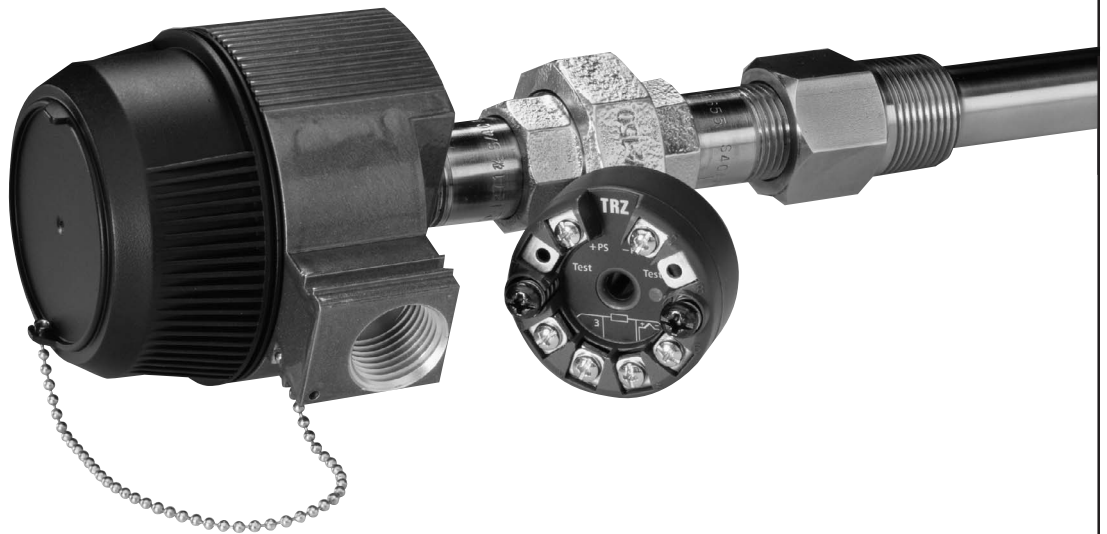


TRZ Smart HART®
Temperature Transmitter





 **MOORE
INDUSTRIES**

The Interface Solution Experts

www.miinet.com

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Introduction

This is the users' manual for Moore Industries' TRZ Smart HART Temperature Transmitter. It contains all of the information needed to configure, install, operate, and maintain the TRZ. If you would like additional assistance, call one of our STAR centers.

The following guidelines are used in this manual:

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.

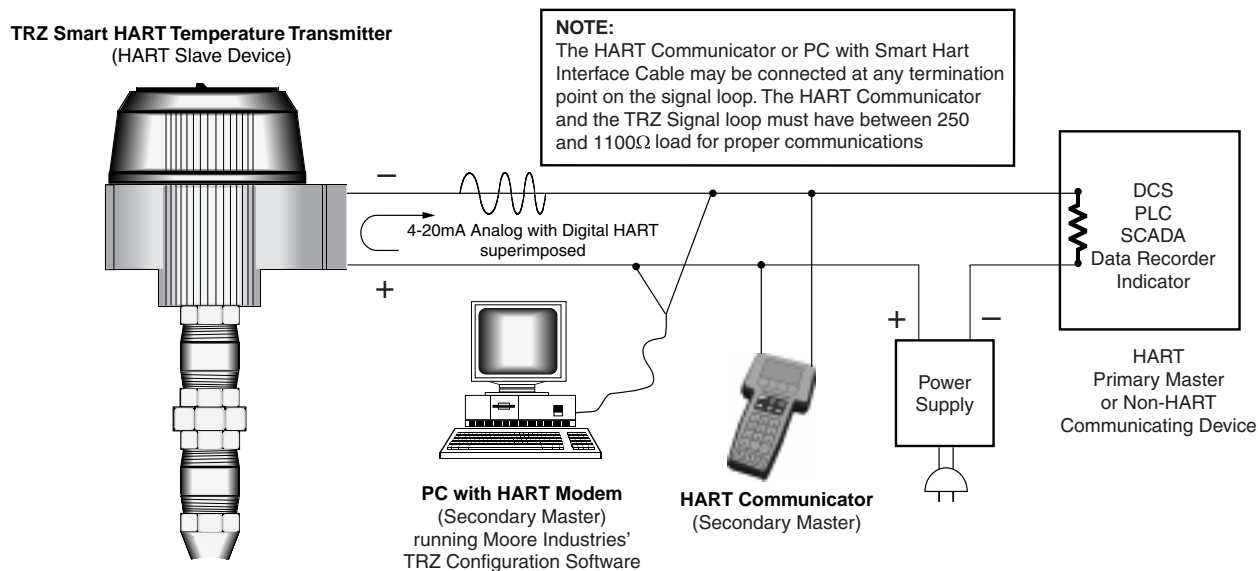
Description

The TRZ is a 2-wire (loop-powered), user-configurable, HART®-based temperature transmitter. Typically paired with a complete temperature assembly from our extensive line of durable housing and enclosure options, the TRZ's size, accuracy, and compatibility make it the ideal solution when temperature measurements must be made in remote or otherwise difficult-to-access locations.

The TRZ "reads" the signal from a RTD, Thermocouple, Millivolt source, Potentiometer, or source of direct resistance. Based on this input, it transmits both a linear, isolated 4-20mA signal *and* superimposed, digital HART data. Table 1 lists the accommodated input types.

The TRZ's hybrid analog/digital signal is ideal for a direct interface with *both* HART and non-HART read-out instruments: recorders, DCS's, PLC's, and other, computer-based SCADA equipment.

Figure 1. The TRZ Smart HART Temperature Transmitter's remotely programmable input and combination analog/digital output make it the perfect answer to problems encountered when interfacing control room equipment and field sensors.



Specifications

HART Specifications	Address Range: 0-15 (Addresses 1-15 are for digital communications only) Transmission Speed: 1200 baud Character Format: 1 Start Bit - 8 Data Bits - 1 Odd Parity Bit - 1 Stop Bit	Performance (continued)	Intrinsic Safety (continued)
Performance	Input Accuracy: Refer to Table 1 Output Accuracy: ±0.1% of span (Total accuracy combines input accuracy, output accuracy, and temperature effect; for T/C inputs only, include Reference Junction Compensation in Total Accuracy.) Reference Junction Compensation Accuracy: ±0.8°C Stability: T/C and RTD inputs 0.05°C for one year Isolation: 500Vac input-to-output Output Response: 1.0 second for output to go from 10-90% in response to a full step change on input (2.0 second response time for resistance measurements over 2000Ω and RTD measurements over 1000Ω) Ripple: Less than 0.06V peak-to-peak, max, 60-120Hz Maximum Input Protection: ±35Vdc	Power Supply Effect: 0.005% of span per 1V Load Effect: Negligible within power and load limits Load Capability: Load (KΩ) = $\frac{(V_{dc} - 12)}{23mA}$ Burnout Protection: User-programmable; Upscale from 20.00 to 23.00mA; Downscale from 3.60 to 4.00mA Output Current Limiting: User-programmable; Input Overrange from 20.00 to 23.00mA; Input Underrange from 3.60 to 4.00mA T/C Input Impedance: 40μΩ, nominal RTD Excitation: 200μA, ±10% RTD Lead Wire Resistance Maximum: 10Ω per wire for temperatures less than 600°C; 30Ω per wire for temperatures greater than 600°C; 0.1°C per 10Ω per wire maximum compensation error Damping: User-set; 0-15 seconds Resolution: Input, 16-bit; Output, 12-bit	Internal Capacitance: ≤1nF Barrier Data: 28Vdc, max; 100mA max Ambient Conditions
Intrinsic Safety		Supply Range: 12-28Vdc Internal Inductance: ≤15μH	Operating and Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 0-98%, condensing Ambient Temperature Effect: 0.01% of span per °C change, max; 0.003% of span per °C change, typical Effect on Reference (Cold) Junction Compensation: ±0.005°C per °C change from room temperature (25°C) RFI/EMI Immunity: 30V/m @ 20-1000MHz, when tested according to SAMA standard 33.1 in metal enclosure (10V/m @ 27-1000MHz, when tested according to IEC 1000-4-3-1995 in metal enclosure) Common Mode Rejection: 110dB, min, @ 50/60Hz Normal Mode Rejection: 55dB, typical, @ 1V peak-to-peak, 50/60Hz Weight
			In LH1 Housing: 329 g (11.6 oz) In LH2 Housing: 549 g (19.4 oz) In HPP Housing: 51 g (1.8 oz)

Specifications subject to change without notice. Printed in the U.S.A.

Complete Temperature Assemblies

We are your "One-Stop Temperature Shop"; with ready-to-install assemblies that include your choice of everything from TRY or TRX Non-HART PC-Programmable transmitters, to isolators (HART and non-HART), power supplies, and meters.

We offer complete lines of RTDs, thermocouples, thermowells, connection heads, and fittings—with all types of certifications, colors, materials, and specifications.

