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## Introduction

Moore Industries' Alternating Current Transmitter (ACT) accepts an ac voltage or current input from a motor, current transformer, or similar device and converts it to a standard process voltage or current (refer to table 1).

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

## Description

The ACT accepts an alternating current or voltage and produces a proportional, process variable voltage or current output. The ACT is factory-configured for a specific input and output type and rating (except SC outputs, refer to table 1), and provides complete isolation of the input and output, which prevents troublesome system ground-loops.

The ACT is available in two primary housing styles; the Standard (STD) and Plug-in Card (PC). The STD Housing is equipped with a U-back bracket that provides extra protection for the ACT's aluminum housing and allows for mounting on flat, sturdy surfaces. The STD Housing is actually available in several mounting configurations — each having a different housing code. The PC Housing is designed to mount in one of Moore Industries' 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 block is supplied with EX units for making the electrical connections. The bottom of the ACT housing is fitted with pins that mate with the connector block in the base of the explosion-proof 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. Also, PC housed units with a current input **MUST** have the EM Option, while with other current input units this is optional.

The ACT has no visual indicators, but it does feature two adjustments (ZERO and SPAN), which are located on the front panel of each unit (including the EX Housing). The ZERO adjustment is used to set the zero-percent output of the unit. The SPAN adjustment is used to set the 100-percent output.

Table 1 contains the operational and performance specifications for the ACT.

## Options

The ACT is available with several optional features. The following are brief descriptions of a few of the ACT's options:

**EM Option.** Externally mounted transformer for current input (required for all PC units with current input).

**FU Option.** A 400 mA power fuse for protecting the PC Housing from power surges.

**HI Option.** High current of 20 mA for voltage outputs (0-1.5, 0-5, 1-5, or 0-10 Vdc).

**RF Option.** RF/EMI protection; not available with all housing styles or with all other options.

For information on availability of other ACT options contact your local Moore Industries' Sales Representative.

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

Characteristic	Specification
<b>Input<sup>1</sup></b>	Factory-configured: <b>0-1, 0-2, 0-3, 0-4, or 0-5 Amps</b> (into 0.1 $\Omega$ impedance) <b>0-1.5 Vac</b> <b>0-5 Vac</b> <b>0-10 Vac</b> <b>0-25 Vac</b> <b>0-50 Vac</b> <b>0-125 Vac</b> <b>0-150 Vac</b> (Voltage input impedance: 1000 $\Omega$ /volt)
<b>Output<sup>1</sup></b>	Factory-configured: <b>1-5 mA</b> (into 0-4800 $\Omega$ ) <b>4-20 mA</b> (into 0-1200 $\Omega$ ) <b>10-50 mA</b> (into 0-480) <b>Selectable Current (SC)</b> , any one of the above outputs is field-selectable <b>0-1 Vdc</b> (into 20 k $\Omega$ ) <b>0-5 Vdc</b> (into 20 k $\Omega$ ) <b>0-10 Vdc</b> (into 20 k $\Omega$ ) <b>1-5 Vdc</b> (into 20 k $\Omega$ )
<b>Power</b>	Factory-configured <b>24 or 45 Vdc, <math>\pm 10\%</math></b> <b>117, 220, or 240 Vac; 50/60 Hz; <math>\pm 10\%</math>; 5 W, nominal (STD units only)</b>
<b>Controls</b>	<b>Zero:</b> With zero-percent input, adjusts output for zero-percent, $\pm 10\%$ of output span <b>Span:</b> With full-scale input, adjusts output for 100-percent, $\pm 20\%$ of output span
<b>Performance</b>	<b>Accuracy:</b> $\pm 0.5\%$ of span (includes linearity and repeatability) <b>Isolation:</b> Input, output, and power terminals are transformer isolated to 500 Vrms; no dc connections <b>Over Current Protection:</b> Accepts 35 A for 30 seconds with EM Option without damage <b>Over Voltage Protection:</b> Accepts 150% of rated input without damage <b>Common Mode Rejection:</b> $>120$ dB @ 60 Hz with a limit of 500 Vrms <b>Ripple:</b> $\leq 10$ mV P/P @ maximum load and span <b>Load Effect:</b> $\pm 0.01\%$ of span from 0 to maximum load resistance <b>Line Voltage Effect:</b> $\pm 0.005\%/1\%$ line change (ac or dc) <b>Temperature Effect on Amplifier:</b> $\pm 0.018\%/^{\circ}\text{C}$ ( $\pm 0.01\%/^{\circ}\text{F}$ ) over ambient operating range
<b>Environmental Ratings</b>	<b>Ambient Operating Temperature:</b> $-29$ to $82$ $^{\circ}\text{C}$ ( $-20$ to $180$ $^{\circ}\text{F}$ )
<b>NOTES:</b> 1. Other input and output ranges are available; consult the factory. 2. Refer to the Installation Section of this manual for unit dimensions.	

