MOORE INDUSTRIES

THZ
Smart HART®
Temperature Transmitter

March 2000

Data Sheet 3.80

Description

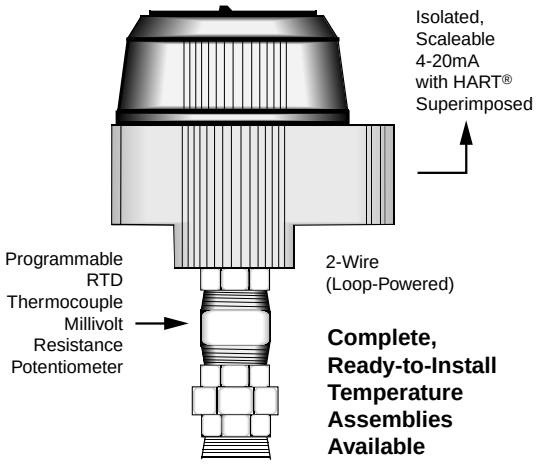
The THZ Smart HART® Temperature Transmitter is the industry's most accurate temperature transmitter. Combine this remarkable accuracy, versatility, and Moore Industries' reliability, and you have the ideal solution whenever accurate temperature measurements are required–from a rugged environment to a quiet control room.

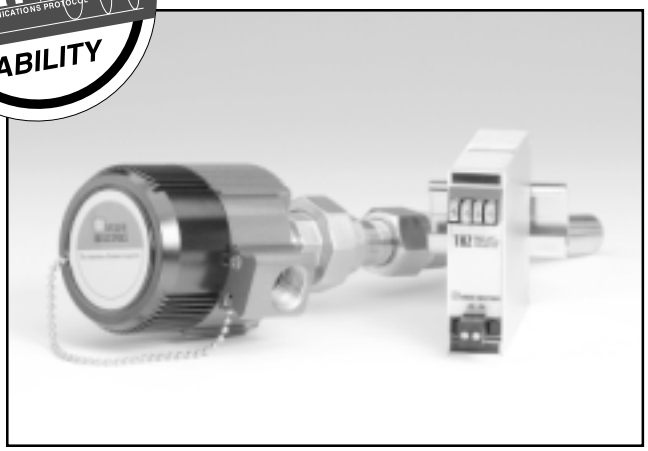
The universal THZ configures to accept direct low-level signal inputs from RTD, thermocouple, ohm, and mV sources (see Table 1). It provides a proportional, isolated 4-20mA output ready for direct interface with HART or non-HART based DCS, PLC, and other computer-based SCADA systems.

Using HART digital communications, you can check the status of, or perform measurement parameter changes to, the THZ from the control room or from any point on the 4-20mA wires without interrupting the transmitter's output signal.

Complete Point Solutions—Why shop around for pieces and parts? We specialize in complete point solutions that can handle the most challenging environments. We offer transmitters, thermowells, housings, sensors, and a variety of other parts.

Figure 1. *The THZ Smart HART Temperature Transmitter features programmable inputs with a fully isolated output.*





The THZ *is offered in a variety of ready-to-install temperature assemblies, a head-mount "hockey-puck" housing, and a rail-mount DIN housing.*

Features

- **Accuracy of up to ±0.014°C (±0.025°F)*** is the absolute best in the industry.
- **Universal, microprocessor-based electronics** allow selection of nearly every available RTD, T/C, ohm, and mV input type and range.
- **Superior long-term stability** provides up to 5 years between calibrations and a 1-year input-to-output drift of up to 0.08% of span.
- **Sensor referencing capability** provides amazing accuracy when our THZ is matched with a RTD, and calibrated as a complete temperature system.
- **Enhanced EMI/RFI and ambient temperature protection** guard against environmental factors that can quickly degrade measurement accuracy.
- **PC software's "HelpMap Navigation System",** the most complete resource of its kind, provides quick and complete answers to performance, setup, installation, and maintenance questions.

Certifications

FM APPROVED · Ex (pending) · Ex (pending) · CE

Check the listing on page 9 for certification details.

HelpMap Navigation System — EQUIPPED WITH

*High-accuracy measurements are achieved by using a 4-wire, 1000Ω platinum RTD with a span of 100°F (50°F minimum) calibrated in our sensor-matching calibration bath.

