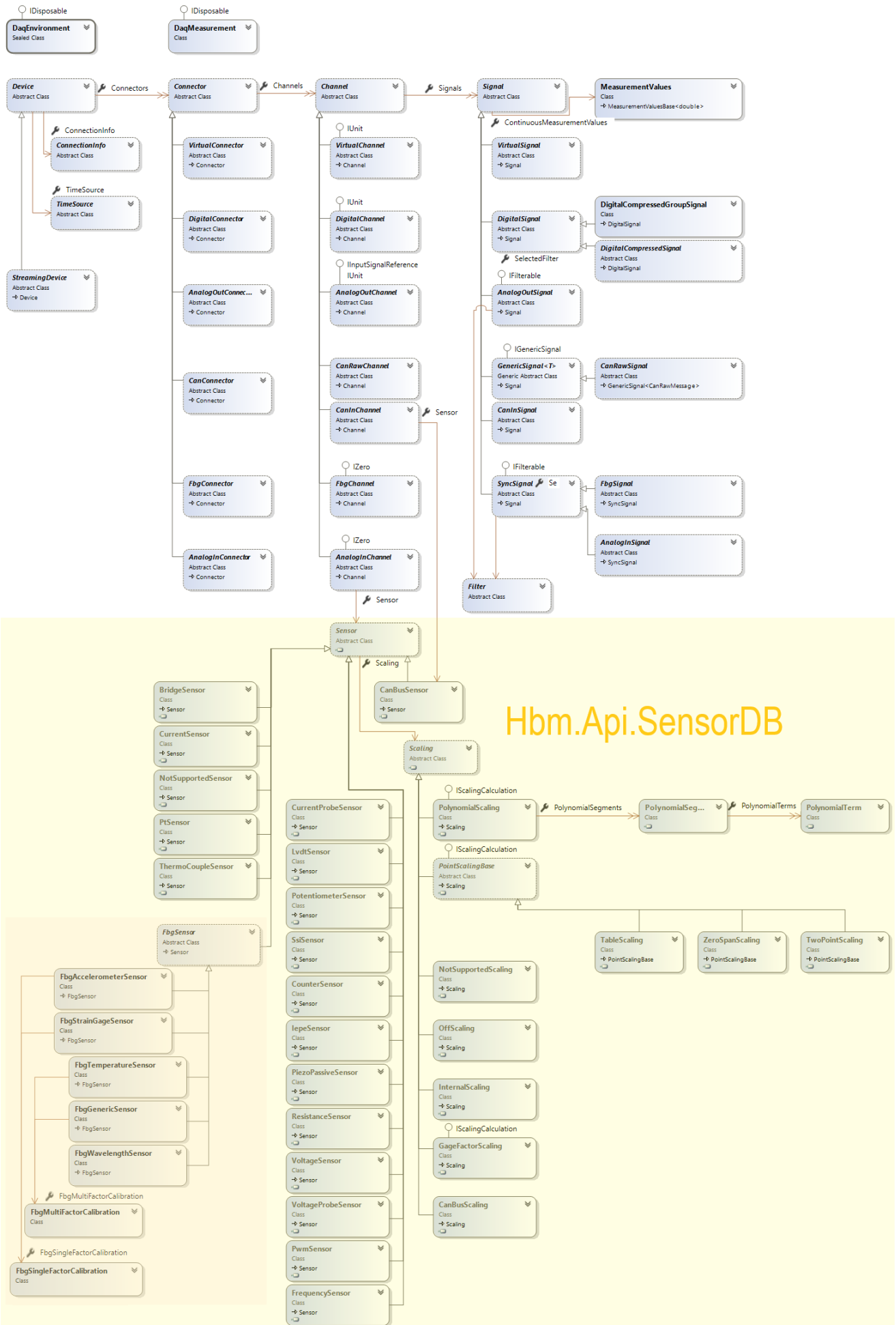


Figure 2 : Common Object Model

2.6 Message system

The Common API contains a central messaging system. This system is mainly based on a static central reachable message broker that contains all available events (see Figure 1).

Register event handlers for every event you are interested in at class `MessageBroker`.

It can be found in namespace `Hbm.Api.Common.Messaging` and is used for internal as well as external communications.

Example:

```
//MessageBroker handles all events of the common API.
MessageBroker.DeviceConnected += MessageBroker_DeviceConnected;

void MessageBroker_DeviceConnected( object sender, DeviceEventArgs e ) {
    // Handle event here
}
```

The message system raises all events asynchronously, meaning that each event handler is called on a separate thread. Take this fact into account when you want to reflect events on your GUI. You then have to marshal to the GUI thread first.

2.7 Use with Visual Studio

To work with the Common API you need a development environment such like Visual Studio and the .NET Framework 4.0 installed.

We recommend using Microsoft Visual Studio 2012 or higher to work with, but every other IDE supporting .NET 4 should work fine.

2.7.1 References

In your project open up the *Reference Manager* and browse to the folder where you previously installed the Common API assemblies (32-/64-Bit). As a minimum you need references to `Hbm.Api.Common.dll` and `Hbm.Api.SensorDB.dll`.

