**Problems with cross-talk on the LabJack T7-PRO**

**Mark Rivers, University of Chicago**

**November 17, 2022**

In my Word document on November 11, 2022 I identified the following 3 issues which all involve channel cross-talk on the LabJack T7-PRO.

**Issue 8: There are very significant glitches in voltage readout immediately after reading TEMPERATURE\_DEVICE\_K.**

**Issue 9: There is significant cross-talk between analog inputs on the T7-Pro that cannot be reduced by increasing the settling time.**

**Issue 10: Initial scan values have large errors on T7-Pro when running high gain.**

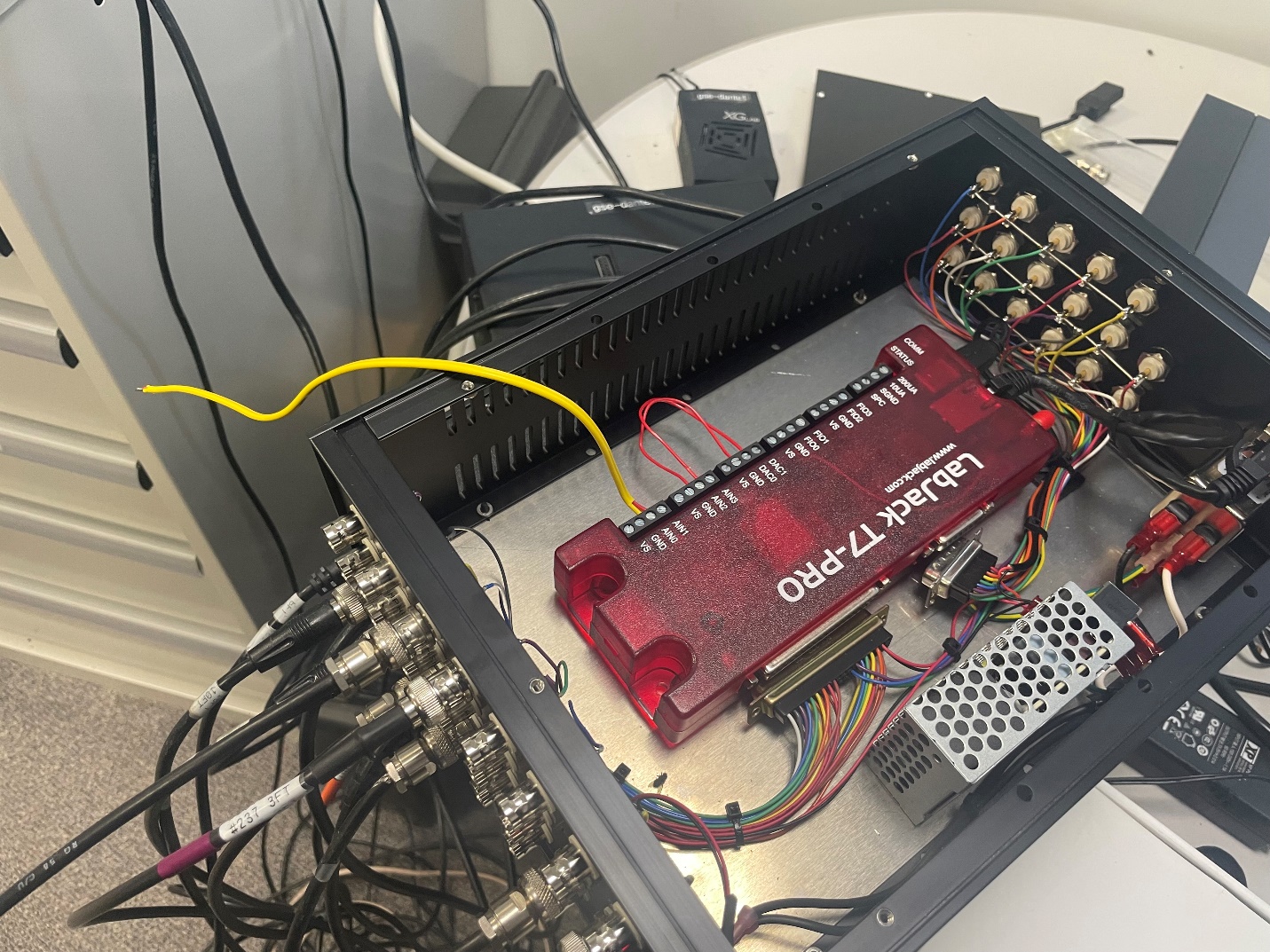
**Soloman replied to these issues as follows:**

