MOORE INDUSTRIES

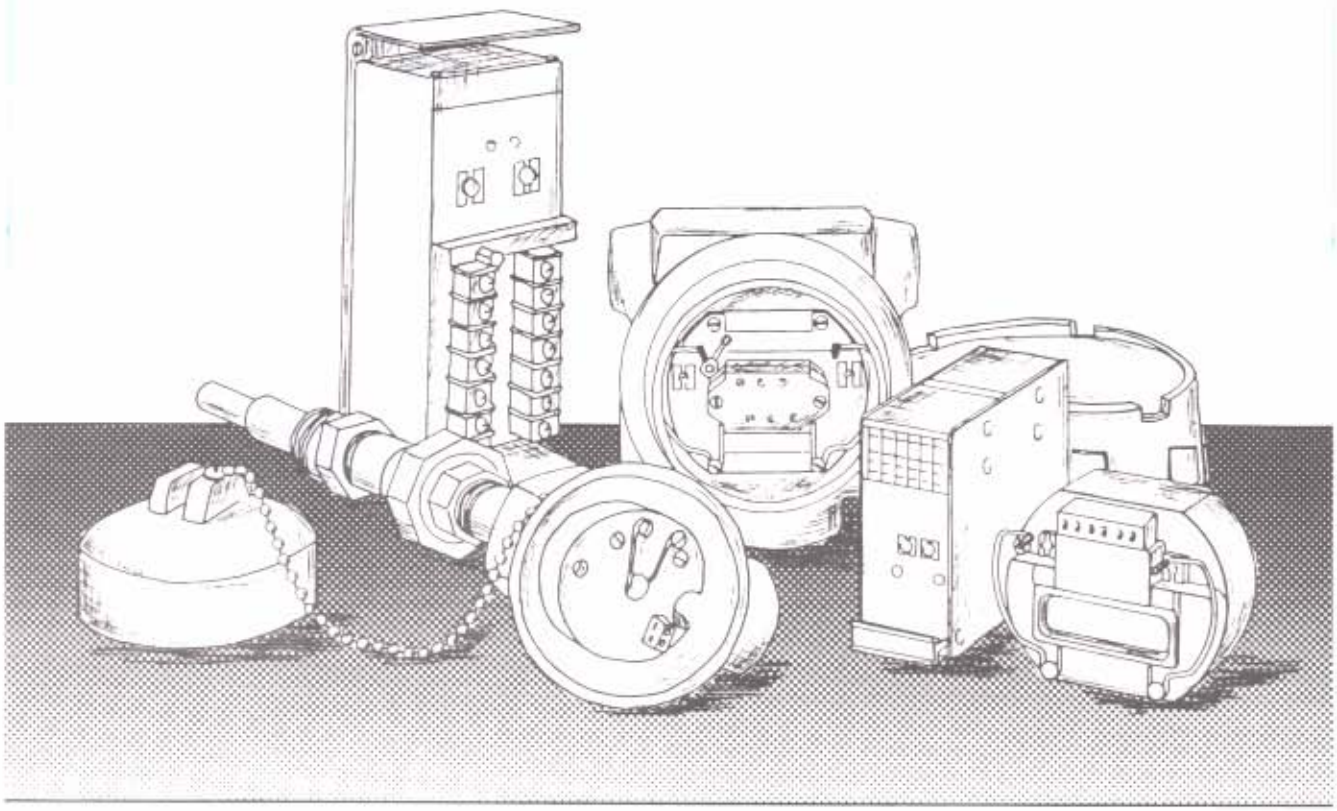
INSTRUCTION MANUAL

DSM

Digital Scaling Module

Form 157-701-00G

May 1988



Description

Introduction

The Moore Industries Digital Scaling Meter (DSM) is a single channel, microprocessor-controlled, digital panel meter for the display of analog bi-polar voltages or currents. It is a line operated meter with a 7-segment, 4-digit readout. The 13 mm high display has a ±9,999 count resolution.

The unit normally reads 0.0 to 100.0%; however, it can be offset and scaled to read in engineering units. Engineering unit labels are provided on the front panel.