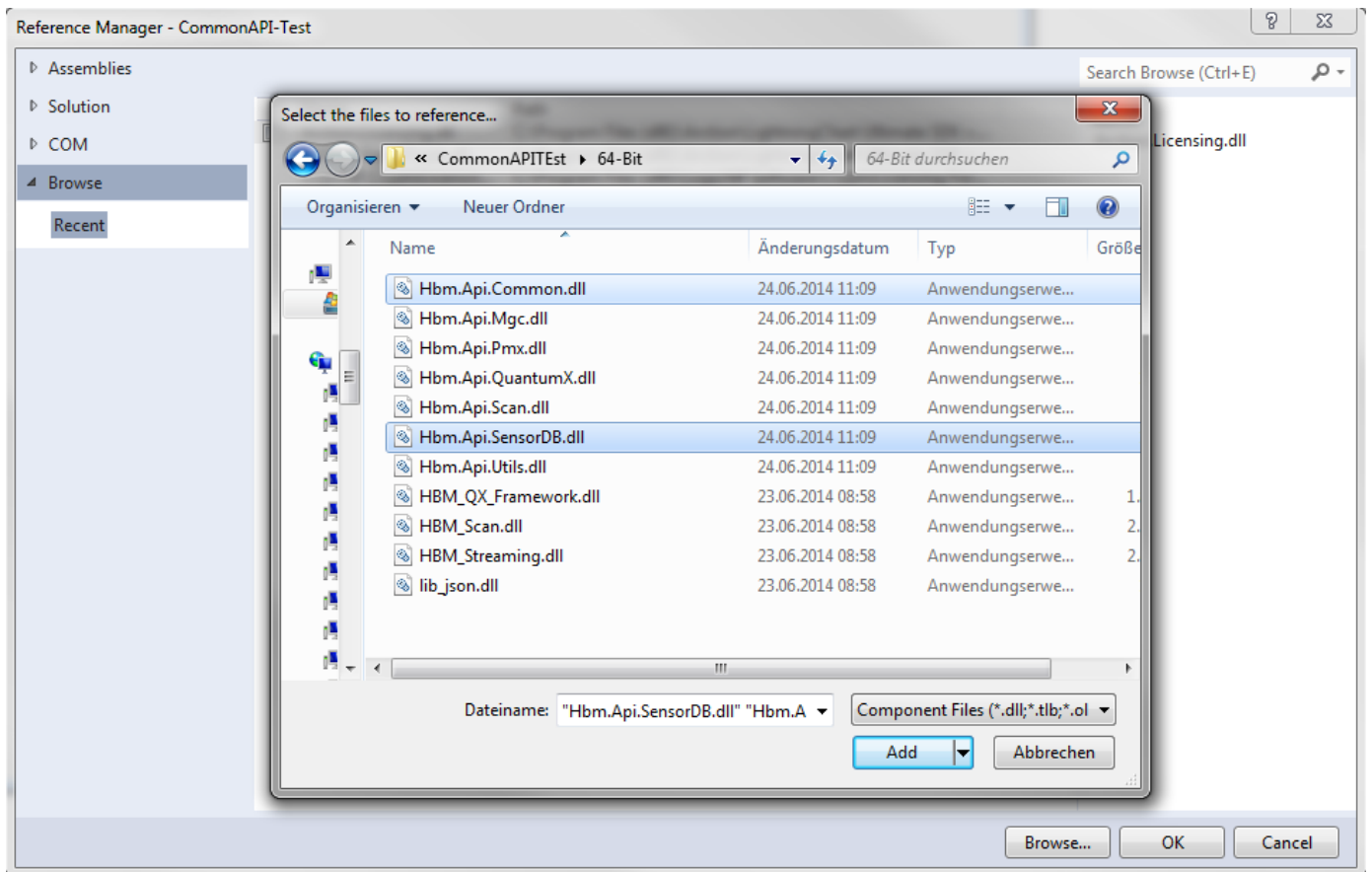


Figure 3 : API References

As long as you don't work with special features of a certain device that is all you need. In case you want to use properties and functions unique to a certain device and therefore not accessible through the common part, you also need references to those assemblies, e.g. Hbm.Api.QuantumX.dll. Under normal circumstances you never need references to Hbm.Api.Scan.dll and Hbm.Api.Utils.dll.

Info:
 Be aware that you always need **ALL** DLL files and also the DeviceDriver.plugins file, all skill files (e.g. PmxSkills.json) and also the complete TEDSDefinition directory in the same location as your main EXE file, no matter what references you need in your project.

2.7.2 Intellisense

For full convenience during development with the Common API the help of Intellisense is essential. To make Intellisense work properly you must ensure that the xml files (see Figure 4), containing the Intellisense help, are placed in the same directory as the referenced assemblies. You find these files already placed in the correct folders right after you installed the API. So, Intellisense should work right out of the box.

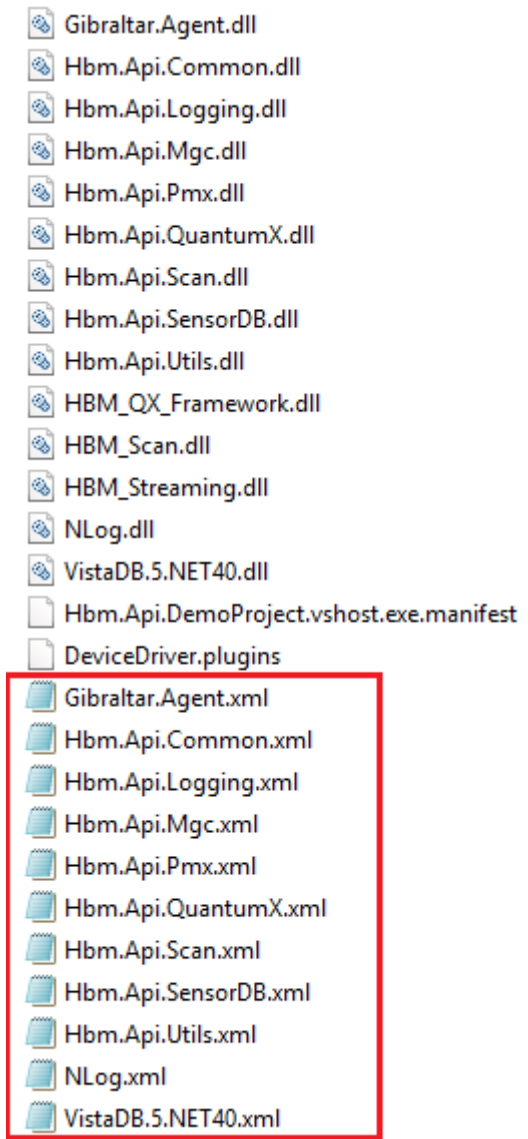


Figure 4 : Intellisense files

2.8 Main workflows and concepts

2.8.1 Scan

To find devices within the current network some device families implement the HBM scan protocol. To check whether a device family supports scanning you can examine the property `IsScanSupported` of class `DeviceFamily`.

Example:

```
MgcDeviceFamily mgcFamily = new MgcDeviceFamily();
bool hasScan = mgcFamily.IsScanSupported;
```

To execute a scan for all devices in the network you have to use one of the `Scan()` methods in `DaqEnvironment`. The scan mechanism searches for all device families which are found as plugins during initialization but of course only for those supporting the scan mechanism.

Example:

```
// Init (all families are enumerated, scan is initialized)
DaqEnvironment env = DaqEnvironment.GetInstance();

// Scan for all available devices
List<Device> foundDevices = env.Scan();
```

During the scan, some properties of the device such as ConnectionInfo, SerialNo, Model, Name and FirmwareVersion are filled and can be examined afterwards.

Due to the nature of the scan mechanism – device sends multicast message only every couple seconds - it can happen that after the call to Scan() not all devices are already gathered. So, to be sure you'll find all devices you have to wait some time (max. 5 seconds) after the first call to GetInstance() or periodically rescan.

2.8.2 Measuring

The API provides two ways of retrieving measurement values. One way is to retrieve just a single snapshot value and the second way is to setup a complete continuous measurement session.

To setup a continuous measurement session follow these steps:

1. Choose your devices you want to measure with.
2. Connect to these chosen devices. You can either select devices from the scan result or connect devices manually. See 5.2 for more information on how to manually connect to a device.
3. Set the time source that should be used to synchronize the devices. See 2.8.5 for details.
4. Parameterize all devices, e.g. assign and setup sensors. At least set sample rate on each signal you want to measure with and assign signal back to device.
5. Create a new DaqMeasurement session
6. Add signals you want to measure with to the measurement session
7. Prepare DAQ session
8. Start DAQ session
9. Periodically transfer measurement values from circular buffers to measurement values buffer in each signal.
10. Stop DAQ session

The prepare action in step 7 is necessary to initialize buffers, threads and how timestamps are handled. By default, equidistant signals contain just one single timestamp per fetch interval. For non-equidistant signals you always get a timestamp for each value, no matter what you specified in step 7. Normally you don't need to fiddle around with the above mentioned parameters, just use the parameterless method PrepareDaq() and everything is setup with default values. In some rare cases it might be necessary to influence the parameters, timestamps, number of fetching threads, fetching interval and so on to best suit your needs. But be careful in altering the default values, please check carefully the code documentation (CHM file) on function PrepareDaq()!

Info:

Timestamps are always provided as double precision values in seconds since the start of the measurement (see DaqMeasurement.MeasurementStartTime, MeasurementStartUTCTime and MeasurementStartSystemTime).

To transfer the data in step 9 you have to call DaqMeasurement.FillMeasurementValues in some kind of a timer-controlled loop within a suitable interval. The interval length depends on how fast

the sample rate is, how much memory is available and how you want to process the measurement data.

If the fetch interval is chosen too slowly, the underlying circular buffers will overflow and the oldest values will be overwritten. Therefore you should always check the flags `Signal.MeasurementValues.BufferOverrunOccurred` as well as `Signal.IsExcludedFromDaq` for all signals that are involved in a running measurement.

The internal API data fetching interval to retrieve data from the participating devices is set to 50ms by default. This interval determines how often data is transferred from the device into the circular buffers. Therefore, it doesn't make sense to set your data fetching timer interval to less than that value. If you need a faster data fetching interval you first need to alter the internal API data fetching interval by giving a lower value to the constructor of class `DaqMeasurement` (Step 5).

For a complete example see 5.5 or check the supplied Demo project.

2.8.3 Exceptions, Errors and Warnings

The Common API supports three different levels to report that something went wrong. Classical Exceptions to indicate fatal code errors, Warnings and Errors.

Exceptions are used when something is wrong and the desired action must be aborted, e.g. if you call `PrepareDaq()` in class `DaqMeasurement` and no signals were registered for measurement. In that case you get a `DaqNoSignalsAddedException` and `PrepareDaq()` is aborted. Other cases for Exceptions are, e.g. when you somehow messed up method parameters (`ArgumentNullException`).

