

# FCT

Field-Configurable  
Signal Converter/Isolator



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## Introduction

Moore Industries' Field-Configurable Signal Converter/Isolator, the FCT, takes in either current or voltage and provides isolated current or voltage output.

This manual contains the information necessary to calibrate, install, operate, maintain, and troubleshoot the FCT. It includes a brief unit description, a table of performance and operational specifications, and an explanation of Moore Industries' model/serial number-based product data tracking system.

The following guidelines are used throughout the manual:

**WARNING** – Hazardous procedure or condition that could injure or be fatal to the operator.

**Caution** – Hazardous procedure or condition that could damage or destroy the unit.

**Note** – Information that is essential for a procedure, condition, or operation of the unit.

## Description

The FCT is a compact, versatile device, featuring field-configurable input and output, universal powering, and user-set zero and span.

**Field-configurable Inputs and Outputs** accommodate all common signal types. Ranges can be set by the user, or ordered configured by the factory. Jumpers on one of the FCT printed circuit (PC) boards, accessible through a removable side panel, give the user the capability to re-configure the unit in the field. Refer to the specifications table for more information.

**Universal Power Input** signifies that the FCT can be powered either by alternating or direct current. The standard unit accepts from 90-260Vac and from 22-300Vdc power. No field configuring is required. Units can also be ordered pre-set by the factory for a specified, fixed power range.

**Complete Input/Output/Power isolation** stops ground loops up to 1000Vrms.

**RFI/EMI Protection** is built in to the FCT. Standard units afford 10V/m. Optional 30V/m is available.

**Two-wire Transmitter Excitation** is standard on all programmable (PRG) units. It is also available as an option on non-PRG units.

**A DIN-style, Universal Housing Clip** provides for quick installation on either 32mm G-type (EN50035) or 35mm Top Hat (EN50022) rail, making the FCT applicable in either control room or field-mounted cabinetry. Refer to the Installation section of this manual for unit outline dimensions.

# FCT

## Specifications

<p><b>Performance Accuracy:</b> ± 0.1% of span (includes adjustment resolution and linearity)</p> <p><b>Isolation:</b> 1000Vrms between input, output and power (500Vac with DRF option).</p> <p><b>Dielectric Withstand Capability:</b> 1500Vrms between case, power, inputs and outputs (500Vac with -RF option)</p> <p><b>Frequency Response:</b> 5Hz at -3dB</p> <p><b>Ripple:</b> 10mV peak-to-peak at maximum span and maximum load resistance.</p> <p><b>Common Mode Rejection:</b> Exceeds 120dB at 60Hz with a</p>	<p><b>Performance Maximum Input (continued) Overrange:</b> Voltage inputs, ±60V; Current Inputs, ±50mA for 0-20mA inputs, ±100mA for 0-50mA inputs</p> <p><b>Output Limiting:</b> 160% of full scale, maximum</p> <p><b>RFI/EMI Effect:</b> 10V/m - ABC<sup>2</sup> ±0.5% of full scale when tested according to SAMA Standard PMC 33.1 (Enhanced protection available with -RF option)</p> <p><b>Load Effect:</b> ±0.01% of span from zero to maximum load resistance</p> <p><b>Power Supply Effect:</b> &lt;0.05% of span over the full power supply range</p>	<p><b>Performance Transmitter Excitation: (continued)</b> Regulated, 24Vdc @ 25mA for one, 2-wire external transmitter. Standard on PRG units. Option selection required on non-PRG FCT's</p> <p><b>Ambient Temperature Range: Condition</b> -30°C to +82°C</p> <p><b>Ratings</b> (-22°F to 180°F)</p> <p><b>Effect on Accuracy:</b> ±0.015% of span/°C maximum change over -30°C to +70°C range (±0.008% of span/°F over -22°F to 158°F range)</p> <p><b>Adjustments Type:</b> External multiturn potentiometers</p> <p><b>Span:</b> ±10%</p> <p><b>Zero:</b> ±5%</p> <p><b>Weight</b> 300 grams (0.6 lbs)</p>
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Specifications and information subject to change without notice.