#8, #9, #10: I tried a couple of quick tests and cannot seem to reproduce these behaviors. I suspect they could be something related to the thermocouple setup. How do you have the thermocouple connected to the device? Are you using an ungrounded probe? Please try reproducing the test with the thermocouple connection replaced by the AIN connected to GND with a short wire. If you still see the issue from there, I would ask that you provide a simple script to reproduce the error.

**Device Wiring**

The wiring to the T7-PRO is shown in the following photograph.

* The T7-PRO is mounted in a box with 41 BNC connectors.
* Normally these BNCs are connected to the T7-PRO via the 2 D connectors.
* However, for this test the D connector cables were removed and very simple wiring was used.
  + A short Type K thermocouple is connected to AIN0 and AIN1. This is effectively a short between these 2 inputs, except for the thermocouple EMF.
  + DAC0 is connected to AIN2.
  + DAC1 is connected to AIN3.



**Test Program**

As requested I have written a short C program that demonstrates all 3 of the issues I reported, test\_temp\_t7pro.c. The program is run with 2 arguments:

test\_temp\_t7.pro deviceID numChannelsToRead

* deviceID is the IP address or serial number of the T7-PRO
* numChannelsToRead is the number of AIN channels to read during the test. It must be between 1 and 14.

The program configures the analog inputs as follows:

* AIN0 set to differential (AIN0\_NEGATIVE\_CH=1), RANGE=0.01 V, RESOLUTION\_INDEX=11,
* AIN2-AIN13 are set to single-ended (AINn\_NEGATIVE\_CH=199), RANGE=10V, RESOLUTION\_INDEX=0.
* AIN\_ALL\_SETTLING\_US is set to 2000 for 2 ms settling time on all channels.

The program then does the following sequence of operations 4 times:

* Sets DAC0 and DAC1 each to either 0 V or 5 V. The DAC0,DAC1 values are [0,0], [0,5], [5,0], and [5,5] on the 4 loops.
* Reads the DEVICE\_TEMPERATURE\_K to get the cold junction temperature.
* Does the following steps 10 times
  + Reads AIN0 and converts from volts to temperature using the cold junction temperature
  + Optionally reads the other analog inputs (AIN2-AIN13) according to the user-specified value of numChannelsToRead if it is between 3 and 14.
  + Prints out the AIN0 temperature and the other voltages

The program then does a stream burst input of AIN0 with the following settings:

* 256 scans
* 500 Hz scan rate
* STREAM\_RESOLUTION\_INDEX=8
* STREAM\_SETTLING\_US=0 (default)

At the end of the scan the AIN0 values are converted to temperature and printed out.

**Results of the test\_temp\_t7pro.c test program with numChannelsToRead=1**

The following is the output of the program when numChannelsToRead=1 so it only reads AIN0 during the first phase of the program.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

corvette:labjack/LabJackApp/src>../../bin/linux-x86\_64/test\_temp\_t7pro 10.54.160.73 1

deviceType: LJM\_dtT7

connectionType: LJM\_ctETHERNET

serialNumber: 470028527

IP address: 10.54.160.73

port: 502

Maximum number of bytes per packet: 1040

Configuration:

numChannelsToRead: 1

AIN0\_NEGATIVE\_CH : 1

AIN0\_RANGE : 0.010000

AIN0\_RESOLUTION\_INDEX : 11

AIN\_ALL\_SETTLING\_US : 2000

Cold junction temperature (C): 24.963892, DAC0: 0.000000, DAC1: 0.000000

Temp (C): 21.253711

Temp (C): 20.715417

Temp (C): 20.408728

Temp (C): 20.409095

Temp (C): 20.404317

Temp (C): 20.406859

Temp (C): 20.402448

Temp (C): 20.395954

Temp (C): 20.398803

Temp (C): 20.393718

Cold junction temperature (C): 24.963892, DAC0: 0.000000, DAC1: 5.000000

Temp (C): 21.236630

Temp (C): 20.695357

Temp (C): 20.389888

Temp (C): 20.384313

Temp (C): 20.384129

Temp (C): 20.382138

Temp (C): 20.379106

Temp (C): 20.379320

Temp (C): 20.378799

Temp (C): 20.380270

Cold junction temperature (C): 24.963892, DAC0: 5.000000, DAC1: 0.000000

Temp (C): 21.230538

Temp (C): 20.704698

Temp (C): 20.394147

Temp (C): 20.385631

Temp (C): 20.383854

Temp (C): 20.383517

Temp (C): 20.382598

Temp (C): 20.382598

Temp (C): 20.377084

Temp (C): 20.375123

Cold junction temperature (C): 24.963892, DAC0: 5.000000, DAC1: 5.000000

Temp (C): 21.229712

Temp (C): 20.698144

Temp (C): 20.384987

Temp (C): 20.382291

Temp (C): 20.387652

Temp (C): 20.384926

Temp (C): 20.379014

Temp (C): 20.379871

Temp (C): 20.382077

Temp (C): 20.379106

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

I have highlighted in red the first 2 AIN0 values read after reading the cold junction temperature. Note that the last 8 values each time are very close to 20.39 degrees. However, the first value is about 21.24, which is about 0.85 degrees too high. The second reading in each case if is about 20.70, which is about 0.31 degrees too high.

There is thus a voltage/temperature glitch after reading the cold junction temperature. The glitch is removed by reading the AIN0 voltage 2 times right after reading the device temperature. This is how I have currently worked around the issue in my EPICS driver.

Note that the final 8 temperatures in each test above are all very similar, and do not depend on the values of DAC0 and DAC1. This makes sense, because AIN2 and AIN3 are not being read in this case, so the DAC values do not matter.

I have omitted the stream output in the output shown above, because it does not show a problem when only reading AIN0 before the stream begins.

**Results of the test\_temp\_t7pro.c test program with numChannelsToRead=4**

The following is the output of the program when numChannelsToRead=4 so it reads AIN0, AIN2, and AIN3 during the first phase of the program.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

corvette:labjack/LabJackApp/src>../../bin/linux-x86\_64/test\_temp\_t7pro 10.54.160.73 4

deviceType: LJM\_dtT7

connectionType: LJM\_ctETHERNET

serialNumber: 470028527

IP address: 10.54.160.73

port: 502

Maximum number of bytes per packet: 1040

Configuration:

numChannelsToRead: 4

AIN0\_NEGATIVE\_CH : 1

AIN2\_NEGATIVE\_CH : 199

AIN3\_NEGATIVE\_CH : 199

AIN0\_RANGE : 0.010000

AIN2\_NEGATIVE\_CH : 10.000000

AIN3\_NEGATIVE\_CH : 10.000000

AIN0\_RESOLUTION\_INDEX : 11

AIN2\_RESOLUTION\_INDEX: 0

AIN3\_RESOLUTION\_INDEX: 0

AIN\_ALL\_SETTLING\_US : 2000

Cold junction temperature (C): 25.000452, DAC0: 0.000000, DAC1: 0.000000

Temp (C): 21.355533, 0.001468, 0.002367

Temp (C): 21.712155, 0.001467, 0.002403

Temp (C): 21.824814, 0.001504, 0.002374

Temp (C): 21.861895, 0.001447, 0.002355

Temp (C): 21.879823, 0.001417, 0.002379

Temp (C): 21.893805, 0.001452, 0.002410

Temp (C): 21.905889, 0.001480, 0.002388

Temp (C): 21.916933, 0.001451, 0.002361

Temp (C): 21.926784, 0.001481, 0.002334

Temp (C): 21.943610, 0.001475, 0.002379

Cold junction temperature (C): 25.000452, DAC0: 0.000000, DAC1: 5.000000

Temp (C): 21.707290, 0.001417, 4.976908

Temp (C): 21.462259, 0.001470, 4.976671

Temp (C): 21.468442, 0.001491, 4.977014

Temp (C): 21.471655, 0.001491, 4.979081

Temp (C): 21.475328, 0.001510, 4.979575

Temp (C): 21.475083, 0.001447, 4.979075

Temp (C): 21.479857, 0.001452, 4.977011

Temp (C): 21.467523, 0.001428, 4.976643

Temp (C): 21.471196, 0.001454, 4.977066

Temp (C): 21.460056, 0.001485, 4.979344

Cold junction temperature (C): 25.000452, DAC0: 5.000000, DAC1: 0.000000

Temp (C): 21.586296, 4.975274, 0.002394

Temp (C): 21.698998, 4.975228, 0.002402

Temp (C): 21.712920, 4.975177, 0.002381

Temp (C): 21.715704, 4.975070, 0.002356

Temp (C): 21.713930, 4.975207, 0.002379

Temp (C): 21.710319, 4.975043, 0.002332

Temp (C): 21.714848, 4.975244, 0.002363

Temp (C): 21.712308, 4.975250, 0.002382

Temp (C): 21.710839, 4.975226, 0.002358

Temp (C): 21.709677, 4.975209, 0.002374

Cold junction temperature (C): 24.993127, DAC0: 5.000000, DAC1: 5.000000

Temp (C): 21.570018, 4.975134, 4.976752

Temp (C): 21.329887, 4.975024, 4.976605

Temp (C): 21.322234, 4.975170, 4.976926

Temp (C): 21.324224, 4.975235, 4.979007

Temp (C): 21.314551, 4.975266, 4.979454

Temp (C): 21.313664, 4.975264, 4.979191

Temp (C): 21.305981, 4.975038, 4.976645

Temp (C): 21.311062, 4.975188, 4.977076

Temp (C): 21.305552, 4.975092, 4.976439

Temp (C): 21.303287, 4.975152, 4.978982

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

The output above demonstrates that there is cross-talk about AIN0, and AIN2/AIN3.

This table shows the temperature measured by AIN0 as a function of the voltages applied to AIN2 and AIN3.

|  |  |  |
| --- | --- | --- |
| **AIN2** | **AIN3** | **AIN0 temperature** |
| 0 | 0 | 21.90 |
| 0 | 5 | 21.47 |
| 5 | 0 | 21.71 |
| 5 | 5 | 21.30 |

So the temperature measured on AIN0 differs by 0.60 degrees when the AIN2/AIN3 voltages are changed from [0,0] to [5,5].

When numChannelsToRead is 4 there is also a problem with the stream input. This is the output of that part of the program. For brevity I have only showed the first 100 values captured in the stream, out of 256 total.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Configuring stream:

Setting STREAM\_TRIGGER\_INDEX to 0

Setting STREAM\_CLOCK\_SOURCE to 0

Setting STREAM\_RESOLUTION\_INDEX to 8

Setting STREAM\_SETTLING\_US to 0.000000

Starting stream:

scan rate: 500.00 Hz (500.00 sample rate)

number of scans : 256

number of samples: 256

Stream burst complete:

Actual scanRate was: 500.000000

256 scans over approximately 611 milliseconds

Stream data:

Point 0: Temp (C): 21.521525

Point 1: Temp (C): 21.490166

Point 2: Temp (C): 21.490166

Point 3: Temp (C): 21.443124

Point 4: Temp (C): 21.466645

Point 5: Temp (C): 21.443124

Point 6: Temp (C): 21.427443

Point 7: Temp (C): 21.403922

Point 8: Temp (C): 21.419603

Point 9: Temp (C): 21.419603

Point 10: Temp (C): 21.380399

Point 11: Temp (C): 21.364718

Point 12: Temp (C): 21.349036

Point 13: Temp (C): 21.317671

Point 14: Temp (C): 21.294147

Point 15: Temp (C): 21.286306

Point 16: Temp (C): 21.262781

Point 17: Temp (C): 21.270623

Point 18: Temp (C): 21.254940

Point 19: Temp (C): 21.239256

Point 20: Temp (C): 21.200047

Point 21: Temp (C): 21.176520

Point 22: Temp (C): 21.192204

Point 23: Temp (C): 21.160836

Point 24: Temp (C): 21.168678

Point 25: Temp (C): 21.160836

Point 26: Temp (C): 21.129466

Point 27: Temp (C): 21.105938

Point 28: Temp (C): 21.129466

Point 29: Temp (C): 21.098095

Point 30: Temp (C): 21.058881

Point 31: Temp (C): 21.035352

Point 32: Temp (C): 20.996136

Point 33: Temp (C): 20.996136

Point 34: Temp (C): 20.988292

Point 35: Temp (C): 20.956918

Point 36: Temp (C): 20.949074

Point 37: Temp (C): 20.917699

Point 38: Temp (C): 20.933386

Point 39: Temp (C): 20.894166

Point 40: Temp (C): 20.886322

Point 41: Temp (C): 20.854945

Point 42: Temp (C): 20.847101

Point 43: Temp (C): 20.831412

Point 44: Temp (C): 20.807878

Point 45: Temp (C): 20.807878

Point 46: Temp (C): 20.792188

Point 47: Temp (C): 20.737274

Point 48: Temp (C): 20.745119

Point 49: Temp (C): 20.729429

Point 50: Temp (C): 20.721583

Point 51: Temp (C): 20.674511

Point 52: Temp (C): 20.682356

Point 53: Temp (C): 20.666665

Point 54: Temp (C): 20.643128

Point 55: Temp (C): 20.635282

Point 56: Temp (C): 20.619590

Point 57: Temp (C): 20.588206

Point 58: Temp (C): 20.588206

Point 59: Temp (C): 20.580360

Point 60: Temp (C): 20.548975

Point 61: Temp (C): 20.556821

Point 62: Temp (C): 20.541128

Point 63: Temp (C): 20.525435

Point 64: Temp (C): 20.509742

Point 65: Temp (C): 20.525435

Point 66: Temp (C): 20.533281

Point 67: Temp (C): 20.525435

Point 68: Temp (C): 20.509742

Point 69: Temp (C): 20.525435

Point 70: Temp (C): 20.525435

Point 71: Temp (C): 20.517588

Point 72: Temp (C): 20.525435

Point 73: Temp (C): 20.533281

Point 74: Temp (C): 20.517588

Point 75: Temp (C): 20.509742

Point 76: Temp (C): 20.517588

Point 77: Temp (C): 20.525435

Point 78: Temp (C): 20.525435

Point 79: Temp (C): 20.533281

Point 80: Temp (C): 20.533281

Point 81: Temp (C): 20.517588

Point 82: Temp (C): 20.517588

Point 83: Temp (C): 20.525435

Point 84: Temp (C): 20.501895

Point 85: Temp (C): 20.501895

Point 86: Temp (C): 20.533281

Point 87: Temp (C): 20.509742

Point 88: Temp (C): 20.494048

Point 89: Temp (C): 20.509742

Point 90: Temp (C): 20.525435

Point 91: Temp (C): 20.509742

Point 92: Temp (C): 20.509742

Point 93: Temp (C): 20.533281

Point 94: Temp (C): 20.525435

Point 95: Temp (C): 20.541128

Point 96: Temp (C): 20.509742

Point 97: Temp (C): 20.533281

Point 98: Temp (C): 20.517588

Point 99: Temp (C): 20.494048

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Note that the first temperature value in the scan is 21.52 degrees. The values then continuously decrease to about point 63 where the temperature is 20.52. The values after that are quite constant. So the temperature drops by 1.00 degrees in the first 63 points = 126 ms.

This drop does not occur if numSamplesPerRead=1, so it is clearly caused by the 5 V values read immediately before the scan from AIN2 and AIN3.

**Results of the test\_temp\_t7pro.c test program with numChannelsToRead=14**

The following is the output of the program when numChannelsToRead=4 so it reads AIN0, and AIN2-AIN13 during the first phase of the program. AIN4-AIN13 have no connection, so they are open inputs.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

corvette:labjack/LabJackApp/src>../../bin/linux-x86\_64/test\_temp\_t7pro 10.54.160.73 14

deviceType: LJM\_dtT7

connectionType: LJM\_ctETHERNET

serialNumber: 470028527

IP address: 10.54.160.73

port: 502

Maximum number of bytes per packet: 1040

Configuration:

numChannelsToRead: 14

AIN0\_NEGATIVE\_CH : 1

AIN2\_NEGATIVE\_CH : 199

AIN3\_NEGATIVE\_CH : 199

AIN4\_NEGATIVE\_CH : 199

AIN5\_NEGATIVE\_CH : 199

AIN6\_NEGATIVE\_CH : 199

AIN7\_NEGATIVE\_CH : 199

AIN8\_NEGATIVE\_CH : 199

AIN9\_NEGATIVE\_CH : 199

AIN10\_NEGATIVE\_CH : 199

AIN11\_NEGATIVE\_CH : 199

AIN12\_NEGATIVE\_CH : 199

AIN13\_NEGATIVE\_CH : 199

AIN0\_RANGE : 0.010000

AIN2\_NEGATIVE\_CH : 10.000000

AIN3\_NEGATIVE\_CH : 10.000000

AIN4\_NEGATIVE\_CH : 10.000000

AIN5\_NEGATIVE\_CH : 10.000000

AIN6\_NEGATIVE\_CH : 10.000000

AIN7\_NEGATIVE\_CH : 10.000000

AIN8\_NEGATIVE\_CH : 10.000000

AIN9\_NEGATIVE\_CH : 10.000000

AIN10\_NEGATIVE\_CH : 10.000000

AIN11\_NEGATIVE\_CH : 10.000000

AIN12\_NEGATIVE\_CH : 10.000000

AIN13\_NEGATIVE\_CH : 10.000000

AIN0\_RESOLUTION\_INDEX : 11

AIN2\_RESOLUTION\_INDEX: 0

AIN3\_RESOLUTION\_INDEX: 0

AIN4\_RESOLUTION\_INDEX: 0

AIN5\_RESOLUTION\_INDEX: 0

AIN6\_RESOLUTION\_INDEX: 0

AIN7\_RESOLUTION\_INDEX: 0

AIN8\_RESOLUTION\_INDEX: 0

AIN9\_RESOLUTION\_INDEX: 0

AIN10\_RESOLUTION\_INDEX: 0

AIN11\_RESOLUTION\_INDEX: 0

AIN12\_RESOLUTION\_INDEX: 0

AIN13\_RESOLUTION\_INDEX: 0

AIN\_ALL\_SETTLING\_US : 2000

Cold junction temperature (C): 24.956598, DAC0: 0.000000, DAC1: 0.000000

Temp (C): 21.713061, 0.001464, 0.002403, -1.330076, -2.113195, -3.185067, -4.095049, -5.167713, -6.158010, -7.452581, -8.498862, -10.066872, -10.588218

Temp (C): 24.129624, 0.001401, 0.002314, -1.631409, -2.572551, -3.872102, -4.987309, -6.338501, -7.491362, -9.093014, -10.321020, -10.588232, -10.588199

Temp (C): 25.294420, 0.001353, 0.002319, -1.642547, -2.588910, -3.922239, -5.063541, -6.469249, -7.670194, -9.389692, -10.514839, -10.588188, -10.588223

Temp (C): 25.294420, 0.001427, 0.002371, -1.638751, -2.583639, -3.920491, -5.060099, -6.473446, -7.678156, -9.416042, -10.530054, -10.588233, -10.588249

Temp (C): 25.295001, 0.001394, 0.002308, -1.641275, -2.586927, -3.923503, -5.064929, -6.479325, -7.681677, -9.419564, -10.530613, -10.588200, -10.588200

Temp (C): 25.294176, 0.001415, 0.002342, -1.641788, -2.586594, -3.925255, -5.065187, -6.476280, -7.679375, -9.418097, -10.530067, -10.588217, -10.588159

Temp (C): 25.294696, 0.001402, 0.002324, -1.640804, -2.585614, -3.926485, -5.067688, -6.484829, -7.688937, -9.431884, -10.537333, -10.588229, -10.588218

Temp (C): 25.294573, 0.001421, 0.002290, -1.636576, -2.581412, -3.920750, -5.061702, -6.476583, -7.682236, -9.426916, -10.533357, -10.588222, -10.588200

Temp (C): 25.294206, 0.001396, 0.002256, -1.639763, -2.584927, -3.920297, -5.061322, -6.477171, -7.682819, -9.424682, -10.532712, -10.588245, -10.588241

Temp (C): 25.294268, 0.001407, 0.002316, -1.639849, -2.584677, -3.921291, -5.061483, -6.473017, -7.675841, -9.414893, -10.528649, -10.588243, -10.588209

Cold junction temperature (C): 24.963892, DAC0: 0.000000, DAC1: 5.000000

Temp (C): 21.667159, 0.001428, 4.980422, 1.346372, 1.218026, -0.530381, -1.570675, -3.119533, -4.375651, -5.907675, -7.251986, -8.945885, -10.216112

Temp (C): 23.952701, 0.001409, 4.976995, 1.647652, 1.568256, 0.007847, -0.919964, -2.304229, -3.436971, -4.817454, -6.046815, -7.612873, -8.731004