Simple Remote Testing, Viewing, and Configuration

The THZ can be programmed in minutes and interrogated at any time, from anywhere on the 4-20mA loop (see Figure 2). You can use a standard HART Communicator (such as Model 275), a HART-based control system, or a PC using Asset Management Solutions (AMS) software or Moore Industries' Intelligent PC Configuration Software to:

- **Program Input Type and Range—**Span, Zero, and Input Type values are all fully programmable (see Table 1 on page 10 for available input types and ranges).
- **Adjust Sensor Trim Offset—**Set an offset to compensate for measurement errors that are caused when a temperature sensor is not calibrated or not performing to its rated specifications.
- **Set Damping Time—**Eliminate imprecise readings caused by noise and other insignificant process fluctuations by setting a damping time between 1-30 seconds.
- **View Real-Time Process Values—**View the existing process value (in the appropriate engineering unit), lower and upper range values, actual output current, and output current as a percentage of output span.
- **Choose Sensor Failure Mode—**If the input is lost, you have the choice of the output going upscale (to 23.6mA) or downscale (to 3.6mA).
- **Select Device Identification and Data—**Tag number (8 characters), configuration date, unit location code (16 characters), a message (32 characters), and polling address (0-15) are selectable.
- **Fix Output Current (Loop Test)—**To assist in calibrating your system, the THZ's current output can be fixed to a known value so you can check it against the value being read by your receiving device.

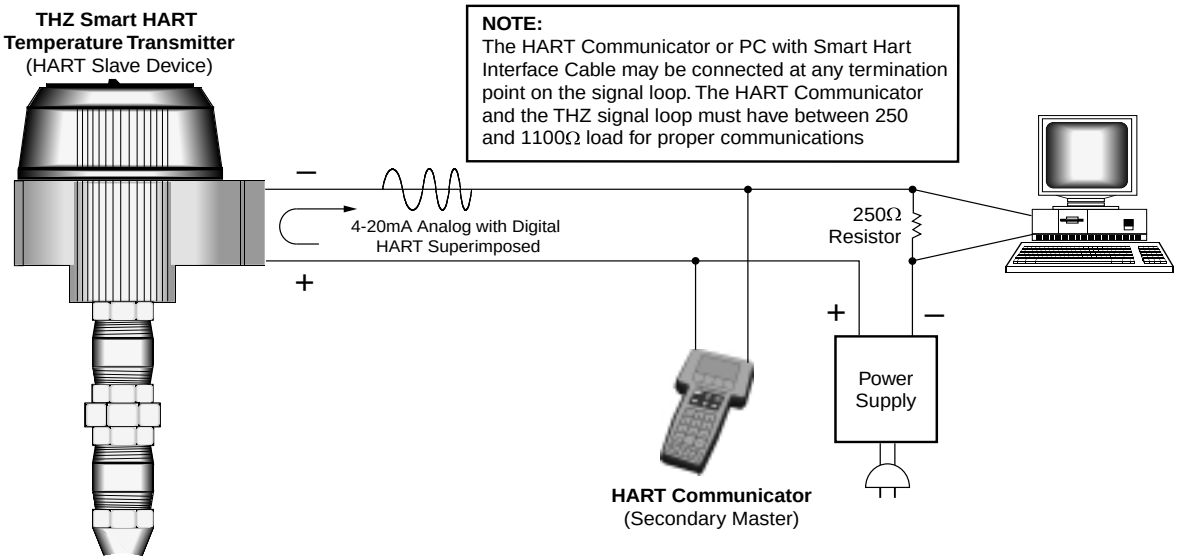
Non-Volatile Memory

If power to the THZ is lost, the unit resumes normal operation with the parameters you've configured upon reapplication of power.

THZ Device Description (DD)

Moore Industries THZ Device Description (DD) is the device-specific programming information that is loaded into a standard HART Communicator (such as the Model 275). It allows access to all of the THZ's programming functions except the custom linearization table function. The THZ DD is available on the HART Communication Foundation's October 1999 and later Device Driver Library release. We can custom configure your THZ or update your Model 275 at any of our solution centers.