## Ordering Information

Unit	Input	Output	Power	Options	Housing
FCT	<p><b>PRG</b> Universal (programmable) Unit can be field-configured via connection terminals on front panel and internal, solderless jumpers for any input listed under FACTORY CONFIGURATION, below. (PRG input default is 4-20MA. PRG input available only with PRG output.)</p> <p><u>FACTORY CONFIGURATION</u> Specify one of these inputs for unit with jumpers* set at the factory for:</p> <p><b>0-20MA</b> into 50Ω  <b>4-20MA</b> into 50Ω  <b>0-50MA</b> into 20Ω  <b>10-50MA</b> into 20Ω  <b>0-5V</b> into 1MΩ  <b>1-5V</b> into 1MΩ  <b>0-10V</b> into 2MΩ                      (*Internal jumpers are included to allow for field-reconfiguration unless unit is also equipped with the -NJ option. FCT's equipped with -NJ are not reconfigurable.)</p> <p><u>SPECIAL INPUTS</u> Special, PRG or fixed input ranges to accommodate almost any application. Spans from 1 to 24V, or 1 to 100MA</p>	<p><b>PRG</b> Universal (programmable) Unit can be field-configured via internal, solderless jumpers for any output listed under FACTORY CONFIGURATION below. (PRG output default is 4-20MA. PRG output is available only with PRG input.)</p> <p><u>FACTORY CONFIGURATION</u> Specify one of these outputs for unit with jumpers* set at the factory for:</p> <p><b>0-20MA</b> into 0-1200Ω  <b>4-20MA</b> into 0-1200Ω  <b>0-5V</b> into 20KΩ, minimum  <b>0-10V</b> into 40KΩ, minimum  <b>1-5V</b> into 20KΩ, minimum                      (*Internal jumpers are included to allow for field-reconfiguration unless unit is also equipped with the -NJ option. FCT's equipped with -NJ are not reconfigurable.)</p> <p><u>SPECIAL OUTPUTS</u> Special, PRG or fixed output ranges to accommodate almost any application. Spans from 1 to 20V, or 1 to 50MA.</p>	<p><b>U</b> Universal Power Accepts 22-300VDC or 90-260AC, sensing and switching automatically (3.5W nominal, 5W maximum, depending on output)</p>	<p><b>-RF</b> RFI/EMI Protection  <b>-RO</b> Reverse Output  <b>-NJ</b> No Internal Jumpers  <b>-TX</b> Transmitter Excitation  <b>-LA</b> Approved by the City of Los Angeles for applications in General Locations</p>	<p><b>DIN</b> Aluminum DIN-style housing mounts on G-type or TopHat rail</p>

## Options

The following list provides an overview of the FCTs options. Complete information on mounting hardware options, changes to this list, or currently available certifications and approvals is available from your Moore Industries Sales Representative, or by contacting the factory.

**RF Option – RFI/EMI Immunity.** Provides additional RFI/EMI protection of 30V/m – ABC =  $\pm 0.5\%$  of full scale, when tested according to SAMA standard PMC 33.1.

**RO Option – Reverse Output.** Configures the unit to decrease output proportionally as input increases and increase output proportionally as input decreases. Requires 4-20mA, 10-50mA, or 1-5V output. This option is not available on PRG units.

**TX Option – Transmitter Excitation.** Available as an option only on non-PRG FCTs (standard on PRG units), this option provides a regulated 24Vdc supply at 25mA to power one external transmitter.

**NJ Option – No Internal Jumpers.** Fixed range unit. Selection of appropriate “FACTORY CONFIGURATION” is required. TX option is available on units with NJ option.

**LA Option – Approved by the City of Los Angeles for applications in General Locations.**

## FCT Model Numbers

To order additional or replacement modules for your system, refer to the Ordering Information table and “build” a model number using the information in bold text. Specify the following in order:

Product / Input / Output / Power / Option [Housing]

For a standard FCT, specify:

FCT / PRG / PRG / U / –RF [DIN]

On the FCT, look for the model and serial numbers on one of the housing side panels.

## Calibration

Prior to shipment, every FCT is subjected to rigorous testing by our team of skilled technicians. Every product Moore Industries manufactures, sells and services is guaranteed to meet the strict quality standards that have become synonymous with our name.