Table 1. Input Types and Accuracy Specifications for the TRZ Transmitter

Input	Type	α	Ω	Measuring Range	Minimum Span	Input Accuracy
RTD	Platinum	0.003850	25-500	-200 to 850°C -328 to 1562°F	10°C 18°F	±0.2°C ±0.36°F
			1000	-200 to 320°C -328 to 608°F		
		0.003902	25-500	-100 to 650°C -148 to 1202°F		
			1000	-100 to 320°C -148 to 608°F		
		0.003916	25-500	-200 to 500°C -328 to 932°F		
			1000	-200 to 320°C -328 to 608°F		
	Nickel	0.00618	25-500	-50 to 250°C -58 to 482°F	10°C 18°F	±0.2°C ±0.36°F
			1000			
	Copper	0.00427	25-1000	-50 to 200°C -58 to 392°F	10°C 18°F	±0.2°C ±0.36°F
Ω	Direct Resistance or Potentiometer	n/a	n/a	0 to 390 Ω	5 Ω	±0.08 Ω
				0 to 2200 Ω	25 Ω	±0.4 Ω
Input	Type	Maximum Range	Conformance Range	Minimum Span	Input Accuracy	
T/C	J	-210 to 1200°C -346 to 2192°F	-200 to 1000°C -328 to 1832°F	50°C 90°F	±1.0°C ±1.8°F	
	K	-250 to 1372°C -454 to 2502°F	-230 to 1370°C -382 to 2498°F			
	E	-270 to 1000°C -454 to 1832°F	-250°C to 900°C -418 to 1652°F			
	T	-250 to 400°C -454 to 752°F	-220 to 400°C -364 to 752°F			
	R	-50 to 1768°C -58 to 3216°F	0 to 1750°C	100°C	±2.0°C ±3.6°F	
	S		32 to 3182°F	180°F		
	N	-270 to 1300°C -454 to 2372°F	-130 to 1300°C -202 to 2372°F	50°C 90°F	±1.0°C ±1.8°F	
	B	100 to 1820°C 392 to 3308°F	500 to 1820°C 932 to 3308°F	50°C 90°F	±2.0°C ±3.6°F	
	C (W5)	0 to 2300°C 32 to 4172°F	0 to 2300°C 32 to 4172°F	100°C		
	D (W3)			180°F		
	L	-200 to 900°C -328 to 1652°F	-200 to 900°C -328 to 1652°F	50°C 90°F	±1.0°C ±1.8°F	
	U	-200 to 600°C -328 to 1112°F	-200 to 600°C -328 to 1112°F			
mV	DC	-10 to +70mV	n/a	2mV	±0.04mV	
		-0.1 to +1.1V		20mV	±0.4mV	

Ordering Information

Unit	Input	Output	Power	Housing
TRZ Smart HART Temperature Transmitter	PRG Programmable with standard HART Communicator, HART-based control system, or Moore Industries' PC-based Configuration Software (included)	4-20MA output with HART digital data superimposed	12-28Vdc (loop-powered from output side)	HPP Hockey-puck housing for mounting in standard connection heads LH1NS* Connection head (FM approved, NEMA 4X, IP66) with two entry ports: ½-inch NPT cable and process—black PBT polyester cover LH1NA* Connection head (FM approved, NEMA 4X, IP66) with two entry ports: ½-inch NPT cable and process—black aluminum cover LH1MS* Connection head (FM approved, NEMA 4X, IP66) with two entry ports: M20 cable and ½-inch NPT process—black PBT polyester cover LH1CS* Connection head with two entry ports: M20 cable and G½ (BSP) process—black PBT polyester cover LH2NS*‡ Explosion-proof connection head (FM approved, Class I, Div 1, Groups A**,B,C,D; Class II, Groups E,F,G; Class III) with two entry ports: ½-inch NPT cable and process—black metal cover LH2MS*‡ Explosion-proof connection head (FM approved, Class I, Div 1, Groups A**,B,C,D; Class II, Groups E,F,G; Class III) with two entry ports: M20 cable and ½-inch NPT process—black metal cover CH6 Plastic polypropylene connection head * For alternate cover color, replace the fifth designator in the LH1 model number with appropriate letter from below (i.e. LH1 NG): C = Clear (LH1 only), B = Blue, R = Red, Y = Yellow, G = Green. NOTE: Add " P " suffix to any LH or CH housing for 2-inch pipe mounting hardware (e.g., LH1NS P). ** For Group A (only) all conduit must be sealed within 18 inches. ‡ LH2 Explosion-proof certification carries 60°C (140°F) max ambient temperature restriction. Other connection heads, cabinets, and enclosures are also available. Ask your Interface Solutions Expert for details.

When ordering specify: Unit / Input / Output / Power [Housing]
Model Number Example: TRZ / PRG / 4-20MA / 12-28DC [LH1NSP]

Model and Serial Numbers

Moore Industries uses a system of model and serial numbers to keep track of all of the information on every unit it sells and services. If a problem occurs with a TRZ, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

If additional units are needed, use the information printed in bold text in the table above to “build” a model number for the type of transmitter required.

Additional Parts

Each TRZ order comes with one copy of our Configuration Software on a 3½-inch floppy disk (Windows '95, '98, and Windows NT compatible). A HART Communicator is not included with the TRZ. The TRZ unit will work with any standard, third-party unit, such as the Fisher-Rosemount model 275.

Additional accessories are available as follows:

<i>Part Number</i> 235-829-01	PC-Programming Kit Includes one copy of the TRZ Intelligent PC Configuration Software and one HART-to-RS232 Cable with HART Modem.
<i>Part Number</i> 235-75120-03	TRZ Intelligent PC Configuration Software (One copy comes free with each order)
<i>Part Number</i> 803-048-26	HART-to-RS232 Smart Interface Cable with HART Modem

Configuring a TRZ

The TRZ can be configured with either a HART Communicator or a PC and Moore Industries' TRZ Intelligent PC Configuration Software.

One of the benefits of the TRZ transmitter is that there are no internal or external controls to adjust or settings to change. All operating parameters are set using either a HART Communicator or the Configuration software. Once these software settings are made, they are "downloaded" to the transmitter in the form of a Configuration File and stored in the non-volatile unit memory and on your PC hard drive or diskette. The transmitter communicates with the PC through a HART modem connection to the PC's serial (COM) port. The transmitter and the HART Communicator can communicate at any termination point on the loop.

You can configure the TRZ with either a standard HART Communicator or our PC software. Figure 2 shows the hookup for configuring the TRZ with a PC. Figure 3 shows the configuration hookup with a HART Communicator. Refer to Table 2 for the specifications for the equipment shown in these figures.

The following section of the manual contains instructions for configuring the TRZ with or without the use of a HART Communicator:

- Installing the TRZ Configuration Software (if necessary) page 8
- Saving the TRZ Configuration Files (if necessary) page 10
- Setting Output, page 13, 17-18
- Configuring the Device Information, page 13
- Using the Loop Test function, page 14
- Trimming the Input, page 14
- Displaying and Resetting the Minimum and Maximum Process Values, page 15

Figure 2. Using a PC to configure the TRZ.