Figure 2. *From any point on the 4-20mA loop, you can view, test, and change THZ operating parameters.*

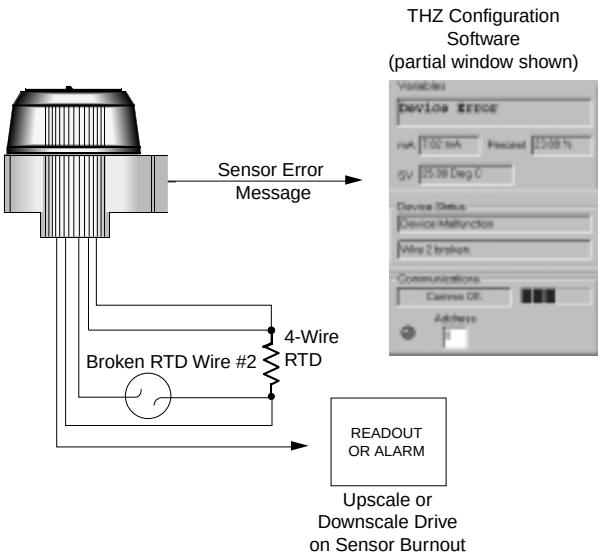


Total Sensor Diagnostics

The THZ performs continuous sensor diagnostics. This patented Moore Industries feature can save you from costly lost production time and hours of troubleshooting.

If the sensor breaks or otherwise stops sending a signal during operation, the THZ sends the output upscale or downscale to warn of trouble and provides a HART digital error message that can be read by a HART communicator or computer-based system. If the sensor being utilized is a RTD, the THZ PC configuration software instantly displays the type and location of the error.

Figure 3. *Total Sensor Diagnostics saves troubleshooting time.*



Precise Linearization and RJC

The THZ uses a 128-point linearization curve to minimize the conformance error. Its advanced Reference (Cold) Junction Compensation techniques produce stable readings even in fluctuating ambient temperature conditions. Custom linearization curves, to accommodate non-linear inputs, can be created using our PC Configuration Software.

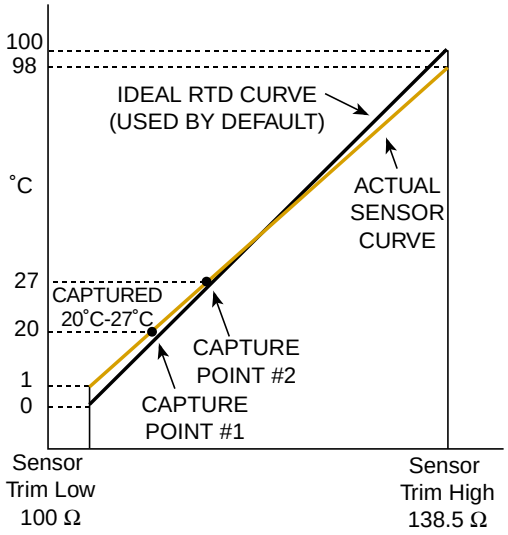
Trims to Respond to Specific Sensor Curve Segments

The THZ's zero and span values can be calibrated to measure a specific range within a sensor's overall curve capability. However, for even greater measurement accuracy, the THZ's trim capabilities go much further.

The THZ can be trimmed with two data points within the selected zero and span measurement range. This advantage allows a complete process range to be monitored, while placing measurement emphasis on a specific segment of the range most critical to the process.

In the figure below, the actual sensor curve is used in place of the ideal RTD curve between 20°C and 27°C. This provides incredible precision over a limited portion of span, while measuring the remainder of the span with the THZ's usual outstanding accuracy.

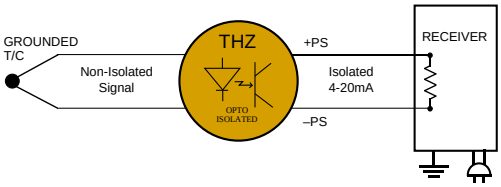
Figure 4. *The THZ can be set to measure the segment most critical to the process.*



Complete Signal Isolation

Delivering up to 1000Vrms input-to-output isolation, the THZ stops ground loops, motor noise, and other electrical interferences from distorting signals.

