MOORE INDUSTRIES

# TCT

Thermocouple Transmitter

## USER'S MANUAL

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# Introduction

Moore Industries' Thermocouple Transmitter (TCT) converts an input from standard ISA thermocouples to a proportional process current or voltage output. The input and output are factory-configured for a user-specified thermocouple type and range, and process variable output.

This manual contains descriptive, calibration, and installation information for the TCT. Notes, Cautions, and Warnings are presented in this manual to help you avoid minor inconveniences, equipment damage, and personal injury while calibrating or installing this instrument.

# Description

The TCT accepts an input from any standard ISA thermocouple and converts it to a 1-5 mA, 4-20 mA, 10-50 mA, or 1-5 Vdc output. This transmitter features upscale burnout, which causes the output to rise above the rated full-scale output, but be limited to 125-150% of full-scale, should the thermocouple input burn out (electrically open).

The TCT is powered by either a dc or an ac power source, depending on its housing style. The input, output, and power source requirements are all factory-configured based on customer specifications.

Two primary housing options are available for the TCT; the Standard (STD) and Plug-in Card (PC). The STD housing is equipped with a U-back bracket that provides extra protection for the TCT's aluminum housing and allows for mounting on flat sturdy surfaces. The STD unit is actually available in several other mounting configurations; each having a different housing code. The PC housing is designed to mount in one of Moore Industries' 19-inch card racks; the RMR or SMR.

The EX housing is a STD unit that has been modified to fit in a high-dome, explosion-proof enclosure. On EX units, the electrical connections have been moved from the front of the unit to the bottom. A mating connector is affixed to the base of the explosion-proof enclosure for making the electrical connections. The bottom of the TCT housing is fitted with pins that mate with the connector in the base of the enclosure.

Each housing style is designed for a different mounting application, but functionally they are identical. The housing style you select should be based on the application and the environment in which it is to be used.

Not all features and options are available for all housing styles. For example; while the STD unit can operate from a dc or an ac power source, the PC unit operates on dc power only.

The basic TCT has no visual indicators, and features only two adjustments (ZERO and SPAN), which are located on the front panel of each unit (including EX units). The ZERO adjustment is used to set the zero-percent output of the unit, while the SPAN adjustment is used to set the 100-percent output.

Table 1 contains the performance and operational specfications for the TCT.

## Options

The TCT is available with several optional features. The following is a brief description of some of the more popular options:

*DD Option* — Downscale burnout; output is driven to a value less than zero percent should the thermocouple burn out or otherwise appear to be open.

*EZ Option* — Elevated Zero input; specifies the input value that yields a zero-percent output.

*FU Option* — Provides a 400 mA power fuse for PC Housing units.

*LNT Option* — Linearization of the thermocouple input (not available with all other options).

# TCT

***Table 1.*** *TCT Performance and Operational Specifications*

| Characteristic | Specification |
|---|---|
| **Input** | Factory-configured<br>**Thermocouple** – all standard ISA types<br>Spans of: **5-10 mV Full-scale**<br>**10-20 mV Full-scale**<br>**20-50 mV Full-scale** |
| **Output** | Factory-configured<br>**1-5 mA** – into 0-4800Ω<br>**4-20 mA** – into 0-1200Ω<br>**10-50 mA** – into 0-480Ω<br>**1-5 Vdc** – into 20 KΩ, minimum |
| **Power** | Factory-configured<br>**24 or 45 Vdc**, ±10%<br>**117, 220 or 240 Vac**; 50/60 Hz; ±10% (not for PC Housing) |
| **Controls** | *Basic Unit:*<br>**Zero** – With minimum input, adjusts output for zero-percent, ±20% (±10% with LNT)<br>**Span** – With maximum input, adjusts output for 100-percent<br>*With LNT Option (two additional adjustments):*<br>**Offset** – Varies reference point of the pre-selected input type for T/C linearization<br>**Gain** – Varies amplification of the pre-selected input type for T/C linearization<br>*With ST Option (one additional adjustment):*<br>**Excitation Adjustment** – Varies thermocouple reference voltage to match the user-selected thermocouple |
| **Performance** | **Accuracy:** ±0.1% of span ( ±0.25% with LSA Option)<br>**Upscale Burnout Protection:** Output limited to 125-150% of full-scale output<br>**Common Mode Rejection:** >120 dB @ 60 Hz with a limit of 500 Vrms<br>**Input Impedance:** 10 MΩ, minimum<br>**Ripple:** <10 mV P/P @ maximum load and span<br>**Load Effect:** ±0.01% of span from 0 to maximum load resistance<br>**Line Voltage Effect:** ±0.005%/1% line change (ac or dc)<br>**Temperature Effect on Amplifier:** ±0.005%/°F over ambient operating range<br>**Temperature Effect on Cold Junction Compensation:** ±1 °C (LSA Option, +2°) maximum offset per 100 °C ambient change |
| **Environmental Ratings** | **Ambient Operating Temperature:** –29 to 82 °C (–20 to 180 °F) |
| **NOTE:** Refer to the Installation Section of this manual for unit dimensions. | |

*LSA Option* — Lower input spans of 2-5 mV full-scale.

*RF Option* — RFI/EMI protection; 50 V/m – abc ≤ 0.1% of full-scale as defined by SAMA Standard 33.1; this option also provides 500 Vdc input-to-output isolation (not available with all options).

*ST Option* — Selectable thermocouple type; includes field-selection of thermocouples E, J, K, and T (not available with LNT Option).

For information on availability of other TCT options please contact your local Sales Representative or the factory.