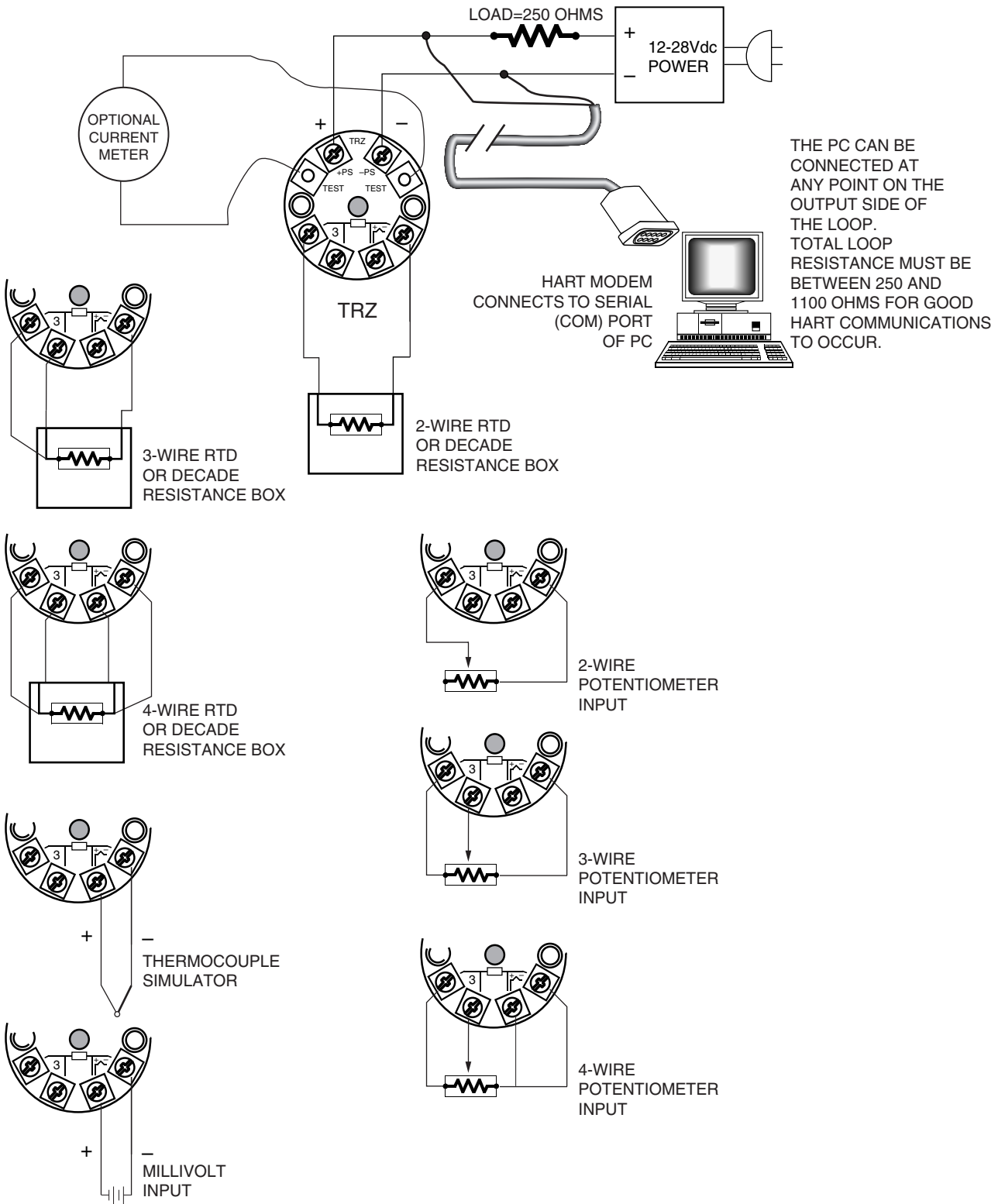


Figure 3. Using a HART Communicator to configure the TRZ.

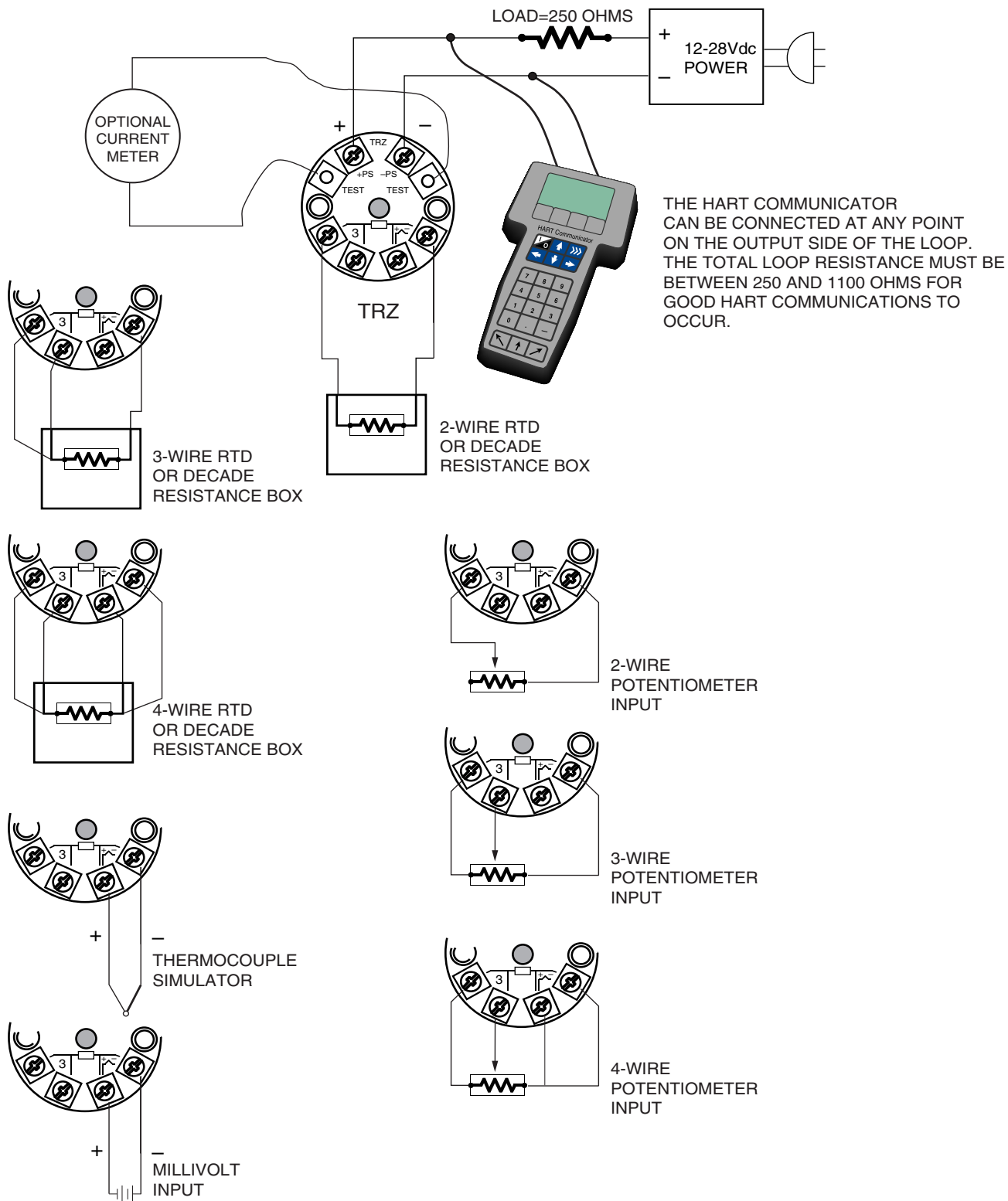


Table 2. Assembling the equipment needed to configure the TRZ.

Device	Specifications
Variable Input Simulator for Thermocouple, RTD, Millivolt, Potentiometer, or Decade Resistance Box	Variable; Accurate to $\pm 0.05\%$ of unit span.
Power Supply	32Vdc, $\pm 10\%$
Precision Load Resistor	250 Ω . $\pm 0.01\%$ HART specifies that total loop resistance be maintained between 250 Ω and 1100 Ω .
Multimeter (optional)	Accurate to $\pm 0.025\%$ of span; e.g., Fluke Model 87
Personal Computer (optional)	80386-based IBM PC, or 100% compatible; 1.44Mb floppy diskette drive; 4Mb free Random Access Memory (RAM); 1Mb free disk space on hard drive (suggested); Microsoft Windows® '95, '98, or NT (Windows® '98 or NT will require additional RAM and a faster processor--see requirements on Windows® manual for details) 1 (one) free serial communications port (COM 1, 2, or 3) set to 4800 baud, no parity, 8 data bits, and 1 stop bit
HART Modem Cable (required if using a PC)	Moore Industries part number 803-048-26, or equivalent
HART Communicator (required if not using a PC)	Fisher-Rosemount Model 275 or equivalent
Moore Industries' TRZ Configuration software, TRZ_setup.exe (required if using a PC)	Version 1.0 or greater, successfully installed on the hard disk of the specified PC

If using a PC...

It will be necessary to install Moore Industries' TRZ Intelligent PC Configuration software first. Once the program is loaded and running, nearly all of the operating parameters for the connected transmitter are shown on a single screen (see Figure 4). This makes it easy to determine which aspects of transmitter operation need to be changed to suit the application requirements.

Installing the TRZ Configuration Software

Refer to Table 2 for the specifications of the PC needed.

1. Insert the diskette labeled "TRZ Installation" into the floppy drive of the PC.
2. Quit any applications that may be running in the background on the PC, including any virus detection software or other programs running in Terminate and Stay Resident (TSR) mode.