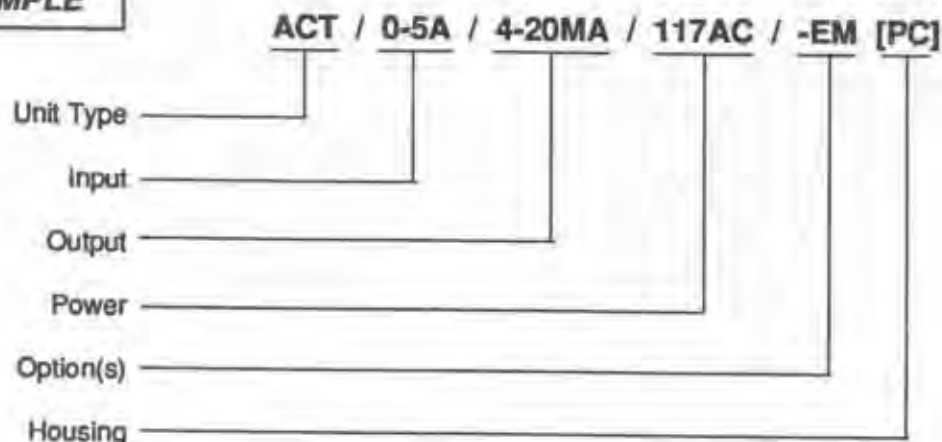
**Serial Number.** A historical record is kept at the factory on every product Moore Industries sells and services. This information is keyed to each unit's serial number. If you wish to obtain historical information about a particular product, you must provide the factory with the serial number of the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

The serial number for STD units is etched into a stainless steel tag that is secured to the front of the unit 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 unit's 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 ACT model number.

**EXAMPLE**

## Calibration

All ACT's are calibrated and checked at the factory before shipment. After receiving your unit, 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 ACT 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.

## ACT Controls

The ACT has two adjustments; ZERO and SPAN. These multiturn 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).

# ACT

Both potentiometers on the ACT are equipped with a slip-clutch that prevents them from being damaged should you turn the adjustment beyond the wiper stop. The use of each of these controls is explained in the calibration procedure later in this section.

**The SC Output.** The Selectable Current (SC) output feature is controlled by a resistor that is connected across specific terminals to produce a predetermined output range. Units equipped with this feature are shipped with three resistors, each having a different resistance value. The difference in resistance yields a different current range output. The three ranges are: 1-5 mA (200 $\Omega$ , 5%), 4-20 mA (50 $\Omega$ , 5%), and 10-50 mA (20 $\Omega$ , 5%). Before calibrating a unit with an SC output, verify the value and location of the SC resistor (see figure 1, 2, or 3).

**The EM Option.** ACT's configured with the EM Option are shipped from the factory with an external transformer that is to be connected between the current input and the input terminals of the unit. This transformer reduces the input from amperes to milliamperes. During bench check or calibration, this transformer must be used. See the calibration hookup diagram for the EM Option later in this section for hookup requirements.

## Calibration Setup

The ACT has no visual indicators. To check or change its operational settings, you must use *calibration equipment*. The equipment required to bench check or calibrate the ACT is listed in table 2.

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

Setting up a 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 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 individual card slots of the rack.