The meter incorporates a self-calibration feature that ensures long term stability. This is achieved through the use of a stable reference and digital self-calibration circuit. The self-calibration is accomplished every 4 seconds by comparing the voltage reference to a calibration factor stored in the non-volatile memory of the unit. The calibration factor is derived by comparison of the internal voltage reference to a known voltage/current standard (this is done at the factory).

Available options include a three-state, parallel BCD output with 1400Vpk isolation to the signal input.

Installation

Introduction

The DSM is available in an industrial case. A Neoprene gasket seals the unit to the panel conforming to the NEMA 12 oiltight standard. The front panel can be hosed down for cleaning, and the rear panel is drip proof.

Mechanical Installation

Although each unit is designed for convection cooling, it is advisable to mount the unit on a surface made of material that can serve as a heat sink. The unit should be located in an area that is protected from dust, moisture, and corrosive atmospheres.

Electrical Connections

All electrical connections on standard units are made to the terminal blocks on the unit.

Figure 1 depicts the connections made to the P1 edge connector on the main logic board. For dc operation, see figure 1, but connect +V Input to either pin 2 or pin B on the P1 edge connector. Connect V Return to either pin 4 or pin D on the P1 edge connector. Connect shield drain wire to pin 5.

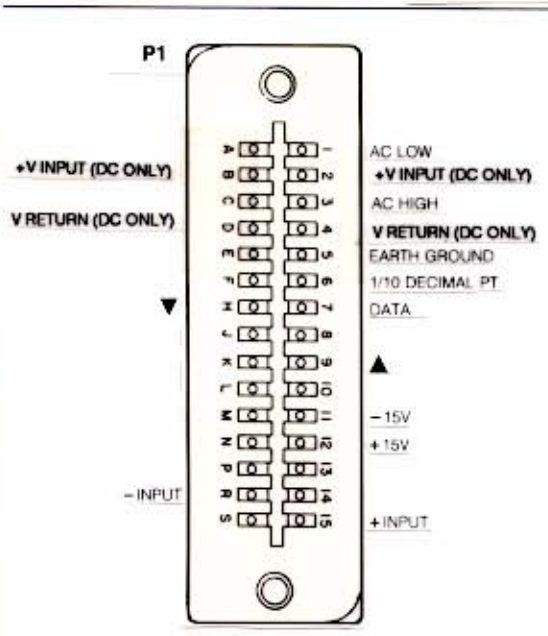


Figure 1. *P1 Connections*

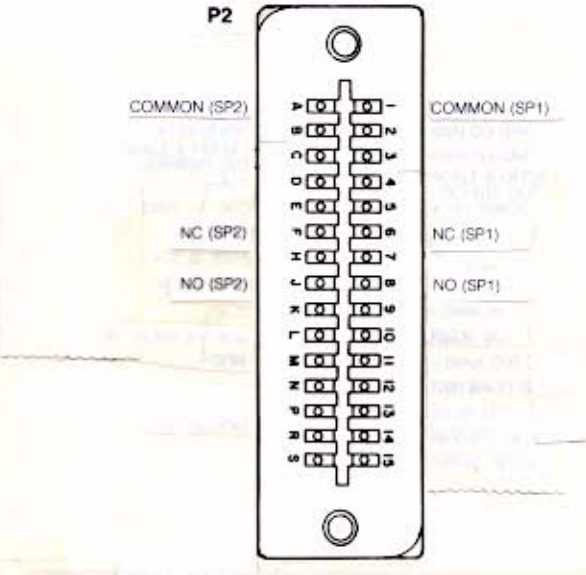


Figure 2. *-C Option Connections (P2)*

Important Note: This document is complete as of the printing date; however, subsequent product changes may be reflected in companion documents.

Specifications

Characteristics

Display
Type: 7-segment, vacuum fluorescent; 0.5" (13mm)
Format: 4 (±9999 counts)
Rate: 2 updates per second
Decimal Point: One of 4 selectable positions (factory set)
Polarity Indicator: Automatic plus and minus signs
Overload Indicator: Display reads "OFLO"

Performance
Ambient Temperature Range (span): 50 ppm of reading/°C maximum
Operating Temperature: 0-50°C
Storage Temperature: −40°C to +85°C (−40°F to 185°F)
Relative Humidity: 20-80% noncondensing
Input Impedance: Voltage—10 megaohms
4-20mA—50 ohms
10-50mA—20 ohms
Normal Mode Rejection: 60dB at 50/60Hz
CMRR: >80dB at 50/60Hz
CMV: ±1400VpK
Maximum Differential: 20V without damage
Total Error: ± .02% Reading ± .005% Range ± 1 count