Example:

```
try {
    // Create new DAQ session
    DaqMeasurement daqSession = new DaqMeasurement();

    // Prepare DAQ session
    daqSession.PrepareDaq(); // Throws exception. No signals registered
} catch(DaqNoSignalsAddedException noSignalsEx) {
    // No signals registered for measurement
}
```

Errors and Warnings are mainly used in situations where more things can go wrong and we want to report back all problems at once, e.g. if you want to connect to multiple devices at once. In this scenario it would not make much sense to throw an Exception if one device cannot be reached because the method would be aborted and from that point onwards no more devices would be connected. Such problems are reported as Errors and Warnings together in form of an out parameter of type *List of Problems*. Both classes, `Error` and `Warning`, derive from class `Problem` and can therefore be packed together in a list of problems.

Additionally, these methods normally have a Boolean return value indicating if the list of problems contains an Error or not. If no error is in the list, you can be sure that the action was successfully executed but the list still may contain warnings. A warning could be for instance when you assign a sensor to a device, that this device may have adapted one or more parameters of the sensor, e.g. excitation voltage.

All Connect- and Assign-functions (`AssignSensor`, `AssignConnector`, `AssignChannel`, `AssignSignal`, etc.) operate in accordance with this principle.

Example: Connect to multiple devices

```
// Get instance of DaqEnvironment
DaqEnvironment env = DaqEnvironment.GetInstance();

// Scan for all available devices
List<Device> foundDevices = env.Scan();

// Connect to all devices
List<Problem> connectProblems;
bool isOk = env.Connect(foundDevices, out connectProblems);

if(isOk) {
    // No error occurred and all devices are connected,
    // check list for Warnings
} else {
    // Some or all devices are not connected
}
```

Example: Assign signal

```
// Change the name and sample rate of the first signal
// of the first channel of the first connector
Signal firstSignal = myDevice.Connectors[0].Channels[0].Signals[0];

// Change name
firstSignal.Name = "My signal name";

// Change sample rate
firstSignal.SampleRate = 19200;

// Assign changes back to device
List<Problem> assignProblems;
bool isOk = myDevice.AssignSignal(firstSignal, out assignProblems);

if(isOk) {
    // No error occurred, signal could be assigned

    // Check for possible warnings
    if(assignProblems.HasWarning()) {
        // Check each warning
    }
} else {
    // Signal could not be assigned to device
}
```

2.8.4 Device parameterization

To parameterize a device, e.g. assign a sensor, you have to follow these steps:

Connect to device

Modify desired properties within the object model of the device

Assign changes back to device

Info:

Modifying a property within the object model doesn't change that value in the hardware device! Changes require a call to the corresponding AssignXYZ function to take effect.

Example:

```
// Change the name and sample rate of the first signal of the first channel of the
// first connector
Signal firstSignal = myDevice.Connectors[0].Channels[0].Signals[0];

// Change name
firstSignal.Name = "My signal name";

// Change sample rate
firstSignal.SampleRate = 19200;

// Assign changes back to device
List<Problem> problemsDuringAssign;
myDevice.AssignSignal(firstSignal, out problemsDuringAssign);
```

2.8.5 Device synchronization

Device synchronization ensures, that the clocks of the devices are running as synchronous as possible to each other. Since the common API generally uses timestamps to realize a synchronized measurement start across multiple devices, equal clocked devices are mandatory in this case.

When measuring multiple devices of the same family, there are typically no issues concerning device synchronization because all families support cable based synchronization methods (e.g. respective sync cable for MGC and PMX, FireWire cable for QuantumX / SomatXR), that insure, that the clocks can keenly be synchronized. However, depending on the used device family, even when measuring only one device with multiple sample rates, the first timestamp of signals with different sample rates may differ (e.g. PMX).

When measuring multiple devices of different device families (e.g. PMX together with a QuantumX / SomatXR), or measuring multiple devices of one family that cannot be wired by sync cable (e.g. due to their distance), following issues become relevant:

- A divergence of the timestamps for measurement values of different devices, even with same sample rates.
- A different number of measurement values of different devices, even with the same sample rates.

This is because the clocks/quartzes of the devices do not run 100% synchronous. When running a timestamp synchronized measurement, the API always delivers the same number of measurement values for signals that use the same sample rate. After a certain time, this could lead to an internal buffer overrun within the API because the “slowest” signal within the sample group (e.g. 19200Hz) defines the number of delivered measurement values for the whole sample group. The effects can be minimized/eliminated by using an appropriate time source or by starting the measurement unsynchronized.

When measuring unsynchronized, a buffer overrun will not occur since the API always returns all measurement values of all signals instead of only the number of measurement values of the “slowest” signal within a sample rate group.

In order to synchronize the devices, the API provides several “TimeSources”, which are not necessarily supported by all devices:

- **AutoTimeSource:** The device uses its internal synchronization method.

You could use this time source e.g. when measuring several QuantumX / SomatXR devices that are connected via a FireWire cable, or when measuring a number of MGC or PMX devices using their sync cable.

- **NtpTimeSource:** The device uses the Network Time Protocol (NTP) protocol to synchronize its clock throughout a computer network against a given time server. On a local area network, it achieves clock accuracy better than one millisecond.

You could use this time source e.g. when measuring a QuantumX / SomatXR and a PMX or a MGC device in parallel.

- **PtpTimeSource:** The device uses the Precision Time Protocol (PTP) protocol to synchronize its clock throughout a computer network. On a local area network, it achieves clock accuracy in the sub-microsecond range.

You could use this time source e.g. when measuring various QuantumX / SomatXR devices, which are not connected via FireWire.

- **EtherCatTimeSource:** The device uses the Ethernet for Controller and Automation Technology to synchronize with other devices. It achieves clock accuracy in the sub-microsecond range.

You could use this time source e.g. when measuring various QuantumX / SomatXR devices, which are not connected via FireWire.

To check the quality of the synchronization, you can call `Device.GetTimeSourceQuality(...)`, which returns the offset to the current time source and a string with further details depending on the type of the used `TimeSource`.

Following example shows how to synchronize a PMX and a QuantumX / SomatXR device with a certain NTP-Server and how to check the accuracy of the synchronization between the clocks.

```
// Assume we have a list of connected devices:
// First one is e.g. a QuantumXDevice (_deviceList[0])
// Second device is e.g. a PmxDevice (_deviceList[1])
List<Problem> problemsDuringAssign;
// Setup time source...
foreach(Device device in _deviceList)
{
    // Create an NTP time source with a valid NTP-Server
    device.TimeSource = new NtpTimeSource("172.19.160.111");
    // and assign it
    if (!device.AssignTimeSource(out problemsDuringAssign))
    {
        // error handling: e.g. check the problems here...
    }
}
// wait a while (let the devices synchronize this may take a moment...)
System.Threading.Thread.Sleep(5000);
foreach(Device device in _deviceList)
{
    // check offset to NTP server in ms and further quality parameters
    double offset;
    string quality;
    device.GetTimeSourceQuality(out offset, out quality);
    Console.WriteLine(string.Format("Time offset in ms between NTP server and device {0}
= {1} ", device.Name, offset));
}
// Following similar output will be generated:
// Time offset in ms between NTP server and device MX840_RT = -1,072
```



```
// Time offset in ms between NTP server and device PMX_01 = -2,141
```

2.8.6 Additional Features

Each device implementation supports special functions which are unique to that device and are therefore not implemented in the common part of the API.

These special functions can be found under property `AdditionalFeatures` of each device.