**Table 2.** ACT Calibration Equipment

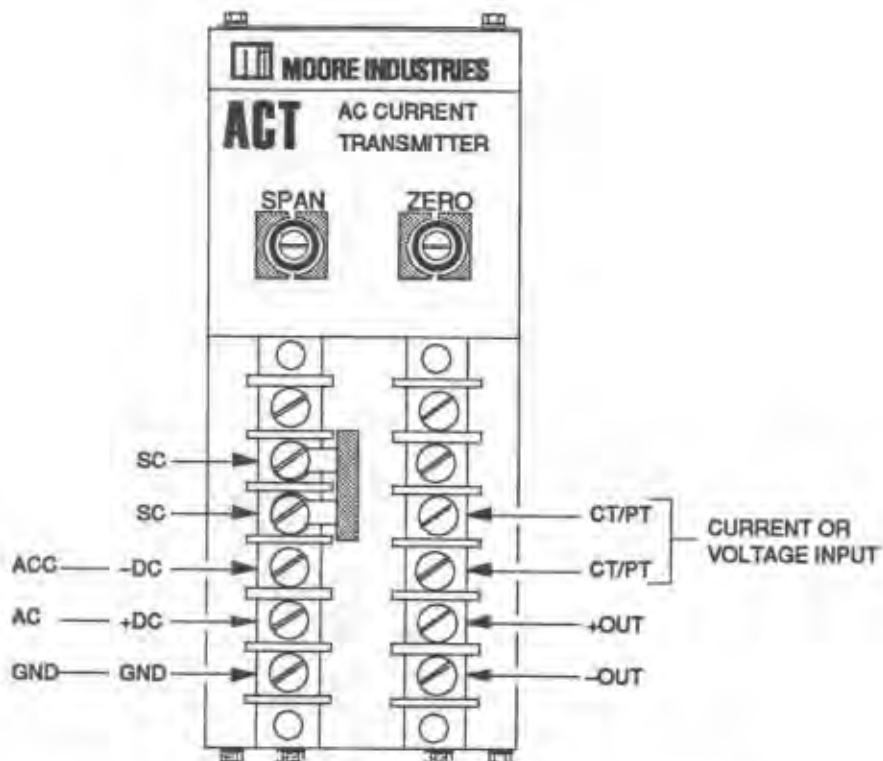
Equipment	Characteristic
Adjustable Input Source	Capable of producing the current or voltage range required for the specific product application
DC Power Source (for dc units only)	24 or 45 Vdc, $\pm 10\%$ (as required per unit configuration)
AC Ammeter	Accuracy of 0.05% or better; for monitoring specified input
AC Voltmeter	Accuracy of 0.05% or better; for monitoring specified input
DC Voltmeter	Accuracy of 0.05% or better; for monitoring output
Load Resistor	For measuring <i>current outputs</i> with a voltmeter. Tolerance, $\pm 0.01\%$ . Represents meter readings of 1-5 Vdc for: 1-5 mA output, 1000 $\Omega$ ; 4-20 mA, 250 $\Omega$ ; 10-50 mA, 100 $\Omega$ .
Screwdriver	Slotted-head, head width no greater than 2.54 mm (0.1 inch)

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.

The PPS (with CT Option) is designed to accept the PC unit and it provides terminals for connecting calibration equipment. 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 ACT and

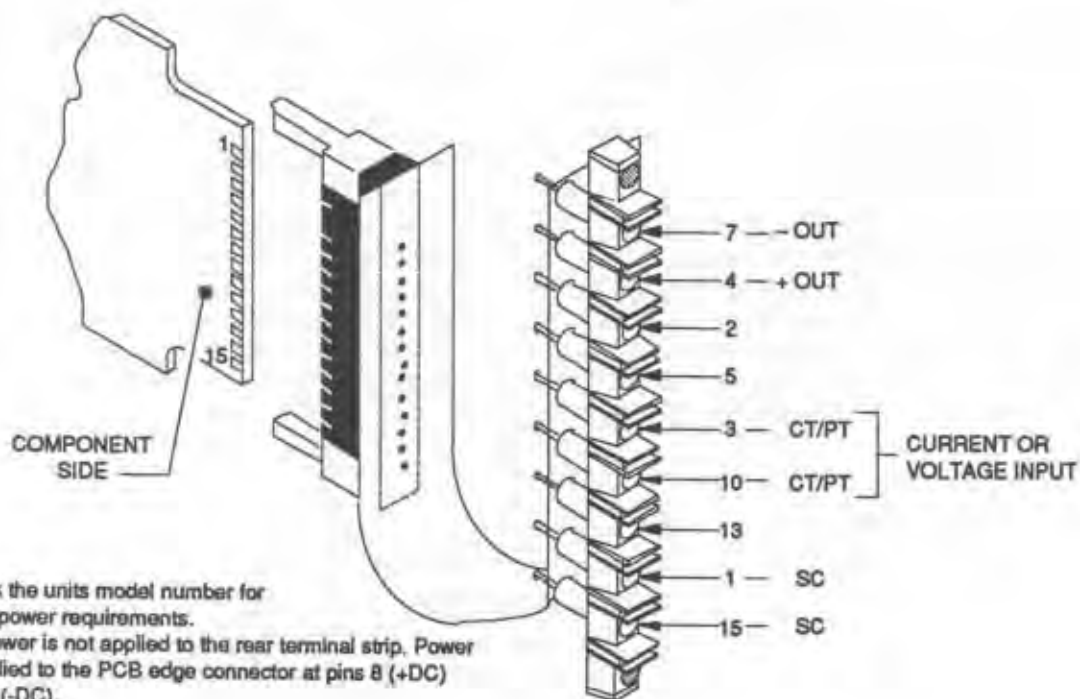
provides for connection of other calibration equipment. Figure 2 shows the terminal locations for the PC-style unit.

