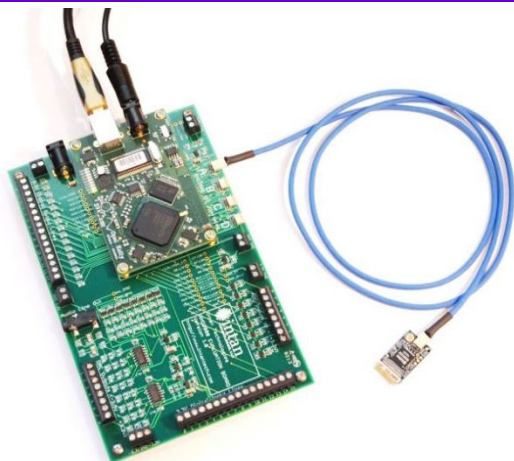


RHD

Application Note: Adapting SPI Cables to a Commutator

19 April 2013; updated 7 February 2020



Q:

How can the Intan Technologies RHD recording system be wired to a commutator or other custom connector using the Intan SPI interface cables?

A:

Intan Technologies provides simple hardware that allows signals from standard RHD SPI interface cables to be adapted to commutators or other user-specific connectors with ease. This application note describes how to use the **SPI cable adapter board** (part #C3430) to accomplish this.

The RHD recording system uses custom SPI (Serial Peripheral Interface) cables to link the RHD recording controller or USB interface board to RHD headstages. These cables provide both power and low-voltage differential signals (LVDS) conveying digital data. The details of these cables and associated connectors are described in the **RHD SPI Cable/Connector Specification** available from the Intan Technologies website.

Figures 1 and 2 below show the SPI cable adapter board connected to an RHD SPI interface cable. The adapter board contains no active circuitry; it simply breaks out all 12 signals from an SPI interface cable to easily accessible gold-plated holes with a 0.1" pitch. Wires or other connectors may be soldered to these holes.

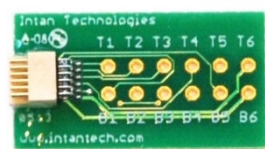


Figure 1. SPI cable adapter board

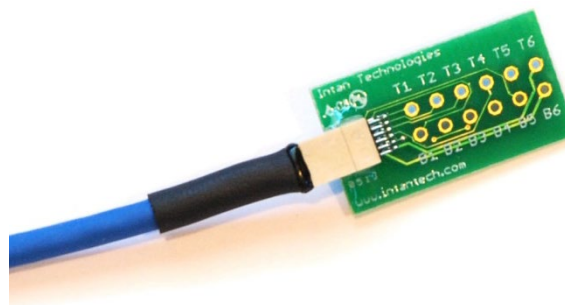


Figure 2. SPI cable adapter board plugged into RHD SPI interface cable.

RHD Application Note

The signals on each SPI cable adapter board are labeled T1 – T6 and B1 – B6. Note that the ‘T’ and ‘B’ pin names refer to the top and bottom row of pins on the connector attached to the adapter board. Due to the daisy chaining capability of these connectors, signals will alternate between ‘top’ and ‘bottom’ depending on how the adapter is connected to the system. The following table provides a quick reference to these signal locations:

Table 1: SPI cable adapter signals

SPI adapter pin number	Signal with cable adapter plugged into headstage	Signal with cable adapter plugged into recording controller
B1	$\overline{\text{CS}}+$	$\overline{\text{CS}}-$
T1	$\overline{\text{CS}}-$	$\overline{\text{CS}}+$
B2	SCLK+	SCLK-
T2	SCLK-	SCLK+
B3	MOSI+	MOSI-
T3	MOSI-	MOSI+
B4	MISO1+	MISO1-
T4	MISO1-	MISO1+
B5	MISO2+	MISO2-
T5	MISO2-	MISO2+
B6	Power (3.3V)	Ground
T6	Ground	Power (3.3V)

To adapt SPI cables to a commutator or other custom connector, two SPI cable adapter boards may be used in manner depicted in Figure 3:

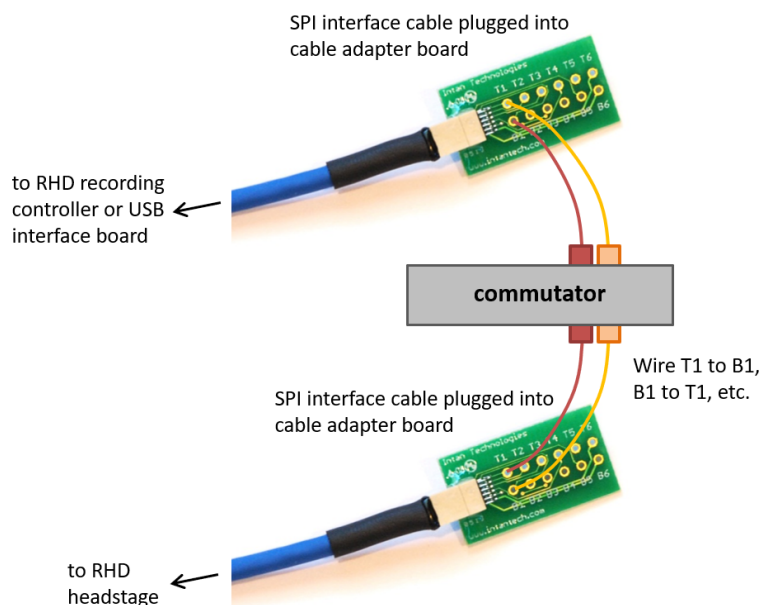


Figure 3. Two SPI interface cables and two SPI cable adapter boards are used to pass signals through a commutator or other custom connector.

Note that ‘T’ signals from one cable adapter board must be wired to ‘B’ signals in the other board. (See Table 1 above.)

If a headstage containing a single RHD2000 chip is used, the signals B5 and T5 can be omitted as the MISO2 differential data line is used only when a second RHD2000 chip is used.

Therefore single-chip headstages (e.g., RHD 16-, 32-, or 64-channel headstages) require 10 signals to pass through the commutator or custom connector. The RHD 128-channel headstage contains two RHD2000 chips and thus requires all 12 signals. A cable with two headstages (using an **RHD dual headstage adapter**) requires all 12 signals.

Wires between each SPI cable adapter board and the commutator should be kept short to maintain high signal integrity. If long wires are required, twisted pairs should be used for each differential data signal (e.g., SCLK+ and SCLK-, etc.).