

**PC-Programmable MODBUS
Signal Converter**

TMZ



*Left: TMZ TPRG: PC-Programmable MODBUS Temperature Transmitter
Right: TMZ HLPRG: PC-Programmable MODBUS Signal Converter*

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TMZ

PC-Programmable MODBUS
Signal Converter

Introduction

This is the users' manual for the Moore Industries TMZ PC-Programmable MODBUS Signal Converter (HLPRG: Volt and Milliamp input limits). It contains all of the information needed to configure, install, operate and maintain this instrument.

About this Manual

Wherever you see a "**Note**", "**Caution**" or "**WARNING**" pay particular attention.

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

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

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

The TMZ

The TMZ is a PC-Programmable, user-configurable, signal converter. It has a digital output and retains the high accuracy of an Analog to Digital converter without the limitation of low resolution which is associated with analog outputs. The multi-drop nature of the RS-485 port allows the connection of up to 32 units on a single drop of cable that consists of two pairs of wires. The TMZ has a READY LED to indicate the health of the unit and an INPUT LED to indicate status.

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 TMZ, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

Inputs

The current input range of your unit is from 0-50mA. The voltage input range is from 0-10V.

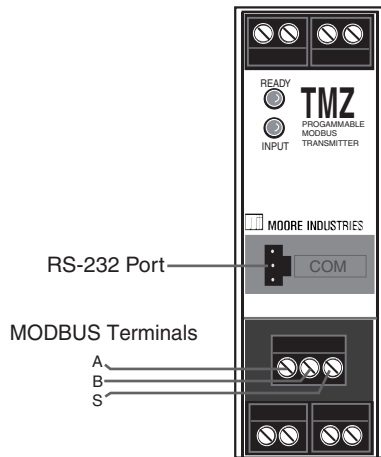
Outputs

The TMZ has a standard RS-485 port that supports the MODBUS RTU protocol.

TX Power

A transmitter excitation power supply is standard on your unit. You may access it externally at the terminals shown in Figure 3. This is a regulated 24Vdc power supply @ $\pm 3\%$ and 24mA max.

Figure 1. The TMZ (HLPRG)



Specifications

<p>Performance</p> <p>Input Accuracy: Current, $\pm 0.01\%$ of max. span ($\pm 2 \mu\text{A}$); Voltage, $\pm 0.01\%$ of max. span ($\pm 1\text{mV}$)</p> <p>Overall Accuracy: The overall accuracy of the unit is the input accuracy. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution.</p> <p>Stability: See Table 1</p> <p>Response Time: INPUT UPDATE TIME: 128msec; MODBUS POLLING TIME: Dependent upon how fast and how often a MODBUS master requests data</p> <p>Isolation: Standard unit, 1000Vrms between case and input. 1500Vrms between power and input; WITH -RF OPTION, 500Vrms between case, input and power</p> <p>Power Consumption: 1W max.</p> <p>Input Impedance: Current, 20ohms; Voltage, 1.1Mohms</p> <p>Input Over-Range Protection: Current, $\pm 100\text{mA}$; Voltage, $\pm 30\text{Vdc}$</p>	<p>Communications</p> <p>Type: Standard MODBUS RTU protocol interface over RS-485 (parameters as specified in U.S. Standard EIA-RS485)</p> <p>Address Range: Configurable from 1 to 247. Unit will assume a MODBUS address of 01 by default.</p> <p>Baud Rates: Interface supports the following: 300, 600, 1200, 2400, 4800, 9600, 19.2k and 38.4k</p> <p>Character Format: One start bit, 8 data bits and one stop bit</p> <p>Indicators</p> <p>LED Type: INPUT LED: Dual color LED indicates input failure READY LED: Green LED indicates unit is operating properly</p>	<p>Ambient Conditions</p> <p>Operating & Storage Range: -40°C to $+85^{\circ}\text{C}$ (-40°F to $+185^{\circ}\text{F}$)</p> <p>Relative Humidity: 0-95%, non-condensing</p> <p>Ambient Temperature Effect: Current, $2\mu\text{A}/^{\circ}\text{C}$; Voltage, $1\text{mV}/^{\circ}\text{C}$</p> <p>RFI/EMI Immunity (Standard Unit): 10V/m@20-1000MHz, 1kHz when tested according to IEC1000-4-3-1995 WITH -RF OPTION, 30V/m@20-1000MHz, 1kHz AM when tested according to IEC1000-4-3-1995</p> <p>Noise Rejection: Common mode: 100dB@50/60Hz; Normal Mode: Current Input, 100dB typical@50mAp-p@50/60Hz; Voltage Input, 100dB typical@1Vp-p@50/60Hz</p> <p>Weight 290 g (10.2 oz)</p>
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Specifications and information subject to change without notice.