Figure 5. *The THZ's complete signal isolation stops ground loops from affecting signal accuracy.*

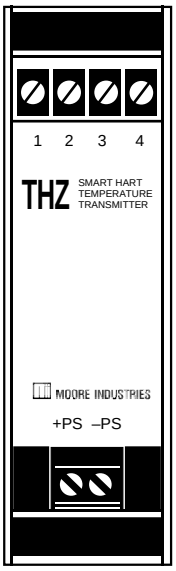


Intelligent PC Configuration Software

Now, in addition to configuring your THZ with a HART® Communicator, you can configure it with your PC! Our new Intelligent PC Configuration Software will allow you (with the aid of our HART-to-RS232 Smart Interface Cable) to set up all the THZ settings from just one window!

Precise Input Capturing

The THZ Configuration Software will capture the upper and lower range of the sensor with just a click of a mouse. With this advanced technology, greater measurement accuracy is less than a minute away!



Set-Up Safeguards

Specialized setup tools built into the software make it nearly impossible to make incompatible configuration selections.

Transmitter Auto-Recognition

The PC Configuration Program automatically recognizes the type of unit you have attached, such as the THZ DIN shown at right, the THZ HPP, and even our TDZ HART Transmitter with display.

Toolbar for Frequently Used Commands

A conveniently-located toolbar provides quick access to often-used configuration functions.

Real-Time Process Readout

The software continuously displays the process measurement and the communication status between the THZ transmitter and PC.

Time-Saving Quikset Feature

Save time by programming select information on the THZ instead of having to program the entire transmitter every time you decide to make a small change.

Store and Print Files

The configuration record you've created may be downloaded to any number of transmitters, stored for record keeping, or printed.

Precise Digital Output Trimming

This fine adjustment minimizes the impact of measurement errors introduced by inaccurate readout devices, allowing you to take full advantage of the exceptional precision of the THZ.

On-Screen Setup Confirmation with Auto Recognition

When you connect the THZ to the PC, our software tells you exactly when, and with what parameters, the transmitter was configured. If you make changes, your new choices are quickly displayed.

Selectable Under Range, Over Range, and Sensor Failure Values

By setting different default values for each condition, you can distinguish between the failure modes when they occur.

