

MODEL 10A10-4

QUAD ISOLATED THERMOCOUPLE CONDITIONER CARD

1 GENERAL DESCRIPTION AND SPECIFICATIONS

The Model 10A10-4 is a precision conditioner designed for TC-based temperature measurements requiring *high input isolation*. With built-in reference-junction compensation, it accepts up to four independent temperature signals from **Types B, E, J, K, R, S, and T Thermocouples**. Any desired mixture of these thermocouple types is permitted. Sensors may be grounded or ungrounded, in any desired mix. An amplifier-per-channel design with chopper stabilization and active low-pass filtering allows high-speed scan switching of high-level, stabilized signals, at exceptionally low cost per channel.

All four 10A10-4 inputs are transformer-isolated, so that sensor-to-chassis and/or sensor-to-sensor common-mode voltages as high as 1500 V-DC can be accommodated at DC or low frequencies without damaging the instrument or perceptibly affecting measurement accuracy (at 60 Hz, the common-mode voltage can be as high as 1000 V-AC (rms)).

During operation, appropriate reference-junction compensation, real-time digital linearization, and engineering-unit scaling are automatically applied by the System 10 Central Processor for each type of thermocouple used. Detection of “open” thermocouples is also provided, as explained in Section 3.a.

The Model 10A10-4 includes a rear-panel connector block with screw terminals for direct attachment of TC leads (which cannot be soldered). The same connector accommodates all TC types. Since the connector assembly also contains a dual-bead **precision thermistor** for measurement of the reference-junction temperature, no external cold junction is required—although the user may supply his own Controlled Ambient Temperature Zone for reference-junction compensation, if desired.

The reference-junction-corrected temperature is made available to the Central Processor through the **Model 10A11 Thermocouple Output Processor Card**. The purpose of the 10A11 is to proportion and sum the cold-junction reference signal and the amplified TC signal of each channel for presentation to the system's Analog Signal Bus. *One 10A11 must therefore be installed in every System 10 A-card rack containing one or more Model 10A10-4's.*

You can use an optional **Model 10CTJB-8 Thermocouple Junction Box** with a Model 10A10-4 to move the temperature-compensated reference junction to the actual site of up to eight *remote* thermocouple sensors. As explained in Section 4, below, TC leads connect directly to the 10CTJB-8's internal screw terminals, in any desired type mixture. The Junction Box then sends their signals to the 10A10-4 Conditioner via copper conductors (only).*

* The 10CTJB-8 can only be used in environments with an ambient temperature between 0° F and +140° F.

10A10-4 QUAD ISOLATED THERMOCOUPLE CARD

ADDITIONAL 10A10-4 SPECIFICATIONS

Measurement Range and Resolution: See Table 1, below; automatically selected—on an individual channel basis—when the channel is configured; for System 10 channel “type” codes assigned to 10A10-4 data channels, see Table 1

Linearization: Internal digital look-up via system processor; maximum error: $\pm 0.05^\circ\text{C}$

Reference-Junction Compensation: At connector block, using a built-in precision thermistor, or at remote TC site, using the **Model 10CTJB-8 Thermocouple Junction Box***

Thermocouple Break Detection (per channel): Off-scale negative indication

Amplifier (per channel):

Common-Mode Range: At DC, ± 1500 V-DC operating and without instrument damage; at 60 Hz, ± 1000 V-AC (rms) without damage

Common-Mode Rejection Ratio: DC: -154 dB; at 60 Hz: -160 dB

Input Impedance: Differential: 10 M Ω ; Common-Mode: infinite

Offset: Initial: ± 5 μV ; vs. Temperature: ± 0.1 $\mu\text{V}/^\circ\text{C}$; vs. Time: ± 1 $\mu\text{V}/\text{month}$

Gain Accuracy: $\pm 0.02\%$ of absolute mV input range of -10 to +80 mV

Gain Stability: vs. Temperature: ± 25 ppm/ $^\circ\text{C}$; vs. Time: ± 20 ppm/month

Filter (per channel): 3-pole modified Butterworth; 3 dB down at 1 Hz; 60 dB down at 60 Hz

