Channel-to-Channel Accuracy

When you need to measure temperature from multiple channels with precision, you want high accuracy and minimal variation from one channel to another.

The TEMPpoint instrument has a simultaneous architecture, with an independent 24-bit Delta-Sigma converter for each channel. (Delta-Sigma converters provide a built-in anti-aliasing filtering that rejects 50 Hz and 60 Hz power line frequency components). When the instrument gets a pulse from the onboard clock, all input signals are sampled at the same time. This architecture virtually eliminates time skew between channels and simplifies both time and frequency-based analysis techniques. In addition, simultaneous A/Ds eliminate several sources of errors found in multiplexed architectures, including settling time and channel-to-channel crosstalk errors. Further, TEMPpoint instruments provide galvanic isolation of 1000 V to protect each channel from noise and high voltages that are inherent in industrial machinery. All of these factors contribute to accurate temperature measurements across channels.

To characterize the channel-to-channel accuracy of the TEMPpoint RTD instrument, we selected a resistor that approximated a standard European PT1000 sensor at room temperature and placed it across one channel. We then measured its resistance (R) using an Agilent Model 3458 precision 28-bit multimeter; the resulting value was 1095.95 ohms. Since the TEMPpoint instrument provides a constant current (I) of 425 μA , we could then compute the corresponding voltage using Ohms law (V=I*R).

Using the standard Callendar-van Dusen coefficients for a PT1000 RTD type, we then determined the corresponding temperature (24.64° C) for this voltage.

We then placed this resistor across each of the 48 channels and measured data from all channels for 5 seconds, saving the data to disk. The table on page 3 shows the results of the logged data on each channel compared to the expected value of 24.64° C.

As you can see, the lowest minimum value was 24.57° C on channel 23 for a difference of -0.07° C from the expected value of 24.64° C; the highest maximum value was 26.65 on channel 0 for a difference of +0.01° C from the expected value of 24.64° C. The standard deviation on each channel was no greater than 0.01° C. This data validated the excellent channel-to-channel accuracy of the TEMPpoint RTD instrument.

The following page displays a table with Channel-to-Channel Accuracy of TEMPpoint RTD Instruments.

Table: Channel-to-Channel Accuracy of TEMPpoint RTD Instruments

	Ch0	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7
Min	24.62	24.61	24.61	24.6	24.61	24.6	24.62	24.59
Max	24.65	24.63	24.62	24.62	24.63	24.62	24.63	24.61
Avg	24.63	24.62	24.62	24.61	24.62	24.61	24.62	24.60
Std Dev	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01
Avg Err	.01	.02	.02	.03	.02	.03	.02	.04

	Ch8	Ch9	Ch10	Ch11	Ch12	Ch13	Ch14	Ch15
Min	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.58
Max	24.62	24.62	24.63	24.63	24.62	24.62	24.62	24.61
Avg	24.62	24.61	24.61	24.61	24.61	24.61	24.61	24.60
Std Dev	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
Avg Err	.02	.03	.03	.03	.03	.03	.03	.04

	Ch16	Ch17	Ch18	Ch19	Ch20	Ch21	Ch22	Ch23
Min	24.59	24.6	24.6	24.59	24.6	24.59	24.6	24.57
Max	24.61	24.62	24.62	24.61	24.62	24.62	24.62	24.59
Avg	24.60	24.61	24.61	24.61	24.61	24.61	24.61	24.59
Std Dev	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Avg Err	.04	.03	.03	.03	.03	.03	.03	.05

	Ch24	Ch25	Ch26	Ch27	Ch28	Ch29	Ch30	Ch31
Min	24.6	24.61	24.6	24.6	24.6	24.59	24.59	24.59
Max	24.62	24.63	24.62	24.62	24.62	24.62	24.62	24.62
Avg	24.61	24.62	24.61	24.61	24.61	24.60	24.61	24.61
Std Dev	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Avg Err	.03	.02	.03	.03	.03	.04	.03	.03

	Ch32	Ch33	Ch34	Ch35	Ch36	Ch37	Ch38	Ch39
Min	24.6	24.6	24.6	24.6	24.59	24.6	24.6	24.59
Max	24.62	24.62	24.62	24.62	24.62	24.62	24.62	24.61
Avg	24.61	24.61	24.61	24.61	24.60	24.61	24.61	24.60
Std Dev	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
Avg Err	.03	.03	.03	.03	.04	.03	.03	.04

	Ch40	Ch41	Ch42	Ch43	Ch44	Ch45	Ch46	Ch47
Min	24.61	24.6	24.6	24.59	24.6	24.6	24.59	24.61
Max	24.63	24.62	24.62	24.61	24.62	24.62	24.62	24.63
Avg	24.62	24.61	24.61	24.61	24.61	24.61	24.61	24.62
Std Dev	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Avg Err	.02	.03	.03	.03	.03	.03	.03	.02

Absolute Min: 24.57 Absolute Max: 24.65 Max Average Err: .05