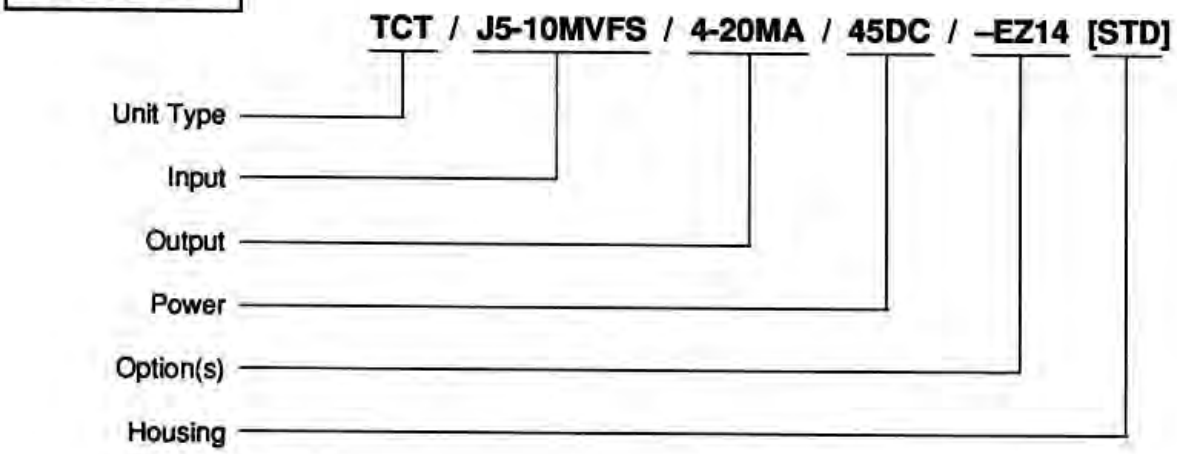
**Serial Number.** A historical record is kept at the factory on every product Moore Industries sells and services. This information is keyed to the unit's serial number. If you wish to obtain historical information about a particular product, you must provide the factory with the serial number of the unit.

The serial number for STD units, and units of similar packaging, is edged into a stainless steel tag that is secured to the front of the TCT across the top of the terminal strips. The serial number for PC units is printed on a label that is affixed to the outer-left side of the front panel. The serial number for EX units is located on a label affixed to the top of the unit and on a metal tag on the top of the explosion-proof enclosure.

**Model Number.** Moore Industries model numbers identify the unit type, functional characteristics, input and output types, any options, and the units housing type. You should always verify the model number of a unit before placing it into service to ensure it is properly configured for the intended application.

The model number is found in the same location as the serial number. The example below identifies the significance of each field of the TCT model number.

***EXAMPLE***



# Calibration

All TCT's are calibrated and checked at the factory before shipment. After receiving your TCT, you should set it up for a bench check and verify that it responds to known inputs in a predictable manner. To do this properly, you must use test equipment to control the input and monitor the output. The bench check will indicate if the TCT is ready to be placed into service, or if it needs to be re-calibrated for your particular application. We recommend you perform a bench check on each unit before placing it into service.

## TCT Controls

The basic TCT has only two adjustments; ZERO and SPAN. Both of these potentiometers are accessible at the front panel of all housing styles. The ZERO potentiometer adjusts the output for the zero-percent rating of the unit (e.g., 1 mA, 4 mA, 1 Vdc). The SPAN potentiometer adjusts the output for the 100-percent rating of the unit (e.g., 20 mA, 50 mA, 5 Vdc).

The ST Option provides an additional potentiometer that is also located on the front panel. To access this potentiometer, the plastic safety cover must be removed from the STD unit. The adjustment is identified with the marking "EXCIT ADJUST" on STD units and "EXCITATION" on PC units. This adjustment is used to vary the reference voltage to an appropriate setting for the thermocouple type you select (refer to table 3 in the Calibration Procedures).

The LNT Option provides two additional front panel adjustments; OFFSET and GAIN. The OFFSET and GAIN adjustments are used to linearize the thermocouple input before it reaches the final stages of the TCT circuitry. With this option, the two additional adjustments are located below the ZERO and SPAN potentiometers on the front panel. (You can not have both the ST and the LNT Options on the same unit.)

All potentiometers on the TCT are equipped with a slip-clutch that prevents the potentiometer from being damaged should you turn the adjustment beyond the wiper stop. The use of each of these controls is explained in subsequent calibration procedures.

## Calibration Setup

Since the TCT has no visual indicators, its operational performance can only be verified with calibration equipment. The equipment required to bench check and calibrate the TCT is listed in table 2.

Be sure to use accurately calibrated test equipment to calibrate the TCT. If uncalibrated test equipment is used, the input you apply and output readings you observe will be unreliable and the performance of the TCT unpredictable.

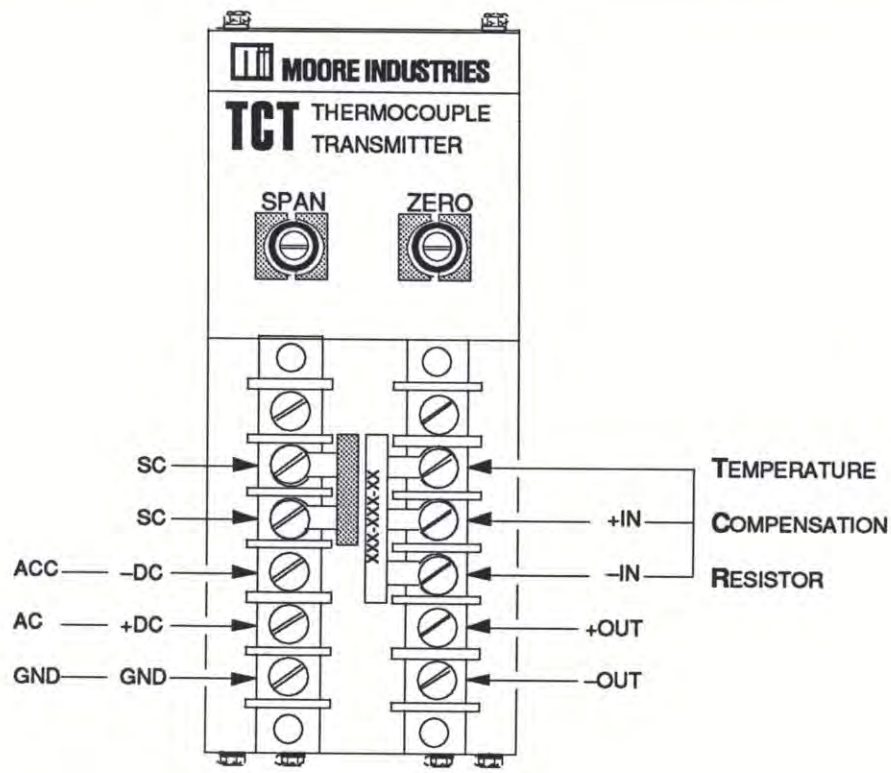
To set up the STD unit on a shop or laboratory bench for bench check/calibration is relatively easy. The wiring terminals for the STD unit are easy to access since they are all on the front of the unit (see figure 1). But, making connections to the PC and EX units is slightly more involved.