Before placing your FCT into service, a bench check of basic operation is recommended to ensure that the unit hasn’t sustained any damage during transit, and to set zero and span for your application.

### Every unit should be:

- Checked to verify that the appropriate FCT model has been ordered for the intended application.
- Partially disassembled to verify that the internal jumpers are correctly positioned.
- Connected in a calibration setup (described later in this section) and checked for desired output.
- Adjusted for desired zero and span.

Even if a unit has been configured to your specifications by the factory (factory calibration), it is a good idea to perform this calibration as a simple bench check. The procedures provide a safe means to uncover any unit damage that may have occurred during shipping, and offer a simple familiarization with FCT operation in the safety of a testing environment, separate from the intended process or application.

These procedures should be carried out in an environment considered appropriate for general testing of electronic equipment, rather than in the field. Use a technician’s bench or a similar, lab-type environment.

# FCT

## Setting Internal Jumpers

The setting of the unit's internal jumpers control the input and output ranges of the FCT. The internal jumpers must be configured prior to calibrating the FCT.

The jumpers are located on one of the unit's internal PC boards. To access them, remove the Phillips-head screws from the access panel on the side of the unit case. Figure 1 shows the access panel, which is labeled on the unit itself, and the relative locations of the jumpers. Note that the jumper positions also appear on the board.

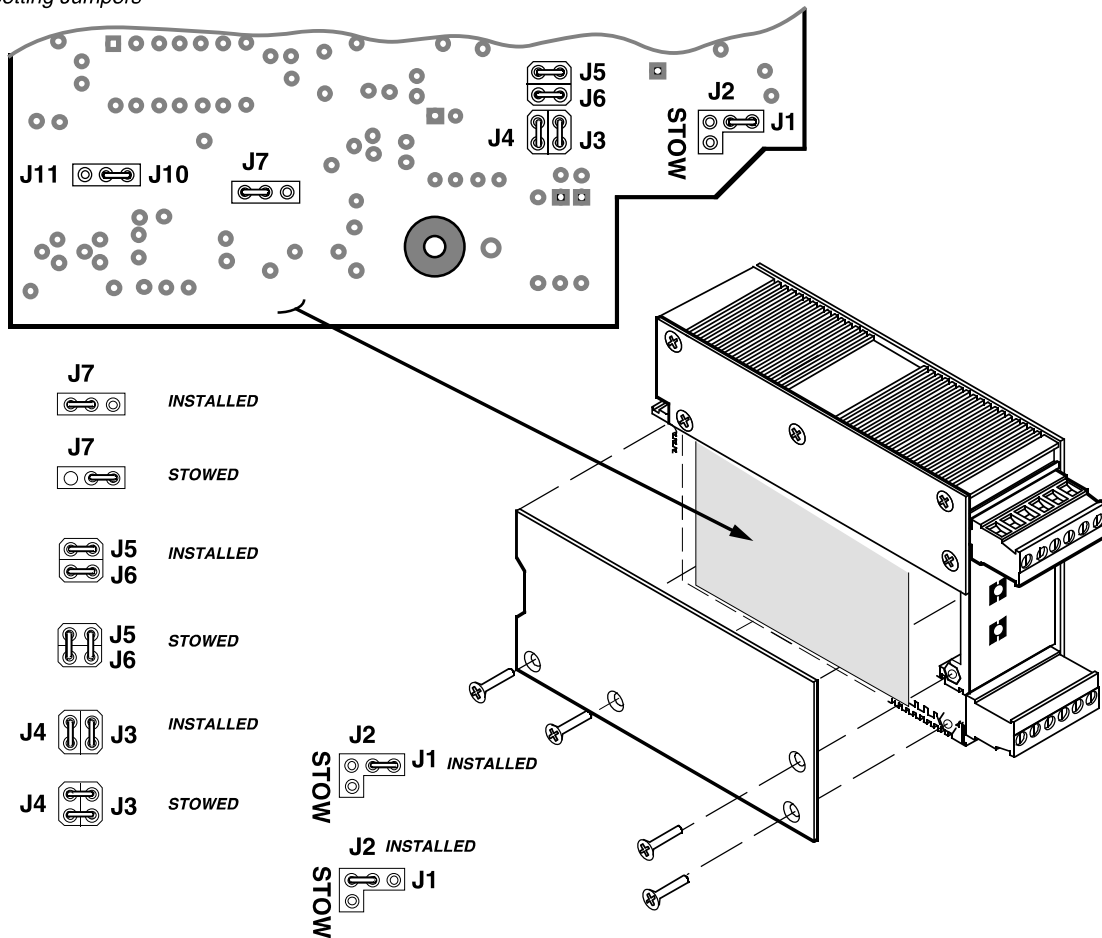
Use a pair of technician's tweezers or fine, needle-nosed pliers to remove/install the jumpers as required for the intended application. Refer to Table 1 for the settings associated with the various available ranges.

