NbTi RIBBON CABLE WITH UCC-2P

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- JPE product used: UHV Cryogenic Connector

[1] C. Broyles *et al.*, *Adv. Mater.* 2414966 (2024).
[2] Y.F. Wang *et al.*, *arXiv Preprint* **2408**, 06209 (2024).

The experiment

The JPE CBS5(-RLS) cryogenic positioners will be utilized in our Bluefors dilution refrigerator for the study of quantum materials. The piezo actuation will position a sample nearby to a superconducting quantum interference device (SQUID) for magnetic imaging. This will be leveraged to capture surface phenomena such as topological surface states in the Dirac semimetal UOTe [1] and superconducting vortices in UTe_2 [2].

For connection of CBS5(-RLS) cryogenic positioners via a 25 pins micro-D connector (*MDM-25SSB, ITT Cannon*) a cable is made which connects to 5 pieces of JPE's UHV Cryogenic Connector (UCC-2p) for the power supply, and 3 pcs generic ZIF connector (*68610414422, Wurth Elektronik*) for the Resistive Linear Sensor (-RLS) position feedback (see Figure 1). A 12-pair NbTi ribbon cable is used with 100 µm diameter NbTi wire, cupro-nickel clad, a polyimide insulation and melting point above 400 °C. The cable assembly is soldered at a temperature setting of 250 °C and is wired up with pins (1,14,2,15,3) as signal lines, pins (22,11,23,12,24) as reference lines and the middle 12 pins for the four wire ZIF connectors.

For the room temperature breakout from a common 25 pins sub-D connector, we built a breakout box composed of a circuit board with 3 LEMO 2 pin connectors for the power supply, I1-RSM kit with D-SUB Interface PCB soldered into the circuit board, and 4 BNC coaxial connectors (see Figure 2). From the breakout box, we can directly connect to the JPE power supply and RLS HDMI cables, while controlling our homebuilt piezo scanner with coaxial cables.



Figure 1: (a) Realized ribbon cable with UCC-2p and ZIF connectors, to be mated with a 25 pins D-sub connector. (b) Zoomed-in image of the ZIF connector, with solder joints supported by G10 board and Stycast 2850FT Expoxy. (c) Zoomed-in image of the ribbon cable breakout to 5pc UCC-2p and 3 ZIF connectors.

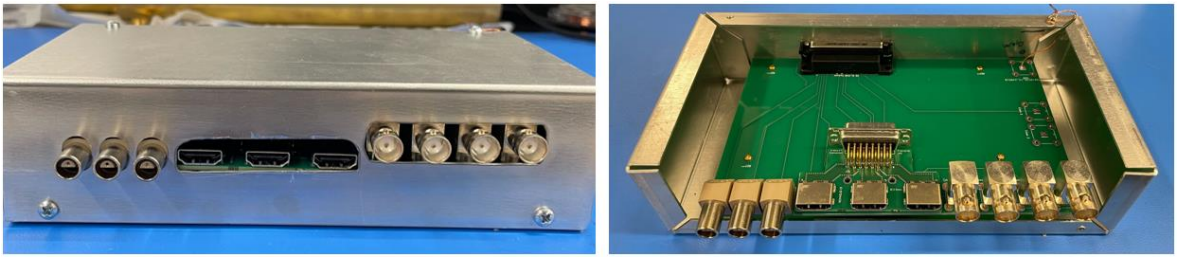


Figure 2: Custom build breakout box from a 25 pin Sub-D connector to 3 CBS5 power supply channels, 3 RLS measurement channels, and 4 coaxial cables to drive a home build cryogenic XY scanner.

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