Step-Response Settling Time (Full-Scale Output):

To 1% of final value: 0.3 sec

To 0.1% of final value: 0.6 sec

To 0.02% of final value: 1.5 sec

Total System Accuracy (typical, including Model 10A10-4, Model 10A11 Thermocouple Output Processor, and system data collection and processing): see Table 1, below

Auxiliary Outputs to Mainframe Wire-Wrap Pins: None

Table 1 Thermocouple Ranges for the Model 10A10-4

TC Type	Range	Display Resolution	Typical System Accuracy**	Maximum Expected Error**	Channel Type Code
E	-130° C to +1000° C	0.1° C	$\pm 0.4^\circ\text{C}$	$\pm 0.6^\circ\text{C}$	20
J	-130° C to +750° C	0.1° C	$\pm 0.5^\circ\text{C}$	$\pm 0.7^\circ\text{C}$	21
K	-75° C to +1350° C	0.1° C	$\pm 0.7^\circ\text{C}$	$\pm 1.1^\circ\text{C}$	22
R	-20° C to +1750° C	0.1° C	$\pm 1.1^\circ\text{C}$	$\pm 2.1^\circ\text{C}$	23
S	-20° C to +1750° C	0.1° C	$\pm 1.1^\circ\text{C}$	$\pm 2.1^\circ\text{C}$	24
T	-130° C to +400° C	0.1° C	$\pm 0.5^\circ\text{C}$	$\pm 0.8^\circ\text{C}$	25
B	+480° C to +1820° C	0.1° C	$\pm 1.1^\circ\text{C}$	$\pm 2.1^\circ\text{C}$	26
E	-200° F to +1800° F	0.2° F	$\pm 0.8^\circ\text{F}$	$\pm 1.2^\circ\text{F}$	28
J	-200° F to +1400° F	0.2° F	$\pm 0.8^\circ\text{F}$	$\pm 1.2^\circ\text{F}$	29
K	-100° F to +2500° F	0.2° F	$\pm 1.2^\circ\text{F}$	$\pm 2.0^\circ\text{F}$	2A
R	0° F to +3200° F	0.2° F	$\pm 2.0^\circ\text{F}$	$\pm 3.8^\circ\text{F}$	2B
S	0° F to +3200° F	0.2° F	$\pm 2.0^\circ\text{F}$	$\pm 3.8^\circ\text{F}$	2C
T	-200° F to +750° F	0.2° F	$\pm 0.8^\circ\text{F}$	$\pm 1.2^\circ\text{F}$	2D
B	+900° F to +3300° F	0.2° F	$\pm 2.0^\circ\text{F}$	$\pm 3.8^\circ\text{F}$	2E

(cont'd)

* The 10CTJB-8 can only be used in environments with an ambient temperature between 0° F and +140° F.

** Including \pm one count of least significant digit displayed. *Can be readily improved by control of instrument temperature, calibrating at known temperatures, etc.*

TC Type	Range	Display Resolution	Typical System Accuracy*	Maximum Expected Error*	Channel Type Code
E	-130° C to +1000° C	1° C	±1° C	±2° C	10
J	-130° C to +750° C	1° C	±1° C	±2° C	11
K	-75° C to +1350° C	1° C	±1° C	±2° C	12
R	-20° C to +1750° C	1° C	±2° C	±3° C	13
S	-20° C to +1750° C	1° C	±2° C	±3° C	14
T	-130° C to +400° C	1° C	±1° C	±2° C	15
B	+480° C to +1820° C	1° C	±2° C	±3° C	16
E	-200° F to +1800° F	1° F	±1° F	±2° F	18
J	-200° F to +1400° F	1° F	±1° F	±2° F	19
K	-100° F to +2500° F	1° F	±2° F	±3° F	1A
R	0° F to +3200° F	1° F	±2° F	±4° F	1B
S	0° F to +3200° F	1° F	±2° F	±4° F	1C
T	-200° F to +750° F	1° F	±1° F	±2° F	1D
B	+900° F to +3300° F	1° F	±2° F	±4° F	1E