Table 1. Long-Term Stability

Stability (% of maximum span)	Input-to-Output (Years)		
	1	3	5
Current Inputs	0.081	0.14	0.18
Voltage Inputs	0.093	0.16	0.21

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Figure 2. TMZ (HLPRG) Dimensions

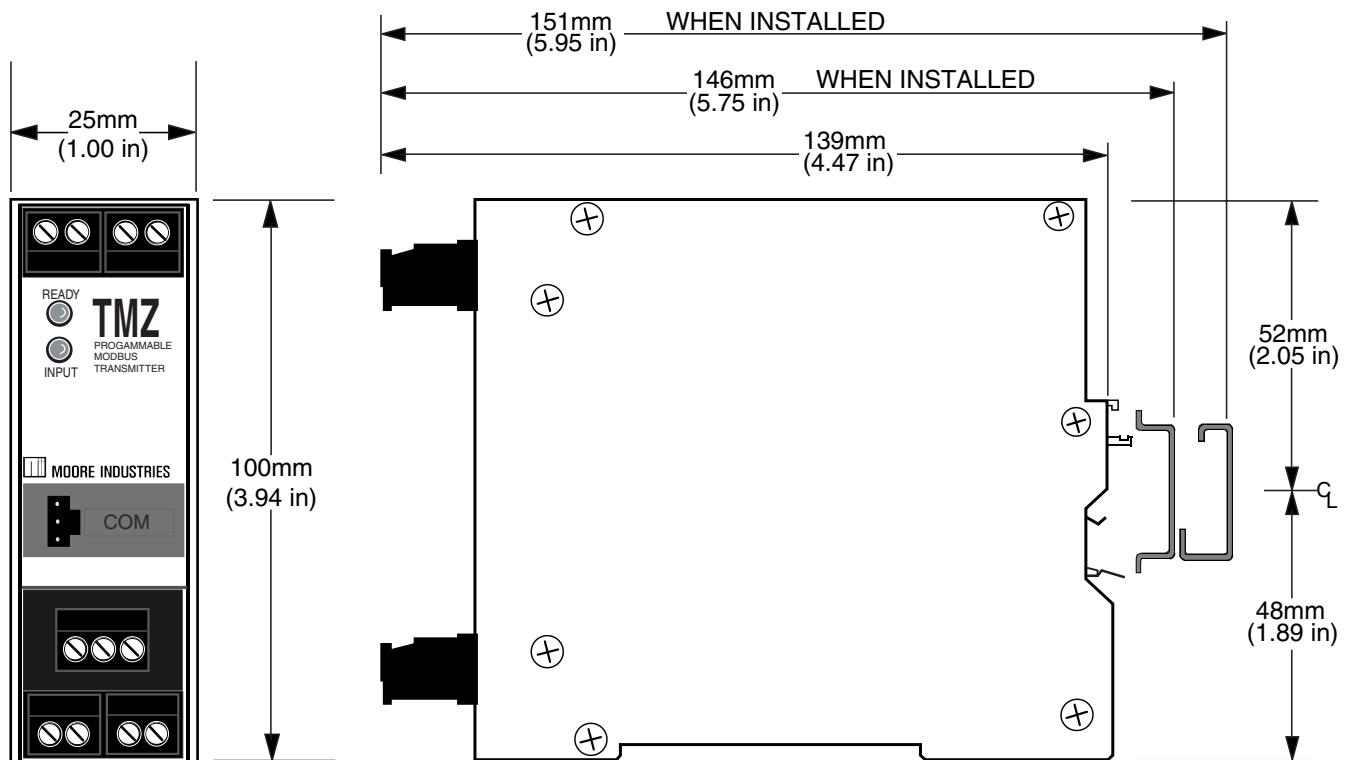


Table 2. Terminal Designations

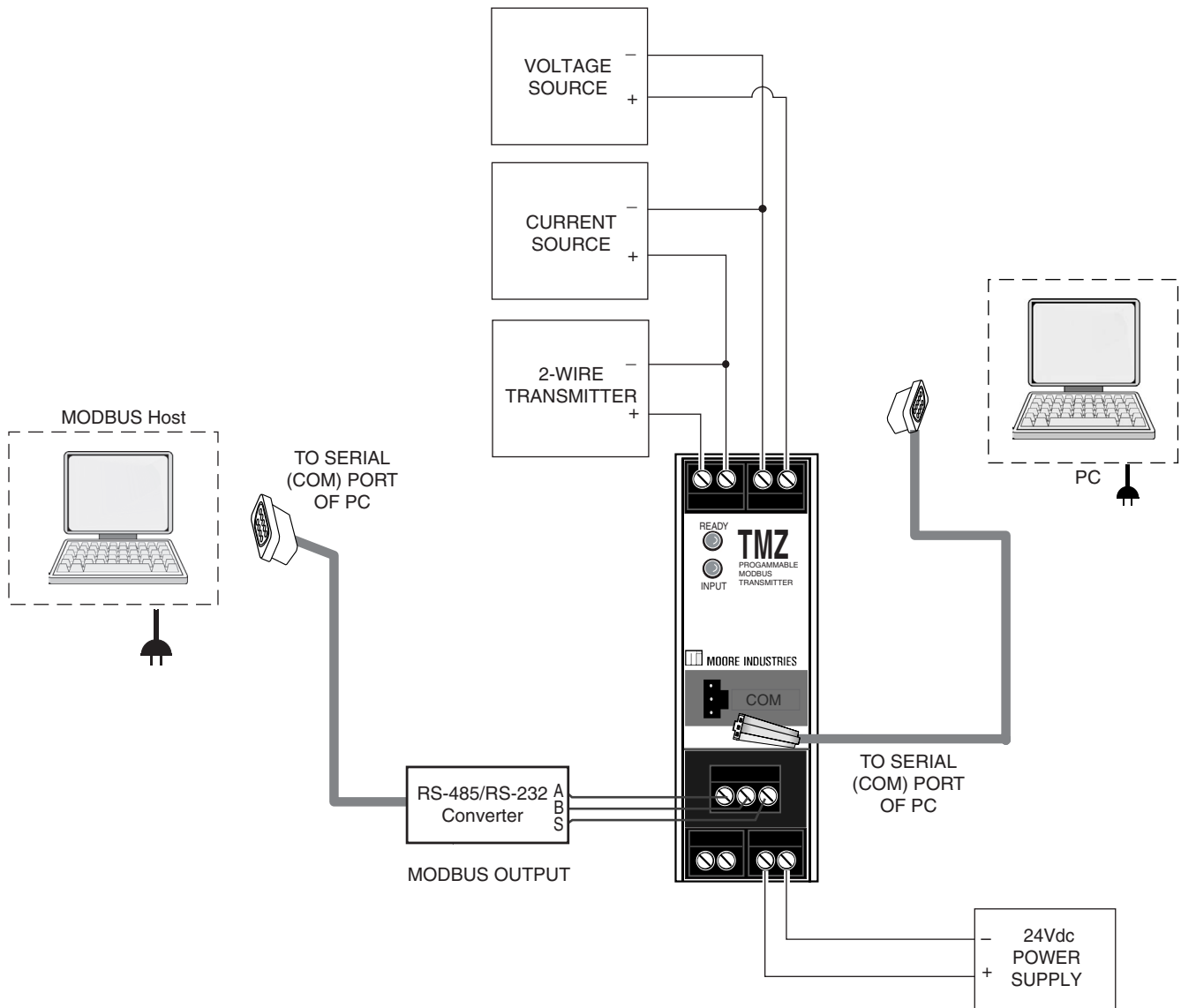
Input Type	Top Terminals (Left to Right)			
	T1	T2	T3	T4
Current Input	Tx	+I	COM	Not Used
Voltage Input	Not Used	Not Used	COM	+V