The PC unit can be bench checked in its intended rack location using a Moore Industries' PC Extender Card (P/N 350-312-00) and by connecting the calibration equipment at the rear terminal strip of the rack. Performing a bench check in the rack can be somewhat cumbersome, but it allows you to verify wiring connections of inidividual card slots of a card rack.

The PC unit can also be bench checked and calibrated on a bench top using the appropriate mating connector. You can build your own test fixture or special connector for this purpose. However, we recommend you use Moore Industries' Process Power Supply (PPS) with the CT Option for bench top checks/calibrations of PC units. The PPS (with CT Option) is designed to accept the PC unit and provides terminals for connecting calibration equip-

*Table 2. TCT Calibration Equipment*

| Equipment | Characteristic |
|---|---|
| **Calibrated Thermocouple Simulator** | Capable of simulating specified thermocouple and input range |
| **DC Power Source (for dc units only)** | 24 or 45 Vdc, ±10% (as required per unit configuration) |
| **Voltmeter & Load Resistor (optional)** | Accuracy of 0.05% or better |
| **Milliammeter (optional)** | Accuracy of 0.05% or better |
| **PC Extender Card (optional)** | For PC Housing units only; Moore Industries part number 350-513-00 |
| **Screwdriver** | Head width no greater than 2.54 mm (0.1 inch) |




**NOTES:** 1. Each unit is factory-configured for ac or dc power as indicated in the model number.
2. A diode is used with the LNT Option instead of a temperature compensation resistor.

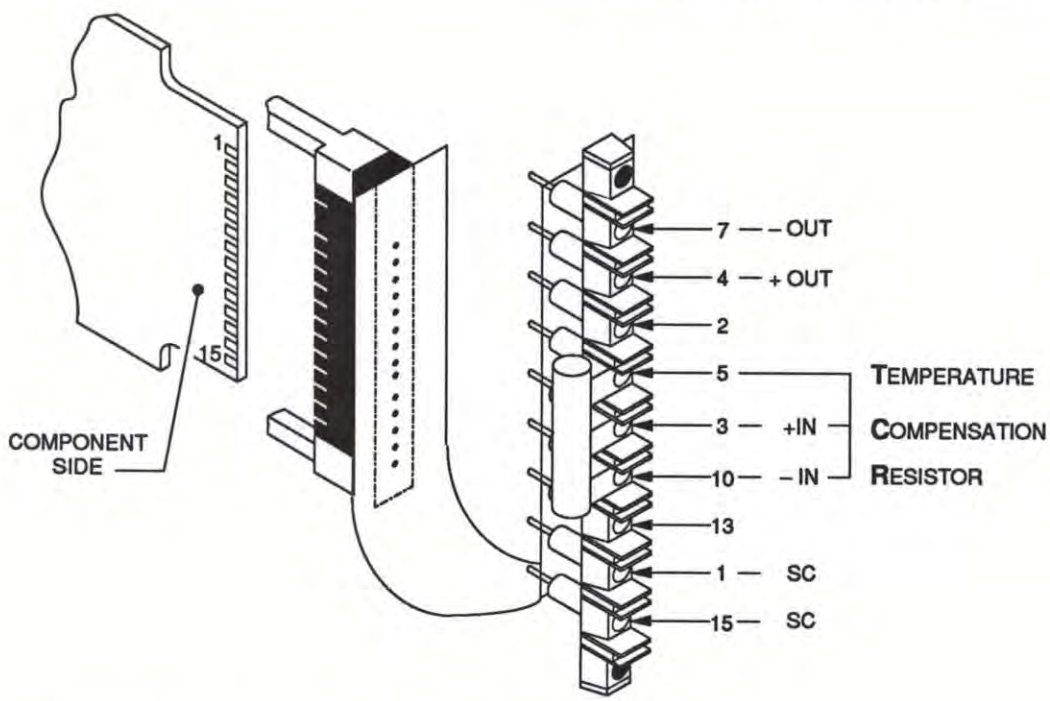
*Figure 1. STD Housing Terminal Locations*

ment. The terminals on the PPS are numbered in the same manner as the terminals on the rear of a card rack. Connections are made to these terminals as they are to the card rack terminals. The PPS supplies 24 Vdc to the TCT and allows for connection of other equipment and the temperature compensating resistor (TCR), or diode, that is normally connected to the rear terminals of the card rack. Figure 2 identifies the terminal locations for the PC unit.

The EX unit includes the explosion-proof enclosure with a terminal block secured to the base of the enclosure. To wire this unit for bench-top calibration, remove the top of the enclosure and pull the TCT straight out to separate it from the terminal block. Individual terminal screws are used to make electrical connections at each of the terminals (numbered 1 through 12). Figure 3 shows the terminal locations for the EX connector.

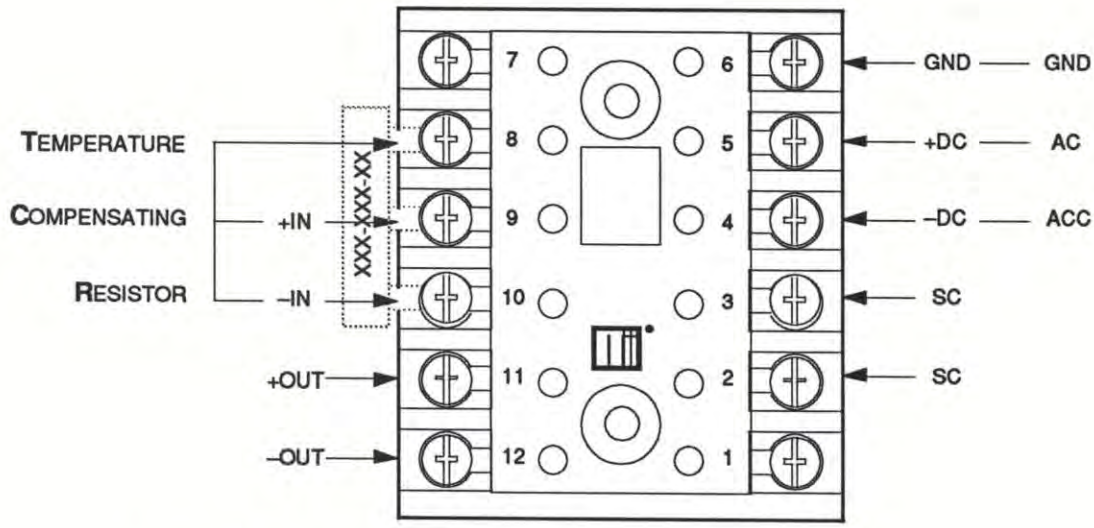
Units equipped with the LNT Option use a diode instead of the TCR that is used in all other instances. It is very important that this diode be installed properly. When used, this diode must be installed in the orientation shown in figure1, 2, or 3, with the part number of several digits visible from the front of the unit (facing forward). The positioning of the TCR is not critical, but positioning of the diode for the LNT Option is critical.

