# QUB LVTTL to TTL and TTL to LVTTL voltage translator for Xsens motion capture system.

Objectivities:

Design High speed High impedance voltage level shifter LVTTL to TTL and TTL to LVTTL. All channels are bi-directional with low voltage reference 3.3V and high voltage reference 5V. The voltage level translator shall be powered from the USB port to provide 5V high voltage reference and to supply regulated 3.3V . All inputs and outputs are terminated with 50 Ohms BNC's. The printed circuit board is installed inside PLA enclosure which has an identical shape as Xsens hub. That should support stacking the Xsens hub directly on the Voltage level translator.

Schematic diagram 1:
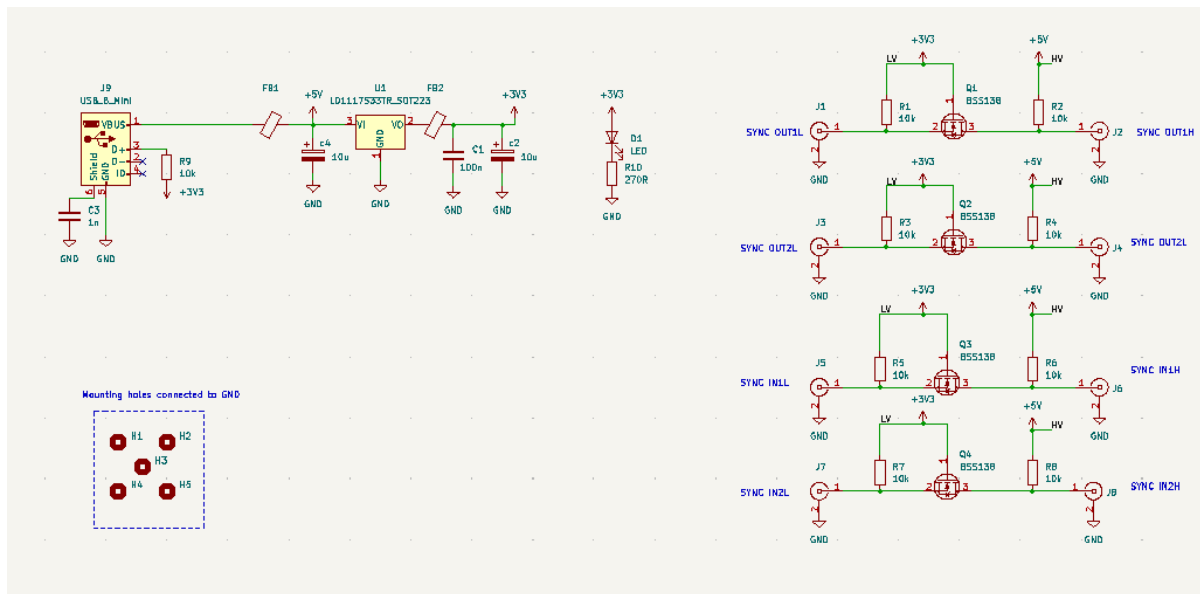
4 Channels voltage translator shall support SYNCH OUT 1, SYNCH OUT 2, SYNCH IN 1 and SYNCH IN 2 XSENS triggers. The 4 channels translator shall be connected directly to associated XSENSE LVTTL pins by means of BNC to BNC cables.

Design prerequisites, Spice circuit simulation:

