# DNx-TC-378

8-Channel Thermocouple Simulator

- DNA-/DNR-/DNF-TC-378 for use in Cube/RACKtangle/ FLATRACK I/O chassis
- 8 independent fully isolated TC outputs
- CJ temp input allows CJ Compensation (if required)
- 1 kHz per channel max update rate
- ±100 mV output range supports all common TCs
- Guardian series diagnostics reads output voltage and current and board temperature
- Simulates open thermocouples
- Simultaneous update across all channels
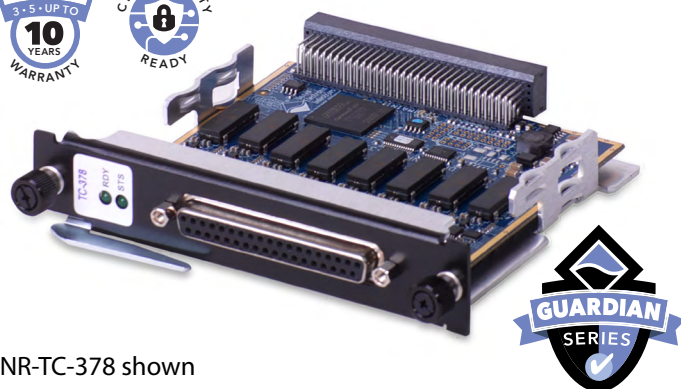
DNR-TC-378 shown

General Description:

The DNA-TC-378, DNR-TC-378 and DNF-TC-378 are fully isolated, high-precision, 8-channel thermocouple simulator board compatible with UEI's popular Cube, RACKtangle and FLATRACK I/O chassis respectively. The boards offer full 16-bit resolution and guarantee monotonicity over the entire operating temperature range. Each DNA/DNR-TC-378 channel provides an output range of ±100 mV which encompasses the output ranges of all common thermocouples. Each output is capable of driving ±10 mA though it's unlikely a TC input would require such high current.

BENEFITS OF UEI'S GUARDIAN SERIES

✓	CIRCUIT BREAKER
✓	VOLTAGE MONITORING
✓	CURRENT MONITORING
✓	FIELD DISCONNECT
✓	TEMPERATURE

UEI's Guardian series boards include a sophisticated, reliable on-board monitoring system, allowing quick and easy system testing, sensor diagnostics monitoring and fault detection for rapid resolution in field or lab.

Learn more about UEI's Guardian series

The DNx-TC-378 provides extensive built-in-test diagnostics. An on-board A/D converter on each channel allows the user to monitor output voltage and current as well as board temperature. A solid state relay on each output allows the D/A channel to be disconnected from the field I/O so an open thermocouple can be simulated and the input systems open TC detection circuitry can be tested. A 1024 sample FIFO allows each D/A to be updated at 1 kHz per channel (8 kHz aggregate) without data loss.

The board provides three cold-junction input channels to measure temperature where the TC-378 is connected to the applications thermocouple input device. This cold-junction temperature can be utilized by the application software to compensate for error caused by the lack of actual cold-junction error (as there will not be the extraneous dissimilar metal connection that causes the whole CJC issue). The three cold-junction channels are fully electrically isolated from the TC channels, but not from each other.

DNx-TC-378 accuracy in °C when used with DNA-STP-TC-378

Thermocouple Type	Typical Error at 0 °C (CJC 25°C)	Error at 0 °C (CJC -20 to 85°C)
E	±0.4	±0.9
J	±0.5	±1.0
K	±0.6	±1.2
N	±1.0	±1.8
R	±3.6	±6.0
S	±3.6	±6.0
T	±0.6	±1.2

Error Includes: Output voltage error, Error due to linearization math (when using UEI SW) and CJC measurement error

Technical Specifications: (at 25°C unless otherwise noted)