		Bottom Terminals (Left to Right)			
		B1	B2	B3	B4
Row 1	MODBUS Output	A	B	S	Not Used
Row 2	Power	Not Used	Not Used	+	-

KEY:	I = Current Input	A = A MODBUS
	V = Voltage Input	B = B MODBUS
	COM = Common terminal	S = S MODBUS
	TX = Power for 2-Wire transmitter	+ = Positive power input
		- = Negative power input

NOTE:
Terminal blocks can accommodate 14-22 AWG solid wiring.

Figure 3. Hooking-Up the TMZ (HLPRG)



Configuring the TMZ

One of the benefits of the TMZ is that there are no internal or external controls to adjust or settings to change. All operating parameters are set using a PC and Moore Industries' Intelligent PC Configuration Software.

The software settings are downloaded to the transmitter in the form of a Configuration File and stored in the instrument's memory. You can save a backup copy of the file on your PC hard drive or disk. The transmitter communicates with the PC through an RS-232 connection to the PC's serial port or through the MODBUS output with a fixed baud rate at 19.2k.

Installing the Configuration Software

Refer to Table 3 for the equipment needed.

1. Insert the *Moore Industries Interface Solution PC Configuration Software* CD into the CD drive of the PC. Access the CD and open the "TMZ PC Configuration Software" folder.
2. Double-click the installation program located in the folder. Follow the prompts to correctly install the program.

Once the Configuration Program is installed on the PC, the TMZ can be connected to equipment to simulate input and monitor output. You can then change the transmitter's operating parameters.

No Transmitter Needed

It is not necessary to connect the instrument to a PC to create configuration files using the software. The Configuration Program can be run without connecting a unit, and **most** parameters can be set without the benefit of input from a sensor or TMZ.

This makes it easy to create a set of operating parameters, save them to disk, and download them to one or more transmitters at a later time.

The TMZ **must** be connected to the PC in order to: perform sensor trimming; assign a tag, descriptor or message; receive (via download) a configuration file; and save the configuration file from the transmitter's memory.

Connecting the TMZ to the PC

Connect the RS-232 end of the cable to the PC's COM port.