Prior to printed circuit board design, voltage shifter translator circuit was simulated in Spice. As a logic level switching component N- Channel, Enhanced mode Field effect transistor BSS138 was selected from Onsemi semiconductor.
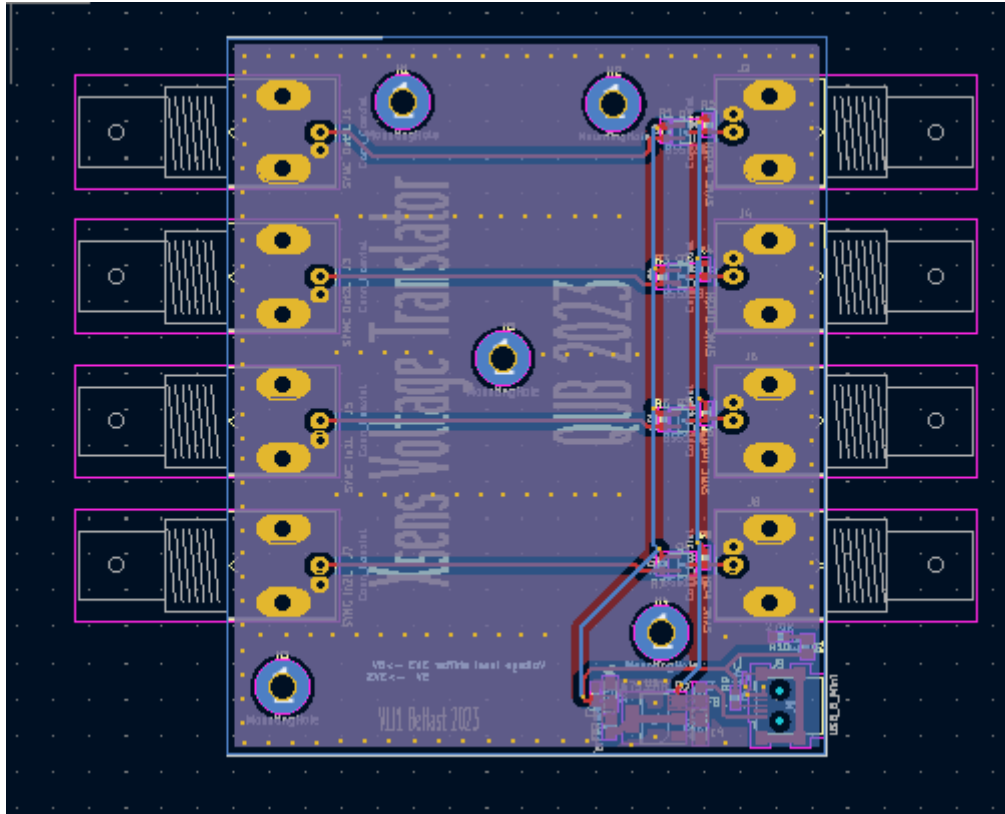
Spice simulation:
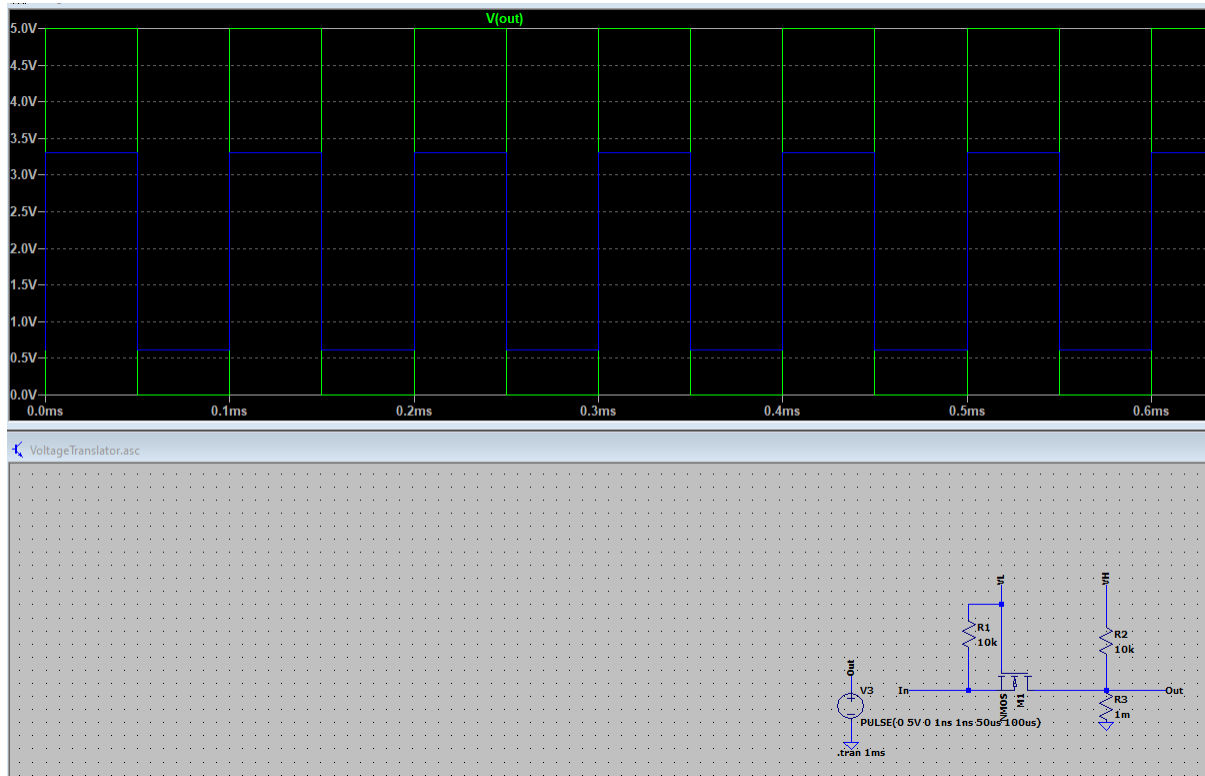
Blue trace LVTTL signal input, green trace corresponding TTL Signal. Single channel simulation.