Case
Material: High impact plastic
Bezel Dimensions (W × H): 3.83" × 2.015" (97,28 × 51,18mm)
Depth Behind Bezel: 5.34" (135,64mm)
Panel Cutout: 3.63" × 1.772" (92 × 45mm)
Weight 14.5 ozs. (410 grams)

Ordering Specifications

Unit **DSM**
Input **Current:** 0 to 20mA, 4 to 20mA, 10 to 50mA
Voltage: 0 to 5V, 1 to 5, 0 to ±10V
Power **Input Voltage:** 120V or 240Vac + 10%, −15% 50/60Hz (user changeable)
Options **-BCD** Parallel, isolated outputs
-C Form C relay output dual high/low
Housing **P** Plastic

Model number description: Unit / Input / Power / Option [Housing]

120/240 Volt Operation

The unit is factory configured for 120 or 240Vac operation.

Enable Digital Limits Form C Relay Output (Option C)

Option C provides high and low limit and alarm setpoints for two Form C relay outputs, giving the meter a total of four setpoints with deadband (hysteresis). These setpoints are programmed via the front panel keypad.

Limit and alarm settings are prioritized from highest priority to lowest priority as follows: HIGH ALARM, LOW ALARM, HIGH LIMIT, LOW LIMIT. A higher alarm will pre-empt a lower limit.

When input exceeds a limit or alarm setpoint, the meter goes into an alarm condition. During an alarm condition, the alarm reading (high or low) and the limit/alarm exceeded (SP1H, SP1L, SP2H, SP2L) flashes from the display to alert the operator. The relay output is activated.

Alarm Messages

HI SP1 ALARM is on. SP1H exceeded. Display also flashes reading.
LO SP1 ALARM is on. SP1L exceeded. Display also flashes reading.
HI SP2 ALARM is on. SP2H exceeded. Display also flashes reading.
LO SP2 ALARM is on. SP2L exceeded. Display also flashes reading.
HI HI SP1 and SP2 ALARMS are on. SP1H and SP2H exceeded. Display also flashes reading.
LO LO SP1 and SP2 ALARMS are on. SP1L and SP2L exceeded. Display also flashes reading.
HI LO SP1 and SP2 ALARMS are on. SP1H and SP2L exceeded. Display also flashes reading.
LO HI SP1 and SP2 ALARMS are on. SP1L and SP2H exceeded. Display also flashes reading.

Connections

Option C enables the meter to control two form C isolated, dry contact relays, each output capable of 5A at 30Vac or dc. Refer to figure 2.

SP1H (Limit High) SP1L (Limit Low) contacts are available on pins 6 and 8 on the P2 connector. SP2H (Alarm High) and SP2L (Alarm Low) contacts are available on pins F and J on the P2 connector.

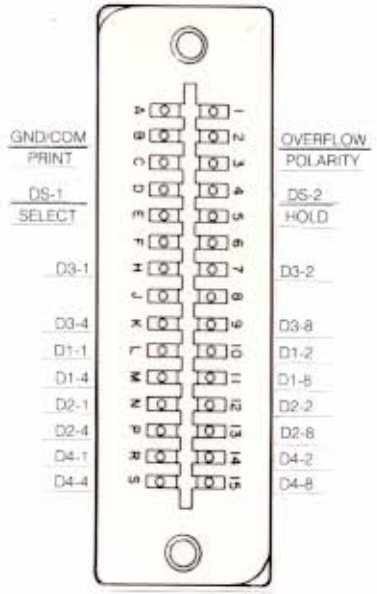


Figure 3. -BCD Option Connections

Parallel BCD Output

The BCD Parallel Interface Connector is located at the rear of the unit. See figure 5.

Logic LOW level "0" = +0.4 volts maximum at 1.6mA sink.
Logic HIGH level "1" = +2.4 volts minimum at 100 microamps source.

See table 1 for BCD connector pin designations.