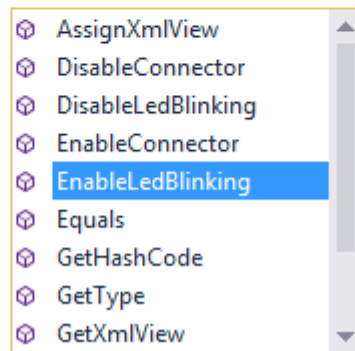
Example:

```
// Init (all families are enumerated, scan is initialized)
DaqEnvironment env = DaqEnvironment.GetInstance();

// Scan for QuantumX devices only
List<Device> foundDevices = env.Scan(new List<string> { "QuantumX" });

// Cast to concrete QuantumX device
QuantumXDevice qxDevice = (QuantumXDevice) foundDevices[0];

qxDevice.AdditionalFeatures.
```



One very important special function which is supported by every device family (QuantumX / SomatXR, PMX, MGC) is a so-called direct command tunnel to the device. Each device family implements this mechanism in a slightly different way depending on the concrete communication protocol, but they all have in common that you can directly “speak” to the device. For an example see 5.6.

This communication path enables you to use features of the device which are currently not directly supported by the Common API.

Info:

You need to know exactly the communication protocol of a certain device when using this function. So, be very careful when making use of this functionality.

2.9 Sensor database API

The Common API comes with a “read-only” HBM sensor database (which contains most HBM sensors) and an empty template of a user sensor database which can be used to manage your own sensors.

To create and parameterize your own sensors, the API provides a sensor object model that defines all useable sensor types and their properties. Using the `SensorDBManager`, the API allows you to manage sensors of existing sensor databases.

2.9.1 The sensor object model

The sensor model is represented by the entity classes found in namespace `Hbm.Api.SensorDB.Entities`.

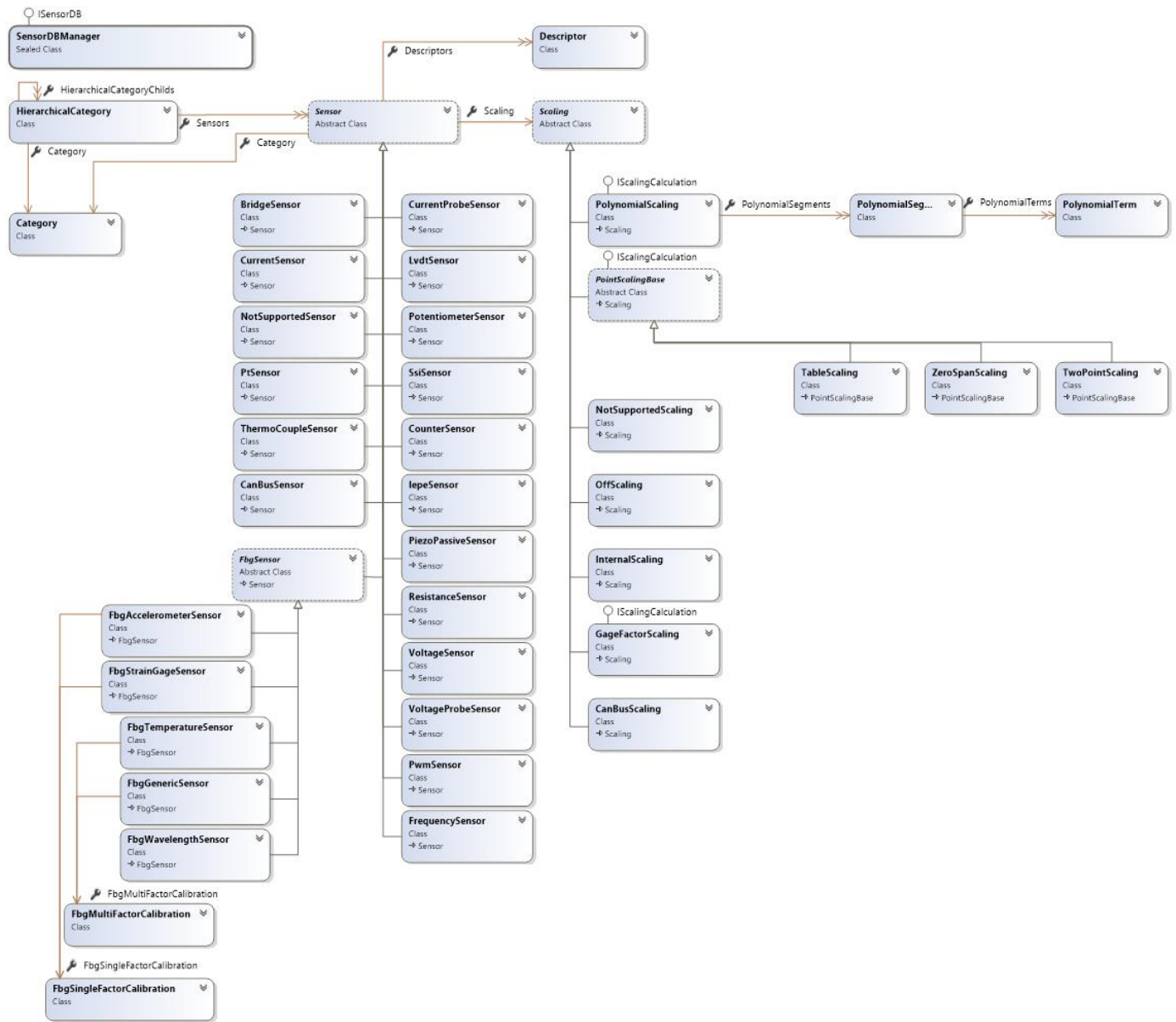


Figure 5 : Sensor object model

The sensor object model mainly consists of the following classes:

Component	Description
Sensor	Abstract base class of all physical sensors.
BridgeSensor	Bridge sensor. Type is specified by BridgeType (Quarter, Half, Full)
CanBusSensor	Represents a sensor connected via CAN bus
CounterSensor	Counter sensor
CurrentProbeSensor	Current probe sensor
CurrentSensor	Current sensor
FbgSensor	Abstract base class of all optical sensors
FbgAcceleratorSensor	Optical accelerator sensor

Component	Description
FbgStraingageSensor	Optical strain gage sensor
FbgTemperatureSensor	Optical temperature sensor
FbgGenericSensor	Optical generic sensor
FbgWavelengthSensor	Optical wavelength sensor
FbgMultiFactorCalibration	Describes a multi factor calibration for optical sensor
FbgSingleFactorCalibration	Describes a single factor calibration for optical sensor
FrequencySensor	Frequency sensor
IepeSensor	Integrated electronics piezo-electric sensor
LvdtSensor	Linear variable differential transformer sensor
NotSupportedSensor	Sensor object which is used when the Common API reads the settings from a device and finds a sensor type which is not supported by the API, e.g. IRIG sensor
PiezoPassiveSensor	Passive piezo sensor
PotentiometerSensor	Potentiometer sensor
PtSensor	Platin temperature sensor
PwmSensor	Pulse-width modulation sensor
ResistanceSensor	Resistance sensor
SsiSensor	SSI sensor
ThermoCoupleSensor	Themocouple sensor.
VoltageProbeSensor	Voltage probe sensor.
VoltageSensor	Voltage Sensor
Scaling	Abstract base class of all scalings.
GageFactorScaling	Gage factor scaling (K-Factor, Bridge factor)
InternalScaling	Internal device scaling. Set when a device specific scaling is used.
NotSupportedScaling	If a device uses a scaling in its settings which is not supported by the API, this scaling type is used. This can happen when a new Firmware, supporting new scalings, is used on the device and the API is from an older date.
OffScaling	Disables scaling in the device.
PolynomialScaling	Polynom scaling. Contains list of PolynomialSegments
TableScaling	Multi straight line scaling (lines defined by table points)
TwoPointScaling	Two-point scaling.
ZeroSpanScaling	Zero span scaling.
PointScalingBase	Abstract base class for all point based scalings (Zero span, two point, etc.)
PolynomialSegment	Defines a single segment of a polynomial scaling with its starting x value. Contains list of PolynomialTerm
PolynomialTerm	Defines a term for a polynomial segment (Coefficient, Exponent), e.g. $5x^2$
ScalingPoint	Represents a single scaling point for point based scalings (table, zero span, etc.) with x- and y- value.
Descriptor	Represents a descriptor of the sensor, e.g. the data sheet or a photo, etc.