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 ACT straight out of the base 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 identifies the terminal locations for the EX terminal block.



**NOTE:** Each unit is factory-configured for ac or dc power as indicated in the model number.

*Figure 1. ACT STD Housing Terminal Locations*



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

Figure 4 is a calibration hookup diagram for the basic ACT (STD and PC). Figure 5 is for units with the EM Option. When connecting the calibration equipment to the ACT, be sure to observe the electrical connection polarities as indicated.

## 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 output is configured for. The following procedure is suitable for all ACT's.

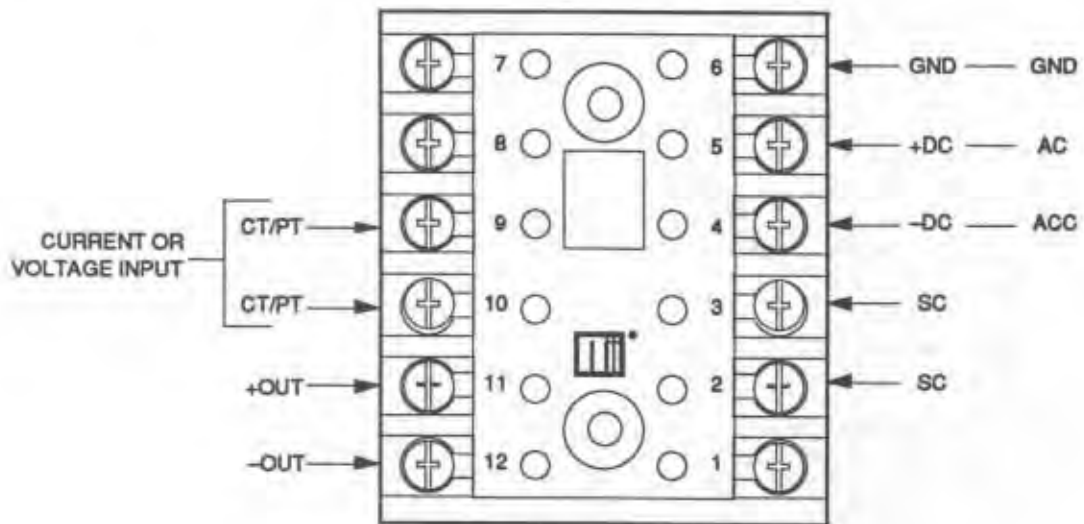
1. Connect ACT and calibration equipment as shown in figure 4 or 5 (refer to table 2).

### **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.*

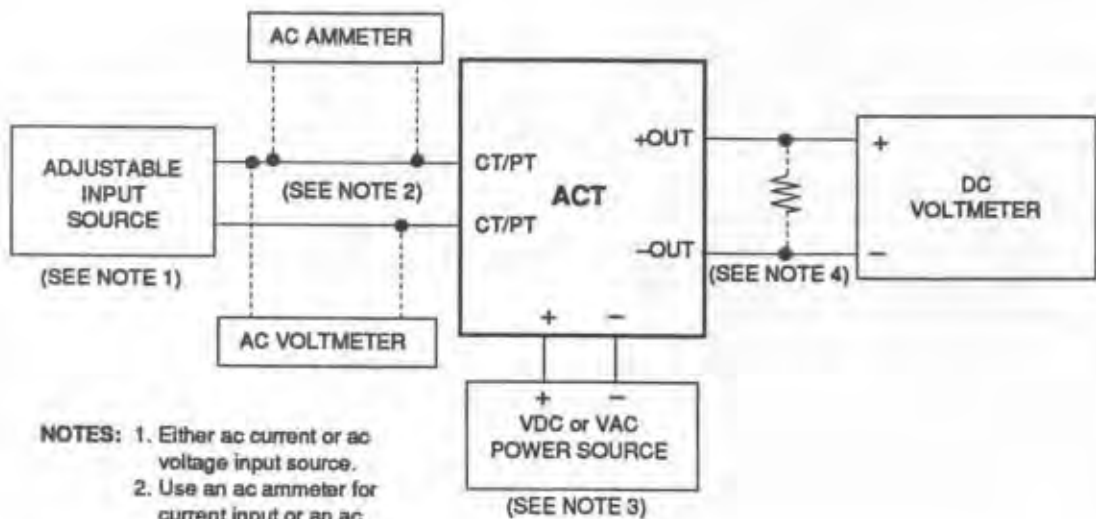
2. Apply power and allow ACT to warm-up for 5 minutes.
3. Set adjustable input source to zero-percent setting.
4. Monitor output to verify zero-percent output is as stated in model number.
5. Adjust ZERO potentiometer, as required, to bring zero-percent output to required setting.





