TECH NOTE QuantumX :: MX430B Precision Bridge Module

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Abstract

This document describes the real-time functionality of the **QuantumX MX430B Precision Bridge Module.**

Condition

Selected QuantumX modules support **on-board math** and **direct output** functionality in **real-time**.

MX430B will be mainly used in high performance lab testing and calibration. In some applications on-board math and real-time integration via direct analog voltage output brings additional value for the user.

In some applications multi component load cells are used with 3, 4 or 6 degree of freedom. Measurement spots in that multi component load cell show cross-talk because of parasitic effects between the channels. This cross-talk can be compensated in real-time by a matrix calculation.

Benefits for the user:

- In total 4 precise strain gage full bridge inputs for pressure, force or torque measurement
- Embedded real-time calculation allows reaction without a PC in the loop
- Quick integration via voltage output to the test automation machine (no more extra effort)
- Long term stability and repeatability of tests
- High quality straight forward amplifier (full bridge input and voltage output)
- Efficiency in testing (TEDS, on-board math)

Real-time Calculation

More and more test engineers in aerospace, machinery or automotive market use **multi component transducers** for example from HBM or design it themselves. These types of sensors measure force and torque in the requested degree of freedom and are also called multi axis transducer. In most use cases 3-components are used, followed by 5- and 6-components or degree of freedom (DOF).

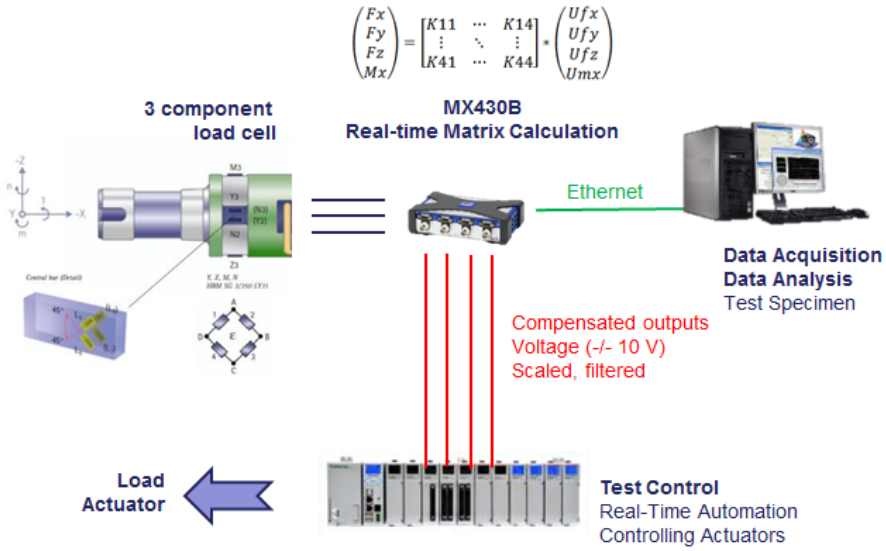
Together with this type of sensor the customer gets so called **compensation matrix**, an EXCEL sheet which shows the cross-talk or cross influence between components.

The generic 4 x 4 matrix:

$$\begin{pmatrix} Fx \\ Fy \\ Fz \\ Mx \end{pmatrix} = \begin{bmatrix} K11 & \cdots & K14 \\ \vdots & \ddots & \vdots \\ K41 & \cdots & K44 \end{bmatrix} * \begin{pmatrix} Ufx \\ Ufy \\ Ufz \\ Umx \end{pmatrix}$$

U_{fx}, U_{fy}, U_{fz} and U_{mx} are the raw signals measured in mV/V. K11, K12 … are the coefficients.

Multiplication of the measured quantities with the matrix results in fully compensated force and torque values in X, Y and Z direction. The compensated true forces Fx, Fy and Fz in N or kN can be linked to the dedicated voltage output under the input channel or directly transmitted in real-time to the FireWire bus and to CAN (MX471B) or CX27B (EtherCAT). Outputs in return can be transferred to a real-time automation instance controlling the test.