Example: Creating a sensor object with 2-point scaling

```
// Create new sensor object
BridgeSensor newSensor = new BridgeSensor();
newSensor.UniqueName = "Sensor 200";
newSensor.Wiring = BridgeSensorWiring.SixWire;
newSensor.MinExcitationVoltage = 0.1M;
newSensor.MaxExcitationVoltage = 15;
newSensor.PreferredExcitationVoltage = 5; // 5 Volt
newSensor.Impedance = 350; // 350 Ohm

// Create 2 point scaling
TwoPointScaling scaling2P = new TwoPointScaling();
scaling2P.EngineeringUnit = "kg";
scaling2P.MaxEngineeringRange = 200;
scaling2P.MinEngineeringRange = -200;

scaling2P.ElectricalP1 = 0; // x1
scaling2P.EngineeringP1 = 0; // y1
scaling2P.ElectricalP2 = 2; // x2
scaling2P.EngineeringP2 = 200; // y2

// Add scaling to sensor
newSensor.Scoring = scaling2P;
```

2.9.2 The SensorDBManager

The SensorDBManger (which implements the ISensorDB interface) provides functions to get, insert, update and delete sensors as well as functions to manage hierarchical groups (categories) of sensors within sensor databases in various languages.

All optical sensors (derived from FbgSensor) are not supported!

To get a complete object representation of all categories and sensors of an existing sensor database you can call ISensorDB.GetHierarchicalCategories. See Figure 6 to get an idea of the relationship of the involved objects.

Examples that show how to access sensor databases can be found in chapter 5 (“How To’s”).

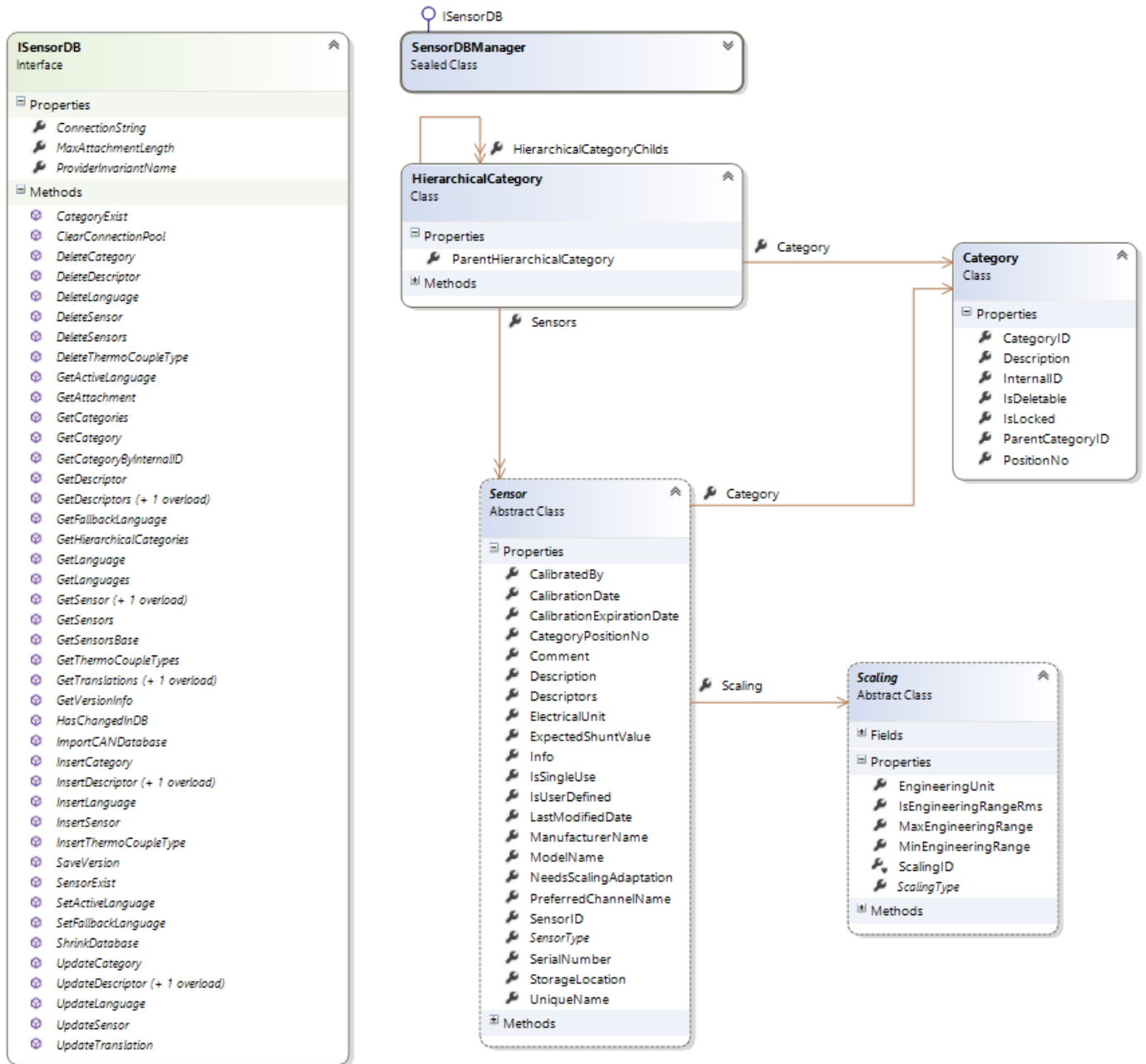


Figure 6 : Relationship of HierarchicalCategory, Category and Sensor

Please consider following hints when using the SensorDBManager:

- Every sensor must have a category assigned to. The category must be stored before the sensor can be inserted.
- Every sensor must have a scaling assigned to. If no concrete scaling information is available, the `ScalingType` should be set to “Internal”.
- If a new language is inserted, it’s required to create new translation records for the new language for every existing translation. The API uses the translations of the fallback language to create the translation records for the new language.

2.10 Logging

The Hbm.Api.Logging namespace contains functionality that makes it possible to log messages using different logging frameworks (until now we support NLog and Loupe).

To group log entries according to their context (e.g. database access, device communication, etc.) you may define various LogContexts to build hierarchical structures under which your log entries will be inserted.

Notice that, if you use logging, the underlying common API will also log messages, additional to yours!

You can download a free logfile viewer to inspect the binary logfiles that have been created using the Loupe framework (see <http://www.gibraltarsoftware.com>). Logfiles that have been created using the NLog framework are just text files.

An example that shows how to use logging in your application can be found in chapter 5 (“How To’s”).








Figure 7 : Relevant classes and enumerations of the Logging namespace



3 Feature Overview

The following table shows an overview of the various features related to the version of the Common API.

Feature	QuantumX / SomatXR	PMX	MGCplus
Device scan			(CP52 only)
Measurement configuration			
Calibration certificates			Not possible
TimeSource configuration			
Sensor configuration			
Bridge			
CanBus		Not possible	
Counter			
Current			
CurrentProbe	Not possible	Not possible	Not possible
Frequency			
FbgAccelerometerSensor	(MXFS only)	Not possible	Not possible
FbgGenericSensor	(MXFS only)	Not possible	Not possible
FbgStrainGageSensor	(MXFS only)	Not possible	Not possible
FbgTemperatureSensor	(MXFS only)	Not possible	Not possible
FbgWavelengthSensor	(MXFS only)	Not possible	Not possible
IEPE		Not possible	
LVDT			
PiezoPassive		Not possible	
Potentiometer			
Pt		Not possible	
PWM			
Resistance		Not possible	
SSI			Not possible
ThermoCouple		Not possible	
Voltage			
VoltageProbe	Not possible	Not possible	Not possible
Analog In DAQ			
Analog Out (direct setting)			
Analog Out (channel routing)			
Digital In DAQ			
Digital Out DAQ			
Digital Out (direct setting)			

Feature	QuantumX / SomatXR	PMX	MGCplus
CAN DAQ		 (via CODESYS /calc. channels)	
CAN Raw-DAQ		Not possible	Not possible
Optical DAQ		Not possible	Not possible

  Supported in Common API version 5.0

  Supported from Common API version 6.0/6.1 onward

3.1 New features of Common API V6.1

The most relevant properties and functions, that have been added since the last release, are mentioned here:

General:

- Optical devices based on Fiber Bragg Gratings (FBG) are supported now (MXFS)
- Various objects and functions have been added in the context of FBG (FbgConnector, FbgChannel, FbgSignal, FbgSpectrum, FbgBandsDetectionResult,, etc.)
- New sensors types added to support FBG (NOT included in sensor database)
- Various objects concerning CAN Raw data acquisition added (CanRawChannel, CanRawSignal, etc.)
- Asynchronous signals are supported now (at present CanRawSignal is the only asynchronous one)
- It is possible to use any data type (e.g. CanRawMessages) as measurement values (until now only double has been supported)
- Data acquisition of mixed synchronous and asynchronous signals is supported
- MGC does no longer reset tare values to 0.0 during connect. Please use SetTareValue and GetTareValue functions to set/get tare values of MGC devices.