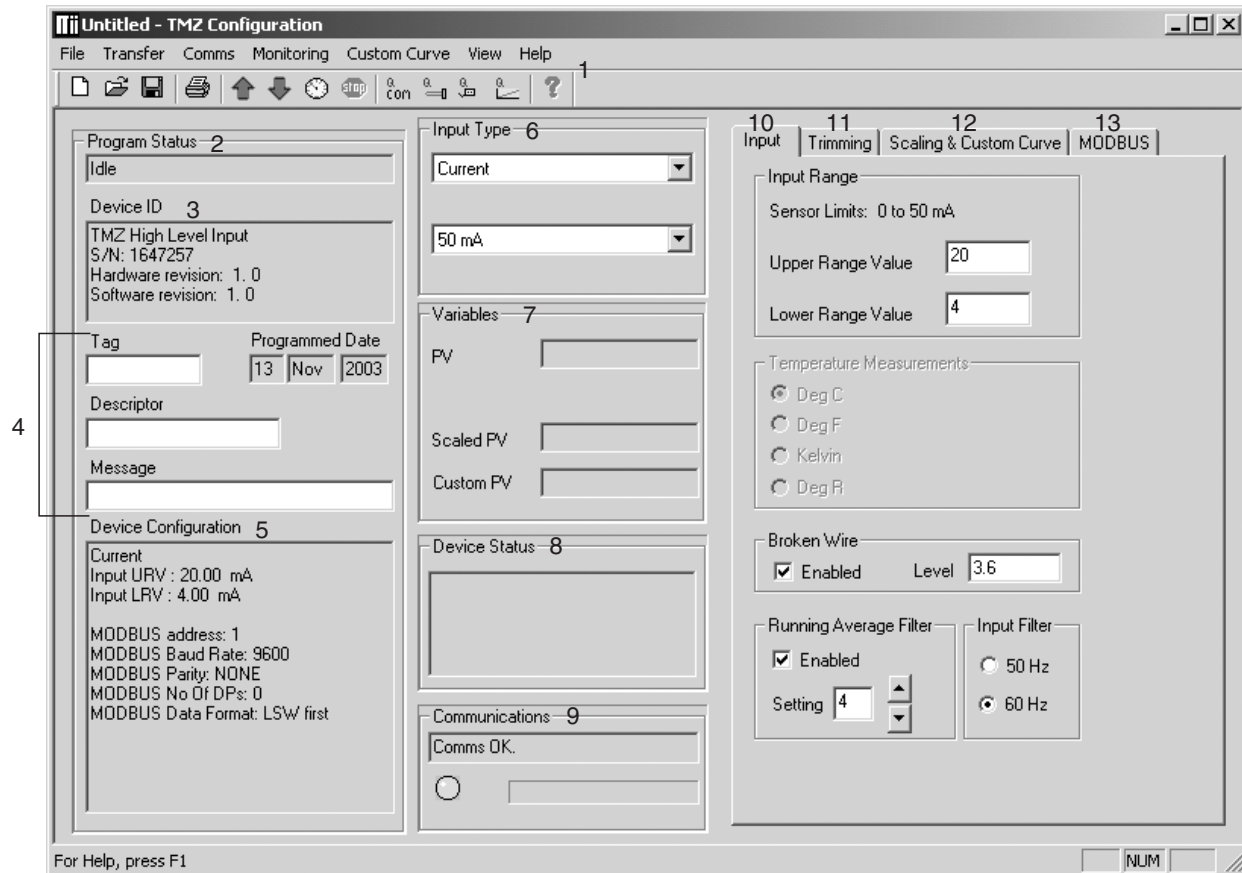
See Table 3 for information on the necessary equipment.

Table 3. Assembling the equipment needed to configure the TMZ (HLPRG)

Device	Specifications
Current or Voltage Source	Accurate to 0.05% of span for the intended application
Power Supply	24Vdc, ±10% or 117/230Vac (depending on configuration)
Multimeter (optional)	Accurate to ±0.009% of span; e.g., HP Model 3478A
Personal Computer	80386-based (or faster) IBM PC, or 100% compatible; 4Mb free RAM; 8Mb recommended; 20Mb free disk space on hard drive (More RAM & hard disk space is required for Windows 98, NT 2000 or XP) Microsoft Windows® 95, 98, NT, 2000 or XP Internet Explorer 3.0+ 1 (one) serial port (COM 1, 2, 3 or 4) set to 9600 baud, no parity, 8 data bits, and 1 stop bit
Moore Industries PC Configuration Software	Version 1.0 or greater, successfully installed to the hard drive
Communication Cable	Part# 803-053-26

PC Configuration Software Summary

Figure 4. TMZ (HLPRG) PC Configuration Software Screen




Once the default configuration has been saved to disk, it is safe to program other parameters. The PC Software is made up of these sections:

1. Tool Bar/Status Bar– Dropdown menus and corresponding icons allow you to perform various functions throughout the PC Configuration Program. Refer to the *Status and Tool Bar Legend* section for a complete description.