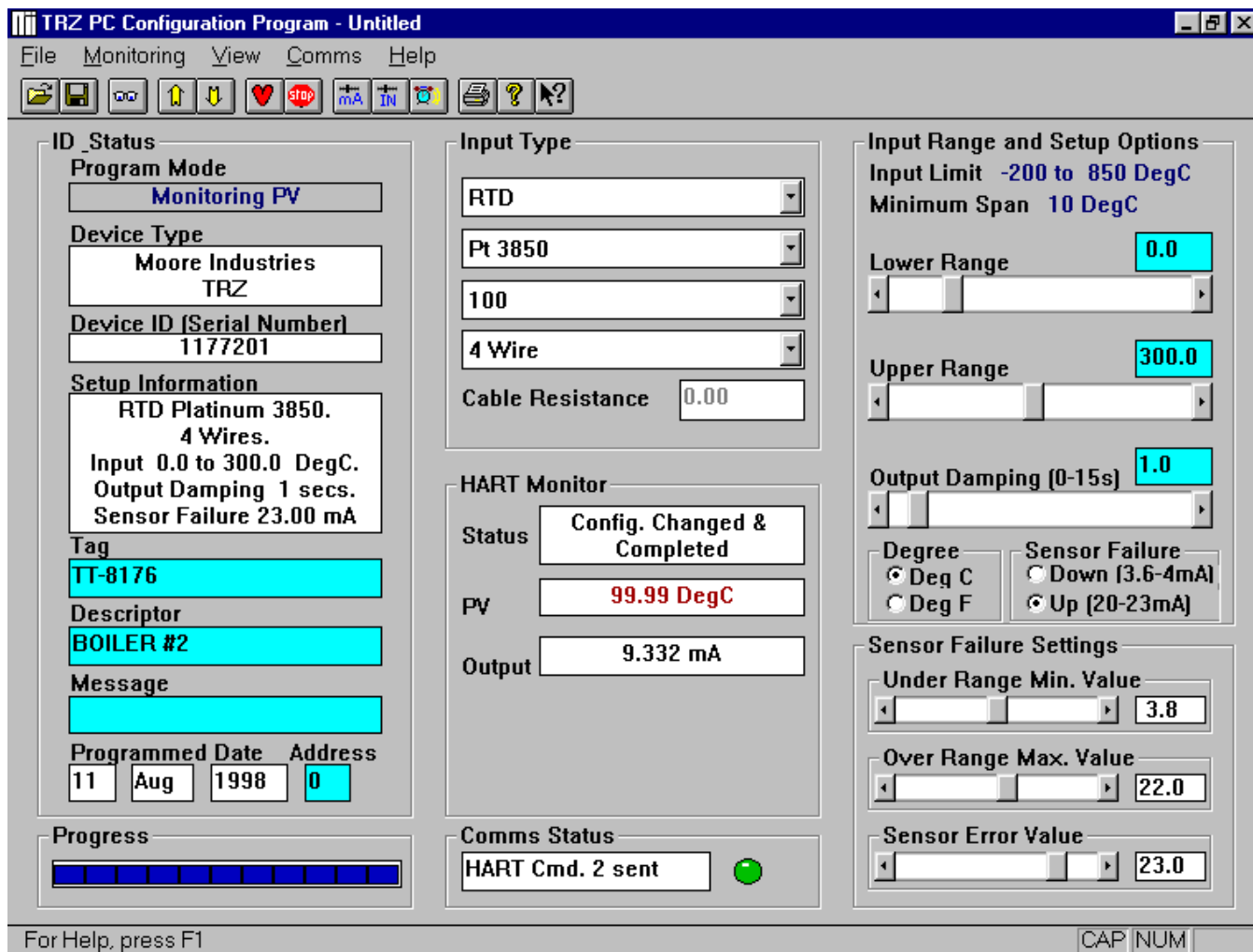
3. In Windows 95, go to the "Start" menu, and access "Settings", then "Control Panels", and finally "Add/Remove Programs".
4. Click on "Install" and then follow the on-screen instructions.

Once the Configuration Program is installed on the PC, the TRZ can be connected to equipment to simulate input and monitor output. With the PC program, the user can then view and/or change its operating parameters.

If not using a PC...

Use the HART Communicator to specify the operating parameters of the TRZ.

Figure 4. Most of the TRZ Operating Parameters can be set from the Main Screen of the Configuration Program.



No Transmitter Needed

It is not necessary to connect the TRZ to a PC to create Configuration Files using the Configuration Software. The Configuration Program can be run without connecting a transmitter, and **most** operating parameters can be set without benefit of input from a sensor or from a transmitter. 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.

Note:

Not all parameters can be set without a transmitter attached.

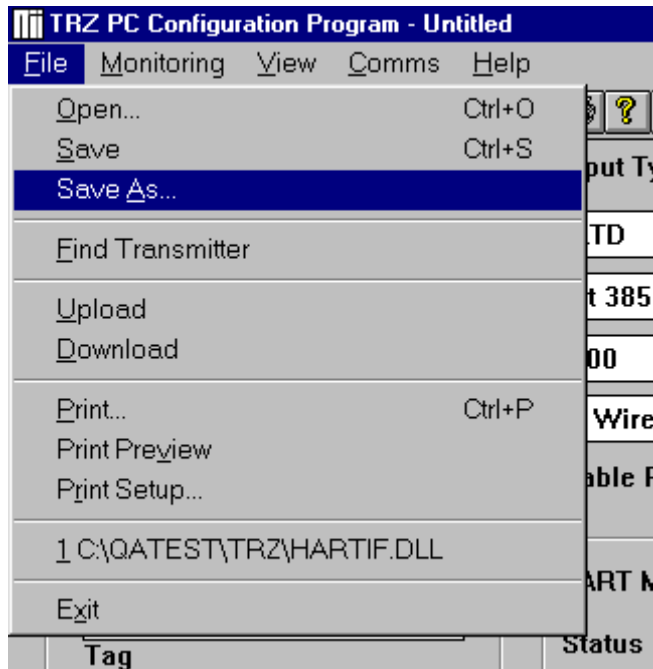
The TRZ **must** be connected to the PC in order to:

- Trim Input
- Trim Output
- Assign a Tag
- Perform a Loop Test
- Receive (via download) a Configuration File

And, perhaps most importantly...

- **SAVE THE CONFIGURATION FILE ALREADY IN THE TRANSMITTER'S MEMORY** (refer to "Saving the TRZ Configuration Files", which follows.)

Figure 5. Using the “Save As...” Function to Store the TRZ Default Settings on Disk.



Saving the TRZ Configuration Files


Every TRZ is shipped from the factory with a Configuration File already installed in its memory. This file is comprised of either the factory default set of operating parameters or the set of parameters specified by the customer at the time of order.


The Factory Defaults are...

- Input Type: 3-Wire Platinum RTD, 100Ω, α0.3850
- Input Range: 0 to 100°C (32 to 212°F)
- Output: 4-20mA with HART
- Upscale Drive (to 23mA) on input failure
- Overrange Maximum Value: 22.0mA
- No input damping

To save the Configuration File already resident in the transmitter’s memory, pull down the “File” menu on the Main Configuration Screen (Figure 5) and select “Save As...”.

Use standard Windows’ conventions to save the file on the PC disk in the desired location.

Alternatively, click on the “” icon at the top of the screen. This starts the “Save As...” function in the same manner.

Later, if you want to retrieve the saved information, you can do so by selecting “Open” from the “File” menu or by pressing the “” icon and then using standard Windows’ conventions to find the file.

Using the PC Program

Once the default configuration has been saved to disk, it is safe to program the other TRZ parameters. Use either the PC-based Configuration software or the HART Communicator—the results are the same.

For help with the PC program, press F1.

Consult the documentation for the HART Communicator for information on getting help with the hand-held’s menus.

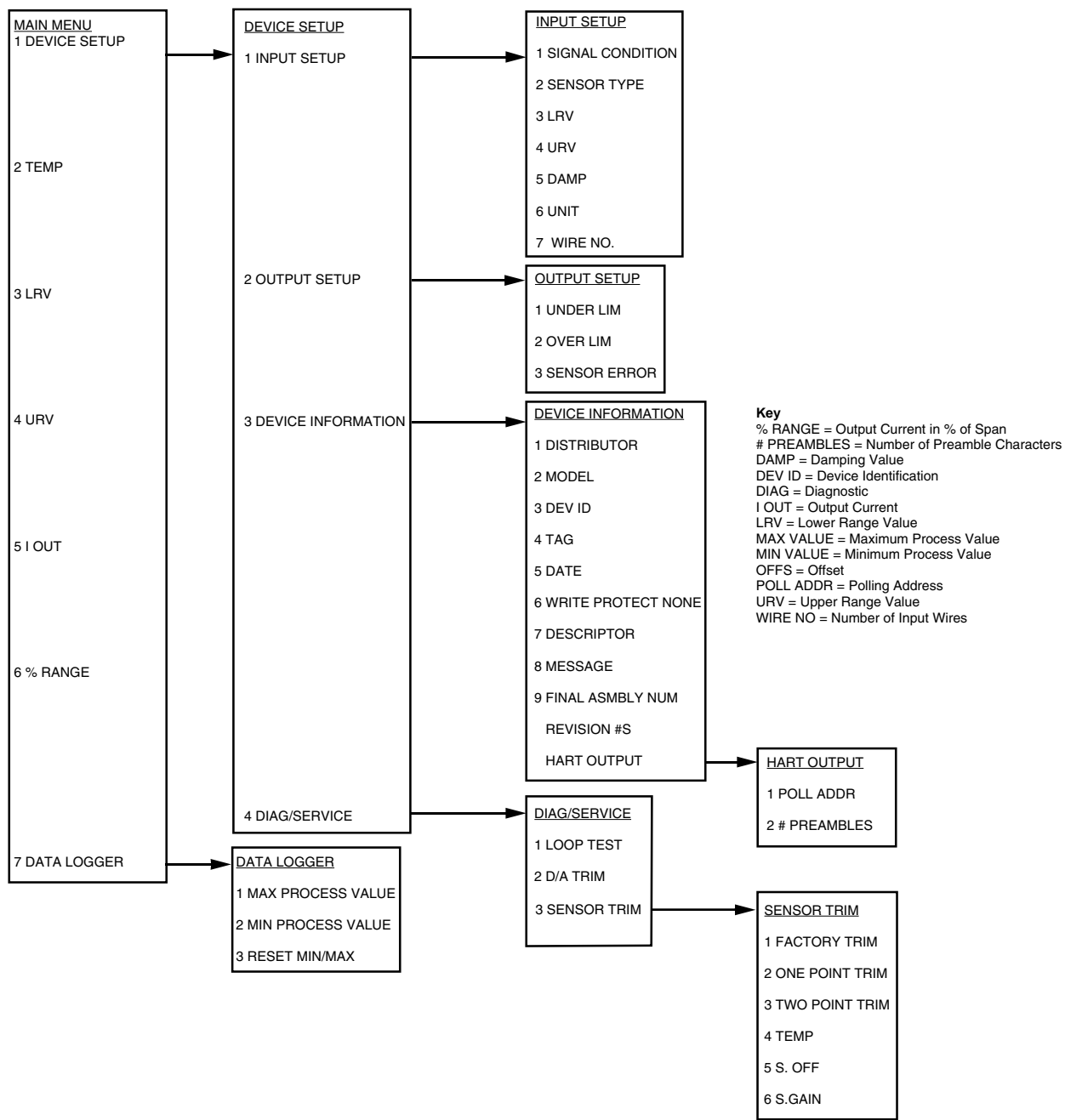
Using the HART Communicator

The TRZ is programmed using a HART Communicator. If your communicator is equipped with a Device Description (DD) for the TRZ, the following section, “Programming the TRZ when a Device Description is Available”, gives an overview of the menus and instructions for programming. To determine if your communicator has the TRZ Device Description, press “1” to select “Offline” and press “1” again to select “New Configuration”. A list of companies will appear which, if your communicator is loaded with the TRZ Device Description, will include Moore Industries.