20 BCD LINES — The data outputs are parallel BCD, one TTL load compatible, and valid while SELECT (pin E) is low.

PRINT (pin C) — When an update cycle begins, this pin goes logic HIGH; when the update cycle ends, the pin goes logic LOW.

POLARITY (pin 3) — A logic LOW indicates a positive reading.

HOLD (pin 5) — When this pin receives a logic LOW, the meter maintains present BCD output until a logic HIGH is applied. Processing continues while the meter is in the HOLD state.

SELECT (pin E) — When this pin recieves a logic LOW, the state of the 20 BCD lines is checked. If all the BCD lines are HIGH, the unit writes to the BCD lines and PRINT (pin C) goes LOW. If any of the BCD lines are LOW, the unit does not write and PRINT remains HIGH.

Table 1. BCD Connector Pin Designation

Pin	Output		Pin	Output	
L	1		R	1	
10	2	D1	14	2	D4
M	4		5	4	
11	8		15	8	
N	1		D	1	
12	2	D2	4	2	D5
P	4				
13	8		C	Print	
			3	Polarity	
H	1		5	Hold	
7	2	D3	E	Select	
K	4		2	Overflow	
9	8		B	Ground	

OVER FLOW (pin 2) — When a reading is greater than full scale, this pin goes logic HIGH.

Periodic Inspection

Once adjusted and installed, the Digital Scaling Meter operates unattended. Because each unit uses highly reliable solid-state components, the meter operates maintenance free for extended periods of time. If, at a future time, a malfunction is isolated to the power supply, refer to the troubleshooting procedures.

The DSM should be recalibrated after one year of operation, although specified accuracy is maintained much longer. Most component settling values occur in the first year. Thereafter, specified accuracy is maintained for at least three years, due to internal auto-calibration.

A meter may become warm during operation, especially where the ambient temperature is above normal. This is acceptable and should not cause alarm unless a malfunction is also observed.

Calibration

Test Equipment Setup

After a Digital Scaling Meter is unpacked, general operating level checks are recommended. The operation check consists of connecting the unit to the primary power source and checking for the correct display.

The test equipment must be provided by the user. A voltmeter or milliammeter is required for the general setup configuration. Access the calibration terminals through the terminals provided on the I/O connector P1.

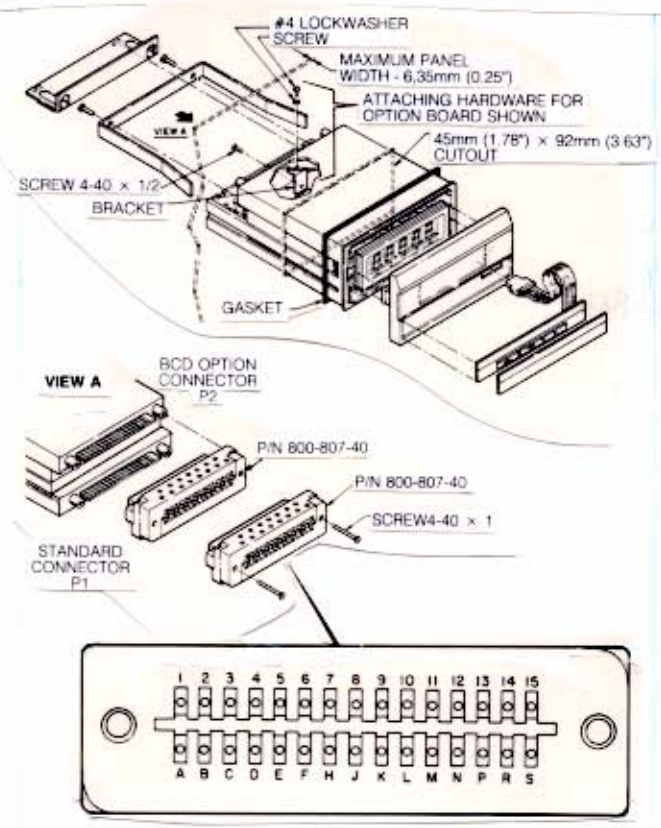


***Figure 4.** Unit Disassembly*

Operation

Introduction

This section describes how to operate the DSM using the front panel keypad.

The front panel keypad is used in conjunction with the setup program. The setup program allows the user to select scaling and offset parameters.