4 Limitations

The Common API in version 6.1 does not support every feature. The following tables give you an overview of what is currently not supported:

4.1 QuantumX / SomatXR

The following table lists several features which are currently not supported by the API:

Feature	Description
IRIG time service configuration	Not supported.
Test signals	Not supported.
Virtual Channels	Virtual channels like calculated math channels are not supported
Firmware	Supported from 4.2.56 onwards, tested with 4.36.12

Info:

Unsupported Modules: MX590

4.2 PMX

The following table lists several features which are currently not supported by the PMX API:

Feature	Description
Virtual Channels	Virtual channels/signals cannot be parameterized.
Firmware	Supported from 2.04 onwards, tested with 4.40

Info:

Unsupported fieldbus boards: PX01EC, PX01PN, PX01EP

4.3 MGCplus

Only CP52 of the MGC device family supports the HBM scan mechanism. MGC devices that are provided with a CP22 or CP42 do not support the scan mechanism and you must “manually” connect to such a device. Please see 5.2 for an example on how to connect manually to an MGC device.

The following table shows additional general limitations for the MGC device family:

Feature	Description
Trigger	No support for internal trigger machine.
Hard disk recording	Recording to internal hard disk is not supported.

Limitations

Feature	Description
Serial port	Serial interface RS-232 is not supported.
Virtual Channels	Virtual channels/signals like calculated math channels are not supported
Sensors	SSI is generally not supported by MGCplus
Firmware	MGCplus: CP52: Supported from 5.0.15 onwards, tested with CP52 5.6.0 CP42: Supported from 4.84 onwards CP22: Supported from 4.44 onwards

Info:

Unsupported amplifier modules: ML70, ML71S6, ML77, (ML74 measuring only – no parameterization)

5 How To's

5.1 Scan

Please note, between the initialization of the scan, which is done through the first call to `DaqEnvironment.GetInstance()`, and the actual execution of the scan should be some time to gather all devices (max. 5 seconds).

Example: Execute scan.

```
// Init (all device family PPlugins are enumerated, scan is initialized)
DaqEnvironment env = DaqEnvironment.GetInstance();

// This is only for demonstration purposes
Thread.Sleep(5000);

// --- Scan for all available devices
List<Device> allDevices = env.Scan();
```

In case you only want to scan for certain device families use the following line:

```
// --- Scan for QuantumX and PMX devices only
List<Device> someDevices = env.Scan(new List<string> { "QuantumX", "PMX" });
```

5.2 Connect

There are two possibilities to connect to a device. You can first execute a scan and use one of the devices from the result list or you already know the connection details of a certain device and connect manually with that device. The latter is also the only way if a device family doesn't provide a scan.

If you connect to multiple devices at once this could take some time. Therefore, the `Connect()` method connects all devices asynchronously.

Example: Connect with device from scan

```
// --- Execute scan
// .. see above

// Connect to first found device
List<Problem> connectProblems;
bool isOk = env.Connect(allDevices[0], out connectProblems);

// Check for any problems
if(isOk) {
    // No error occurred and the device is connected

    if(connectProblems.HasWarning()) {
        // Check possible warnings
    }
} else {
    // Device could not be connected
}
```

Example: Connect with MGC device manually

```
// Create connection info
MgcDevice mgc = new MgcDevice("1.2.3.4", 7);
// Connect to device directly without scan
DaqEnvironment env = DaqEnvironment.GetInstance();
```

```

List<Problem> connectProblems;
bool isOk = env.Connect(mgc, out connectProblems);

// Check for any problems
if(isOk) {
    // No error occurred and the device is connected

    if(connectProblems.HasWarning()) {
        // Check possible warnings
    }
} else {
    // Device could not be connected
}

```

Example: Connect with multiple devices at once, get notified when device is connected

```

// Get instance of DaqEnvironment
DaqEnvironment env = DaqEnvironment.GetInstance();

// Thread.Sleep (3000);
// Scan for all available devices
List<Device> foundDevices = env.Scan();

// Register event handler for Connected-Event
MessageBroker.DeviceConnected += MessageBroker_DeviceConnected;

// Connect to all devices asynchronously
List<Problem> connectProblems;
bool isOk = env.Connect(foundDevices, out connectProblems);

void MessageBroker_DeviceConnected( object sender, DeviceEventArgs e ) {
    Console.WriteLine("Device {0} connected", e.UniqueDeviceID);
}

```

5.3 Assign sensor

Assigning sensors can be completely done on the common layer, no need to cast to concrete device implementations. To assign a sensor you only need two things, a connected device and of course a sensor.

Example: Assign resistance sensor with 2-Point scaling

```

// Scan
DaqEnvironment env = DaqEnvironment.GetInstance();
List<Device> foundDevices = env.Scan();

// Use first found device
Device device = foundDevices[0];

// Connect to device --> fills object model
List<Problem> connectProblems;
bool isConnected = env.Connect(device, out connectProblems);

if(isConnected) {
    // Only analog in channels have a sensor
    AnalogInChannel ch = device.Connectors[0].Channels[0] as AnalogInChannel;

    // Was it really an analog in channel
    if(ch != null) {
        // Create sensor object, add to device
    }
}

```

```

ResistanceSensor resSensor = new ResistanceSensor();
resSensor.NominalResistance = 500; //Ohm
resSensor.UniqueName = "My Resistance 500 Ohm";

TwoPointScaling scaling = new TwoPointScaling();
scaling.MinEngineeringRange = -500;
scaling.MaxEngineeringRange = 500;
scaling.EngineeringUnit = "Ohm";

scaling.ElectricalP1 = 0;
scaling.EngineeringP1 = 0;
scaling.ElectricalP2 = 500;
scaling.EngineeringP2 = 500;

// Set scaling
resSensor.Scaling = scaling;

// Set sensor
ch.Sensor = resSensor;

// --- Assign sensor to device -----
List<Problem> assignProblems;
bool isOk = device.AssignSensor(ch, out assignProblems);

// Check list of problems for errors and warning
// .....
    }
}

```

5.4 Retrieve snapshot

Example: Retrieve one single value for each signal (snapshot) of a device

```

// Scan
DaqEnvironment env = DaqEnvironment.GetInstance();
List<Device> foundDevices = env.Scan();

// Use first found device
Device device = foundDevices[0];

// Connect to device --> fills object model
List<Problem> connectProblems;
bool isConnected = env.Connect(device, out connectProblems);

if(isConnected) {
    // Read snapshot for each signal from device (fill buffers)
    device.ReadSingleMeasurementValueOfAllSignals();

    // Iterate through all signals to show the snapshot data
    List<Signal> allSignals = device.GetAllSignals ();
    foreach(Signal sig in allSignals) {
        // Read data from buffer
        MeasurementValue snapData = sig.GetSingleMeasurementValue();

        // Show the data
        Console.WriteLine("Signal : {0} - {1}", sig.Name, sig.GetUniqueID());
        Console.WriteLine("Timestamp : {0}", snapData.Timestamp);
        Console.WriteLine("Value : {0}", snapData.Value);
        Console.WriteLine("State : {0}", snapData.State);
    }
}
}

```

5.5 Continuous measurement

The following example demonstrates how to setup and run a continuous measurement session. The example omits any error/problem handling for the purposes of clean demonstration.