Hardware design:

4 Channel voltage translator and associated power supply circuit was designed in opensource software Kicad 6.0. as two layer PCB for reference see schematic 1. The circuit was manufactured by JLCPCB. All design files, Bill of materials, gerber files , component pick and place file and enclosure files are available on gitHub here.

4 Channels Voltage translator 2 layers layout, top view:
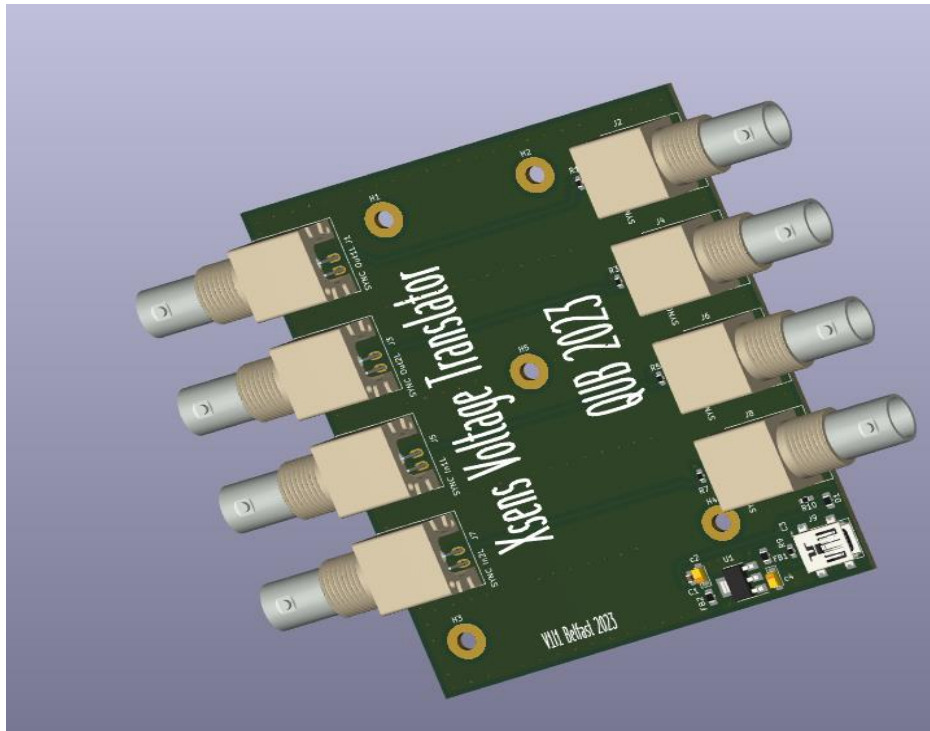
User Manual.

Stack the Xsens hub on the 4 channels voltage translator box.

Connect corresponding channels Xsense with LTTL Inputs/Outputs. All signals are aligned on the sides of the front and rear panels. For reference see pictures top view on the connector side and system connection.
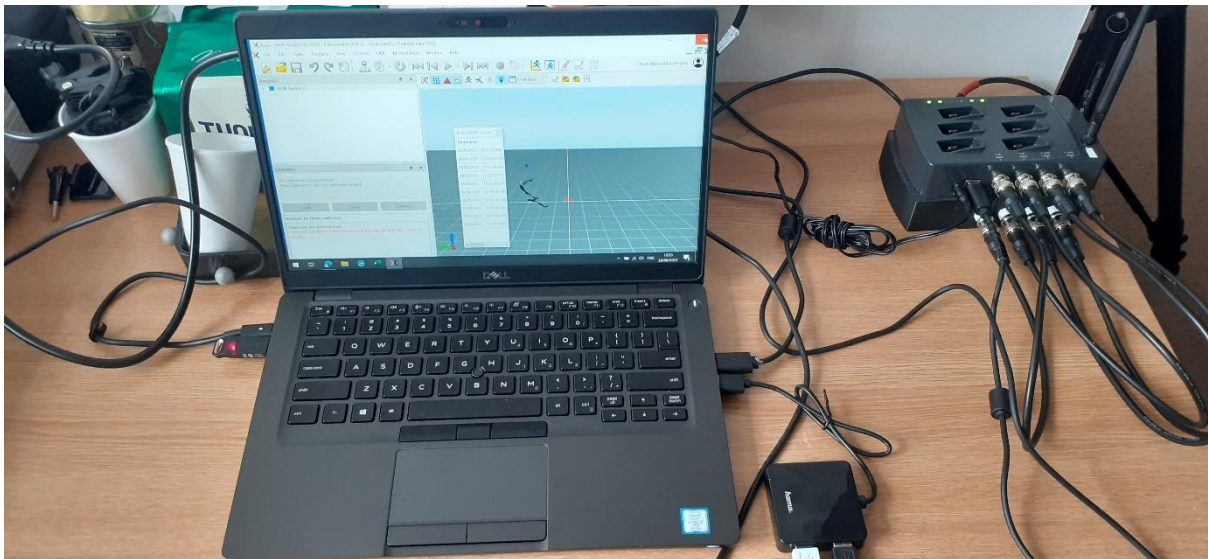
Connect external TTL Inputs / Outputs.