Figure 4 is a calibration hookup diagram for the basic TCT (STD and PC). When connecting the calibration equipment to the TCT, be sure to observe the electrical polarities indicated in this illustration.



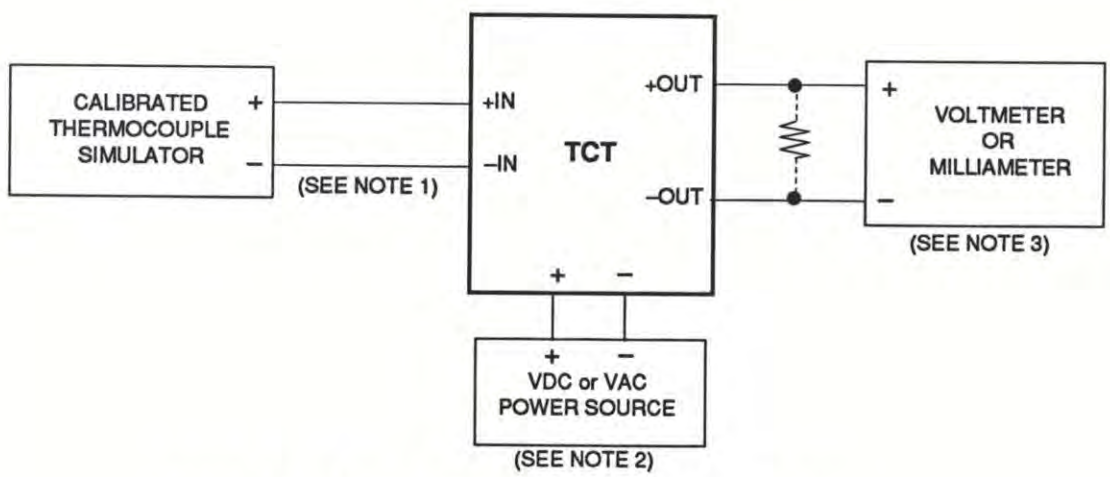

**NOTES:** 1. Check the unit's model number for its dc power requirements.
2. A diode is used with the LNT Option instead of a temperature compensation resistor.
3. DC power is not applied to the rear terminal strip. Power is applied to the PCB edge connector at pins 8 (+DC) and 9 (–DC).

***Figure 2.*** *PC Housing Terminal Locations*




**NOTES:** 1. Check the unit's model number for its power requirements.
2. A diode is used with the LNT Option instead of a temperature compensation resistor.

***Figure 3.*** *EX Housing Terminal Locations*




**NOTES:** 1. Use T/C wire that is compatible with the intended application.
2. Check the model number for power source requirements.
3. If a voltmeter is used, a precision 250Ω load resistor is also required. You must convert current output ratings to an appropriate voltage drop range for the output rating of your unit. Voltage drop (E) = Current (I) x 250Ω (R).

***Figure 4.*** *TCT Calibration Hookup Diagram*

## Calibration Procedure

Before beginning this procedure, check the model number of the unit to be calibrated to verify what power requirement the unit has and what the input and output are configured for. The following procedure is suitable for all TCT's.

Refer to table 2 for a list of calibration equipment and use figure 1, 2, or 3, as applicable.

1. Connect TCT and calibration equipment as shown in figure 4.

   ***WARNING***

   *Power terminals are exposed on the STD Housing while the plastic safety cover is removed. To reduce the risk of electrical shock, replace the safety cover after completing wiring connections and before applying power.*

2. Apply power and allow TCT to warm-up for 5 minutes.
3. Set thermocouple simulator for thermocouple type and to minimum input setting as stated in model number.
4. Monitor output with milliammeter or voltmeter (with load resistor) to verify zero-percent output is as stated in model number (±0.1% of span)
5. Adjust ZERO potentiometer, as required, to bring zero-percent output to required setting.
6. Set thermocouple simulator for 100-percent input as stated in model number.
7. Monitor output to verify 100-percent output is as stated in model number (±0.1% of span).
8. Adjust SPAN potentiometer, as required, to bring 100-percent output to required setting.
9. Repeat steps 2 through 7 until zero- and 100-percent outputs are stable when input is changed between minimum and maximum settings without needing further adjustments.
10. Remove power and disconnect calibration equipment. Basic calibration is complete.

## ST Option Calibration Procedure

The Selectable Thermocouple (ST) Option allows you to select a thermocouple type input of E, J, K, or T by changing the thermocouple reference voltage. Table 3 lists the reference voltage for the respective thermocouple types.

***Table 3.*** *Voltage Reference for ST Option*

| T/C* Type | Voltage |
|---|---|
| E | 0.0465 |
| J | 0.0388 |
| K | 0.0303 |
| T | 0.0315 |

* T/C = thermocouple

The reference voltage is varied by the excitation potentiometer that is marked "EXCIT ADJUST" on STD units and "EXCITATION" on PC units.

A dc voltmeter, power source, and narrow slotted screwdriver is the only equipment required to perform this procedure.

1. Apply power to TCT and allow it to warm-up for 5 minutes.
2. Connect positive lead of voltmeter to TCR/–IN terminal and negative lead to TCR terminal.

   ***WARNING***

   *Power terminals are exposed on the STD Housing while the plastic safety cover is removed. To reduce the risk of electrical shock, replace the safety cover after completing wiring connections and before applying power.*

3. Apply power and verify that voltage reading is within 0.0025 volts of voltage listed in table 3 for the required thermocouple setting.

4. If reference voltage is not within tolerance stated in step 2, adjust excitation potentiometer (EXCIT ADJUST or EXCITATION) to bring voltage to appropriate setting listed as in table 3.

5. Remove power and dc voltmeter. ST Option calibration is complete.

6. Perform basic calibration procedure.

## LNT Option Calibration Procedure

The Thermocouple Linearization (LNT) Option allows you to improve the linearity of the thermocouple input, which produces a more linear output than would otherwise be achieved.