Analog Outputs	8 channels
Resolution	16-bits
Output range	±100 mV
Max Update Rate:	1 kHz/channel (8 kHz max aggregate)
FIFO Buffer Size	1024 samples
Output Accuracy	see table below for accuracy in °C
INL (no load)	±3 LSB (0.0046%) typical
DNL (no load)	±1 LSB (0.0015%) typical
Monotonicity	16 bits guaranteed over temperature
Gain Calibration Error	±10 µV, typ, ±20 µV, max
Offset Calibration Error	±5 µV, typ, ±15 µV, max
Output Impedance	<0.5 Ω (typical)
Current Drive	±10 mA/channel
Settling Time	1 ms to 16 bits
Power up state	0 V ±1 mV
Open TC resistance	1 M Ω minimum
Diagnostic readback	
Voltage range	±2 V
Voltage accuracy	±500 µV
Current range	±20 mA
Current accuracy	±100 µA
CJC Monitoring	
CJC sensor type	ADT 7420, (included on DNA-STP-378)
CJC sensor accuracy	±0.1 °C typical, ±0.35 °C max (-40 °C to +105 °C)
Sample/Update rate	10 Hz
Isolation	350 Vrms channel-to-channel and field wiring to chassis.
Power Consumption	4.0 W (not including output loads)
Operating Temp. (tested)	-40 °C to +85 °C
Operating Humidity	95%, non-condensing
Vibration IEC 60068-2-6 IEC 60068-2-64	5 g, 10–500 Hz, sinusoidal 5 g (rms), 10–500 Hz, broad-band random
Shock IEC 60068-2-27	100 g, 3 ms half sine, 18 shocks @ 6 orientations 30 g, 11 ms half sine, 18 shocks @ 6 orientations
MTBF	>200,000 hours

Connections to the DNx-TC-378 are through a female DB37 connector. To simplify connections we recommend the use of the DNA-STP-TC-378 screw terminal panel (sold separately). Using the DNA-STP-TC-37, cold junction compensation is provided by three ADT 7420 temperature sensors mounted on the board. If the DNA-STP-TC-37 is not used, care should be taken to account for the cold junction error created where the DNx-TC-378 outputs are connected to the system's thermocouple inputs. Note that for customer convenience, the DNA-STP-TC-37

provides both screw terminals as well as a second DB37 connector that passes signals through to the DNA-TC-378 board. The CJC temperature sensors are located adjacent to both the pass through DB37 and the screw terminals so can be used for either connection method. Connections between the DNx-TC-378 and the DNA-STP-TC-378 are made via the DNA-CBL-37 or DNA-CBL-37S series cables.

The DNx-TC-378 series includes software drivers supporting all popular operating systems including: Windows, Linux, QNX, VXWorks, and most other popular Real-Time Operating Systems. Windows users may take advantage of the powerful UEIDAQ Framework which provides a simple and complete software interface to all popular Windows programming languages and data acquisition and control applications (e.g. LabVIEW, MATLAB).

Pinout Diagram:

DB-37 (female)
37-pin connector:

nc	1			
CJC-PWR	2	20	nc	
CJC-SDA0	3	21	CJC-GND	
CJC-SDA1	4	22	CJC-SDA2	
CJC-GND	5	23	CJC-CLK	
nc	6	24	nc	
nc	7	25	nc	
CH7-	8	26	CH7+	
CH6+	9	27	nc	
nc	10	28	CH6-	
CH5-	11	29	CH5+	
CH4+	12	30	nc	
nc	13	31	CH4-	
CH3-	14	32	CH3+	
CH2+	15	33	nc	
nc	16	34	CH2-	
CH1-	17	35	CH1+	
CH0+	18	36	nc	
nc	19	37	CH0-	

DNA-STP-TC-37 screw terminal panel:

The DNA-STP-TC-37 (sold separately) provides easy connection via either screw terminals or a pass-through DB37. It also provides the temperature sensors required to compensate for cold-junction errors. Care must be take to account for the cold junction errors if the DNA-STP-
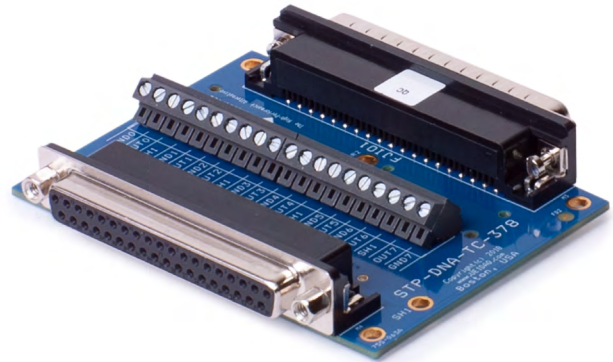
Ordering Guide:

Part #	Description
DNx-TC-378	8-Channel Thermocouple Simulator

Connection Options:

Part #	Description
DNA-CBL-37S	Shielded 37 conductor cable (3 foot standard, 1, 5, 10 and 20 foot lengths available)
DNA-CBL-37	Unshielded ribbon 37 conductor cable (3 foot length. Other lengths available on a special order basis)
DNA-STP-TC-378	37 terminal screw terminal panel with 3 CJC sensors