**Note:**

Units that have been factory-configured for fixed input or output ranges will show the range settings in the appropriate field of the model number (refer to the explanation of Moore Industries' model numbering system, earlier in this manual).

Units with "PRG" in the input field of their model number will be configured with a 4-20mA input range. Units with "PRG" output will be configured with a 4-20mA output range.

Figure 1. Setting Jumpers



**Table 1. Jumper Settings**

For these INPUTS:	With these OUTPUTS:						
	0-5V	0-10V	0-20mA	0-50mA	1-5V	2-10V	4-20mA
0-5V	J4, J6, J10	J3, J6, J10	J6, J11	J6, J7, J11	J1, J4, J10	J1, J3, J10	J1, J11
0-10V	J4, J6, J10	J3, J6, J10	J6, J11	J6, J7, J11	J1, J4, J10	J1, J3, J10	J1, J11
0-20mA	J4, J6, J10	J3, J6, J10	J6, J11	J6, J7, J11	J1, J4, J10	J1, J3, J10	J1, J11
0-50mA	J4, J6, J10	J3, J6, J10	J6, J11	J6, J7, J11	J1, J4, J10	J1, J3, J10	J1, J11
1-5V	J2, J4, J5, J10	J2, J3, J5, J10	J2, J5, J11	J2, J5, J7, J11	J4, J6, J10	J3, J6, J10	J6, J11
2-10V	J2, J4, J5, J10	J2, J3, J5, J10	J2, J5, J11	J2, J5, J7, J11	J4, J6, J10	J3, J6, J10	J6, J11
4-20mA	J2, J4, J5, J10	J2, J3, J5, J10	J2, J5, J11	J2, J5, J7, J11	J4, J6, J10	J3, J6, J10	J6, J11
10-50mA	J2, J4, J5, J10	J2, J3, J5, J10	J2, J5, J11	J2, J5, J7, J11	J4, J6, J10	J3, J6, J10	J6, J11

If a jumper for a particular configuration is not listed, store it as shown in Figure 1

## Setting Up for Zero/Span Calibration

The equipment listed in Table 2 is needed when calibrating the FCT. These items are not supplied by Moore Industries, but should be available in most testing labs.

Be sure to use calibrated test equipment when performing the bench check and zero/span adjustment of the FCT. The use of inaccurate test equipment will result in unreliable settings and precipitate costly process down-time.

Figure 2 shows the basic hookup used in the calibration procedures. Use a screwdriver to loosen terminal screws and connect appropriate leads to the labeled terminals. With connections completed as shown, apply the appropriate power to the setup and allow a few minutes for stabilization/warm-up.