The LNT Option has two front panel adjustments labeled "OFFSET" and "GAIN", and one internal potentiometer. These adjustments improve the output linearity by 10 fold over a non-LNT unit.

The internal adjustment is used to set the comparator bias voltage for the LNT Option. This adjustment is factory-set to its optimum setting for a particular thermocouple type, then sealed at that setting. You may need to tweak this adjustment slightly to compensate for thermocouple aging or use of a different thermocouple of the same type.

The LNT calibration requires that you access PC2 (both STD and PC units) for the comparator bias adjustment and to reference specific components. To access PC2 in STD units, the electronics must be removed from the aluminum case. Figure 5 shows disassembly of the STD unit to access PC2. Figure 6 shows the location of key components used in this calibration procedure. PC units have no enclosure covering the electronics, so PC2 is easily accessible. Figure 7 shows the location of key components of the PC unit.

Before proceeding with this calibration procedure, check the model number to verify the power requirements for your particular unit. Also, disassemble STD units to access PC2. Use figure 6 or 7 to locate the components specified in this procedure.

***WARNING***

*With the STD unit open, you may be exposed to ac voltages that are hazardous. Use caution when working around exposed electronics and wiring terminals.*

1. Connect TCT and calibration equipment as shown in figure 4.

2. Apply power and allow TCT to warm-up for 5 minutes.

3. Using a dc voltmeter, check comparator bias voltage by placing positive voltmeter lead on junction of R201 and R212 for STD units (R201 and R233 for PC units) and negative lead on negative side of C201 for STD units (C202 for PC units).

***CAUTION***

*Moore Industries places a protective coating over all its printed circuit boards. You must penetrate this coating to make contact with the locations described here.*

4. Verify voltage reading is 6.222 Vdc, ±0.001 V. If not, adjust R212 for STD units (R233 for PC units) to correct setting.

***NOTE***

*Ensure that temperature compensating diode CR101 is in its proper orientation before proceeding with this procedure. See figure 1, 2, or 3.*

