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*Low-Power
Temperature Transmitter*

LRX

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Introduction

This is the user's manual for the Moore Industries LRX Low-Power Temperature Transmitter. It contains all of the information needed to configure, install, operate, calibrate and maintain this instrument.

About this Manual

Pay particular attention wherever you see a "**Note**", "**Caution**" or "**WARNING**".

Note— Information that is helpful for a procedure, condition or operation of the unit.

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

WARNING— Hazardous procedure or condition that could injure the operator.

The LRX

The LRX Low-Power Temperature Transmitter is specifically designed to operate in remote locations where 8-30Vdc is readily available via solar-powered batteries or a similar power source.

The LRX accepts 3-wire RTD, K-type thermocouple or direct millivolt inputs. It converts the input to a 1-5Vdc output signal that is proportional to the input.

The advanced circuit design of the LRX allows it to operate on 8-30Vdc with a nominal current consumption of 4mA.

The LRX is packaged in an all-aluminum hockey-puck (HP) housing. The standard HP housing is equipped with spring clips which hold the unit securely inside standard explosion-proof enclosures.

Model and Serial Numbers

Moore Industries uses the model and serial numbers of our instruments to track information on each unit that we sell and service. If a problem occurs with your instrument, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

Options

-RF Option

This is a factory-installed option. It provides immunity for the LRX from radio frequency interference (RFI) and electromechanical interference (EMI) as stated in the *Specifications* table.

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Specifications

<p>Performance</p> <p>Input Accuracy: $\pm 0.15\%$ of calibrated span (includes linearity, hysteresis and repeatability)</p> <p>Input Type: 3-wire RTD: 100 ohm Platinum RTD ($\alpha=0.00385$ ohms/$^{\circ}\text{C}$), 0-500$^{\circ}\text{F}$; K-type thermocouple: 0-2,500$^{\circ}\text{F}$; Direct millivolt input: up to 100mV</p> <p>Output Type: 1-5Vdc (proportional to input)</p> <p>Stability: 6 months: $\pm 0.15\%$ of calibrated span or 0.1$^{\circ}\text{C}$, whichever is greater</p> <p>Power Supply: 8-30Vdc</p> <p>Current Consumption: 4mA@12Vdc</p> <p>Load Impedance: 100 kohms, minimum</p>	<p>Performance (Continued)</p> <p>Ripple: Less than 10mVpp, maximum</p> <p>Power Supply Effect: $\pm 0.005\%/V$, maximum</p> <p>Overload Protection: Transient protection on output to 24V, reverse polarity on output</p> <p>Upscale Drive Limiting: 150% of span, typical; 160% of span, maximum</p> <p>Frequency Response: 5Hz (3dB point)</p> <p>Adjustments</p> <p>Zero and Span: Front panel potentiometers, $\pm 5\%$ of input span</p> <p>Ambient Conditions</p> <p>Operating Range: -45$^{\circ}\text{C}$ to +82$^{\circ}\text{C}$ (-49$^{\circ}\text{F}$ to +180$^{\circ}\text{F}$)</p> <p>Storage Range: -45$^{\circ}\text{C}$ to +100$^{\circ}\text{C}$ (-49$^{\circ}\text{F}$ to +212$^{\circ}\text{F}$)</p>	<p>Ambient Conditions</p> <p>Relative Humidity: 0-95%, non-condensing</p> <p>Ambient Temperature Effect: $\pm 0.02\%/^{\circ}\text{C}$, maximum</p> <p>RFI/EMI Immunity (Standard): 10V/m@80-1000MHz, 1kHz AM, when tested according to IEC61326 with error of 0.5% of span or less</p> <p>RFI/EMI Immunity (with -RF Option): 20V/m@80-1000MHz, 1kHz, when tested according to IEC61326 with error of 0.5% of span or less</p> <p>Weight 113.4 g (4.0 oz)</p>
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Specifications and information subject to change without notice.

