DESCRIPTION

The Model Series 380T Thermocouple Converter Module accepts a thermocouple input signal and converts it into a proportional output current.

The electrically isolated input circuit is factory wired to accept one of the six most common thermocouples with a choice of a standard or a narrow span capability. Automatic cold junction compensating circuit is effective over the entire ambient temperature range. A break in the thermocouple can be selected to produce an upscale or a downscale drive.

The output circuit can be changed in the field via two jumpers to produce one of two available output current ranges (see SPECIFICATIONS section). A protective circuit limits the output current to 150% of the maximum current range, thus preventing possible damage to the connected instruments.

MODEL DESIGNATIONS

<table>
<thead>
<tr>
<th>Basic Series Designation</th>
<th>Type of Thermocouple</th>
<th>Input Span</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 8 0 T J 2</td>
<td>J — Type J (iron/constantan)</td>
<td>1 — 2.5 mVdc</td>
<td>Thermocouple, Factory wired for one of the following types: J, K, T, S, R or E.</td>
</tr>
<tr>
<td></td>
<td>K — Type K (chromel/alumel)</td>
<td>2 — 5.0 mVdc</td>
<td>Span: Factory wired for one of the following: Standard: 5 to 50 mVdc Narrow: 2 to 5 mVdc</td>
</tr>
<tr>
<td></td>
<td>T — Type T (copper/constantan)</td>
<td></td>
<td>Overload (Without Damage): ± 5 Volts Impedance: 200,000 Ohms (minimum) Isolation: Input circuit is electrically isolated from the output and power circuits, permitting it to operate at up to 100 Vdc above ground.</td>
</tr>
<tr>
<td></td>
<td>S — Type R and S (platinum/platinum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E — Type E (chromel/constantan)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Thermocouple, Factory wired for one of the following types: J, K, T, S, R or E.</th>
</tr>
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<tbody>
<tr>
<td>Span</td>
<td>Factory wired for one of the following: Standard: 5 to 50 mVdc Narrow: 2 to 5 mVdc</td>
</tr>
<tr>
<td>Overload</td>
<td>(Without Damage): ± 5 Volts</td>
</tr>
<tr>
<td>Impedance</td>
<td>200,000 Ohms (minimum)</td>
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<td>Isolation</td>
<td>Input circuit is electrically isolated from the output and power circuits, permitting it to operate at up to 100 Vdc above ground.</td>
</tr>
</tbody>
</table>

COLD JUNCTION

Automatic temperature compensation over specified operating temperature range.

ADJUSTMENTS

TC Break Indication

<table>
<thead>
<tr>
<th>Jumper Selected</th>
<th>&quot;UP&quot; Jumper</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC break produces output above full range</td>
<td>IN</td>
</tr>
<tr>
<td>TC break produces output below zero scale</td>
<td>OUT</td>
</tr>
</tbody>
</table>

Output Range

<table>
<thead>
<tr>
<th>Jumper Selected</th>
<th>4 to 20 mA</th>
<th>10 to 50 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OUT</td>
<td>IN</td>
</tr>
</tbody>
</table>

Zero (R42).............. - 5 to +25 mV (Jumper Z cut) with Standard Span. The zero range is smaller when Jumper Z is intact.

Span (R45)............. 5 to 50 mV (Jumper S cut) with Standard Span. The span range is smaller when Jumper S is intact.

OUTPUT

<table>
<thead>
<tr>
<th>Field Selectable Range</th>
<th>Permissible Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 20 mA</td>
<td>0 to 1000 Ohms</td>
</tr>
<tr>
<td>10 to 50 mA</td>
<td>0 to 400 Ohms</td>
</tr>
</tbody>
</table>

Load Effect............ Less than 0.1% within permissible load range.

Current Limiting........ Output will not exceed approx. 150% of full scale when input is overdriven.
RESPONSE TIME........500 mSec (typical) to reach 98% of output span.

ACCURACY*..................± 0.15% (maximum) on standard range.
                         ± 0.3% (maximum) on narrow range.

OPERATING TEMP..........32 to 122°F (0 to 50°C)

TEMP. EFFECT.............± 0.012%/°F (maximum) over the specified operating temperature range.

*Performance at 25°C ambient with 0 to 10 mV, 100 Ohm source input signal and 4 to 20 mA output into a 500 Ohm load.

INSTALLATION

The Model Series 380T Thermocouple Converter Module must be installed in a Model Series 380 Card Cage Enclosure. It can be plugged into any of the slots in the Enclosure. Refer to customer drawing for the designated slot or assign a convenient slot for it.