2. Program Status– This portion of the program displays the activity (idle, monitoring, downloading, uploading) of the connected unit.

3. Device ID– Displays your unit configuration (HLPRG/TPRG), ID, Hardware revision and Software revision.

4. Identification Parameters– Use this parameter to place an identifying “Tag” (8 alphanumeric characters max.), “Descriptor” (16 alphanumeric characters max.) or “Message” (32 alphanumeric characters max.). You may also use the *Quick Set* feature to set your Tag and download it. Simply click the  button in the Tool Bar.

5. Device Configuration– Displays the *Input* and *MODBUS* parameters you have chosen as settings for your TMZ.

6. Input Type– Select your input type (Current or Voltage) and the respective range of your input.

7. Variables– Displays the value of the Process Variable that is being monitored, as well as the scaled output and custom curve output.

8. Device Status– Notices of any errors or conditions which are outside of tolerance range.

9. Communications– Indicates current PC connection/communications status.








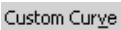



10. Input– Use this tab to set your input parameters. Refer to the *Input* section for a complete description.

11. Trimming– This parameter allows you to configure and perform input trimming. Refer to the *Trimming* section for a complete description.

12. Scaling & Custom Curve– Use this portion of the screen to set up your custom curve table. Refer to the *Scaling & Custom Curve* section for a complete description.

13. MODBUS– Allows you to configure your MODBUS parameters. Refer to the *MODBUS* section for a complete description.

Status and Tool Bar Legend

		Allows such functions as New, Open, Save and Print
		Allows you to Upload and Download configurations
		Select the PC Port (Com Port) that you will use
		Allows you to Monitor and Stop monitoring processes
		Provides functions specific to your Custom Curve table
		Controls whether Tool and Status Bars are viewed on the screen
		Displays the version of the TMZ Configuration Program
		Quick Set Buttons

Configuration Screens

Input

Figure 5. Input Tab

Input Range– Allows you to set your “Upper Range Value” (URV) and “Lower Range Value” (LRV) depending upon the input configuration and range chosen in the *Input Type* section.

Broken Wire– The TMZ monitors your primary variable. If the monitored value falls equal to or below a set value, then a state of Broken Wire is declared.

Check the “Enabled” box in order to activate Broken Wire notification.

In the “Level” textbox, enter the set value you choose as your limit.

Note:

The level you enter should be less than the Lower Range Value.


Running Average Filter– This function is for filtering the input signal. The TMZ provides this filter with a user-selected range between 1 and 16. Factory default is 4.

Note:


A higher Running Average Filter setting provides smoother output transitions however, reduces response time. Conversely, a lower setting provides a faster response time, but may seem more unstable.

Input Filter– This setting is used to configure the input filter. This filter is designed to reduce the effects of mains-induced noise. The input filter frequency value should be set to the frequency of the local AC supply– either 50Hz or 60Hz.

Note:

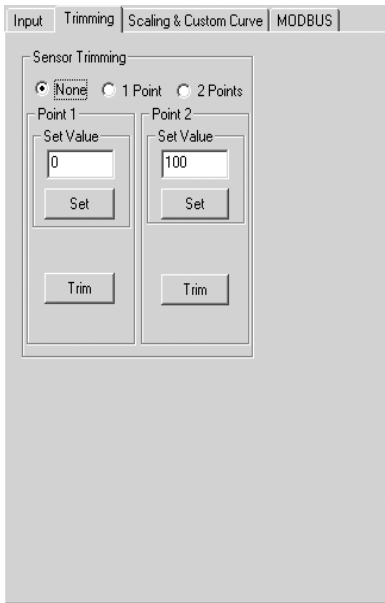
Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. You may also download by clicking the  button in the Tool Bar.