5. Set thermocouple simulator for the required thermocouple type and minimum input setting as stated in model number.

6. Place positive lead of voltmeter on pin 6 of U204 and negative lead on negative side of C201 (C202 for PC units).

7. Adjust OFFSET potentiometer on front panel for a reading of 1.0 Vdc.

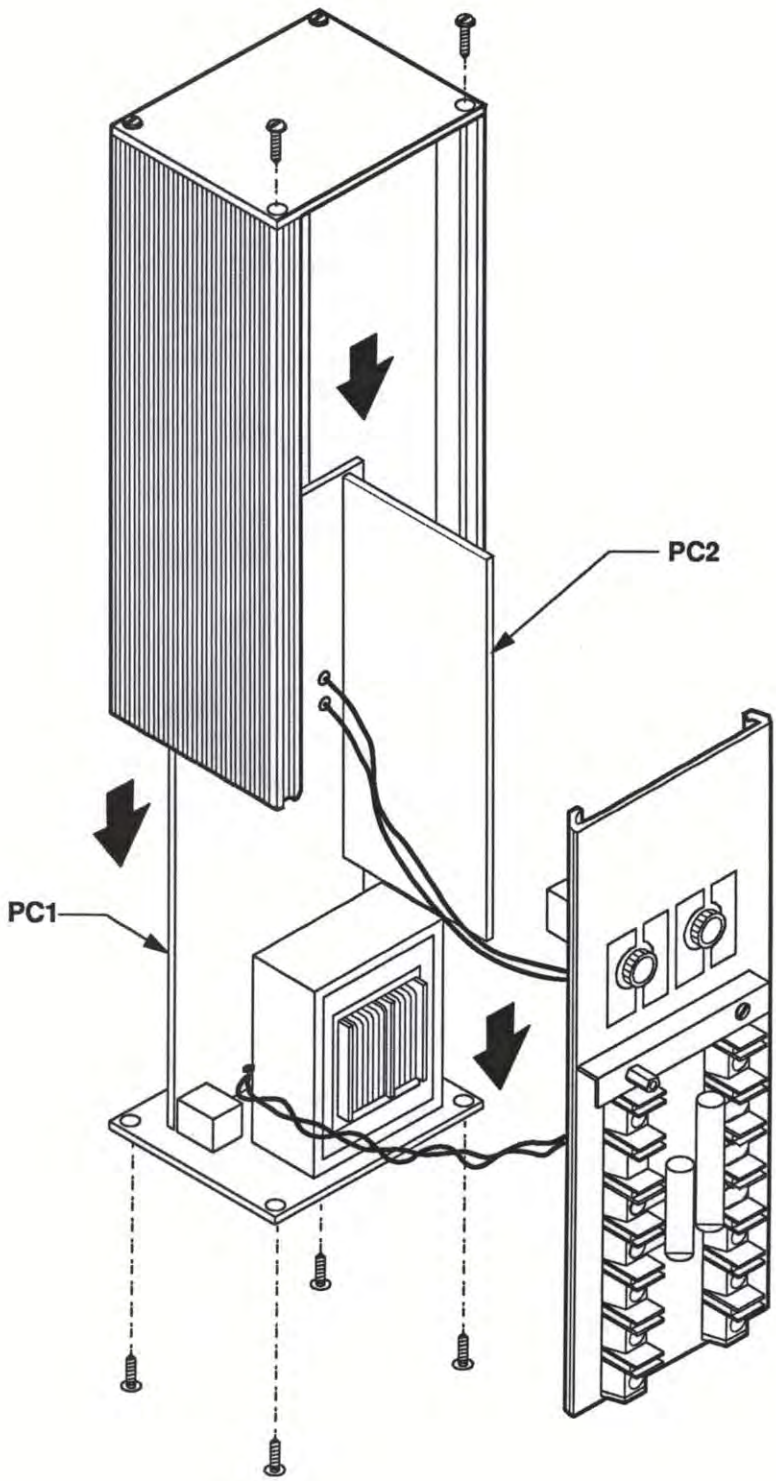



***Figure 5.*** *STD Housing Disassembly*

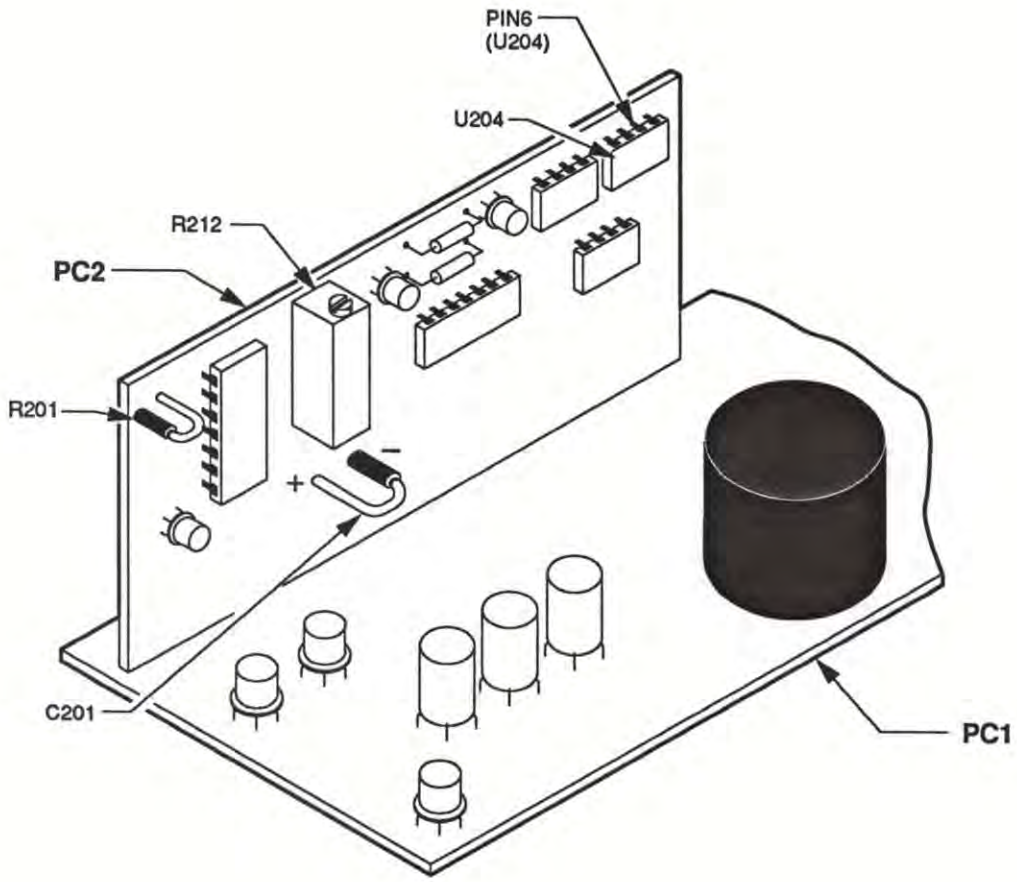



***Figure 6.*** *STD Housing PC2 Component Locations*

8. Monitoring the output, adjust ZERO potentiometer for a zero-percent output.

9. Set thermocouple simulator for 100-percent input.

10. Place positive lead of voltmeter on pin 6 of U204 and negative lead on negative side of C201 (C202 for PC units).

11. Adjust GAIN potentiometer on front panel for a reading of 5.0 Vdc.

12. Monitoring the output, adjust SPAN potentiometer for a full-scale (100-percent) output.

13. Repeat steps 5 through 12 until no further adjustments are required.

14. Disconnect calibration equipment and re-assemble TCT. LNT Option calibration is complete.

***CAUTION***

*When the LNT Calibration Procedure is complete, apply a small amount of high quality protective coating suitable for electronic equipment to those areas where the coating was scraped away.*

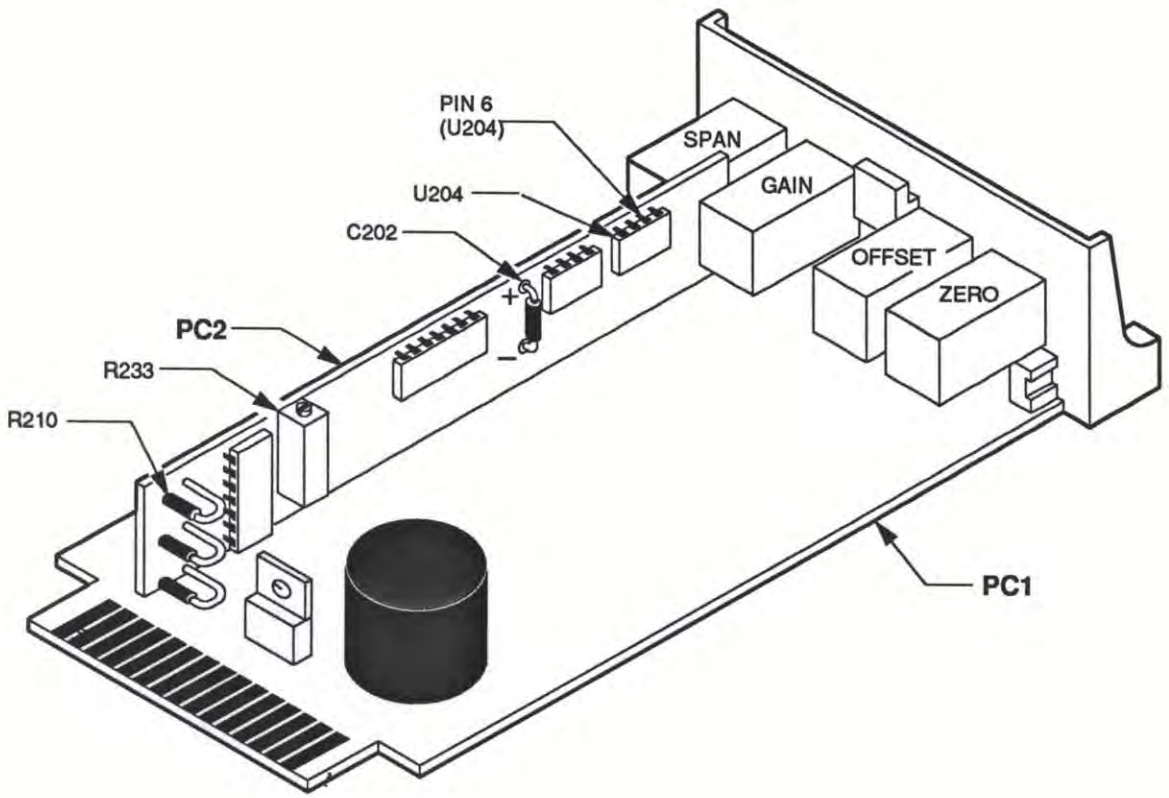



***Figure 7.*** *PC Housing PC2 Component Locations*

You can check the output linearity by dividing the input into percentages and calculating the output that represents each percentage of input, and trying them. That is, apply each input and monitor the output for the percentage of output type (i.e., volts or milliamps) your units is configured for.