There are three front panel keys:

S Set/Step. Used to scroll through the set parameters or to enter a parameter value.

▲ Increment. Used to increase a displayed value or toggle between two or more display choices. Continuously press this key to rapidly increase the displayed value. Hold key for highest reading that occurred while meter was on.*

▼ Decrement. Used to decrease a displayed value or toggle between two or more display choices. Continuously press key to decrease displayed value.

*Run mode only

Setup Prompts

The following setup prompts will appear from the front panel display during the SETUP MODE:

SETUP INPUT	Standard
SP 1H SP 1L SP 2H SP 2L HYS	Option -C
OFFSE SCALE dP RUN	Standard

Setup Program

During the setup mode, parameters and values are entered into the meter's temporary memory until the normal run mode is entered at the end of the setup cycle. At that time, temporary memory is transferred to nonvolatile memory.

Note

Two minute entry time...

During the Setup Mode, the meter allows only 2 minutes between keystrokes to enter or change a parameter. If 2 minutes lapse without a keystroke, the meter automatically returns to the Run Mode and erases any temporary memory without changing nonvolatile memory.

Setup Program

Three front panel switches: **S** starts the setting sequence and acts as an enter key. ▲ increments numerical display values up; ▼ decrements values down.

1. Press **S**. Display shows SETUP. For protection, enter the Code (28) using ▲ to increment displayed value to match factory preset code.

Note

An easy way to get to 28 is to press ▲ until 30 is displayed, then press ▼ twice to decrement the display to 28.

2. Press **S**. Display shows value of input.
3. Press **S**. See **SP 1H**. Display means enter value of Setpoint 1 High limit (SP 1H).
4. Repeat three more times to set **SP 1L**, **SP2H**, and **SP 2L**.
5. Press **S**. See **HYS**. Enter the Hysteresis (deadband) value using the ▲ or ▼ switches.

[6] Press **S.** Display shows OFFSE. Apply your offset value and run ▲ or ▼ to your desired reading.

[7] Press **S.** Display shows SCALE. Apply full scale value and run display ▲ or ▼ to equal your desired span.

[8] Press **S.** Display shows dP. Position the blinking decimal point using ▲ or ▼ switches. Press S to enter.

[9] Press **S.** Display shows RUN. The values and setpoints are now entered into nonvolatile memory (no batteries).

[10] If you see OFLO, display indicates overrange condition.

[11] An alternating display of the reading and **HI** and **LO** indicates a setpoint has been exceeded.

To change a setting, just Scroll (S) through to the step you want to change. Skip whatever you wish.

To exit the Setup Mode, press **S.**

To stay in the Setup Mode, press and hold **S** - when RUN is displayed, then release **S** when one of the other setup parameters appears.

Set Digital Offset and Scale

Display values for scale and offset are entered during setup. There are two methods to derive scale and offset values. Method 1 is a comprehensive, instructional method which is used when input is NOT connected. When input is connected, Method 2 is used.

Method 1

Formula 1: Calculate the Display Value

$$Y = mx + b \text{ (Display = scale } \times \text{ input) + offset}$$

y = Display
m = scale
x = input
b = offset

Formula 2: Calculate the Scale Factor

$$\text{Scale (m)} = \frac{\text{Display High} - \text{Display Low}}{\text{Input High} - \text{Input Low}}$$

Display High = Desired high reading in counts. (disregard decimal).
Display Low = Desired low reading in counts.
Input High* = Normal reading (no scale factor) from high process input, in counts.
Input Low* = Normal reading (no scale factor) from low process input, in counts

* See table 2.

Table 2. Sample Scale Factor, Input/Reading Table

Model: DSM / 4-20MA / 2000. – 9999. LBS / 117AC [P]				
Shunt Resistor 50Ω @ 4-20 mA or 20Ω @ 10-50 mA	Typical Display Low Values		Typical Display High Values	
	Input	**Reading**	**Input**	**Reading**
	4mA	2000	20mA	10,000
Model: DSM / 1-5V / 1000. – 5000. LBS / 117AC [P]				
Shunt Resistor --	Typical Display Low Values		Typical Display High Values	
	Input	**Reading**	**Input**	**Reading**
	1V	1000	5V	5000