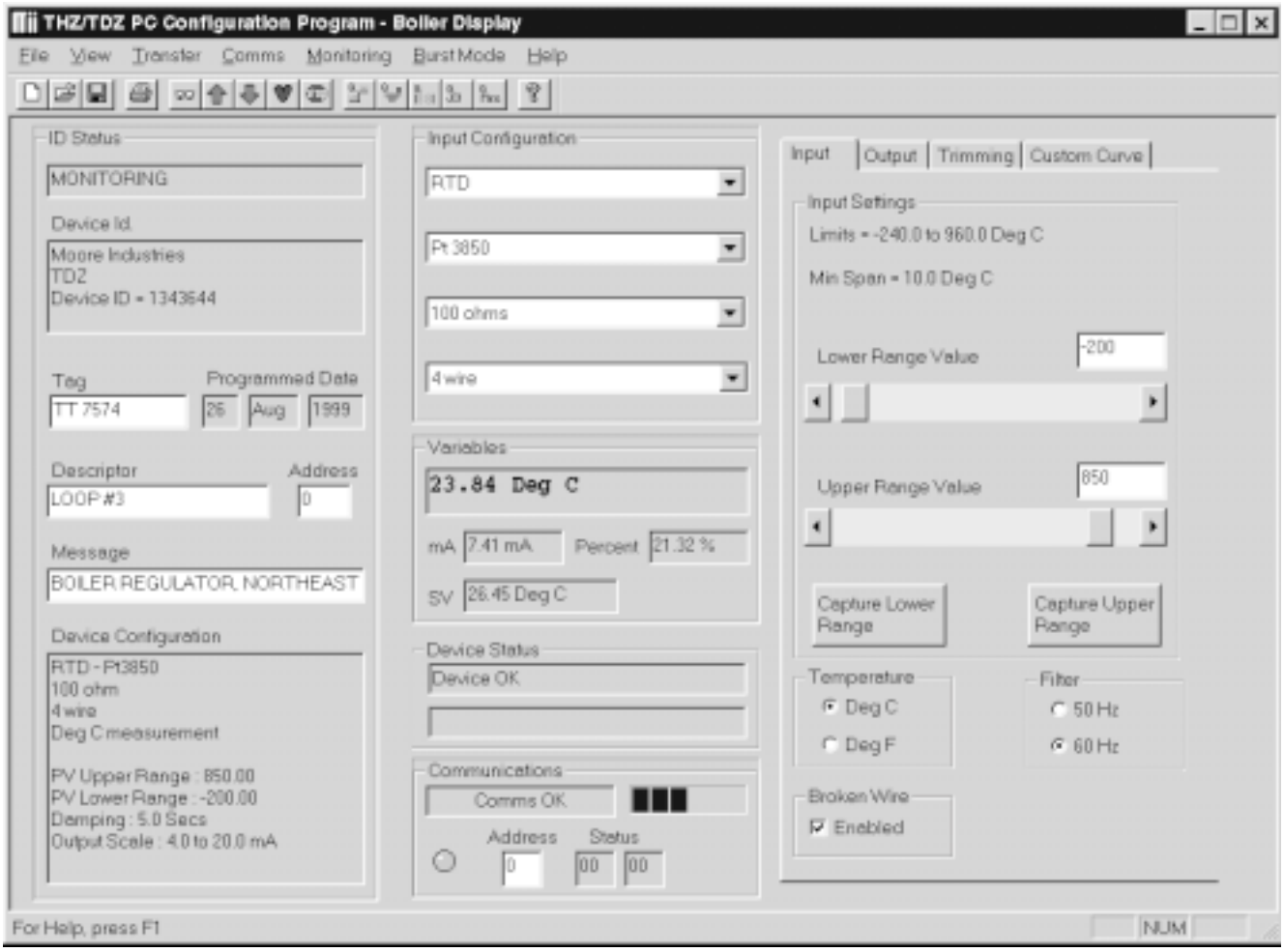
Sensor-Specific Input Trimming

To ensure that the THZ's calibrated input precisely matches the sensor's actual measurement, you can capture and store any two values from the sensor. Our new advanced trimming doesn't limit you to just the zero and span values–you can choose the two values that are most essential to your process.

HelpMap Navigation System

If you have a question during configuration, a push of a button provides your answer. Just click on the questionmark at the upper-right portion of the screen, and our comprehensive HelpMap Navigation System will appear to answer your question.

Figure 6. *All operating parameters can be selected and viewed from a single software screen.*



Complete Temperature Assemblies

We are your *One-Stop Temperature Shop*!
Free yourself from the hassle of looking around for pieces and parts by ordering a complete assembly.