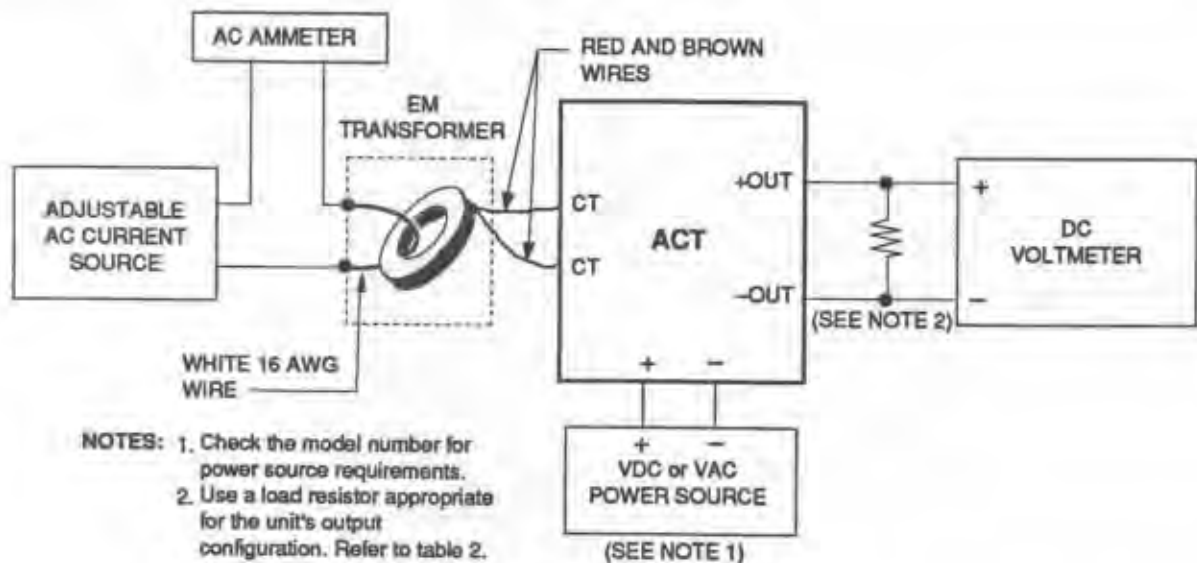
NOTE: Check the unit's model number for its power requirements.

Figure 3. ACT EX Housing Terminal Locations



- NOTES:
1. Either ac current or ac voltage input source.
  2. Use an ac ammeter for current input or an ac voltmeter for voltage input.
  3. Check the model number for power source requirements.
  4. For current outputs, use a load resistor appropriate for the unit's output configuration. Refer to table 2.

Figure 4. ACT Calibration Hookup Diagram (without EM Option)



*Figure 5. EM Option Calibration Hookup*

6. Set adjustable input source for required 100-percent input setting.
7. Monitor output to verify 100-percent output is as stated in model number ( $\pm 0.1\%$  of span).
8. Adjust SPAN potentiometer, as required, to bring 100-percent output to required setting.
9. Since zero and span are interactive, repeat steps 3 through 8 until zero- and 100-percent outputs are at the required levels when the input is changed from minimum to maximum without needing further adjustments.
11. Remove power and disconnect calibration equipment. This procedure is complete.