**Note:**

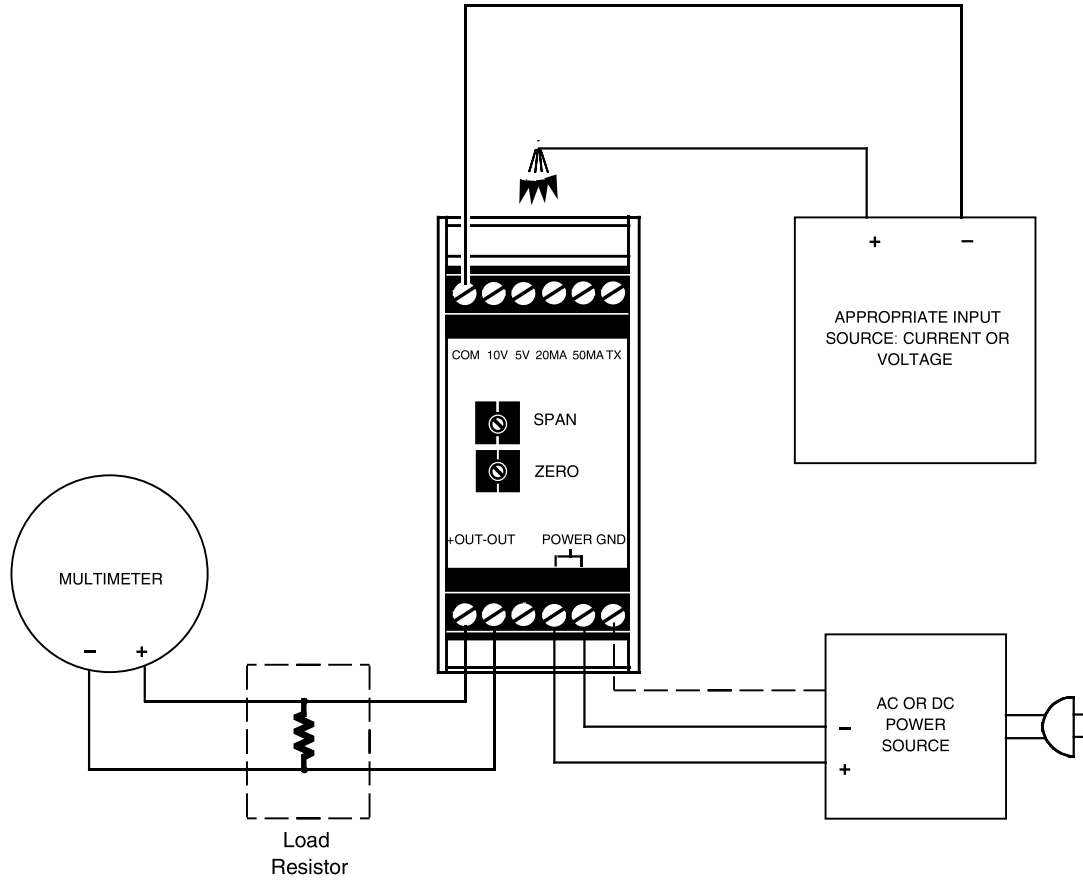
*Input terminals for units that have been configured by the factory for specific ranges are labeled “+” and “-” only. For these units, connect positive to positive and negative to negative.*

**Table 2. Calibration Equipment**

Equipment	Specifications
<b>Voltage or Current Source</b>	Calibrated, adjustable source unit, capable of discrete output levels, $\pm 0.025\%$ , in the appropriate range, and with the appropriate impedance required for the process input level selected with the front panel terminals used.
<b>Power Source</b>	AC or DC, from 22-300 Vdc or 90-260Vac
<b>Multimeter, Ammeter, or Voltmeter</b>	Calibrated meter capable of verifying desired output level, current or voltage. Accuracy of 0.025%. A voltmeter may be used in combination with a load resistor for measuring current outputs.
<b>Load Resistor</b>	Required for verifying current outputs with voltmeter only. Tolerance of $\pm 0.01\%$ , minimum. Use 250 $\Omega$ resistor with current output ranges 0-20mA. Use 100 $\Omega$ resistor with current output ranges from 0-50mA.
<b>Screwdriver</b>	Blade tip. Head width no greater than 2.54mm (0.01in)

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Figure 2. Calibrating the FCT



## Calibrating Zero and Span

Before beginning this procedure, check the model number of the unit to be calibrated for the appropriate input/output type and range, and the required power input type. For PRG (field-configurable) units, refer to Figure 1 for jumper locations and Table 2 for settings.

The two pots on the front panel of the FCT are labeled "ZERO" and "SPAN". They are both 15-turn potentiometers, equipped with slip clutch mechanisms to prevent damage in the event of overturning.

When calibrating the FCT zero and span, turn the appropriate pot clockwise to increase the setting, and counterclockwise to decrease the setting.