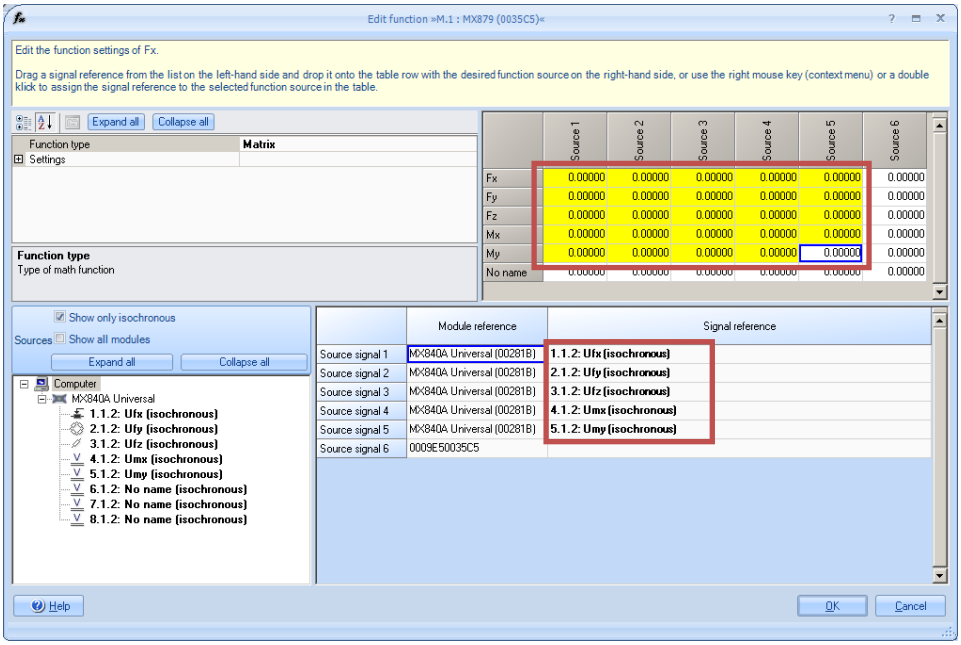
For a full compensation of a 5 or 6 DOF transducer beside a second MX430B a MX878B voltage output module is necessary.

Parameterizing Real-Time Functionality

This real-time functionality need to be parameterized by *MX Assistant* software or *.NET API*.

Step-by-step parameterization with MX Assistant:

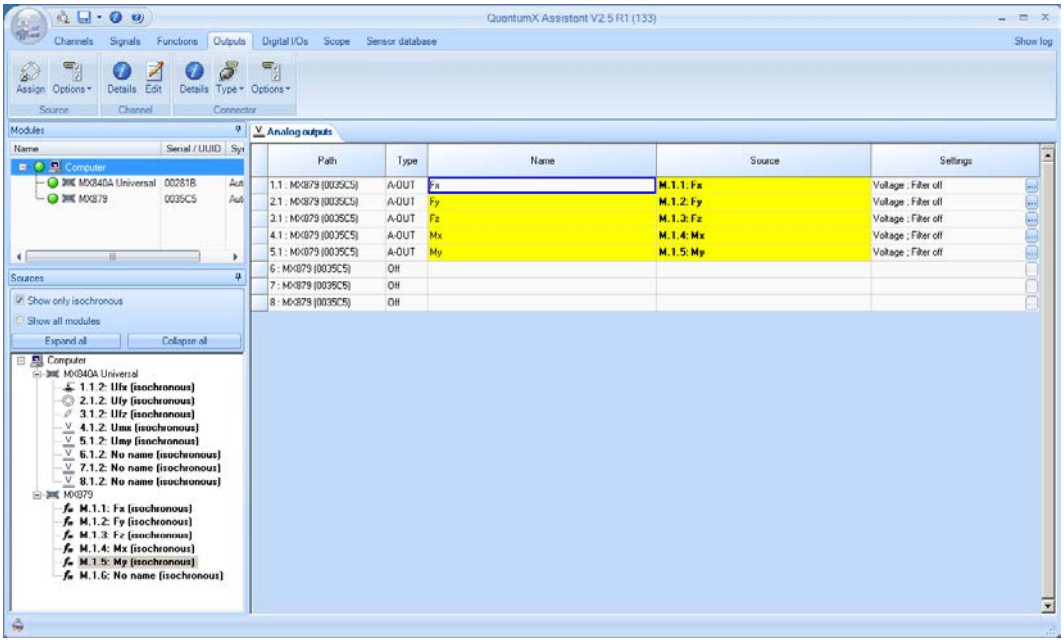
1. Channels tab: and parameterize all inputs via Sensor Database, find an appropriate signal name like Ufx, Ufy, …
2. Functions Tab: Activate **matrix functionality**, enter output signal names like Fx, Fy, … and output rate
3. Matrix settings
    a. Drag and drop input signals to input vector
    b. Go to EXCEL, copy and paste the compensation matrix to the form:



4. Outputs: in case you want to output the compensated signals,

a. Functions Tab: parameterize Fx, Fy, … as isochronous

b. Outputs Tab: drag and drop signals to analog voltage output port A-OUT 1, 2 and 3



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