If it were previously known, the results of the LNT Option calibration would be a linearity improvement of at least 10 fold over the same input to a non-LNT unit.

# Installation

Installing the TCT consists of physically mounting the unit and completing the necessary electrical connections. Before installing the TCT, you should bench check it to ensure that it is properly configured for its intended application.

The TCT is available in several mounting configurations. The two primary housing styles are the STD and the PC Housings. The long-term performance of the TCT will be greatly enhanced if it is mounted and operated in an area free of excessive dust, moisture, or corrosive elements.

## Mounting the TCT

The STD Housing outline dimensions are shown in figure 8. This illustration includes the dimensions for the U-back bracket. For housing styles similar to the STD Housing, the dimensions shown for the aluminum enclosure itself are the primary dimensions to consider. Different variations of the STD Housing allows for mounting on racks, rails, flat surfaces, and instrument panels. The EX Housing mounts directly inside an explosion-proof enclosure.

Figure 9 is an outline dimension drawing of the PC Housing. This housing style is designed specifically for mounting in one of Moore Industries' 19-inch instrument racks (RMR or SMR). These card racks are either rack-mounted (RMR) or surface-mounted (SMR).

## Making the Electrical Connections

Electrical connections to STD and EX units are made to individual terminals. Table 4 lists the terminal assignments for STD and EX units. (See figures 1 and 3 in the Calibration Section for specific terminal locations.) STD-type units are powered by either an ac or a dc power source. The power requirements for each unit is contained in its model number.

PC units slide into card slots in Moore Industries' 19-inch card racks. Each unit has individual contacts on its rear edge that mate with an edge connector at the back of the rack. Internally, each connector is connected to individual terminal strips that are accessed at the rear panel. The numbering adjacent to each terminal strip corresponds to the edge connector