The safety keys of the designated slot in the card cage must be set before the Module can be plugged in. Service Instruction SD3801 identifies these safety keys and gives the procedure for setting them. The positions of the keys for the Thermocouple Converter Module are as follows:

   Left Key:  H (Horizontal)
   Right Key: V (Vertical)

The thermocouple is connected to two screw terminals located at the front of the Module. The output connection is made to screw terminals 4 (+) and 5 (-) of the appropriate terminal strip provided at the front or rear of the card cage enclosure (depending on model). Each terminal strip is identified by a number that matches a corresponding slot number. Service Instruction SD3801 provides complete physical and electrical descriptions of the available card cage enclosures. The Module's input and output connections are identified in Figure 1, Connection Diagram.

WARNING

Ensure that power is removed from all wires being connected.

All plug-in modules in the card cage share a common power supply. The output signals of these modules are referenced to one signal common which is also the negative bus of the power supply.

The input circuit of the Thermocouple Converter Module is isolated from the output circuit. Thus, each thermocouple may be independently grounded without the possibility of creating interfering ground loops.

CALIBRATION

GENERAL

The Thermocouple Module is normally shipped factory calibrated for a specific customer designated range. Such a module requires no additional adjustment and can be put into service immediately.

Modules ordered without a specific calibration request, must be calibrated by the user.

To assure continued accuracy, it is recommended to check the calibration after the first 30 days of operation and then at regular intervals dictated by the severity of the operating environment or whenever an inaccuracy is suspected.

Use the following procedure to perform periodic calibration checks or to calibrate the Module for a new range. Figure 2 shows the location of all jumper wires and trim pots. Typical calibration hook-ups are given in Figure 3.

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NOTES:
1. SEE OUTPUT SPECIFICATIONS FOR LOAD LIMITS.
2. INPUT IS MADE DIRECTLY TO THE BARRIER STRIP ON THE PLUG-IN CARD.

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FIGURE 1 Connection Diagram
NOTES:
1. The Thermocouple (TC) Calibrator, the Reference Cell, and the TC wires must be compatible with the TC type of the given Model 380T Module.
2. Refer to the specific equipment operating manuals for additional, more detailed application information.
REQUARED EQUIPMENT
Calibration of the Module requires the use of the following equipment.
1. Model Series 380 Card Cage Enclosure with power supply.
2. Thermocouple Calibration Source
   The following devices may serve this purpose:
   a) Thermocouple Calibrator
      Covering the required range and thermocouple type.
      Automatic cold-junction compensation desirable.
   b) Precision Millivolt Source
      Output Range: 0 to 50 mVdc
      These signal sources must be adjustable to an accuracy of ±0.1% or better and provide a source resistance of 100 Ohms or less.
3. Digital Output Meter
   The following devices may serve as output meters:
   a) Digital Voltmeter
      Range: 0 to 5 Vdc
      Input Impedance: 1 Megohm (min.)
   b) Digital Milliammeter
      Range: 0 to 50 mA dc
      Insertion Resistance: 200 Ohms (max.)
      Both devices must have an overall accuracy of ±0.1% or better.
4. Miscellaneous and Optional Components
   a) Thermocouple Tables
   b) Thermometer
      Range: 32 to 122°F (0 to 50°C)
      Probe type preferred
   c) Thermocouple or Alloy Extension Wires
   d) Reference Cell
      To provide automatic temperature compensation for Millivolt Source.
   e) Conditioning Resistor
      To convert output current to voltage if a voltmeter is used as an output meter.

PRELIMINARY ADJUSTMENTS
Refer to Figure 2 for the location of the three jumper wires used to select the desired operating modes described below.

1. OUTPUT RANGE
   The output range of the Module is determined by the presence or absence of jumper wires J1 and J2 located on the solder side of the P.C. board. With jumper wires J1 and J2 intact, the output range is 10 to 50 mA; with both removed, the range is 4 to 20 mA.
   Perform the necessary range selection by cutting or installing both jumper wires described above. After making a range change the Module must always be calibrated.

2. THERMOCOUPLE BREAK INDICATION
   The Module has a provision to indicate a break (discontinuity) in the thermocouple. Depending on the status of the UP jumper wire, the Module’s output signal will either go up to 100% or down to 0% if a break in the thermocouple or its connecting wires should occur.
   The Modules are normally shipped with an up-scale break indication (the UP jumper wire is intact). If a down-scale break indication is required, cut the UP jumper wire located on the solder side of the P.C. Board.
   Following these adjustments, plug the Module into its designated slot in the card cage, turn on the power supply, and let it warm up for five minutes before proceeding with the calibration outlined below.

PROCEDURE
The calibration procedure sets the minimum and maximum temperature points for the selected output range of the Module.