Temp (C): 25.283795, 0.001423, 4.976677, 1.661378, 1.578323, 0.049245, -0.865066, -2.184520, -3.290422, -4.619937, -5.814101, -7.311927, -8.515444

Temp (C): 24.206438, 0.001369, 4.980976, 1.660123, 1.575225, 0.047670, -0.866959, -2.177179, -3.276616, -4.597260, -5.766799, -7.259143, -8.284274

Temp (C): 24.137834, 0.001359, 4.978951, 1.658803, 1.574674, 0.046815, -0.867185, -2.181315, -3.283614, -4.603329, -5.780038, -7.264789, -8.279781

Temp (C): 24.154444, 0.001462, 4.979502, 1.659579, 1.573390, 0.046527, -0.867904, -2.180568, -3.279508, -4.601617, -5.778160, -7.264968, -8.280293

Temp (C): 24.130170, 0.001423, 4.979391, 1.660198, 1.575681, 0.047432, -0.865458, -2.177438, -3.278816, -4.599102, -5.773606, -7.258792, -8.271592

Temp (C): 24.148917, 0.001393, 4.976830, 1.660269, 1.574720, 0.047883, -0.866972, -2.179755, -3.280430, -4.601199, -5.777627, -7.263413, -8.277984

Temp (C): 24.151360, 0.001362, 4.979398, 1.658605, 1.574587, 0.047874, -0.866253, -2.177917, -3.279323, -4.600130, -5.777002, -7.264697, -8.279757

Temp (C): 24.144460, 0.001415, 4.980425, 1.659797, 1.574264, 0.045213, -0.868424, -2.179791, -3.280296, -4.599600, -5.775505, -7.262048, -8.274847

Cold junction temperature (C): 24.963892, DAC0: 5.000000, DAC1: 0.000000

Temp (C): 21.727959, 4.975194, 0.002304, 0.328618, -1.237416, -2.095151, -3.197035, -4.335174, -5.427217, -6.763698, -7.871518, -9.515233, -10.526892

Temp (C): 24.088523, 4.975202, 0.002302, 0.197468, -1.475875, -2.447543, -3.665836, -4.922828, -6.106571, -7.570489, -8.751850, -10.456820, -10.588239

Temp (C): 25.302135, 4.974913, 0.002265, 0.201295, -1.477988, -2.472375, -3.707707, -4.992303, -6.202743, -7.720146, -8.937007, -10.562771, -10.588251

Temp (C): 25.301768, 4.975204, 0.002320, 0.202523, -1.474874, -2.469744, -3.707198, -4.992887, -6.204287, -7.728193, -8.949652, -10.565661, -10.588208

Temp (C): 25.302043, 4.975149, 0.002290, 0.201384, -1.477105, -2.474449, -3.710909, -4.998951, -6.210229, -7.738688, -8.962100, -10.570446, -10.588213

Temp (C): 25.302348, 4.975144, 0.002286, 0.203014, -1.473958, -2.469288, -3.706849, -4.995066, -6.208469, -7.738201, -8.964234, -10.570848, -10.588251

Temp (C): 25.301554, 4.975192, 0.002300, 0.200512, -1.477861, -2.472147, -3.708431, -4.996665, -6.208490, -7.733208, -8.959019, -10.569037, -10.588202

Temp (C): 25.302135, 4.975160, 0.002293, 0.202664, -1.474988, -2.471787, -3.709275, -5.000135, -6.212700, -7.743740, -8.969992, -10.573630, -10.588188

Temp (C): 25.301676, 4.975181, 0.002295, 0.201006, -1.478439, -2.475008, -3.713209, -5.001651, -6.216484, -7.745682, -8.972372, -10.573284, -10.588203

Temp (C): 25.302624, 4.975197, 0.002295, 0.200635, -1.478189, -2.473269, -3.711229, -5.000429, -6.214367, -7.743555, -8.970328, -10.571796, -10.588223

Cold junction temperature (C): 24.971216, DAC0: 5.000000, DAC1: 5.000000

Temp (C): 21.768222, 4.975214, 4.977945, 2.826763, 1.979152, 0.521839, -0.604711, -2.059892, -3.301518, -4.736851, -6.062470, -7.653575, -8.978147