To calibrate Zero and Span:

1. **Turn both pots fully counterclockwise (minimum zero and span, 15 turns), then approximately 7 turns clockwise. This approximates mid-scale for the pots.**
2. **Set the input source in the setup to 0% (zero percent). 1V, for example, if the FCT being calibrated is rated (jumpers are set) for 1-5V input.**
3. **Note the meter reading, and turn zero pot clockwise to raise 0% output or counterclockwise to lower 0% output, until the correct level is achieved.**

*Note:*

*Units equipped with the RO option (refer to the Options section, earlier in the manual) operate with a reverse relationship between input and output. This means that the output of the RO-equipped FCT goes up as input goes down, down as input goes up. If calibrating an RO-equipped FCT, input appropriate full scale to adjust unit zero, and input appropriate zero percent to adjust unit full scale.*

4. **Set the input source to 100% (full scale). 5V, for example, if the FCT being calibrated is rated (jumpers are set) for 1-5V input.**
5. **Note the meter reading, and turn span pot clockwise to raise 100% output or counterclockwise to lower 100% output, until the correct level is achieved.**
6. **Repeat steps 2 through 5 until output is stable at both zero and 100 percent input.**

## Installation

Installation of the FCT is a two-step process. First, the unit is mounted, and then the electrical connections are made.

Before installing the FCT, Moore Industries suggests that internal jumper positions be checked, and that the calibration procedures be carried out to confirm that the configuration of the unit is appropriate for the intended application. Costly down-time will result if an inappropriately configured unit is installed.

## Mounting the FCT

To mount the FCT on Top Hat DIN rail, seat the upper extrusion on the back panel over the top of the rail and pivot downward until the housing locks into place.

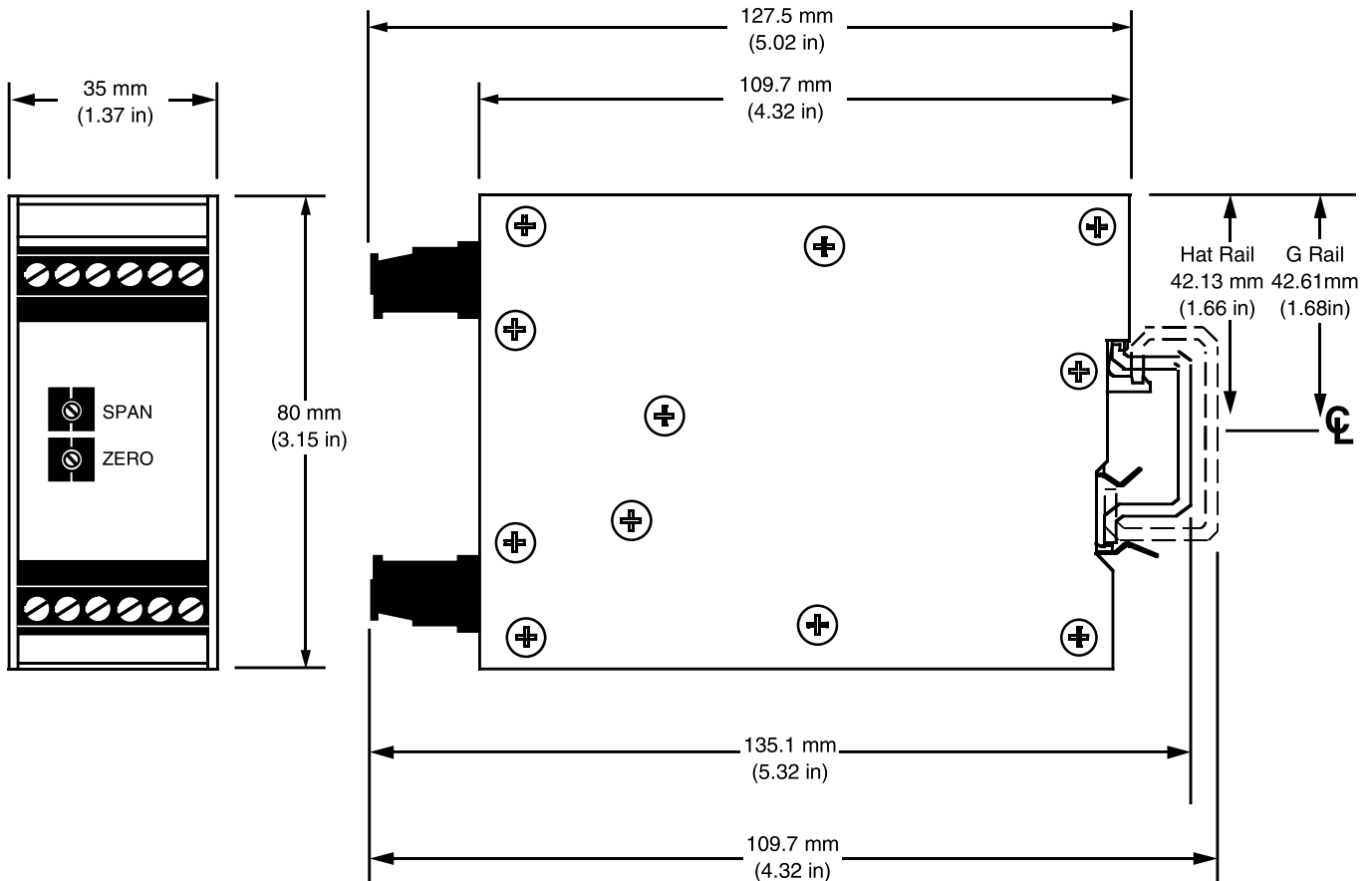
To mount the unit on G-type rail, seat the extrusion under the top lip of the rail and pivot downward.