2 TRANSDUCER CONNECTIONS

The Model 10A10-4's I/O CONNECTOR mates with Daytronic CONDITIONER CONNECTOR No. 60324, similar to the one shown in Fig. 1.5 (in Manual Section 1.E.1). This connector contains four "±" screw-terminal pairs, one for each TC sensor. Each TC lead should be directly attached to its corresponding screw terminal (it should never be soldered). As shown in Fig. 1, each screw terminal connects internally to a specific pin on the 10A10-4's rear 20-pin I/O CONNECTOR. Table 2 gives standard pin assignments for the I/O connector. For connection of an optional **Model 10CTJB-8 Thermocouple Junction Box**, see Section 4, below.

Since reference-junction compensation is provided by the dual-bead thermistor embedded in the Conditioner Connector, no external cold junction is required.

IMPORTANT: UNUSED THERMOCOUPLE INPUT CHANNELS should be shorted together as shown in Fig. 2, to prevent possible crosstalk from the "OPEN TC" detection circuit into working TC channels.

Table 2 Model 10A10-4 Pin Assignments

I/O Connector Pin Number	Screw Terminal	Conditioner Channel Number	Conditioner Line Function
1	1(+)	1	+SIGNAL
A	1(-)	1	-SIGNAL
2			Not Committed
B			Not Committed
3	3(+)	2	+SIGNAL
C	3(-)	2	-SIGNAL
4			Not Committed
D			Not Committed
5	5(+)	3	+SIGNAL
E	5(-)	3	-SIGNAL
6			Not Committed
F			Not Committed

(cont'd)

* Including ± one count of least significant digit displayed. *Can be readily improved by control of instrument temperature, calibrating at known temperatures, etc.*

10A10-4 QUAD ISOLATED THERMOCOUPLE CARD

I/O Connector Pin Number	Screw Terminal	Conditioner Channel Number	Conditioner Line Function
7	7(+)	4	+SIGNAL
H	7(-)	4	-SIGNAL
8			Not Committed
J			Not Committed
9	INTERNAL USE ONLY		THERMISTOR: T1
K,L			THERMISTOR: GROUND (COMMON)
10			THERMISTOR: T2

Fig. 1 Model 10A10-4 Transducer Cabling

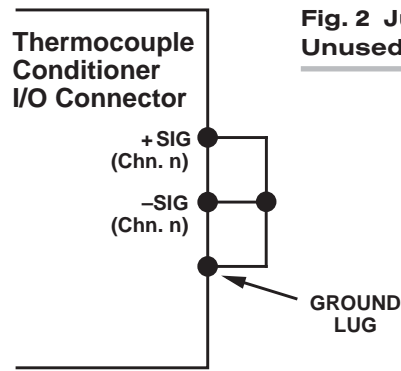
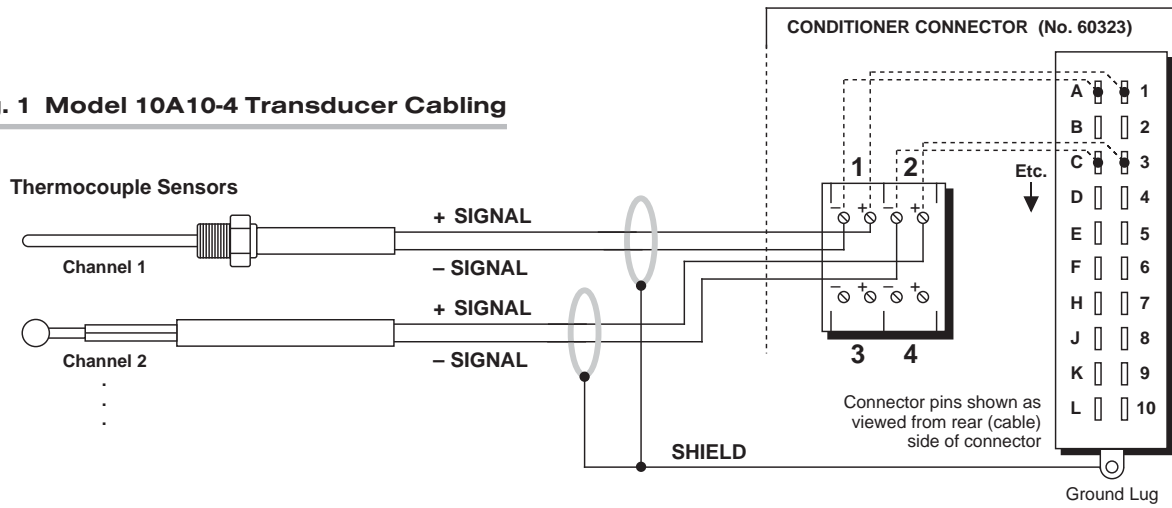