If your communicator is not equipped with the TRZ Device Description, go to “Programming the TRZ when a Device Description is not available” on page 17. Some TRZ capabilities can only be accessed if your communicator is equipped with a Device Description. Moore Industries can factory-configure TRZ parameters that are not accessible through the generic DD.

Moore Industries can update your HART Communicator with all of the latest, approved HART Device Descriptions, including the DD for the TRZ. Just send your communicator to our Interface Solution Center headquarters in Sepulveda, California with our configuration sheet indicating the DD’s you need. We’ll load the Device Descriptions of your choice for a nominal charge.

Figure 6. Summarizing the TRZ Configuration Menus in a HART Communicator



Alternatively, the TRZ Device Description is available from any service center that is approved to upgrade universal HART communicators. Consult the Interface Solution Center nearest you for locations.

Programming the TRZ when a Device Description is Available

With the TRZ connected as shown in either Figure 2 or 3, apply power and turn the communicator on.

After a brief self-test, the communicator will show the main menu and identify the unit as a TRZ.

This section contains the instructions for programming the TRZ using a HART Communicator that has been programmed with a TRZ HART Device Description (see page 11). If your communicator doesn't have a TRZ Device Description, skip to "Programming the TRZ when a Device Description is NOT Available" on page 15.

Figure 6 on page 11 shows an overview of the programming menus for the configuration process. This figure will be used frequently.

Displaying the Current Process Value

The Main Menu displays the current process value (i.e. °C in a temperature application), the lower and upper range values, the actual output current, and the output current as a percentage of output span.

Configuring the TRZ's Input

In the "Input Setup" Menu, you can program the type of sensor being used, the sensor's upper and lower range values, a damping time between 0 and 15 seconds, the number of input wires, and the amount of resistance in the wires connecting the TRZ to the input.

Damping smooths input fluctuations by taking an average over a user-programmed time period, and using this value for the TRZ output. The damping time can be set between 0 and 15 seconds.

To configure the TRZ input:

1. Highlight DEVICE SETUP in the Main menu and push the right arrow.
2. Highlight INPUT SETUP and push the right arrow.
3. Highlight SIGNAL CONDITION and push the right arrow to show the current settings for sensor type, upper and lower sensor values, and the minimum span. Use the left arrow to return to the Input Setup menu.
4. Highlight SENSOR TYPE and push the right arrow to select the sensor type and parameters. Enter the input type and parameters and push ENTER to return to the Input Setup menu.

Note:

After the sensor type and parameters are selected, the TRZ defaults to the range listed in Table 1. If you wish to modify the range, see steps 5 and 6. Otherwise, skip to step 7.

5. Highlight LRV and push the right arrow to change the lower range value. Input the new value and push ENTER to return to the Input Setup menu.
6. Highlight URV and push the right arrow to change the upper range value. Input the new value and push ENTER to return to the Input Setup menu.
7. Highlight DAMP and push the right arrow to enter a damping time between 0 and 15 seconds. Input the value and push ENTER to return to the Input Setup menu.
8. Highlight WIRE NO. and push the right arrow to enter the number of wires used to connect the TRZ to the input. Input the number and push ENTER to return to the Input Setup menu.
9. Highlight CABLE R and push the right arrow to enter the amount of resistance present in the wire. Input the value and push ENTER to return to the Input Setup menu.
10. Push HOME to return to the Main Menu.

Configuring the TRZ's Analog Output

In the "Output Setup" menu, you can enter the output for measurements outside of the programmed range and for sensor failure. The output can go upscale (from 20.00 to 23.00mA) or downscale (from 3.60 to 4.00mA).

To configure TRZ analog output:

1. Highlight DEVICE SETUP in the Main Menu and push the right arrow.
2. Highlight OUTPUT SETUP and push the right arrow.
3. Displayed next to UNDER LIM is its current setting. Highlight UNDER LIM and push the right arrow to enter the output current for measurements lower than the programmed range. Input the value and push ENTER.
4. Displayed next to OVER LIM is its current setting. Highlight OVER LIM and push the right arrow to enter the output current for measurements higher than the programmed range. Input the value and push ENTER.
5. Displayed next to SENSOR ERROR is its current setting. Highlight SENSOR ERROR and push the right arrow to enter the output current in the event of sensor failure. Input the value and push ENTER.
6. Push HOME to return to the Main Menu.

Configuring the TRZ's HART Output

In the "HART Output" menu, you can enter a polling address between 0 and 15 for an individual TRZ and display the number of preamble characters sent by the master to the slave to ensure synchronization.

To configure the HART output:

1. Highlight DEVICE SETUP in the Main Menu and push the right arrow.
2. Highlight DEVICE INFORMATION and push the right arrow.
3. Scroll to HART OUTPUT and push the right arrow.

4. Displayed next to POLL ADDR is the current address. Highlight POLL ADDR and push the right arrow to enter the polling address for the module. It can be any integer between 0 and 15. Input the address and push ENTER to return to the HART screen.

Note:

If the polling address is set to 0, the TRZ is automatically set to analog mode. Multiple TRZ's on the same bus must have different addresses.

5. Displayed next to # REQ PREAMBLES is 5. This is the number of preamble characters sent by the master to the slave. This cannot be changed.
6. Push HOME to return to the Main Menu.

Configuring the Device Information

In the "Device Information" menu, you can enter a tag (8 characters), date, descriptor (i.e. a location code of up to 16 characters), a message (32 characters), and final assembly numbers for the TRZ.

To configure the device information:

1. Highlight DEVICE SETUP from the Main Menu and press the right arrow.
2. Highlight DEVICE INFORMATION and press the right arrow.
3. Scroll past the displays of DISTRIBUTOR, MODEL, and DEV ID. They cannot be changed in the field.
4. Highlight TAG and press the right arrow to enter an eight character name for the unit. Input the name and press ENTER to return to the Device Information menu.
5. Displayed next to DATE is the date input into the TRZ. Highlight DATE and press the right arrow to enter a date for the unit. Input the date and press ENTER to return to the Device Information menu.
6. Scroll past WRITE PROTECT NONE This cannot be changed in the field.

7. Highlight DESCRIPTOR and press the right arrow to enter a location code of up to 16 characters. Input the code and press ENTER to return to the Device Information menu.
 8. Highlight MESSAGE and press the right arrow to enter a message of up to 32 characters. Input the message and press ENTER to return to the Device Information menu.
 9. Highlight FINAL ASSEMBLY # and press the right arrow to enter a reference number of up to 8 characters. Input the number and press ENTER to return to the Device Information menu.
 10. Highlight REVISION #S and press the right arrow to display the revision number of the command set, the TRZ, and the Device Description software. These cannot be changed.
 11. HART OUTPUT configures the HART OUTPUT. See page 13 for instructions.
 12. Push HOME to return to the Main Menu.
6. Highlight “End” and press “Enter”. Push OK to return the loop to automatic control. The screen returns to the Diag/Service menu.
 7. Push HOME to return to the Main Menu.

Changing Loop Current to a Fixed Value

The “Diag/Service” menu allows you to change the loop current to a fixed output. Once the TRZ’s output current is set to a known value, it can be checked against the value being received and displayed by your receiving device.

To change the loop current to a fixed value:

1. Highlight DEVICE SETUP in the Main Menu and push the right arrow.
2. Highlight DIAG/SERVICE and push the right arrow.
3. Highlight LOOP TEST and push the right arrow to change the loop current to a fixed output.

Note:

The TRZ has to be removed from automatic control in order to run the Loop Test.

4. Push OK after removing the loop from automatic control.
5. Choose the current output value and push ENTER. Push OK if the entry is correct, abort if it is not.

Trimming the Input Sensor

From the “Sensor Trim” menu, you can enter the offset for a non-calibrated sensor or reset the TRZ to the factory settings.

Offset for non-calibrated sensors can be entered two different ways. The first time a non-calibrated sensor is connected, SENSOR TRIM is used to enter the offset because it allows the TRZ to synchronize with the input. Subsequent adjustments to the offset can be accomplished in SENSOR TRIM or in OFFS. SENSOR TRIM can only be used in a controlled environment because fluctuating input makes it difficult for the TRZ to synchronize with the input. OFFS can be used in a controlled environment or in the field.