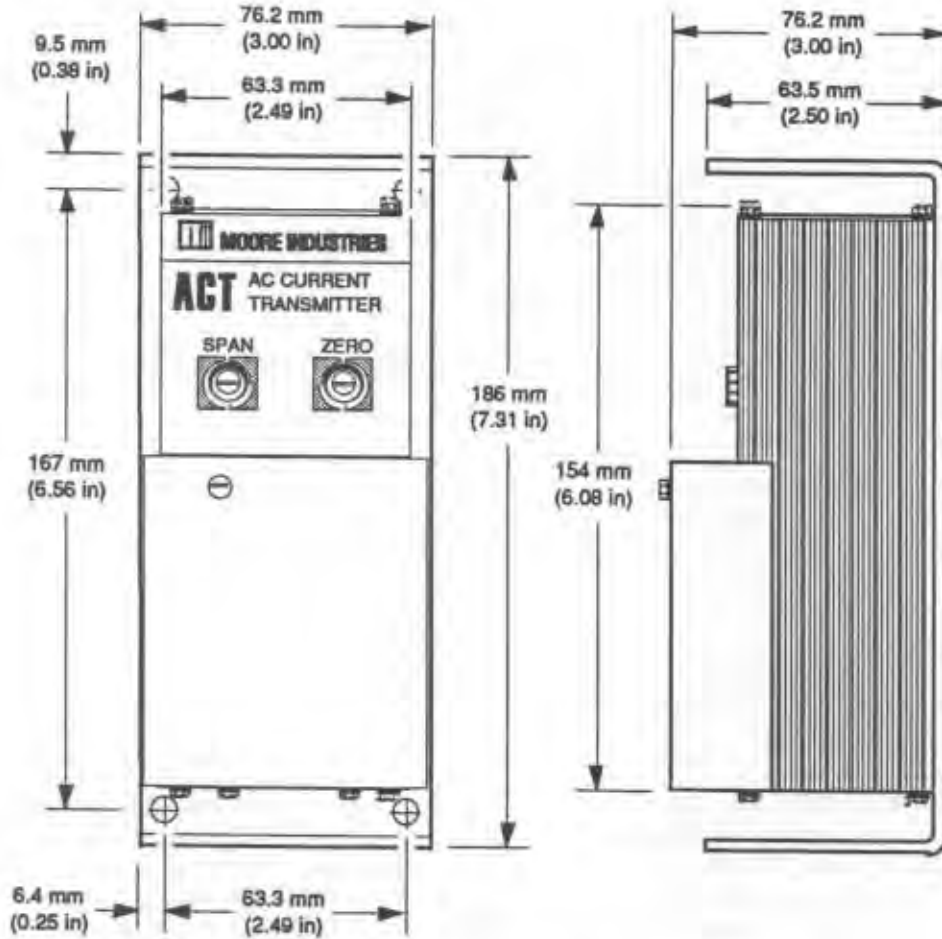
## Installation

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

### Mounting the ACT

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

The STD Housing outline dimensions are shown in figure 6. 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 alone are the primary dimensions to consider.



*Figure 6. STD Housing Outline Dimensions*

Variations of the STD Housing allow for mounting these devices on racks, rails, flat surfaces, and instrument panels. The EX Housing is designed for mounting inside a high-dome, explosion-proof enclosure.

Figure 7 is an outline dimension drawing of the PC Housing. This housing style is designed for mounting in one of Moore Industries' standard card racks (RMR or SMR).

## Making the Electrical Connections

Electrical connections to STD and EX units are made to individual terminals. Table 3 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.