1. Connect the calibration source to the Module.
   Refer to Figure 3 for typical hook-up diagrams. If possible, use the same input wires that will be used with the thermocouple.
   IMPORTANT
   If the signal source is calibrated directly in degrees, be sure it uses the same type of thermocouple that is acceptable to the Module.

2. Connect the digital output meter to terminals 4 (+) and 5 (−) of the designated terminal strip on the card cage.

3. Determine the required low temperature point that should appear as 0% in the output range.
   NOTE
   If the calibrator source provides a direct temperature readout and includes cold junction compensation skip steps 4 and 5. Refer to the calibrator instruction manual for detailed calibrator adjustments.

4. Look up in the Thermocouple Table the equivalent millivoltage of the above determined low temperature point.
   NOTE
   If the calibration source includes a cold junction reference or if an external cold junction reference is being used, skip step 5 and refer to the device manufacturer’s Instruction Manual for adjustment details.

5. Compensate the above millivolt reading to 0°C or 32°F as follows:
   a) Measure the temperature of the appropriate screw terminals shown in Figure 3.
   b) Look up in the Thermocouple Table the equivalent millivoltage.
   c) Subtract the millivolt level of step 5b from the one obtained in step 4. The result is used in the next step.
CAUTION
A signal in excess of ±5 Volts across the input terminals may cause damage to the Module.

6. Set the calibration source to the low temperature point. This setting may be expressed directly in degrees or in the equivalent millivoltage, depending on the type of calibrator used. In either case, it must be a cold junction compensated setting (see step 5 above or refer to the calibrator instruction manual).

7. Adjust the ZERO trimpot (R42) to read the 0% level on the output meter. This reading is 4 mA for the 4 to 20 mA output range, 10 mA for the 10 to 50 mA range, or 1 Volt if a 1 to 5 Volt conditioning resistor is used.

If the ZERO trimpot reaches full travel before the calibration point is reached, cut jumper wire Z to increase the adjustment range of the trimpot.

8. Determine the required high temperature point that should appear as 100% in the output range.

9. Set the calibration source to the high temperature point. This setting is expressed in the same units used in step 6 and must be cold junction compensated in the same manner.

10. Adjust the SPAN trimpot (R45) to read the 100% level on the output meter. This reading is 20 mA for the 4 to 20 mA output range, 50 mA for the 10 to 50 mA range, or 5 Volts if a 1 to 5 Volt conditioning resistor is used.

If the SPAN trimpot reaches full travel before the calibration point is reached, cut jumper wire S to increase the adjustment range of the trimpot.

11. Repeat steps 6, 7, 9, and 10 until proper calibration is achieved. This is necessary due to some interaction between the zero and span adjustments.

12. Simulate a broken thermocouple by disconnecting the signal source. Observe the output meter for the required output signal reaction.

This completes the calibration procedure.

MAINTENANCE
GENERAL
Required maintenance for this Module should consist of periodic cleaning, visual inspection, and calibration checks. The severity of the environment in which the Module is located will determine the required frequency of maintenance.

CLEANING
The Module should be cleaned as often as operating conditions require. The accumulation of dust and dirt on components prevents efficient heat dissipation which can cause overheating and component breakdown. Blow off accumulated dust and dirt with dry, low velocity air. Any dust or dirt that remains should be removed with a soft brush or cloth dampened with a mild detergent and water solution. Cotton-tipped swabs are useful spares.

CAUTION
Avoid the use of chemical agents which may damage plastic components or protective coatings.

VISUAL INSPECTION
The Module should be inspected occasionally for defects such as loose or broken connections, damaged circuit board, and heat-damaged components.

The corrective action for most visible defects is obvious. However, if a heat-damaged component is found, the cause of overheating must be corrected to prevent a recurrence of the damage.

CAUTION
Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage.

TROUBLESHOOTING
If the Module does not operate properly when initially installed check the terminal strip wiring. Most problems in new installations can be traced to wiring mistakes. Also, verify that the equipment associated with the input and output circuits is functioning and is properly calibrated.

If the trouble is traced to the Module, remove the Module and give it a full bench check. A complete schematic of the Module is given in Figure 4.

A Part No. 15378-27 Card Extender can be ordered. It extends the Module beyond the front edge of the card cage enclosure, providing easy access to both sides of the Module’s circuit board.

IMPORTANT
Warranty repair and replacement requires the Module to be returned to Moore Products Co., Spring House, PA 19477. The warranty is null and void if repair is attempted at any other location.

RECOMMENDED SPARES
There are no recommended spare parts for the Thermocouple Converter Module.

One spare module is recommended for every 1 to 10 in service.