Figure 1. LRX Dimensions

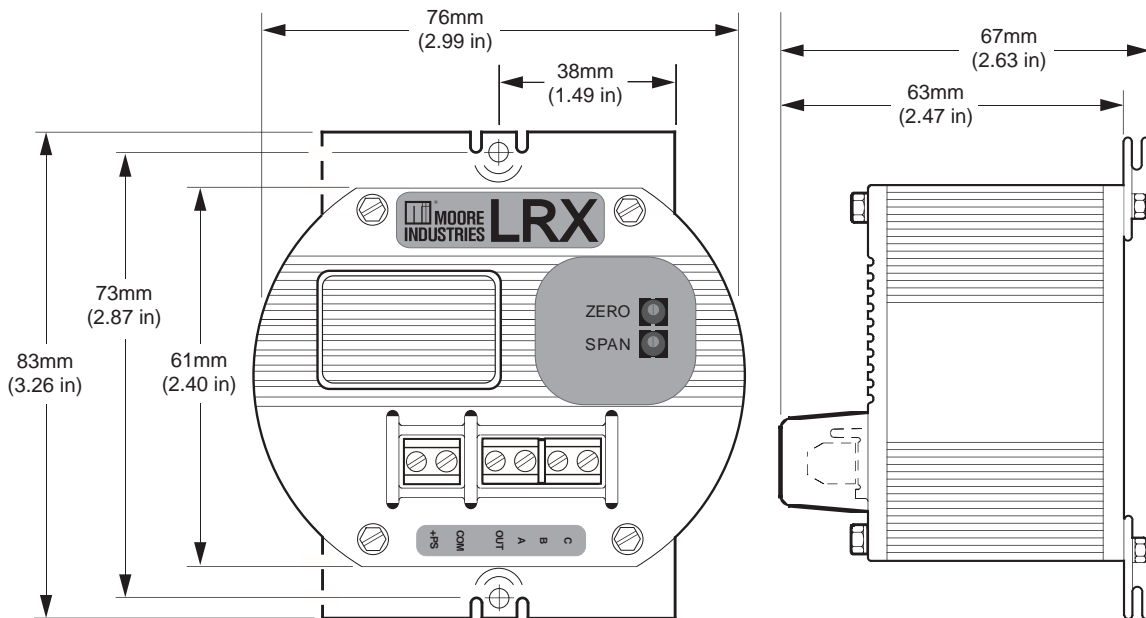


Figure 2. BH Enclosure Dimensions

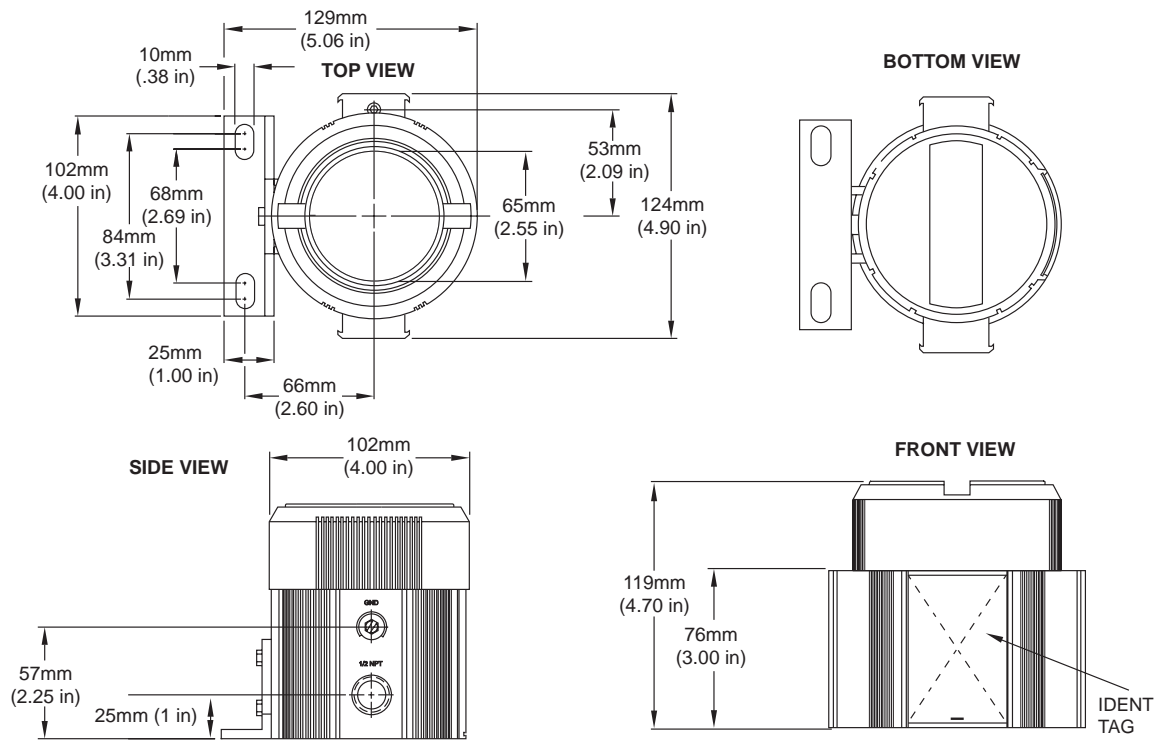
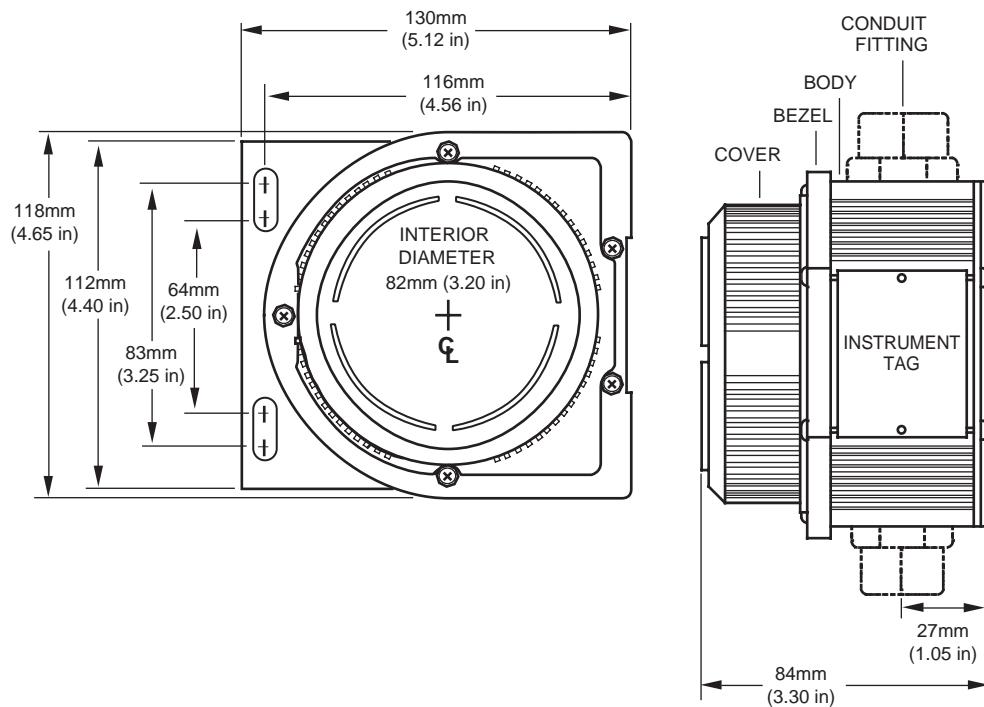


Figure 3. D-Box Enclosure Dimensions



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Calibration

Every LRX is calibrated and checked for proper operation at the factory prior to shipment.

The span and zero settings are the only field adjustments to be performed on the LRX.