Figure 3 shows the unit's dimensions.

In a cabinet or some other type of multiple unit scenario, allow sufficient vertical spacing to pivot the FCTs up and down when mounting.

# FCT

Figure 3. FCT Dimensions



## Electrical Connections

All electrical connections are made in the removable terminal blocks along the top and bottom edges of the unit front panel. Each terminal is labeled. Refer to the Installation drawings for connections for PRG units. Refer to Table 3 for a break out of terminal labeling for TX units.

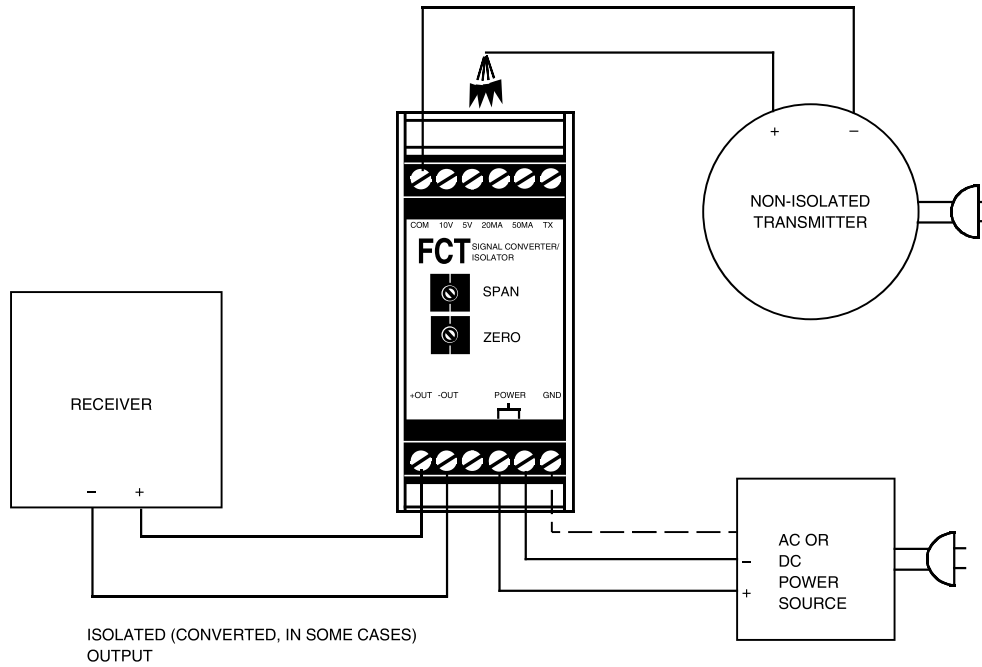
To make a connection, loosen the screw that corresponds to the terminal, insert the stripped end of the connection lead, and tighten the screw until snug. Moore Industries suggests making connections with the terminal block seated in the unit.