To trim the sensor:

1. Highlight DEVICE SETUP in the Main Menu and push the right arrow.
2. Highlight DIAG/SERVICE and push the right arrow.
3. Highlight SENSOR TRIM and push the right arrow to start the trim process.

Note:

To change the offset without synchronizing to the input, skip to step 8.

To reset the TRZ to the factory settings, go to step 9.

Before beginning Sensor Trim, the TRZ reverts to the factory trim settings. This takes 5 seconds. Pushing Abort during this time stops the process.

5. After reverting to the factory settings, the TRZ will synchronize with the input. Adjust the input until the desired value appears, then press OK.
6. A space appears below the input value. Input the desired offset value into the space and press ENTER to return to the Sensor Trim menu.

7. Highlight TEMP and push the right arrow to display the temperature. Press ENTER to return to the Sensor Trim menu.
8. Highlight OFFS and push the right arrow to change the offset. Input the desired offset and push ENTER to return to the Sensor Trim menu.
9. Highlight FACTORY TRIM and push the right arrow to reset the TRZ to the factory settings. If you do not want to reset the TRZ, skip to step 10.

Note:

Once the factory trim process is complete, all other trim values are erased.

Reset takes 5 seconds. Pushing Abort during this time stops the process.

10. Push HOME to return to the Main Menu.

Displaying the Minimum and Maximum Process Values

The highest and lowest process values since the last reset are displayed in the “Data Logger” menu. These values are held in volatile memory and are irretrievable if the TRZ loses power or is reset.

To display the minimum and maximum values:

1. Highlight DATA LOGGER in the Main Menu and push the right arrow.
2. Next to MAX VALUE is the highest process value since the last reset. Push EXIT to return to the Data Logger menu.
3. Next to MIN VALUE is the lowest process value since the last reset. Push EXIT to return to the Data Logger menu.
4. Push HOME to return to the Main Menu.

Resetting the Minimum and Maximum Process Values

The minimum and maximum process values can be reset in this menu. Once reset, they are irretrievable.

Resetting the minimum and maximum process values:

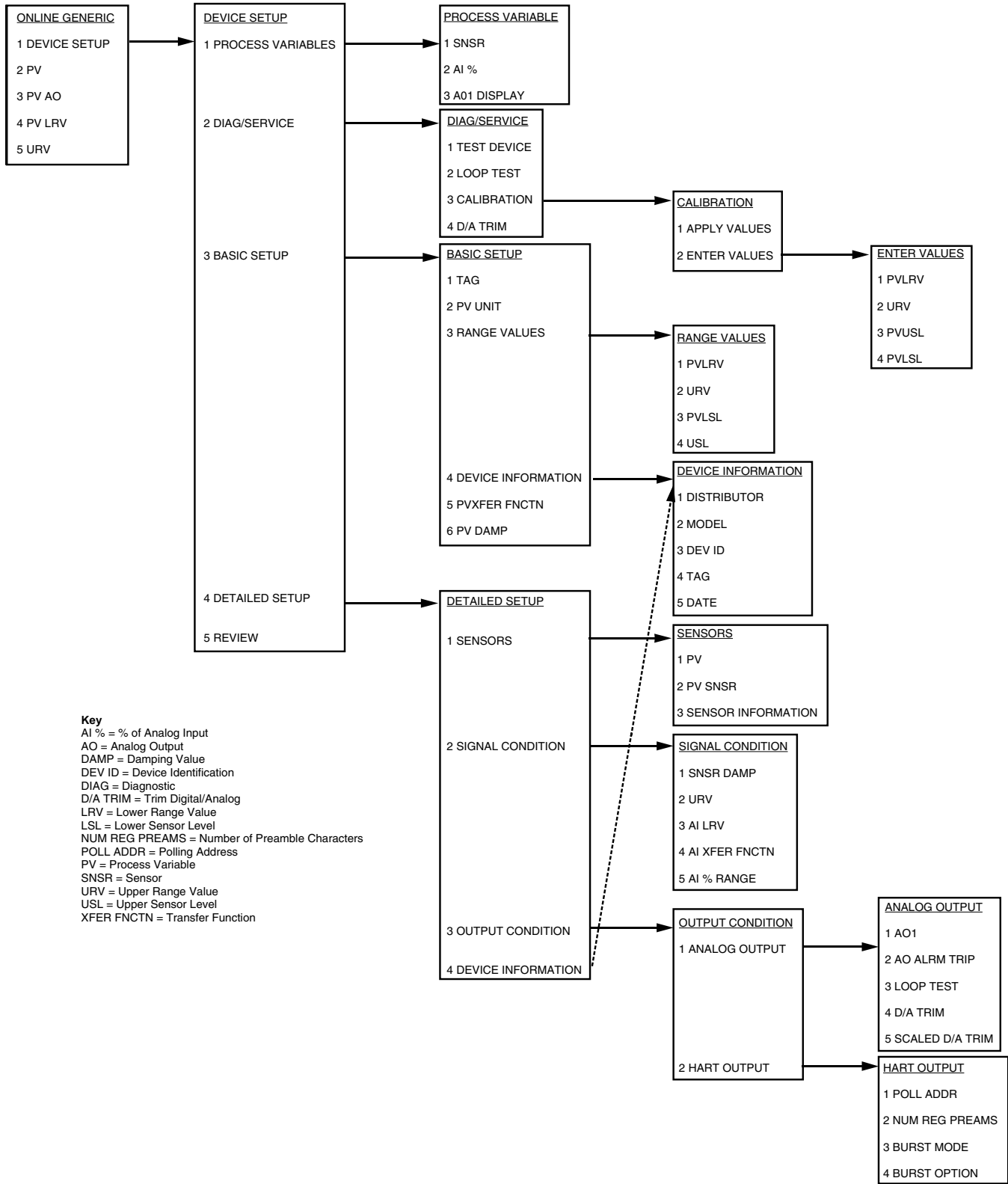
1. Highlight DATA LOGGER in the Main Menu and push the right arrow.
2. Highlight RESET MIN/MAX and push the right arrow to reset the maximum and minimum process values.

Note:

Reset takes five seconds. Pushing Abort during this time stops the process.

3. Push HOME to return to the Main Menu.

Figure 7. Generic Menu Overview



Programming the TRZ when a Device Description is NOT Available

This section contains the instructions for programming a TRZ using a HART communicator without a TRZ Device Description. If your communicator has a Device Description for the TRZ, please see “Programming the TRZ when a Device Description is Available” on page 12.

Displaying the Current Process Values

The initial screen, the “Online Generic” menu, displays the process value, analog output, and the programmed upper and lower parameters of the process value. The main overview menu (Figure 7 on page 16) shows the screen. This menu will be used throughout the process of programming a TRZ without a HART device description.

Configuring TRZ Input

The “Basic Setup” menu allows you to enter a name for an individual TRZ, the units of measurement, the upper and lower range and sensor values, and a damping time between 0 and 15 seconds.

Damping smooths input fluctuations by taking an average over a user-programmed time period and using this value for the TRZ output.

To configure the TRZ input:

1. Highlight DEVICE SETUP in the Online Generic menu and push the right arrow.
2. Highlight BASIC SETUP and push the right arrow.
3. Highlight TAG and push the right arrow to display the current name of an individual TRZ. Push EXIT to return to the Basic Setup menu. To change or enter the TAG, skip to step 6.

4. Highlight PV UNIT and push the right arrow to enter the measurement units. Scroll to the correct units and push ENTER. The screen returns to the Basic Setup menu.
5. Highlight Range Values and push the right arrow to enter the upper and lower range and sensor values for the unit.
 - A. Highlight PVLRV to enter the Lower Range Value for the Process Variable. Input the value and then push ENTER to return to the Range Values Menu.
 - B. Highlight URV to enter the Upper Range Value for the Process Variable. Input the value and then push ENTER to return to the Range Values menu.
 - C. Highlight PVLSL to enter the Lower Sensor Level for the Process Variable. Input the value and then push ENTER to return to the Range Values menu.
 - D. Highlight USL to enter the Upper Sensor Level for the Process Variable. Input the value and then push ENTER to return to the Range Values menu.
 - E. Scroll to PVLRV and use the left arrow to return to the Basic Setup menu.
6. Highlight DEVICE INFORMATION and push the right arrow to enter the name and date for the TRZ.
 - A. Scroll past DISTRIBUTOR, MODEL, and DEV ID. They cannot be changed.
 - B. Highlight TAG and push the right arrow to enter a name up to 8 characters long for the TRZ. Input the name and push ENTER to return to the Device Information menu.
 - C. Highlight DATE and push the right arrow to enter the date. Input the date and push ENTER to return to the Device Information menu.
 - D. Scroll to DISTRIBUTOR and push the left arrow to return to the Basic Setup menu.
7. PV XFER FNCTN is not used. Highlight PV DAMP and push the right arrow to enter a damping time between 0 and 15 seconds for the process value. After entering the value, push ENTER to return to the Basic Setup menu.
8. Press HOME to return to the Online Generic menu.