Before placing the LRX into service, a general functional check and configuration verification is recommended. This check/verification involves setting up the unit for calibration and adjusting the SPAN and ZERO potentiometers, if necessary.

Zero and Span Adjustment

The ZERO and SPAN potentiometers, accessible on the front panel, are multiturn potentiometers that are adjustable with a slotted-head screwdriver.

This type of potentiometer usually requires 18 turns of the shaft to move the wiper from one end of its range to the other. It is equipped with a slip clutch at either end of its travel to prevent damage in case it is turned beyond the wiper stop. Usually, a slight change will be sensed when the clutch is slipping. However, if this change is not sensed, either end can be reached by turning the shaft 18 turns to the desired direction.

Turning the shaft clockwise increases the quantity or makes the respective output more positive. Turning the shaft counterclockwise makes the output become more negative.

Calibration Procedure

Refer to Table 1 for required calibration equipment. For calibration hook-up, refer to Figure 4.

1. Connect the LRX and calibration equipment as shown in Figure 4.

2. Apply power to the unit.

Note:

Each LRX is configured for the input and output specified in the unit's model number.

3. Set the input simulator (resistance box for RTDs; mV simulator for thermocouple) to a value equal to the minimum value of the actual signal input.

Caution:

The screwdriver used to adjust the Zero and Span potentiometers must have a blade no wider than 2.54mm (0.1 in). Use of a wider blade may permanently damage the potentiometer mounting.

4. With minimum signal applied to the input, adjust the ZERO potentiometer to obtain 0% output (1Vdc).

5. Set the input simulator to a value equal to maximum signal input.

6. With the maximum signal applied, adjust the SPAN potentiometer to obtain 100% output (5Vdc).

7. Repeat Steps 3 through 6 until no further adjustment of either ZERO or SPAN is required.

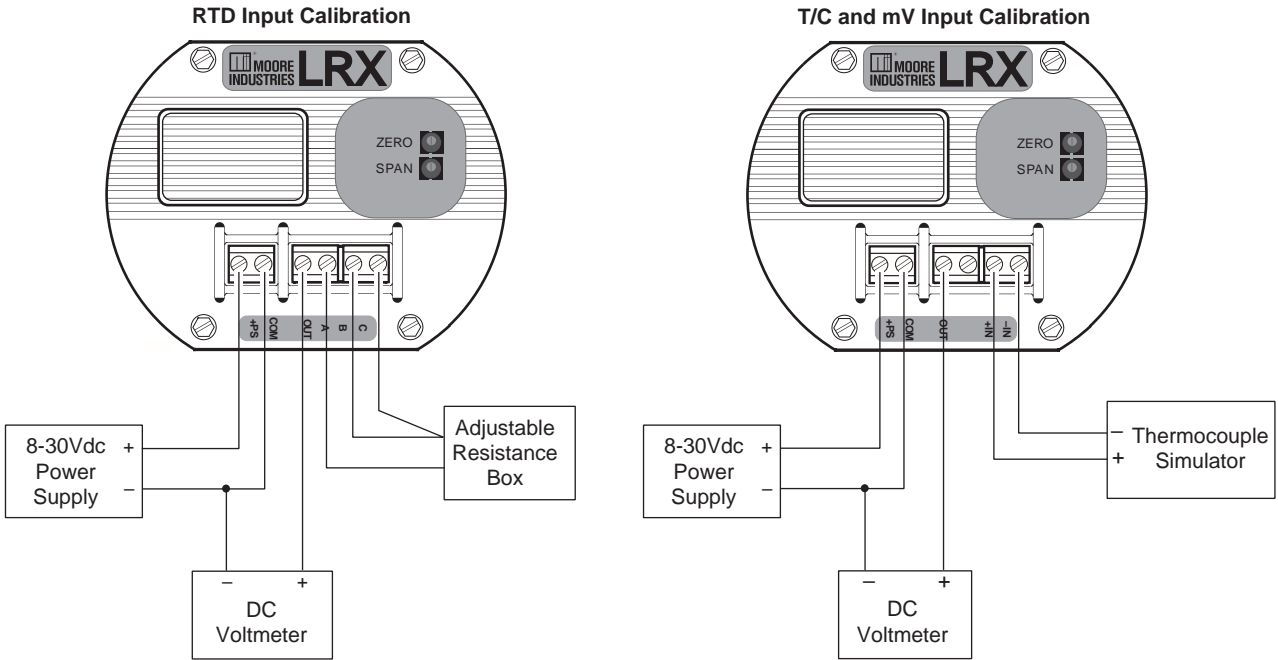
8. Using standard resistance-vs-temperature tables for an RTD (millivolt-vs-temperature tables for thermocouple) adjust the input simulator to several intermediate values and check that the output is linearly proportional to temperature ($\pm 0.15\%$ of the output span).