EXAMPLE A:

DSM / 4-20MA / 2000 – 9999 LBS / 117AC [P]
(50 ohm shunt)

Input = 4 to 20 mA
Display = 0 to 100.0

Display High = 1000 counts (disregard decimal)
Display Low = 0
Input High = 10,000 counts (direct reading with no scale or offset: DSM with 20mA input will display 9999)
Input Low = 2000 counts

$$\text{(scale) } m = \frac{1000 - 0}{10{,}000 - 2000} = \frac{1000}{8000} = 0.1250$$

Formula 3: Calculate the offset factor

Note

The scale factor must be calculated before the offset factor can be calculated.

$$\text{Offset} = \text{Display Low} - (\text{Scale} \times \text{Input Low})$$

Using Example A (from calculating scale):

Display Low = 0
Scale Factor = .1250
Input Low = 2000

(Offset) b = 0 – (.1250 × 2000) = 0 – 250 = –250

Method 2

Note

Method 2 is used when input is connected.

Proceed as follows:

[1] Enter access code (Display: INPUT)

[2] Apply a zero or Process Low load to transducer.

- Note the actual meter reading, disregarding decimal point. This is the Input Low value.
- Note the desired meter reading at this point (disregarding decimal). This is the Display Low value.

[3] Apply a known load to the transducer (preferably close to maximum transducer output).

- Note the actual reading, disregarding decimal. This is the Input High value.
- Note the desired meter reading at this point (disregarding decimal). This is the Display High value.

[4] Calculate Scale Factor:

$$\text{Scale} = \frac{\text{Display High} - \text{Display Low}}{\text{Input High} - \text{Input Low}}$$

[5] Calculate Offset Factor:

$$\text{Offset} = \text{Display Low} - (\text{Scale} \times \text{Input Low})$$

[6] Enter these values as per procedure in manual.

Maintenance

Introduction

All units found to be performing below specifications should be immediately returned to the factory for service in accordance with the instructions found in this manual.

In an emergency, the user may contact the Customer Service department for verbal assistance in diagnosing and repairing a problem.

Terminal Connections

The design of the DSM limits maintenance primarily to keeping the input and output terminals and conductors clean and tight. This is accomplished by installing the unit in an area protected from dust, heat, moisture, and corrosive atmospheres. A thorough cleaning of terminal blocks requires complete disassembly and should be done at the factory. It is recommended that the user check the terminations every six months of service to verify that they are secure and free of oxidation.

Troubleshooting

If a problem is suspected with a DSM, review the following procedures:

a. Verify that all electrical connections are clean and tight.

b. Verify that the measuring instrument used for output voltage is of the proper range and accuracy.

If the problem still exists after correcting any problems in the previous list, the unit may be defective and should be returned to the factory for repair in accordance with the instructions found in this manual.

Return Procedures

Should it become necessary to obtain factory repair of Moore Industries equipment, proceed as follows:

[1] Notify the local Moore Industries sales representative or the factory marketing representative that you are returning equipment for repair. At this time, please furnish the Moore Industries representative with model and serial numbers of the affected equipment.

[2] Carefully pack the equipment to be returned in a sturdy container with sufficient packing material to insure that no damage will occur.

[3] In a cover letter or note, describe completely:

- The symptoms that indicate the equipment needs repair.
- The environment in which the equipment has been operating (weather, vibration, temperature, dust, etc).
- Approximate number of operating hours or approximate date of installation, if known.
- Complete shipping information for the return of the equipment to you.
- Name and phone number of person to contact if questions arise.

[4] Enclose cover letter, packing lists, copies of rejection or discrepancy reports, if available, purchase order or purchase order number, and ship the equipment to the nearest address on the back cover.

The equipment will be carefully inspected and tested at the factory. You will be contacted by the Moore Industries representative if further information is required.

In case of repair pursuant to Moore Industries' return policy, the defective unit will be either repaired or replaced, or the purchase price refunded, at Moore Industries' option. The unit or its replacement will be returned to you in accordance with the shipping instructions furnished in your cover letter.

In other cases, the Moore Industries representative will advise you of the repair cost and estimated return date, if this information is requested in your letter. Repair in such instances must be authorized by a purchase order number before it can be repaired and 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.

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