### **Caution:**

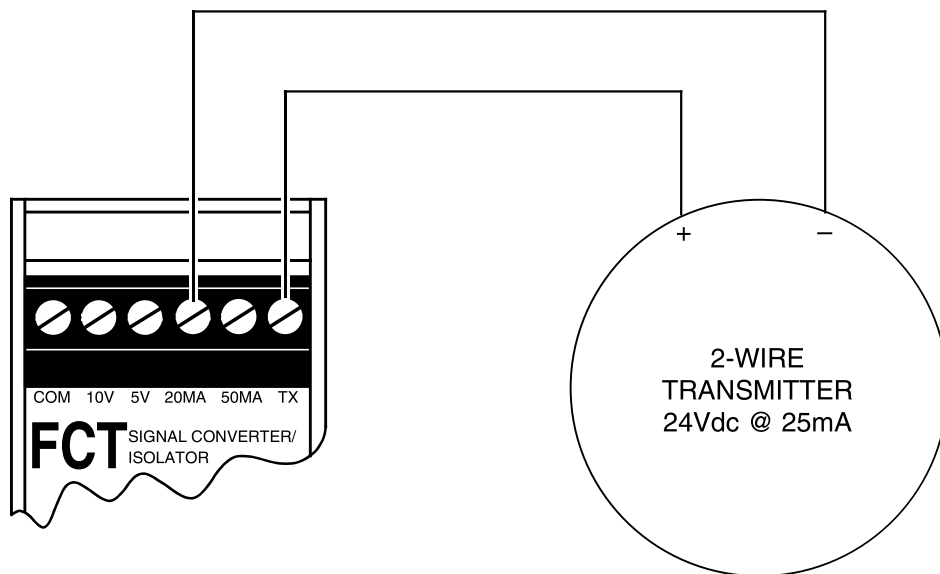
*Do not use a screwdriver with a head width greater than 2.54mm (0.1 in) to loosen or tighten the terminal block screws.*

Figure 4 illustrates the installation hookup for the standard FCT. Figure 5 is a detail showing transmitter excitation connections.

**Figure 4.** Installing the FCT



**Figure 5.** Installing the FCT with the TX option



# FCT

**Table 3. Terminal Designations**

Models with Universal Input/Output											
Top Terminals						Bottom Terminals					
1	2	3	4	5	6	7	8	9	10	11	12
-Signal Input	10V	5V	20 MA	50 MA	TX	+Signal Output	-Signal Output		Power	Power	GND

Models with Fixed Input/Output (Factory Calibration)											
Top Terminals						Bottom Terminals					
1	2	3	4	5	6	7	8	9	10	11	12
-Signal Input	+Signal Input				TX	+Signal Output	-Signal Output		Power	Power	GND

## Recommended Ground Wiring Practices

The following ground wiring practices must be followed to ensure proper performance of the FCT:

- Any Moore Industries product in a metal case or housing should be grounded. Units in DIN housings, for example, should be mounted on a grounded rail.
- All signals to and from Moore Industries' products should be wired using a shielded, twisted pair technique. Shields are to be connected to an earth or safety ground at the unit.
- The maximum length of any unshielded input and/or output signal wiring is 2 inches.

## Operation

Once properly calibrated, connected, and powered, the FCT will operate reliably for an extended period of time. Unit maintenance is a simple check of terminal connections every six months.

If an FCT begins to malfunction or to function below rated specifications, complete the following checklist before calling the factory for assistance.

- Verify that all electrical connections are clean and tight.
- Verify that the power source for the unit is supplying power at levels rated safe and appropriate according to product specifications.
- Check the calibration of the instruments used in calibrating the FCT.
- Verify that other devices in the process loop are not the cause of the problem.

If the difficulties continue, remove the unit from service and recalibrate. The removable terminal blocks on the unit's front panel make it easy to replace the FCT without having to rewire.

## Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customer, both in products and services. We perform a battery of stringent quality assurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help. Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions. Factory phone numbers are on the back cover.

If problems involve a particular FCT, there are several pieces of information you can gather **before** you call the factory that will help our staff to get you answers more efficiently. When you call, please have:

- The model number of the unit in question.
- The serial number of the unit in question.
- The job number (if available).
- The purchase order under which the unit was shipped (if available).

# 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.

### WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

### RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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