RTDs are linear with temperature; thermocouples are linear with millivolts.

9. Disconnect power and calibration equipment to the LRX.

The LRX can now be incorporated into your application.

Figure 4. Calibration Hook-Up



NOTES:

If the calibration equipment used provides only a 2-wire input, terminals B and C of the RTD input must be shorted together.

Table 1. Calibration Equipment Table

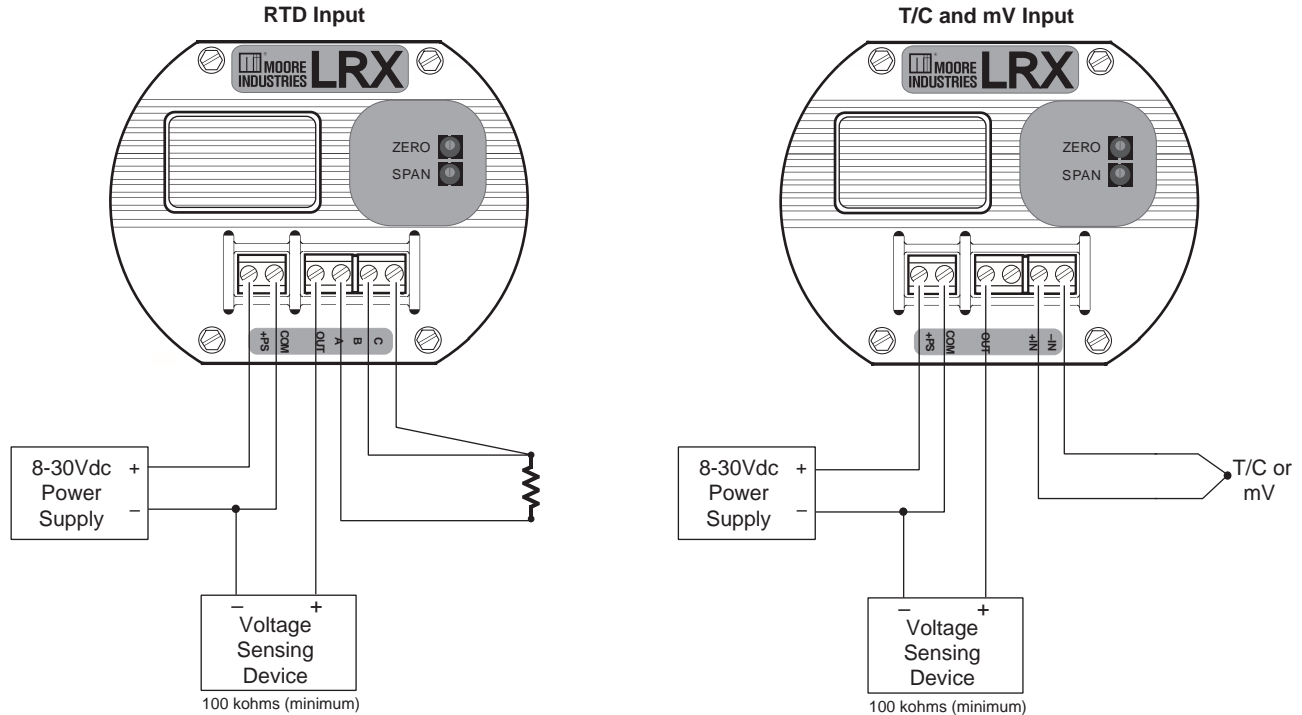
Device	Specifications
Adjustable Resistance Box	Must have accuracy of 0.05% or greater
Adjustable Thermocouple Simulator	Must have accuracy of 0.05% or greater
DC Voltmeter	Must have accuracy of 0.05% or greater
Power Supply	8-30Vdc
Screwdriver (slotted)	Blade width no greater than 2.54mm (0.1 in)