Temp (C): 22.717836, 4.975204, 4.979492, 3.063532, 2.251273, 0.987041, -0.063545, -1.318874, -2.469520, -3.793533, -4.998877, -6.467071, -7.535791

Temp (C): 24.035696, 4.975152, 4.978040, 3.070787, 2.255795, 1.024050, -0.021071, -1.212481, -2.338340, -3.620502, -4.791250, -6.200561, -7.247520

Temp (C): 24.021069, 4.975155, 4.980770, 3.070249, 2.252451, 1.020467, -0.025914, -1.214193, -2.333990, -3.611296, -4.780205, -6.174351, -7.218727

Temp (C): 24.021222, 4.975196, 4.979410, 3.068593, 2.251955, 1.019867, -0.027509, -1.214790, -2.335910, -3.612772, -4.778249, -6.172705, -7.217235

Temp (C): 24.024520, 4.975111, 4.977886, 3.069518, 2.253591, 1.023619, -0.023397, -1.210687, -2.332118, -3.606142, -4.773318, -6.170127, -7.213689

Temp (C): 24.023634, 4.975186, 4.980831, 3.068778, 2.252144, 1.019243, -0.029269, -1.217139, -2.339398, -3.613889, -4.779939, -6.173373, -7.214760

Temp (C): 24.023359, 4.974698, 4.976683, 3.070640, 2.256147, 1.026344, -0.019419, -1.204315, -2.329155, -3.601182, -4.768339, -6.162432, -7.209030

Temp (C): 24.019939, 4.975212, 4.980529, 3.069822, 2.252983, 1.020653, -0.026382, -1.213035, -2.336286, -3.611160, -4.779544, -6.176185, -7.220057

Temp (C): 24.016153, 4.975152, 4.978469, 3.065833, 2.247921, 1.014309, -0.034135, -1.223994, -2.346648, -3.624055, -4.790646, -6.187274, -7.231711

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

In this case the glitch after reading the cold junction temperature is much larger. For clarity here are just the first 6 temperature measurements for the first cycle above when the DAC voltages are both 0.

Temp (C): 21.713061

Temp (C): 24.129624

Temp (C): 25.294420

Temp (C): 25.294420

Temp (C): 25.295001

Temp (C): 25.294176

So the first point has a temperature that is 3.6 degrees lower than the values of points 3 and later.

The stream output also shows a large change at the beginning:

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Configuring stream:

Setting STREAM\_TRIGGER\_INDEX to 0

Setting STREAM\_CLOCK\_SOURCE to 0

Setting STREAM\_RESOLUTION\_INDEX to 8

Setting STREAM\_SETTLING\_US to 0.000000

Starting stream:

scan rate: 500.00 Hz (500.00 sample rate)

number of scans : 256

number of samples: 256

Stream burst complete:

Actual scanRate was: 500.000000

256 scans over approximately 615 milliseconds

Stream data:

Point 0: Temp (C): 22.557379

Point 1: Temp (C): 22.596542

Point 2: Temp (C): 22.596542

Point 3: Temp (C): 22.659200

Point 4: Temp (C): 22.667032

Point 5: Temp (C): 22.651368

Point 6: Temp (C): 22.698359

Point 7: Temp (C): 22.721854

Point 8: Temp (C): 22.761011

Point 9: Temp (C): 22.800167

Point 10: Temp (C): 22.807998

Point 11: Temp (C): 22.862813

Point 12: Temp (C): 22.917626

Point 13: Temp (C): 25.303899

Point 14: Temp (C): 25.303899

Point 15: Temp (C): 25.303899

Point 16: Temp (C): 25.303899

Point 17: Temp (C): 25.303899

Point 18: Temp (C): 25.303899

Point 19: Temp (C): 25.303899

Point 20: Temp (C): 25.303899

Point 21: Temp (C): 25.303899

Point 22: Temp (C): 25.303899

Point 23: Temp (C): 25.303899

Point 24: Temp (C): 25.303899

Point 25: Temp (C): 25.303899

Point 26: Temp (C): 25.303899

Point 27: Temp (C): 25.303899

Point 28: Temp (C): 25.303899

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Note that the first 12 points have temperatures of 22.55-22.91. Then at point 13 the temperature jumps by 2.39 degrees from point 12. This behavior is completely reproducible.