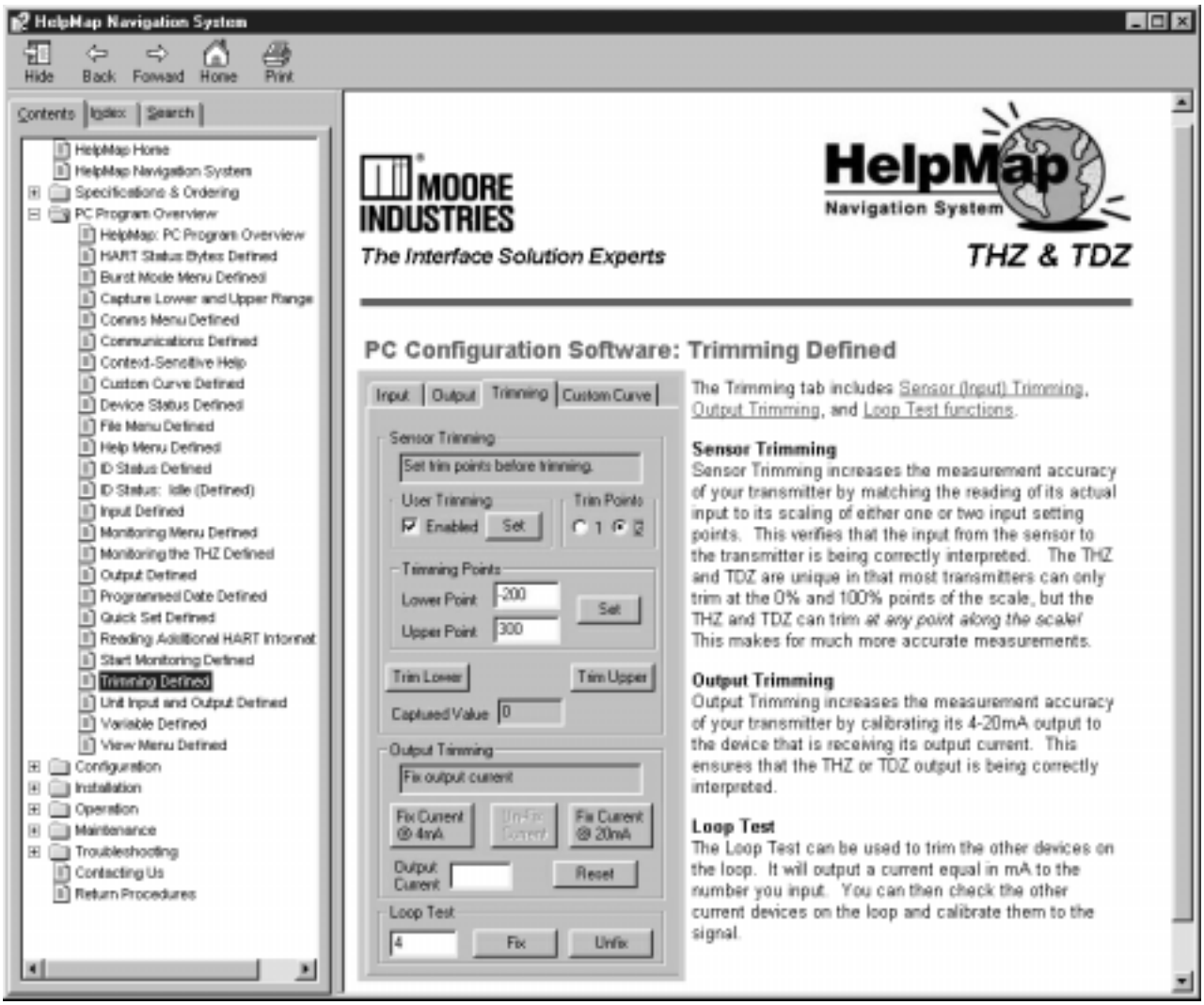
To complement our high-quality transmitters, we carry complete lines of RTDs, thermocouples, thermowells, connection heads, and fittings. Get the quality you need and the options you require with the ease of just one ordering number!

For the best accuracy, have your THZ and sensor calibrated together in our sensor-matching calibration bath.

Sensor-to-Transmitter Matching
Our sensor matching process starts by immersing the temperature sensor into stabilized temperature baths in our "Calibration Suite" calibration lab. The THZ captures two points from the sensor and stores them in nonvolatile memory. It then uses them to compensate for deviations between a sensor's stated linearization curve and its actual measurements.

Sensor matching provides you with incredible accuracy at an affordable price. Accuracy varies with the sensor, so contact the factory for information on your sensor type.

Figure 7. *The HelpMap Navigation System makes it simple to find all the information you need.*



HelpMap Navigation System

Use our comprehensive, searchable digital help system to answer any questions you have on your new THZ.

Easy to Use

The revolutionary HelpMap system is remarkably intuitive. Based on the programming language used to design Internet web pages, it has all the functions you would expect from a high-powered help system with the ease and functionality of a web site.

In-Depth Explanations

The HelpMap is packed with overviews of specific features as well as step-by-step directions on how to configure, install, maintain, and troubleshoot your transmitter.

Intuitive Imagemaps

Point and click your way to any definition by using a picture of the Configuration Software from inside the HelpMap System. Just click on the part of the image that you need more information about.