Fig. 2 Jumpering of an Unused TC Input

3 SETUP AND/OR OPERATING CONSIDERATIONS

3.a “OPEN TC” DETECTION

In the event of a broken thermocouple wire or other “open TC” condition, the Model 10A10-4 will automatically report an indeterminate *negative* off-scale reading for the TC channel in question.

3.b CONFIGURATION AND CALIBRATION

For initial configuration of ANALOG INPUT CHANNELS dedicated to a specific Model 10A10-4 card, see the general remarks on System 10 “real-channel” configuration in Manual Section 1.G.1 and elsewhere in the *System 10 Guidebook*. For 10A10-4 channel “type” codes, see Table 1, above.

REMEMBER: One **Model 10A11 Thermocouple Output Processor Card** must be installed in every A-card deck that contains one or more Model 10A10-4 cards. Note that Model 10A10-4 and Model 10A9-8C cards can share a single 10A11.

The Model 10A10-4 normally employs **CPU-BASED ABSOLUTE CALIBRATION** (described in Manual Section 1.G.3.a). This means that NO calibration need be performed by the user, once each 10A10-4-based input channel has been properly configured. Note, however, that the standard **ZERO (ZRO)** and **FORCE (FRC)** commands can be used to perform **TWO-POINT (DEADWEIGHT) CALIBRATION** in applications where it is desirable to force multiple TC readings to the same *exactly known* temperature.* The mainframe’s **EEPROM Write Protect Switch** must be ON for these commands to be effective. See Manual Section 1.G.5 for a general discussion of this conventional “zero and span” calibration technique.

4 OPTIONAL “REMOTE” TC CONNECTIONS: MODEL 10CTJB-8 THERMOCOUPLE JUNCTION BOX

4.a PURPOSE

You can use the **Model 10CTJB-8 Thermocouple Junction Box** with a Model 10A10-4 to move the temperature-compensated reference junction to the actual site of up to four *remote* thermocouple sensors.**

NOTE: The 10CTJB-8 can only be used in environments with an ambient temperature between 0° F and +140° F.

4.b CONNECTIONS

The label on the top side of the 10CTJB-8 box shows the numbering and polarity of the unit’s eight internal screw-terminal pairs, which match those of the **CONDITIONER CONNECTOR** that attaches to the 10A10-4’s rear I/O **CONNECTOR** (see Fig. 1 and the Pin-Assignment Table, above).

* In heat balance applications, for example, it is useful to be able to zero all readings simultaneously.

** In the case of the 10A10-4, only four TC sensors can be connected to the 10CTJB-8. A single Model 10CTJB-8 can be dedicated to only *one* Model 10A10-4 card.

10A10-4 QUAD ISOLATED THERMOCOUPLE CARD

Introduced through the cutout on the left-hand side of the box, TC leads connect directly to these screw terminals, in any desired type mixture. The 10CJTB-8 then sends their signals to the Model 10A10-4 Conditioner Card via copper conductors (only).

The user must furnish his or her own *pin-to-pin cable* for connecting the 10CTJB-8 Junction Box to the rear I/O CONNECTOR of the Model 10A10-4. Daytronic will supply appropriate solder-terminal connectors for this cable. The cable should be shielded, and should consist of stranded copper wires. While no maximum cable length is actually specified, the wire *size* and *length* combination should be such that the total per-wire resistance does not exceed 25 ohms.