Configuring TRZ Analog Output

The “Analog Output” menu displays the analog output, changes the loop current to a fixed value so that it can be checked against the value being received and displayed by your receiving device, and enters and trims the sensor.

To configure the analog output:

1. Highlight DEVICE SETUP from the Online Generic menu and push the right arrow.
2. Highlight DETAILED SETUP and push the right arrow.
3. Highlight OUTPUT CONDITION and push the right arrow.
4. Highlight ANALOG OUTPUT and push the right arrow.
5. Highlight AO1 and push the right arrow to view the analog output.
6. AO ALRM TRIP is not used. Scroll to LOOP TEST and push the right arrow to change the output current to a fixed value.

Note:

The TRZ must be removed from automatic control to run the loop test.

7. Push OK to remove the loop from automatic control and begin the loop test.
8. Select the fixed current output value and push ENTER. Highlight END to return to the Analog Output menu.
9. Highlight D/A TRIM and push the right arrow to start the trim process.

10. The screen will display the measured temperature. Input this temperature and push ENTER to return to the Analog Output menu.
11. Highlight SCALED D/A TRIM and push the right arrow to enter the offset. Input the offset and push ENTER to return to the Analog Output menu.
12. Press HOME to return to the Online Generic menu.

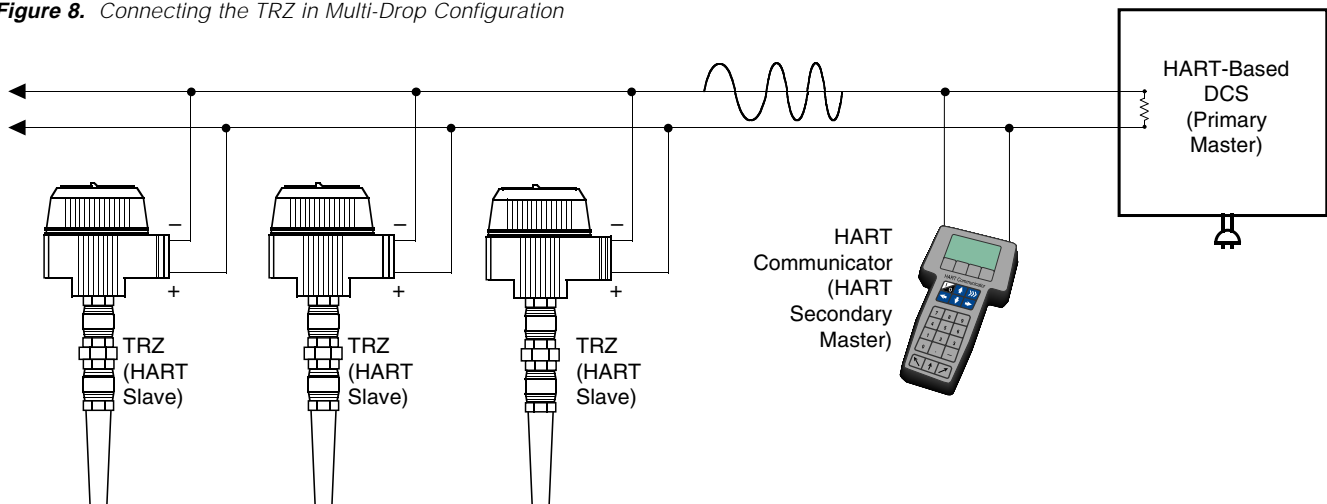
Configuring HART Output

From the "HART Output" menu, you can enter the polling address and display the number of preamble characters sent by the master to the slave to ensure synchronization.

To configure the HART Output:

1. Highlight DEVICE SETUP in the Online Generic menu and push the right arrow.
2. Highlight DETAILED SETUP and push the right arrow.
3. Highlight OUTPUT CONDITION and push the right arrow.
4. Highlight HART OUTPUT and push the right arrow.

Figure 8. Connecting the TRZ in Multi-Drop Configuration



5. Highlight POLL ADDR and push the right arrow to enter the polling address for the module. It can be any integer between 0 and 15. Input the address and push enter to return to the HART output menu.

Note:

If the polling address is set to 0, the TRZ is automatically set to analog mode.

Multiple TRZ's on the same bus must have different addresses.

6. Highlight NUM REG PREAMS and push the right arrow to display 5. This is the number of preamble characters sent from the master to the slave during communication. This cannot be changed. Push EXIT to return to the HART Output menu.
7. BURST MODE and BURST OPTION are not available on the TRZ.
8. Press HOME to return to the Online Generic menu.

Installation

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

Mounting the TRZ

The TRZ fits inside a 30-35mm connection head (such as the LH1) using captive mounting screws.

Making the Electrical Connections

The connections for the various TRZ inputs are shown in Figures 2 and 3 on pages 6 and 7. The figures show a single TRZ unit. If you are using multiple units, connect them using the connections shown in Figure 8.

In multi-drop networks, the TRZ's receiving device is normally a HART-communicating control system acting as the HART Primary Master. The control system uses each TRZ's individual address to access real-time process data, sensor diagnostics, and TRZ diagnostic data. The address is also used to locate the appropriate TRZ to initiate configuration and calibration. A HART communicator, acting as the HART Secondary Master, can be used to simultaneously access information from, or transmit configuration information to the TRZ from anywhere along the HART digital link.

Make sure that the total loop resistance is at least 250Ω so that the 4-20mA signal containing the HART protocol is not shorted. If loop resistance is less than 250Ω, add a resistor.

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 (Commission Electrotechnique) **must** adhere to the guidelines above in order to meet the requirements set forth in applicable EMC (Electromagnetic Compatibility) directives (EN55011, EN 50082-1, EN50082-2, etc.) 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, TRZ transmitters begin to operate immediately. Depending upon environmental conditions, they can be expected to operate unattended for extended periods of time.

HART Protocol

This section of the manual gives an overview of the HART format used by TRZ modules during operation. Use the information in this section to process the data provided by the module(s) during operation. For more information on the HART protocol, contact the HART Foundation at:

The HART Communication Foundation
9390 Research Blvd, Suite 1-350
Austin, TX 78759-6540 U.S.A.
(512) 794-0369
www.ccsi.com/hart

Device Types

To implement two-way communication between the TRZ and the device being used to configure it or receive its information, the TRZ operates in a HART Master/Slave structure. The TRZ is the Slave (or slaves in a multidrop network).

There can be two Masters per system: a Primary Master and a Secondary Master. Masters are typically either a HART Hand-Held Communicator or a HART-based control system.

In many applications, the Primary Master is a HART Hand-Held Communicator. The communicator is used solely as a configuration tool to set up the TRZ, periodically view its real-time process measurement, or view its operating and diagnostic information from a loop termination point.

Digital Signal

One of the advantages of the HART protocol is that the digital information is conveyed by the same wires used to output the 4-20mA signal. After being polled by the master, the TRZ responds to the inquiry by modulating the 4-20mA current 0.5 mA above or below the output signal. 1200 Hz represents 1 and 2200 Hz represents 0.

Communication Speed and Format

The speed of the HART transmission is 1200 baud. The time delay between a master initiating a request for data from a slave and the slave receiving and acknowledging the request depends upon which command is issued. Generally, a master can poll a slave 2-3 times per second.

The byte structure of the HART signal is:

1 Start Bit, 8 Data Bits, 1 Odd Parity Bit, 1 Stop Bit.

Maintenance

Moore Industries suggests a quick 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 TRZ, 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.

GUIDELINES AND CERTIFICATIONS

Low Voltage Directive

When installing any Moore Industries product, always follow all local regulations and standards for grounding, shielding, and safety. The following grounding and wiring practices must be followed in order for the unit(s) to meet the requirements set forth in the EMC directives EN50082-2 and EN55011.

Grounding

If the unit has a metal case it is to be grounded. (DIN rail mounted units should be mounted on a grounded rail).

Wiring

Twisted shielded wire should be used for all input and output signals. The shields are to be grounded at the units, to earth ground (safety ground). The unshielded part of the in/output wires should be no longer than 2 inches.

CE Certification-related Guidelines

The following guidelines must be followed in order to comply with EN61010-1 (Low Voltage Directive). These items affect the AC version of the TRZ. If these products are to be used in a non-CE environment, this directive may be disregarded.

WARNING:

If this unit is used in a manner not specified by Moore Industries, the protection provided by the equipment may be impaired.

Switches and Circuit Breakers

A switch or circuit breaker must be wired in series with the AC power conductors. The switch or circuit breaker used must be located within three meters of the unit.

WARNING:

Terminals on this unit may be connected to hazardous voltages. Before making ANY connections to this unit, ALL hazardous voltages must be de-energized.

The circuit breaker or switch will only remove power to the unit, hazardous voltages may still be connected to other terminals on the unit.

Installation Category

All of Moore Industries' terminals are rated CAT II, except those with the -RF option. These terminals are rated CAT I.

Equipment Ratings

The TRZ does not generate hazardous voltages, rather, it accommodates a temperature input, and generates a 4-20mA current output. Products connected to the TRZ should be designed to receive these inputs.

Supply Wiring

All power connections should be made with proper wire.

The end of each conductor should be stripped no more than 8mm. The end of the stripped wire should be tinned with solder, or inserted into a ferrule and crimped before being placed into a terminal block.