You may also use the *Quick Set* feature to configure your *Input* parameters and download the settings.

Configure your parameters and click the  button, located in the Tool Bar. The input settings you have chosen will be applied and downloaded to your unit.

Trimming

Figure 6. Trimming Tab




Sensor Trimming— Sensor Trimming increases the measurement accuracy of your instrument by matching the reading of its actual input to either a calibrated source or the device to which it is connected. This verifies that the input to the transmitter is being interpreted correctly.

You may trim any point between 0% and 100% along the scale. Note that one-point trimming applies an offset to the sensor reading, while two-point trimming applies both an offset and a gain.

Follow the steps below in order to perform sensor trimming.

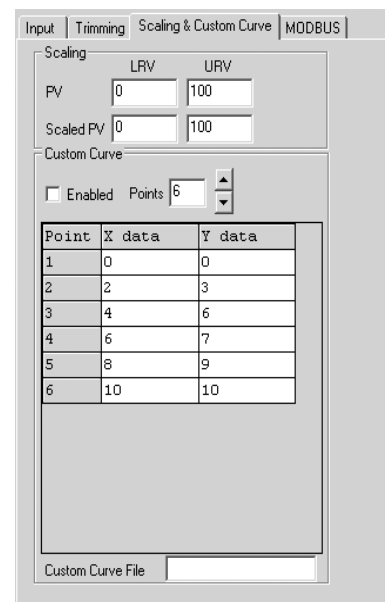
1. Select either “1 Point” (one-point trimming) or “2 Points” (two-point trimming) by clicking the appropriate button. Each pair consists of “Set” and “Trim” values.
2. Enter the values that need to be trimmed into the “Set Value” field and click “Set”.
3. Apply the targeted signal to the input, wait until it settles and click “Trim” to capture the measured value. If you chose “2 Points”, repeat the step above for the second point.

Note:

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. You may also download by clicking the  button in the Tool Bar.

Scaling & Custom Curve

Figure 7. Scaling & Custom Curve Tab




Scaling— Scaling allows you to take your PV (Process Variable) reading and manipulate it to a more customized display range (Scaled PV). PV is the unit read after selecting your input type. For example, choosing a Current input would then produce a PV displayed in mA.

Should you require a Scaled PV, follow the instructions below.

1. In the “PV” parameter, enter the actual range of your input type. Place the minimum value in the “LRV” text box and the maximum value in the “URV” box.
2. In the “Scaled PV” parameter, enter the scale or range you require. In the “LRV” text box, enter the value that you wish displayed when your reading is at its minimum. In the “URV” text box, place the value to be displayed when the process variable has reached maximum.

You may also use the *Quick Set* feature to configure your *Scaling* parameters and download the settings.


Configure your parameters and click the  button, located in the Tool Bar. The settings you have chosen will be applied and downloaded to your unit.

Custom Curve— The Custom Curve feature allows you to set up your own custom curve table. This allows you to tell the transmitter what it should output when it receives a certain input. This feature also allows you the ability to write a table in Microsoft® Excel, save it in a .csv format, and import it into the Configuration Software. This makes it simple to save the custom table for downloading to multiple units or for backup purposes.

To create a custom curve:

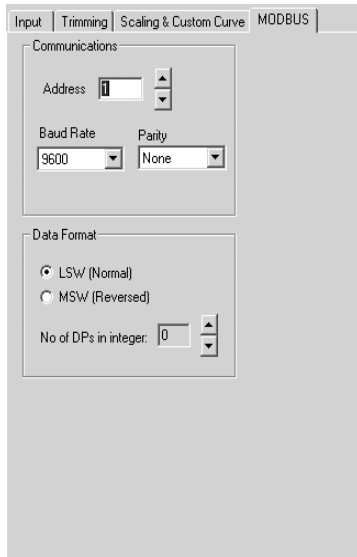
1. Click the “Enabled” box .
2. Select the number of points for your curve (32 points maximum).
3. Type your individual values in the X and Y columns. Source variables are inserted into the X column while the corresponding data is inserted into the Y column.
4. After all of your data has been entered, you ***must*** use the *Custom Curve* dropdown menu to save your newly created custom (“Save Custom Curve”) and to download it to your TMZ (“Download Custom Curve”).