Example: Measurement session with 2 signals

```
private DaqMeasurement _daqSession = null;           // DAQ session
private DaqEnvironment _daqEnv = null;             // DAQ environment
private List<Signal> _sessionSignals = null;       // Registered measurement signals
private System.Threading.Timer _dataFetchTimer = null; // Timer to periodically fetch data

void ContinuousMeasurement() {

    // Init
    _daqEnv = DaqEnvironment.GetInstance();
    _daqSession = new DaqMeasurement();
    _sessionSignals = new List<Signal>(); // To store our registered signals
    // Data fetch timer, with callback. We start it later !!
    _dataFetchTimer = new System.Threading.Timer(FetchData, null, Timeout.Infinite, 0);

    // Please note: You normally need some time to gather devices
    // Thread.Sleep (3000);
    // --- Scan for all available devices
    List<Device> scanDevices = _daqEnv.Scan();

    if(scanDevices.Count > 0) {
        // Use first device, no matter what device type it really is
        Device measDevice = scanDevices[0];

        // Connect to device --> fills object model of device
        List<Problem> problems;
        bool isConnected = _daqEnv.Connect(measDevice, out problems);

        if(isConnected) {
            // Use signals from first 2 connectors
            Signal s1 = measDevice.Connectors[0].Channels[0].Signals[0];
            Signal s2 = measDevice.Connectors[1].Channels[0].Signals[0];

            // -----
            // ... parameterize device --> sensor / filter etc.
            // Omitted for demonstration purposes, only set sample rate!!
            // -----
            s1.SampleRate = 2400; // Hz
            s2.SampleRate = 2400;

            // We don't check problems list here
            measDevice.AssignSignal(s1, out problems);
            measDevice.AssignSignal(s2, out problems);

            // Register first 2 signals for measurement session
            _sessionSignals.Add(s1);
            _sessionSignals.Add(s2);

            _daqSession.AddSignals(measDevice, _sessionSignals);

            // Prepare DAQ session. We only need 1
            // single timestamp per block
            _daqSession.PrepareDaq();

            // ---- Start unsynchronized DAQ session -----
            _daqSession.StartDaq(DataAcquisitionMode.Unsynchronized);
        }
    }
}
```

```

        StartDataFetching(); // Start callback timer

        // -----
        // Stop Daq session after 5 seconds !!
        Thread.Sleep(5000);
        StopDataFetching();
        // -----

        // Disconnect device
        _daqEnv.Disconnect(measDevice);
    }
}

// Cleanup
_daqSession.Dispose();
_daqEnv.Dispose(); // Call this only once at the end of your application
}

/// <summary>
/// Periodically fetch data
/// </summary>
/// <param name="o">Unused. Only needed because of delegate signature</param>
void FetchData( object o ) {
    // Check if our session is running
    if(_daqSession.IsRunning) {

        // Transfer data into signal buffers, Keep in mind we only have 1 timestamp
        _daqSession.FillMeasurementValues();

        // Process data of each signal, e.g. store to file or show it in chart
        // For demonstration purposes we only show first value on console
        foreach(Signal s in _sessionSignals) {
            MeasurementValues measVals = s.ContinuousMeasurementValues;

            // Check for overrun
            if(measVals.BufferOverrunOccurred) {
                Console.WriteLine("Buffer overrun for signal {0}", s.Name);
            }

            // How many new values do we have ?
            int newValuesCount = measVals.UpdatedValueCount;
            Console.WriteLine("{0} updated values {1}", s.Name, newValuesCount);

            if(newValuesCount > 0) {
                // Show first data value
                // In real world application we would take
                // measVals.UpdatedValueCount from buffer
                // --> measVals.Values[measVals.UpdatedValueCount-1]
                double timestamp = measVals.Timestamps[0];
                double value = measVals.Values[0];

                Console.WriteLine("value: {0} : {1}", timestamp, value);
            } else {
                // We don't have values
                Console.WriteLine("No values for signal: {0}", s.Name);
            }
        }
    }
}

void StartDataFetching() {
    // Data fetching every 100ms

```



```

        _dataFetchTimer.Change(0, 100);
    }

    void StopDataFetching() {
        // Stop data fetching
        _dataFetchTimer.Change(Timeout.Infinite, Timeout.Infinite);
        _dataFetchTimer.Dispose();

        // Stop our DAQ session
        _daqSession.StopDaq();
    }

```

5.6 Special device function

Every device family supports special functions. To use such functions you need to cast to a concrete device implementation.

Example: Flash LED on QuantumX device

```

// --- Scan for QuantumX only
DaqEnvironment env = DaqEnvironment.GetInstance();
List<Device> qxDevices = env.Scan(new List<string>{ "QuantumX" });

// Use first QuantumX device
QuantumXDevice qxDevice = (QuantumXDevice) qxDevices[0];

// Connect to device --> fills object model
List<Problem> connectProblems;
bool isConnected = env.Connect(qxDevice, out connectProblems);

if(isConnected) {
    // Flash LED
    qxDevice.AdditionalFeatures.EnableLedBlinking();

    // Let it blink for 2 seconds
    Thread.Sleep(2000);

    // Stop blinking
    qxDevice.AdditionalFeatures.DisableLedBlinking();

    // Disconnect from device
    env.Disconnect(qxDevice);
}

```

Example: Command tunnel to PMX device

```

// --- Scan for PMX only
DaqEnvironment env = DaqEnvironment.GetInstance();
List<Device> pmxDevices = env.Scan(new List<string> { "PMX" });

// Use first PMX device
PmxDevice pmxDevice = (PmxDevice) pmxDevices[0];

// Connect to device
List<Problem> connectProblems;
bool isConnected = env.Connect(pmxDevice, out connectProblems);

if(isConnected) {
    // Use direct device communication tunnel. IDN? = ask device for its identity

```

```

string response = pmxDevice.AdditionalFeatures.SendCommand("IDN?");

// Show result
Console.WriteLine(response);

// Disconnect from device
env.Disconnect(pmxDevice);
}

```

5.7 Sensor database access

Beside the definition of sensor and scaling types, the namespace `Hbm.Api.SensorDB` includes the `SensorDBManager` object, which implements the `ISensorDB` interface that makes it possible to get, insert, update and delete sensors as well as to manage hierarchical categories (groups) of sensors within sensor databases in various languages.

Example: Various ways to get a certain sensor and how to get a complete hierarchy of categories and sensors from an HBM sensor database

```

// Open HBM sensor database that is located
// in the same directory as the executable
string sdbFilename= System.IO.Path.Combine(
    System.IO.Directory.GetCurrentDirectory(),
    "HBMSensorDatabase.vdb5");
// Create a sensorDBManager to get access to the
// sensor database (readonly)
ISensorDB sdbManager = new SensorDBManager(
    "en",
    "Data Source=" + sdbFilename+
    ";Open Mode=NonExclusiveReadOnly;",
    "System.Data.VistaDB5");
// Get the complete hierarchy of the sensor database including all
// categories/subcategories and their sensors
// just add a breakpoint here and explore the nodes:
List<HierarchicalCategory> hierarchicalCategoryNodes =
    sdbManager.GetHierarchicalCategories();
// within each hierarchicalCategoryNode you will find a list of
// sensor objects that belongs to this category

// there are various ways to get a sensor...
// e.g. by getting a list of all sensors of the sensor database
// (do that only once...) and search for a specific sensor on
// your own... (here: get a list of all sensors and search
// for the first voltage sensor)
Sensor sensor;
List<Sensor> listOfAllSensors = sdbManager.GetSensors();
sensor = listOfAllSensors.Where(
    p => p.SensorType== SensorDB.Enums.SensorType.Voltage).First();

// or e.g. Let the sensorDBManager search for a sensor
// with a certain ID
sensor = sdbManager.GetSensor(112);

// or e.g. Let the sensorDBManager search for a sensor
// with a certain unique name
sensor = sdbManager.GetSensor("HBM_T22_50Nm");