Connect mini USB B cable to translator box. Red LED will indicate power presence.
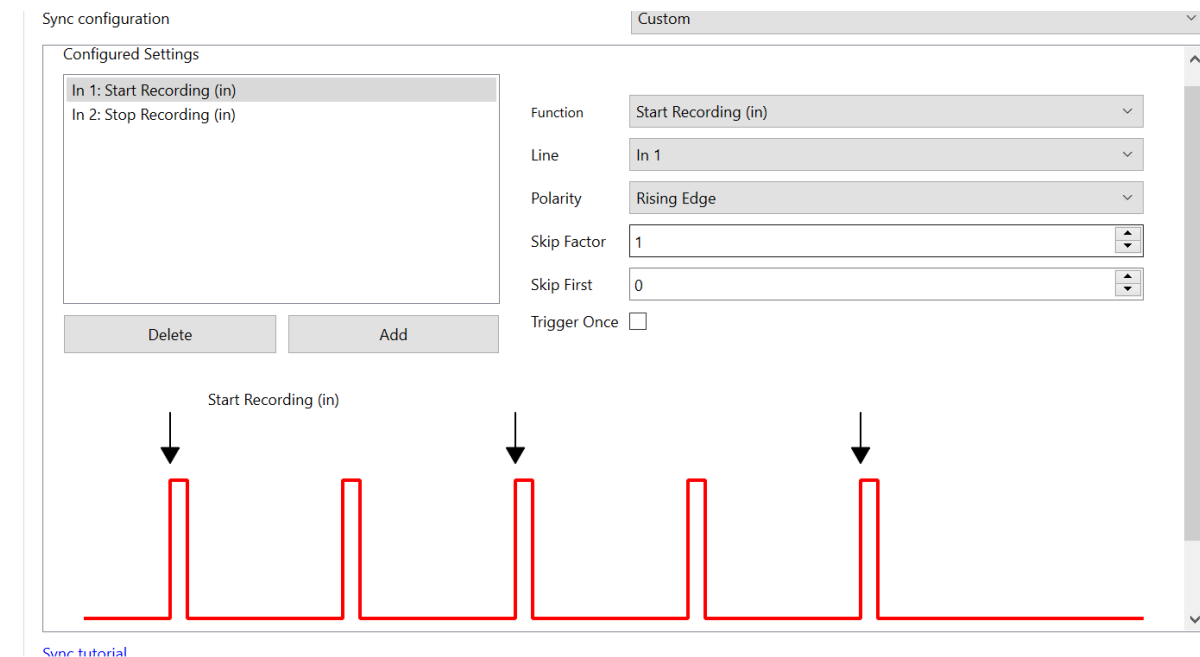
Configure Xsens software to generate or await triggers. Refer to Xsens software reference manual Sync Configuration for sending and receiving trigger signals for start and stop recording.

Top view on the connector side

System connection

Sync Receiving trigger configuration MVN

Sync Sending trigger MVN configuration

Voltage level translator V1I1   Kamil Kanas Electronics Design Engineer

Bill of Materials.

All design files required to manufacture voltage level translator are available at GitHub

https://github.com/kanatronics/XsensVoltageTranslator

PCB:

Gerber **VoltageTranslatyorBNC_TTL-Edge_Gerber_V1I1.zip**

BOM   **VoltageTranslatyorBNC_TTL_BOM_V1i1.csv**

Pick and Place **VoltageTranslatyorBNC_TTL_BOM_V1i1.csv**

Enclosure:

Enclosure Top   XsensTop.stl

Enclosure Bottom   Xsensbottom.stl

Cables and accessories:

BNC Male to BNC Male RG58 Coaxial Lead, 0.5m 50 Ohm - JR9001/58U 0.5M-ROHS

Manufacturer Part No: JR9001/58U 0.5M-ROHS   x8

USB 2.0 A Male to Mini B Male Lead, 0.2m Black - PSG91713

Manufacturer Part No: PSG91713x1   x1

Voltage level translator V1I1   Kamil Kanas Electronics Design Engineer