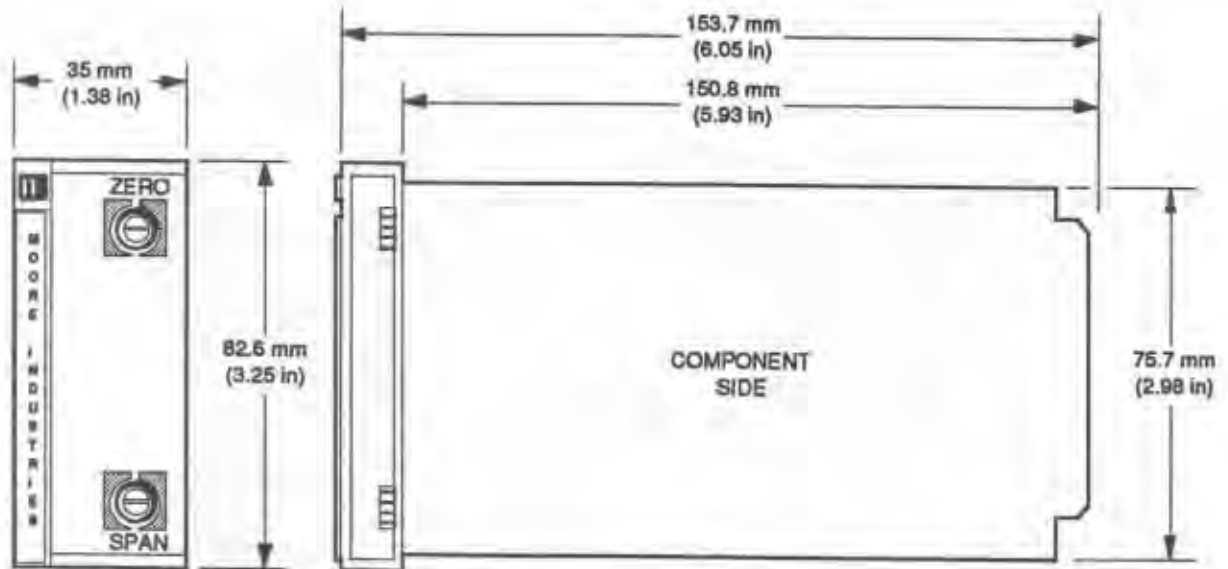


Figure 7. PC Housing Outline Dimensions

PC units mate with card-edge connectors inside the RMR or SMR. 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 on the outside of the rear panel. The numbering along the side of each external terminal strip corresponds to the edge connector contacts for each unit. The number adjacent to each individual terminal indicates which pin of the internal connector it is connected to.

Power is supplied to each PC unit via the power connections at the rear of the rack. They are factory-connected to each card-edge connector (pins 8 and 9). 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 4 lists the terminal assignments for the ACT in the PC Housing. See figure 2 in the Calibration Section for specific terminal locations.

Figure 8 is an installation hookup diagram for the ACT.

**The SC Output.** For units equipped with an SC output, ensure that the value of the resistor used is appropriate for your application, and that it is connected to the proper terminals. Refer to "ACT Controls" in the Calibration Section for SC resistor values.

**The EM Option.** Units equipped with the EM Option are supplied with an external transformer for reducing inputs rated in *amperes* to *milliamperes*. This transformer is accompanied by mounting hardware for securing it near the connection terminal strip.

To mount the EM transformer, a small hole must be drilled near the terminal strip; within a distance so the *red* and *brown* wires reach the input terminals. The drill hole must not be larger than 2.92 mm,  $\pm 0.13$  mm (0.115 in,  $\pm 0.005$  in). A nut, screw, and washer are provided to mount the transformer bracket. A *Ty Rap* is provided to secure the transformer to the bracket.

The installation hookup diagram (figure 8) shows the wiring connections required for the EM Option. Figure 9 shows the hardware orientation and usage.

**Table 3. ACT, STD and EX Housing Terminal Designations**

Configuration	Terminals											
	1	2	3	4	5	6	7	8	9	10	11	12
DC Powered STD/EX Units				-DC	+DC	GND			CT PT	CT PT	+OUT	-OUT
AC Powered STD/EX Units				ACC	AC	GND			CT PT	CT PT	+OUT	-OUT
Unit with SC Output		SC	SC	(NOTE)	(NOTE)	GND			CT PT	CT PT	+OUT	-OUT
<b>NOTE:</b> AC or dc power as stated in unit's model number.												

**LEGEND:** AC, AC power input  
 ACC, AC power return  
 CT, Current input (current transformer)  
 GND, Chassis ground  
 PT, Voltage input (potential transformer)  
 SC, Selectable current resistor  
 +DC, DC power input  
 -DC, DC power return  
 +OUT, Positive current or voltage output  
 -OUT, Negative current or voltage output

**Table 4. ACT, PC Housing Terminal Designations**

Configuration	Terminals (at rear of card rack)									
	7	4	2	5	3	10	13	1	15	
No Options	-OUT	+OUT			CT PT	CT PT				
Unit with SC Output	-OUT	+OUT	SC	SC	CT PT	CT PT				
<b>NOTE:</b> DC power is bussed to pins 8 (-) and 9 (+) of each internal card connector of the RMR or SMR, but is not present at the rear panel terminals.										