```

Example: Various ways to deal with a user sensor database (connect, get hierarchy of categories and sensors, insert, update and delete a sensor)

```
// Open user sensor database that is located
// in the same directory as the executable
string sdbFilename = System.IO.Path.Combine(
    System.IO.Directory.GetCurrentDirectory(),
    "UserSensorDatabase.vdb5");

// Create a sensorDBManager to get access to the
// sensor database (read/write access)
ISensorDB sdbManager = new SensorDBManager(
    "en",
    "Data Source=" +
    sdbFilename +
    ";Open Mode=ExclusiveReadWrite;",
    "System.Data.VistaDB5");

// Get the complete hierarchy of the sensor database
// including all categories/subcategories and their sensors
// just add a breakpoint here and explore the nodes:
List<HierarchicalCategory> nodes =
    sdbManager.GetHierarchicalCategories();

// Insert a sensor into a certain category of the database

// Therefore we have to do 2 things here:
// 1. Create a sensor object (we use the SensorFactory here
// to get a certain sensortype with default scaling...)
VoltageSensor myVoltageSensor = SensorFactory.CreateSensor(
    SensorDB.Enums.SensorType.Voltage) as VoltageSensor;
// set the name of the sensor and further properties if you like
myVoltageSensor.Description = "my voltage sensor";

// 2. To insert a sensor into a sensor database, we have to
// choose an existing category (group) of the sensor database into
// which the sensor should be inserted.
// Here we insert the sensor into the "Imported" category of the
// database (this category exists in each user sensor database).
Category categoryIntoWhichToInsertTheSensor = sdbManager.GetCategories().
    Where(c => c.Description == "Imported").First();
// Set the Category property of the sensor we want to insert
myVoltageSensor.Category = categoryIntoWhichToInsertTheSensor;
// Insert the sensor into the user database
sdbManager.InsertSensor(myVoltageSensor);
// ATTENTION! After successfully inserting the sensor, some
// properties of the sensor have been changed!!!
// Take a look at following sensor properties:
// SensorID, UniqueName, IsUserDefined, LastModifiedDate...

// To update the sensor, we just change its description here
myVoltageSensor.Description = "my updated voltage sensor";
// and update the (now) already existing sensor in the
// sensor database... (Description AND LastModifiedDate will be changed!)
sdbManager.UpdateSensor(myVoltageSensor);

// To delete the sensor we just call
sdbManager.DeleteSensor(myVoltageSensor.SensorID);
```

5.8 Logging

The `Hbm.Api.Logging` namespace contains functionality that makes it possible to log messages using different logging frameworks (until now NLog and Loupe are supported).

Example: How to use logging within your application

```
// Start Logging with a certain LoggingFramework (Loupe or NLog)
// and a combination of "ORed" LogLevels:
LogManager.Start (LoggingFramework.NLog,
                  LogLevel.Error | LogLevel.Warn | LogLevel.Info);

// Create a Logger object that has to be used to Log messages
ILogger logger = LogManager.CreateLogger("ApiDemo");

// We want to group our Log entries into different parts.
// Logging uses LogContext objects to define these groups.
// Notice: The Hbm.CommonAPI will also Log messages
// additional to the messages that will be logged here!

// E.g.: One group to collect entries concerning measurement tasks:
LogContext logContextMeasuring = new LogContext("ApiDemo.Measurement");

// E.g.: One group to collect entries concerning problems:
LogContext logContextProblems = new LogContext("ApiDemo.Problems");

// The resulting hierarchy into which the entries can be logged (using Loupe) is now:
// Categories
// - ApiDemo
//   - Measurement
//     - Error: This is an error type log entry!
//   - Problems
//     - Info: This is an info type log entry!
//     ...
// using NLog, these hierarchy infos are included in the line
// that will be appended to the logfile
// e.g.: 2015-09-10 09:37:25.1234 [10] ERROR |
// ApiDemo.Measurement| ApiDemo: Error: This is an error type log entry!

// Generate some Log entries (under Measurement)
// this entry will be logged because we started logging with "LogLevel.Error"
logger.Error(logContextMeasuring, "Error: This is an error type log entry!");

// Following entry will *** N O T *** be logged because we
// started logging without "LogLevel.Debug"
logger.Debug(logContextMeasuring, "Debug: This is a debug type log entry!");

// Generate Log entry (under Problems)
logger.Info(logContextProblems, "Info: This is an info type log entry!");

// End Logging.
LogManager.Stop();

// You can find the directory and the created logfile under
Debug.Print("Directory of the logfile: "+LogManager.LogFolder);
Debug.Print("Fullt path to the logfile: "+ LogManager.CurrentLogFile);
```

6 Troubleshooting Tips

Following solutions for common errors could help you to solve your problem.

In general: To troubleshoot problems it is suggested to activate logging (e.g. by adding “LogManager.Start(LoggingFramework.NLog, LogLevel.All)”) before using API functionality and to check the logfile, which is produced during the execution of your application. Don’t forget to deactivate or reduce loglevel in your production code.

Problem: Scan does not find any devices.

Solution: Check your firewall settings. The incoming UDP ports 31416 and 31417 need to be opened for the application.

Assert that there is no router between your device and your PC. Routers drop the multicast messages (sent from the scannable devices) that will normally be received by your PC. Also, some managed switches drop these messages.

When your device is directly connected to your PC you have to assert that scan is called AFTER the device has been physically connected to your PC – otherwise the scan will ignore the network adapter to which your device is plugged in.

Also, doublecheck that the file DeviceDriver.plugins is in the same directory as your executable.

Problem: Measurement does not start (“Not enough time to start (a synchronized) measurement”).

Solution: Especially when using very low measurement rates (e.g. 0.1 Hz) the default synchronization timeout (5000ms) may be too low to start a synchronized measurement. Please increase the timeout in that case. This error could also occur, if the devices are not synchronized against each other (e.g. not using the same NTP-server).

Problem: Suddenly (during a running, synchronized measurement) some signals do not get new measurement values any longer.

Solution: Most likely the connection to the device, to which the signal belongs, is lost. Since version 3.0 of the Common API the flag Signal.IsExcludedFromDaq will be set to true if there were no new measurement values received for a certain time, depending on the measurement rate of the signal (Signal.ExcludeFromDaqTimeout). Please check the network connection.

Problem: The ContinuousMeasurementValues contain only one new timestamp and one new status but multiple new measurement values.

Solution: Please use another overloading of the DaqMeasurement.PrepareDaq function to get a timestamp and status for each measurement value. Default is only one timestamp/status due to performance reasons.

Problem: ContinuousMeasurementValues contains unrealistic measurement values or timestamps from the past.

Solution: After updating the measurement values via „DaqMeasurement.FillMeasurement-Values“, you have to use ContinuousMeasurementValues.UpdatedValueCount to determine the number of new measurement values. Do NOT use ContinuousMeasurementValues.Length!

Problem: Sensor delivers strange measurement values or scaling does not fit to the measurement values.

Solution: Assert that you called the according assign function (e.g. AssignSignal or AssignSensor or AssignConnector) after you changed anything within the object representation of the device.

Problem: You want to start a hardware synchronized measurement of a device compound of the same family.

Solution: For QuantumX devices you have to wire all devices via FireWire and start a "TimeStampSynchronized" measurement.

For MGCplus devices you have to plug the sync cable to each device, configure one MGCplus as master and all others as slaves and start a "HardwareSynchronized" measurement.

For PMX devices a hardware synchronized measurement is not yet possible. Please use the same NTP timeserver for each device and start a software synchronized measurement instead.

Problem: Your program will not start (Wrong Assembly error).

Solution: You probably use the wrong version of HBM_Scan.dll or HBM_QX_Framework.dll or HBM_Streaming.dll. Assert that the version fits to your machine/project settings x86 or x64.

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