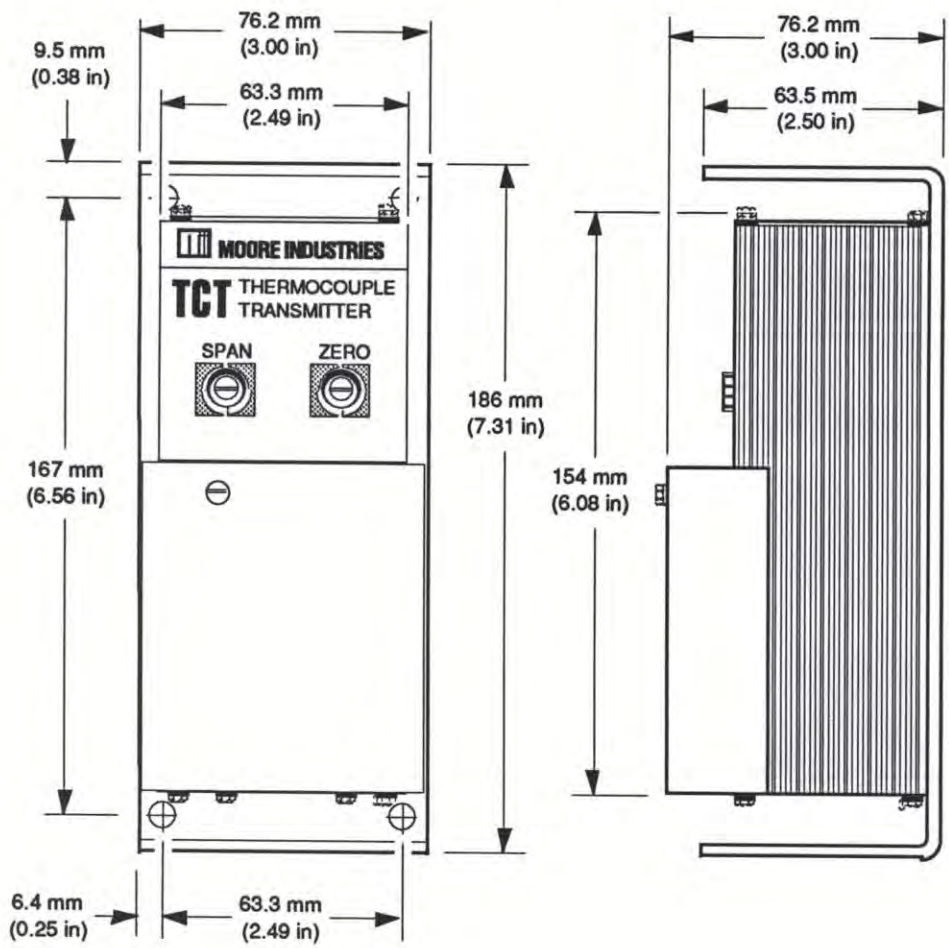



***Figure 8.*** *TCT STD Housing Outline Dimensions*

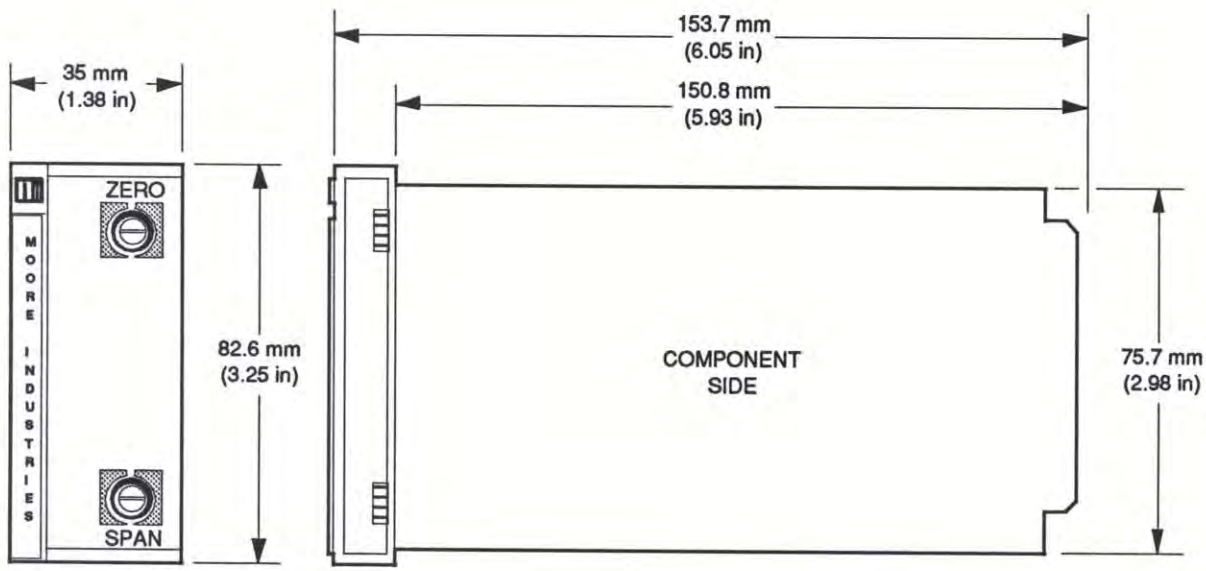



***Figure 9.*** *TCT PC Housing Outline Dimensions*

contacts for each PC unit. Power is supplied to each unit via the power connections to the rack and internal bussing. PC units operate on dc power ONLY, which is specified in each unit's model number. DC power is not present at the rear panel terminal strips. Table 5 lists the terminal assignments for the PC unit. See figure 2 in the Calibration Section for specific terminal locations.

Figure 10 is an installation hookup diagram for the TCT.

For proper operation, ensure that the TCR is connected to the corrent terminals. For units with the LNT Option, ensure that the temperature compensation diode is connected with the proper polarity to the appropriate terminals.

# Maintenance

Once the TCT is properly calibrated and installed, it will operate reliably for extended periods of time. Routine maintenance of the TCT is limited to keeping the unit clean and ensuring terminal connections are secure and free of oxidation. We recommend that you visually inspect the unit at least once every six months to ensure its physical condition is acceptable.

Periodically, you may wish to check the performance of the TCT to ensure that it is operating within the desired parameters. To check its operational performance, take the unit off-line and set it up for a bench check by using the calibration equipment and hookup information contained in the Calibration Section of this manual. Apply a known input to the TCT and monitor its output for a predictable results. If the output is out of tolerance or at an unacceptable level, perform the calibration procedures contained therein.

*Table 4. TCT STD and EX Housing Terminal Designations*

| Options | Terminals | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Basic DC Powered** | | | | –DC | +DC | GND | | *TCR* | +IN *TCR* | –IN *TCR* | +OUT | –OUT |
| **Basic AC Powered** | | | | ACC | AC | GND | | *TCR* | +IN *TCR* | –IN *TCR* | +OUT | –OUT |
| **Unit with SC Option** | | SC | SC | (NOTE 1) | (NOTE 1) | GND | | *TCR* | +IN *TCR* | –IN *TCR* | +OUT | –OUT |

**NOTES:** 1. Apply ac or dc power as stated in unit's model number.
2. With the LNT Option, a diode is used instead of the TCR.

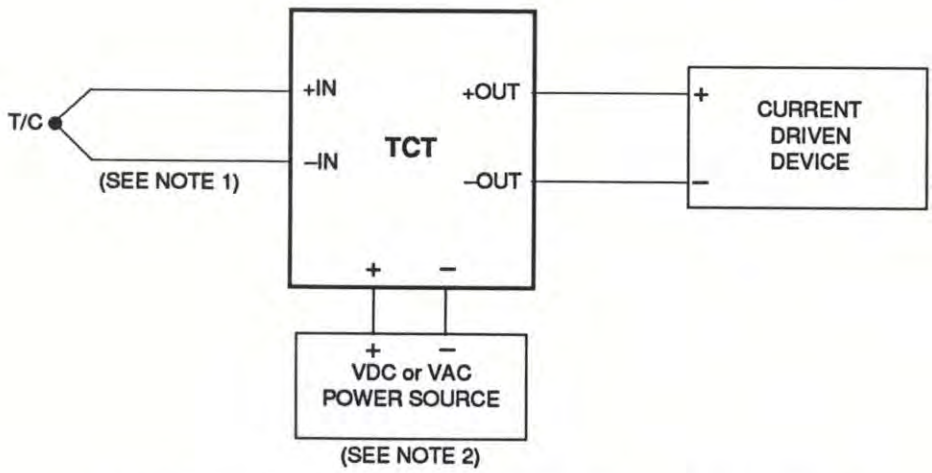
**LEGEND:** **AC,** AC power input
**ACC,** AC power return
**GND,** Chassis ground
**SC,** Selectable Current (option)
**TCR,** Temperature Compensation Resistor
**+DC,** DC power input
**–DC,** DC power return
**+IN,** Positive T/C input
**–IN,** Negative T/C input
**+OUT,** Positive current or voltage output
**–OUT,** Negative current or voltage output

*Table 5. TCT PC Housing Terminal Designations*

| Options | Terminals (at rear of card rack) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 7 | 4 | 2 | 5 | 3 | 10 | 13 | 1 | 15 |
| **DC Powered PC Unit** | –OUT | +OUT | | *TCR* | +IN *TCR* | –IN *TCR* | | | |
| **Unit with SC Option** | –OUT | +OUT | | *TCR* | +IN *TCR* | –IN *TCR* | | SC | SC |

**NOTES:** 1. DC power is bussed to pins 8 and 9 of each internal card connector of the rack, but is not present at the rear terminals.
2. With the LNT Option, a diode is used instead of the TCR.

**LEGEND:** **SC,** Selectable Current (option)
**TCR,** Temperature Compensation Resistor
**+IN,** Positive T/C input
**–IN,** Negative T/C input
**+OUT,** Positive current or voltage output
**–OUT,** Negative current or voltage output




**NOTES:** 1. Connect T/C wire of positive (+) polarity to the +IN terminal of TCT.
2. Check the model number for power source requirements.

***Figure 10.*** *TCT Installation Hookup Diagram*

The schedule for in-service bench checks depends on your facility's maintenance practices and on indications of need. We recommend that you bench check the TCT about once a year. But, if there is no indication of variation in performance, you may elect to let the TCT remain on-line for longer periods.

If an operational problem arises with the TCT, contact Moore Industries' Customer Service Department at 1-800-999-2900 or your local Sales Representative. To return a unit, follow the instructions on the back cover of this manual.

# NOTES

# RETURN PROCEDURES

**To return equipment to Moore Industries for repair, follow these four steps:**

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

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