**LEGEND:** CT, Current input (current transformer)  
 PT, Voltage input (potential transformer)  
 SC, Selectable current resistor  
 +OUT, Positive current or voltage output  
 -OUT, Negative current or voltage output

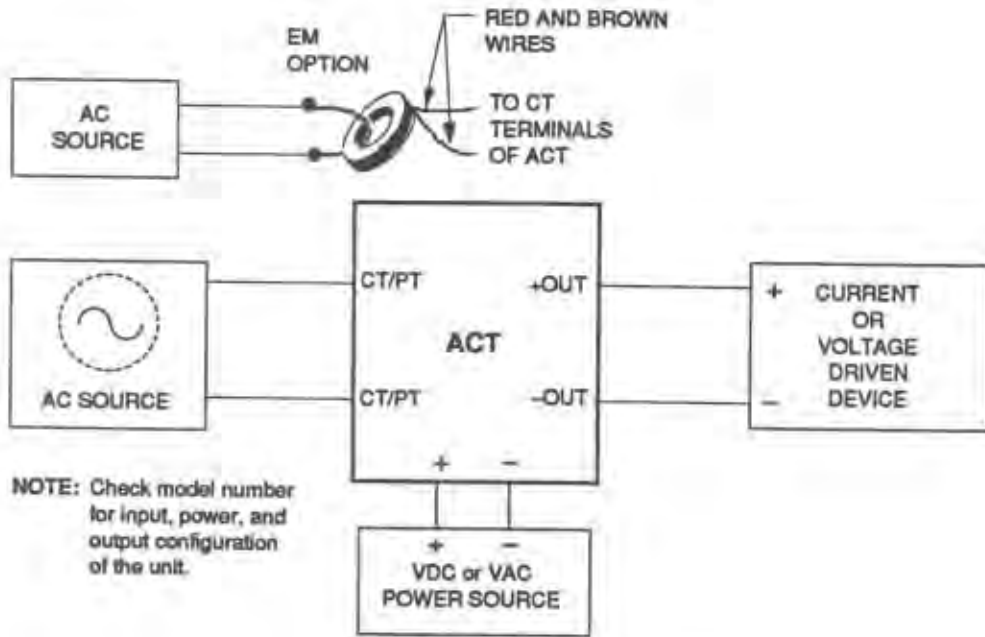


Figure 8. ACT Installation Hookup Diagram

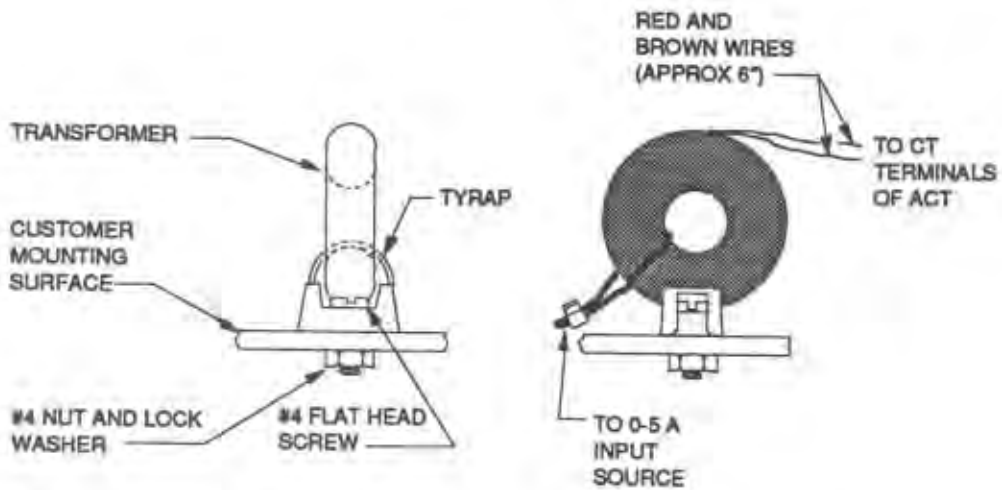


Figure 9. Mounting the EM Option Transformer

## Maintenance

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

Periodically, you may wish to check the performance of the ACT 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 ACT and monitor its output for a predictable result. If the output is out of tolerance or at an unacceptable level, perform the calibration procedures contained therein.

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

If an operational problem arises with the ACT or ACT, 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.

# 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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### 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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