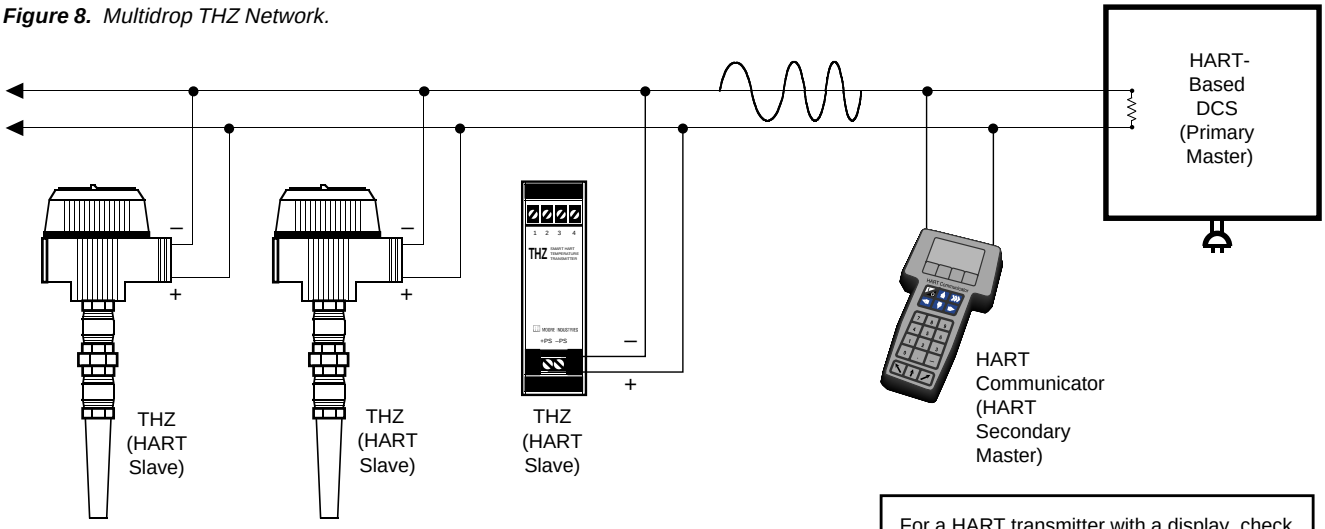
Advanced Search Features

Our advanced search engine will search word-for-word through the help file to quickly find the necessary information. Combine this search engine with a complete index, and all the information for using the THZ is available at your fingertips!

Context-Sensitive Help

Need a quick definition? Concise information and software definitions regarding the part of the program you are using are available from our context-sensitive help system.

Figure 8. *Multidrop THZ Network.*



Point-to-Point Loops Deliver Analog Simplicity with Remote Programmability

In the majority of applications, the THZ is installed on a point-to-point 4-20mA process loop like a regular analog transmitter (Figure 2). A HART Communicator or HART-based system is used to configure and view the THZ's operating parameters and diagnostic data from any point on the loop.

Multidrop Networks Save Wiring Costs

Up to 15 THZ's connect in parallel onto a HART digital communication link (Figure 8). This means you can use a single loop, instead of 15 separate loops, to connect multiple THZ's. In a multidrop network, the THZ's measured process variable is output digitally, so the 4-20mA signal (set to 4mA) is not used.

A HART-based control system uses each THZ's individual address (1-15) to initiate communication with the THZ for configuration or viewing of the transmitter's data. A HART Communicator can be used in this configuration to access information from, or transmit configuration information to, the THZ from anywhere on the HART loop.

HART Master/Slave Structure

To implement two-way communications between the THZ and the device configuring or receiving its information, the THZ operates in a HART Master/Slave structure.

The THZ is a Slave (or Slaves in a multidrop network). There can be two Masters per system: a Primary Master and a Secondary Master. In the majority of applications, the Master is a HART Hand-Held Communicator, but it can also be a HART-based control system. Operating in HART's Poll/Response (Normal) Mode, the HART Master polls the THZ two times per second to access the current process variable status, send setup data to the THZ, or remotely view its identification, configuration, and diagnostic information.