Conductors connected to screw-type connections should have a ring-lug or spade-lug crimped onto the wire end.

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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January 2001

The Physical Instructions Supplement provides references and additional information for safely installing and commissioning a Moore Industries' Hockey-Puck instrument and LH2 Field-Mount Enclosure Apparatus.

Instrument Labeling and Identification—The fully assembled apparatus consists of a Moore Industries' Hockey-Puck unit securely mounted in an LH2 enclosure. Such an apparatus is intended for use in both indoor and outdoor Hazardous (Classified) Locations where a degree of protection from windblown dust and rain, splashing and hose-directed water, and protection from the formation of ice on the enclosure is required. A series of selected Moore Industries' 2-Wire hockey-puck style units mounted in the LH2 enclosure (consult factory for a list of the certified instruments) are certified as an Explosion-Proof and Dust Ignition-Proof apparatus in accordance with Factory Mutual Research '3600' standard (NEC-based) and as Flame-Proof in accordance with the CENELEC/ATEX Directive 94/9/EC (IEC-based). For applications intended in North America and other related areas, the approval classifications are stated on the externally mounted metal ID Tag to be FM approved as Explosion-Proof for Class I, Division 1, Groups A, B, C and D; Dust Ignition-Proof for Class II/III, Division 1, Groups E, F and G; T6 @ 60°C Maximum Operating Ambient Temperature. In regards to protection from Environmental hazards/effects, the apparatus carries a NEMA Type 4X rating with an Ingress Protection Code of IP66 as per IEC-529. For applications intended in Europe and other related areas, the ID Tag clearly states that the apparatus is certified by ISSeP to be Flame-Proof and marked as such:  II 2GD EE x d IIC; T6 @ Tamb. (-20°C ≤ Tamb. ≤ +60°C). The temperature marking for dust atmospheres is up to + 80°C. The maximum power parameters are: Vmax = 42 VDC, Imax = 110 mA and Pmax = 2W. Also, the tag clearly shows the CE marking denoting full compliance with the relevant European Community directives applicable to the Process Instrumentation Industry. For 2-wire transmitters certified and intended to be operated as either Intrinsically Safe, Non-Incendive (Class I, Div. 2) or Type N; the power parameters are clearly stated on both the Instrument ID Label and the Apparatus ID Tag. Also, the power parameters and cabling requirements are stated in the 'Intrinsically Safe Barrier and Field Installation Diagram' that is included in the relevant User's Manuals. This apparatus is designed in such a way that it: a) does not give rise to physical injury or other harm due to contact, b) does not produce excessive surface temperature, infra-red, electromagnetic, ionizing radiation and, c) have no non-electrical dangers.

CAUTION

Read, understand and adhere to the manufacturer's installation and operating procedures. Substitution of components may impair the instrument's Intrinsic Safety and/or Non-Incendivity. Keep cover tightly closed. Do not open unit when energized. Do not open unit when either an explosive gas or dust atmosphere is present. Cable entry temperature may exceed 70°C. Cabling to be suitable. Do not allow layers of dust to accumulate on the surfaces of the equipment. Disconnect power before servicing.

Contact Information—If you have installation, maintenance, periodic service, warranty questions or emergency repair requirements, please contact the nearest Moore Industries sales and service office. Contact information can be found on the back of this Supplement, in the User's Manual for the instrument, or at Moore Industries' web site: www.miinet.com

User's Manual—Complete information for an individual instrument model can be found in the Moore Industries User's Manual for that instrument. The manual provides information for putting the instrument safely into service. This, where applicable, includes instructions, drawings and diagrams. The Manual also includes appropriate Warnings, Cautionary Statements, and Notes.

User's Manual components, where applicable, include:

Introduction—Brief description of the instrument and its general application and use.

Specifications—Provides electrical and environmental conditions under which the instrument is designed to safely perform.

Ordering Information—Provides a description of the product model number to assist in verifying that the instrument received matches the instrument ordered for the installation.

Calibration and Configuration—Describes how to accomplish instrument settings and adjustment required to set up the unit

Installation and Connection—Describes how to install the instrument and make electrical connections (including terminal designations). See the back of this Supplement for additional information on how to install the hockey-puck instrument into the LH2 enclosure.

Maintenance—Describes recommended maintenance (if any required) for the instrument. The user should consult their own maintenance procedures for any site-specific maintenance procedures (such as scheduled recalibrations) or other maintenance schedules that may apply to instruments such as those supplied by Moore Industries.

Troubleshooting—Describes, where applicable, procedures for correcting any operational difficulties that may be encountered as a result of improper configuration/calibration or installation of the instrument.

Customer Support—Describes the procedure and information required to efficiently receive answers to questions regarding instrument installation, set up, or operation.

User's Manual Supplement

Physical Instructions for Installing an Encapsulated Hockey-Puck (HPP) Instrument and LH2 Field-Mount Enclosure Apparatus

Suitability for the Installation—To determine if a unit's area classification approvals are appropriate for a particular installation, first inspect the classification labeling on the instrument and/or instrument enclosure and the "Control Drawing for Installation" found in the User's Manual (where applicable). Second, consult the installation criteria for the approval or electrical standard agencies governing your location to determine if the unit's approvals are suitable for the installation. If the instrument's labeling matches the agency criteria and/or electrical codes for the area, the unit is suitable for the installation. To determine if the unit's electrical and environmental specifications are appropriate for the installation, consult the "Specifications" table in the User's Manual for that instrument. If the instrument's electrical and environmental characteristics are within the expected ambient operating conditions for the installation, the instrument is suitable for the installation.

CAUTION

If for any reason you are uncertain as to whether the instrument's specifications or area classifications meet the operational or safety requirements for the installation, consult Moore Industries prior to installation.

Installation of LH Enclosure Apparatus

1. Install the LH2 enclosure onto a surface, temperature thermowell, or onto a standard 2-inch pipe using the mounting hardware. Remove the cap from the LH2 by rotating the cap counter clockwise after unlocking by rotating the locking screw clockwise.
2. Connect input and output wiring in accordance with the connection information found in the User's Manual for that instrument.
3. Replace the cap to the LH2 by rotating the cap clockwise. Secure (lock) the cap by rotating the locking screw counterclockwise.
4. Connect a ground wire between the ground screw on the LH2 enclosure to an appropriate earth ground.

Ground Wire Recommendations

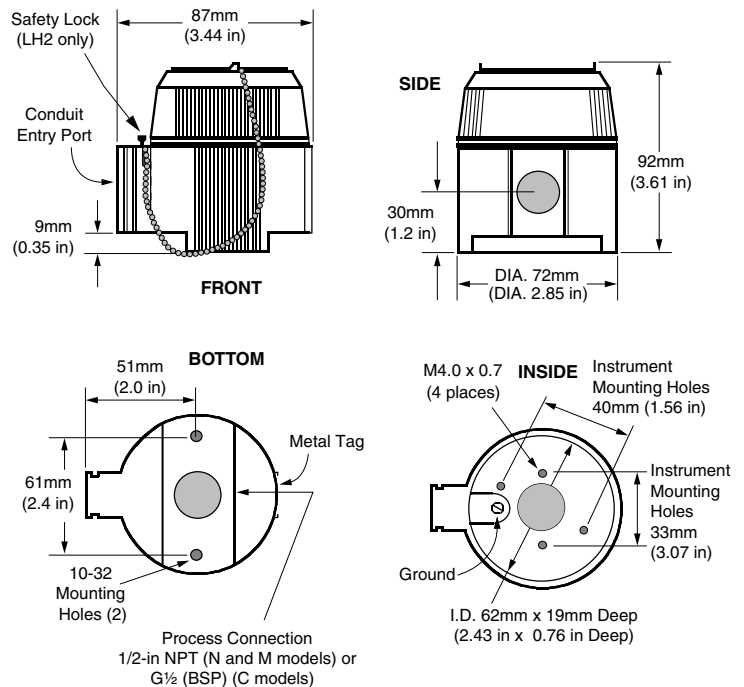
The following ground wiring practices must be followed to ensure proper performance of the Moore Industries instrument in any application.

- Any Moore Industries product in a metal case or housing must be grounded.
- All input signals to, and output signals from, Moore Industries' products should be connected using a shielded, twisted pair technique. Shields should be connected to an earth or safety ground at the unit itself.

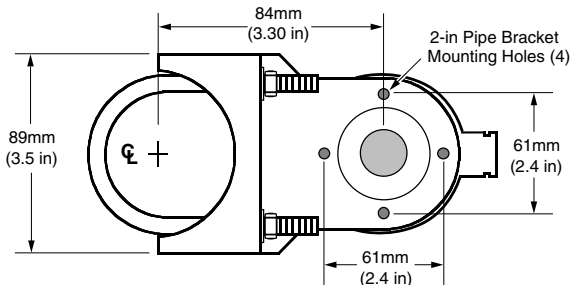
- The maximum allowable length of any unshielded portion of the input and/or output connections is 2 inches (50.8mm).

See the User's Manual for the instrument for additional installation information.

Figure 1. Installation dimensions for LH2 enclosure.



2-INCH PIPE MOUNTING HARDWARE



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