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Figure 5. Installation Hook-Up Diagram



NOTES:

1. If a 2-wire RTD is used, pins B and C of the LRX must be shorted together.
2. Terminal blocks can accommodate 14-22 AWG solid wiring.
3. Tighten terminals to four inch-pounds (maximum).

Installation

Installation consists of physically mounting the unit, grounding the instrument, and completing the electrical connections.

Once the proper power and input have been applied (refer to your instrument's model number for input configuration), the LRX will output a linear 1-5Vdc signal.

Mounting the LRX

The LRX will typically be mounted in an explosion-proof enclosure. Spring clips on the standard hockey-puck (HP) housing are used to hold the unit securely in place inside this type of enclosure.

Making the Electrical Connections

All electrical connections to the LRX are made to the terminals on the front of the unit. Special wire or cable is not required for signal connections. To avoid transient and stray pickups, it is recommended that twisted conductors be used where they run close to other services, such as power wiring.

The LRX is designed to operate directly from a DC power source. When connecting power leads to the +PS and COM terminals, be sure to observe the indicated polarity.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making any other connections.
- All input signals to, and output signals 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 itself.
- The maximum length of unshielded input and output signal wiring should be 2 inches.

CE Conformity

Installation of any Moore Industries' products that carry CE certification (Commission Electrotechnique) **must** adhere to the guidelines in *Recommended Ground Wiring Practices* (above) in order to meet the requirements set forth in applicable EMC (Electromagnetic Compatibility) directives 89/336/EEC, EN 61326. Consult the factory for the most current information on products that have been CE certified.

Operation

Once calibrated, installed and supplied with the correct power, the LRX begins to operate immediately. The only controls on the outside of the unit are the SPAN and ZERO potentiometers, which, after final adjustment, need no further attention. Depending upon environmental conditions, the LRX can be expected to operate unattended for extended periods of time.

Maintenance

Maintenance of the LRX is limited to keeping the terminals clean and tight, and ensuring there is adequate ventilation or heat dissipation for the unit. Moore Industries suggests a check for terminal tightness and

general unit condition every six months. Always adhere to any site requirements for programmed maintenance.

Calibration Interval

Calibration is recommended to be performed once per year.

Troubleshooting

Troubleshooting the LRX involves determining if the unit is performing to specifications. If a unit's performance is suspect the following items should be checked before performing the calibration procedure:

1. Verify that all electrical connections are clean and tight.
2. Verify that the instrument providing the input voltage or current is of proper range and accuracy.
3. Verify that the output circuit is electrically isolated from the input circuit.

If a problem still exists, the LRX calibration procedure should be performed. The equipment specifications for the LRX are listed in Table 1 and should be referred to while evaluating the unit's performance.

It is recommended that any unit found to be performing below specification be returned to the factory for service in accordance with the instructions on the back cover of this manual.

Customer Support

If service assistance is ever required for an instrument in your application, refer to the back cover of this manual for the telephone numbers to Moore Industries' STAR Center customer service department.

If possible, make a note of the model number of the offending unit before calling. For fastest assistance, have the following available: serial number and the job and purchase order number under which it was shipped.

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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