Note:

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. You may also download by clicking the  button in the Tool Bar. However, this does not download your custom table. To do so, you must use the Custom Curve dropdown menu.

MODBUS

Figure 8. MODBUS Tab



Communications– Used to set MODBUS Address, Baud Rate and Parity parameters.

Address- The number that the TMZ uses to identify itself on the MODBUS network. It is configurable from 1 to 247. By default, the assigned MODBUS address is 01.

Baud Rate- The speed of data transmission. It should be set to match the baud rate of the attached controller. Supported Baud Rates include: 300, 600, 1200, 2400, 4800, 9600, 19.2k and 38.4k. Factory default is 9600.

Parity- A method in serial asynchronous communications of “checking” that characters have been sent correctly. Even, Odd and no Parity (None) are supported. Factory default is None.

Data Format– Allows you to select the word order and number of decimal places you choose.

Selecting LSW (Normal), Least Significant Word, stores the most significant bits in the second register and the least significant bits in the first register (factory default).


MSW (Reversed), Most Significant Word, reverses the above order. The most significant bits will be stored in the first register, with the least significant bits stored in the second register.

No of DPs in integer- This is a calculation that stores a more accurate value in the MODBUS register and offers better resolution. Select your value using the up and down arrows to the right of the display. See below for an example of this process.


PV = 123.456789

"No of DPs in integer" Value	Displayed Integer
1	1234
2	12345
3	123456

Note:

Once you have configured all parameters, download to the unit by selecting “Download” in the Transfer dropdown menu located in the Status Bar. You may also download by clicking the  button in the Tool Bar.

You may also use the *Quick Set* feature to configure your MODBUS parameters and download the settings.

Configure your parameters and click the  button, located in the Tool Bar. The settings you have chosen will be applied and downloaded to your unit.

Installation

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

Mounting the TMZ

The TMZ can be mounted on standard DIN mounting rails.

Making the Electrical Connections

Please refer to Figure 3 for electrical connections.

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/or output signal wiring should be two inches.

CE Conformity

Installation of any Moore Industries' products that carry the CE certification **must** adhere to the guidelines above in order to meet the requirements set forth in applicable EMC directive (EN 61326). Consult the factory for the most current information on products that have been CE certified.

Operation

Once programmed, calibrated, installed, and supplied with the correct power, the TMZ transmitter begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

Maintenance

Moore Industries suggests a check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers 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 listed on the back cover of this manual.

If problems involve a particular TMZ (HLPRG), there are several pieces of information that can be gathered **before you call the factory** that will help our staff get the answers you need **in the shortest time possible**. For the fastest service, gather the complete model and serial number(s) of the problem unit(s) and the job number of the original sale.

Appendix A: TMZ MODBUS Register Set

Table A-1 contains all of the MODBUS integer registers supported by the TMZ. These registers constitute both the 30000 and 40000 register set.

Table A-1. MODBUS Register Table

Register	Variable	Read	Description
0	PV	R	PV (integer)
1	SV	R	SV (integer)
2	PercentOfRange	R	Percent of range (integer)
3	ScaledPV	R	Scaled PV (integer)
4	LinearedPV	R	Linearised PV (integer)
5	ErrorStatus	R	TMZ Error / Status Word
6	PV_STATUS	R	UFE PV Status
256-257	PV	R	PV (float)
258-259	SV	R	SV (float)
260-261	PercentOfRange	R	Percent of Range (float)
262-263	ScaledPV	R	Scaled PV (float)
264-265	LinearedPV	R	Linearised PV (float)
266	ErrorStatus	R	TMZ Error / Status Word (*)
267	PV_STATUS	R	UFE PV Status

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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