THZ

Smart HART®
Temperature Transmitter

Specifications

HART Specifications

Address Range: 0-15 (Addresses 1-15 are for multidrop loops)
Transmission Speed: 1200 baud
Character Format: 1 Start Bit - 8 Data Bits - 1 Odd Parity Bit - 1 Stop Bit

Performance

Input Accuracy: Refer to Input Type & Accuracy Table on page 10
Analog Output Accuracy: 0.015% of span
Overall Accuracy: The overall accuracy of the unit is the combined input and output accuracy. It includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution. It does not include ambient temperature effect. For T/C input only, add the Reference Junction Compensation error
Reference Junction Compensation: ±0.45°C (±0.81°F)
Stability: Error is in % of maximum span

Stability	Input to Output		
	1yr	3yrs	5yrs
T/C,mV	0.08	0.14	0.18
RTD Ohm Pot.	0.09	0.16	0.21

Stability	Input to HART		
	1yr	3yrs	5yrs
T/C,mV	0.008	0.014	0.019
RTD Ohm Pot.	0.047	0.081	0.104

Isolation: HPP, 1000Vrms input-to-output continuous; DIN, 500Vrms input-to-output continuous, and will withstand a 500VAC dielectric strength test for one minute without breakdown

Performance (Continued)

Response (Rise) Time: 100 msec maximum for the output to change from 10% to 90% for an input step change of 0% to 100%
Step Response Time: 600 msec maximum, 500 msec typical from the time an input is applied to the output reaching 90% of its final value
Ripple: Less than 10mV peak-to-peak measured across a 250-ohm load resistor at frequencies up to 120Hz
Over-Voltage Protection: Input, ±5Vdc peak, maximum; Output, 48Vdc, maximum
Digital Input Filter: User-programmable; 50/60Hz
Power Supply Effect: ±0.002% of span per 1V change
Load Effect: Negligible within specified power limits
Load Capability:
Load = $\frac{(Vdc - 12)}{0.024}$
Burnout Protection: User-programmable, Upscale to 23.6mA; Downscale to 3.6mA
Output Current Limiting: 3.8mA and 21.6mA for input over range; 25mA maximum
mV & T/C Input Impedance: 40MΩ, nominal
RTD & Ohms Excitation: 250µA, ±10%
RTD Lead Wire Resistance Maximum: RTD resistance + 2X lead wire resistance < 4000ohms; Recommended lead wire resistance for three wire connections: <35 ohms/wire; 10 ohm copper sensor <5 ohms

Performance (Continued)

Sensor Lead Resistance Effect: 1.0 ohms in reading per ohm of lead resistance for 2-wire sensors; 1.0 ohms in reading per ohm of lead of unbalanced resistance for 3-wire sensors; no effect on 4-wire sensors
Damping: user set; 0-30 seconds
Resolution: Input, 20-bit; Output, 16-bit
Supply Range: 12-28V I.S.; 12-42V normal operation

Ambient Temperature

Operating & Storage Range: -40°C to +85°C (-40°F to +185°F)
-40°C to +60°C for I.S. Version (-40°F to 140°F)
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: Digital Accuracy, ±0.003% of maximum span/°C
Effect on Reference (Cold) Junction Compensation: ±0.005% of input span/°C change of ambient temperature
RFI/EMI Immunity: HPP 10V/M, and DIN 30V/M when tested according to SAMA 33.1 abc with 0.5% of span or less error; 10V/M @ 80-1000MHz, 1KHz AM when tested according to IEC 1000-4-3-1995;
Startup Time: Performance within specification 8 seconds after power is applied
Noise Rejection: Common mode: 100dB @ 50/60Hz; Normal Mode: 70dB typical at 200mV peak-to-peak @ 50/60 Hz

Weight

DIN: 221 grams (7.9 oz)
HPP: 101 grams (3.6 oz)
HPP in LH1: 434 grams (15.5 oz)
HPP in LH2: 654 grams (1 lb., 7.3 oz)

Ordering Information

Unit	Input	Output	Power	Options	Housings
THZ Smart HART Temperature Transmitter	**PRG** Programmable with standard HART Communicator, HART-based control system, or Moore Industries' PC-based Configuration Software	**4-20MA** Scaleable to narrower ranges	**12-42DC** **12-30DC** (For Intrinsi-cally Safe and Non-Incendive units)	none	**DIN** DIN-style aluminum housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) **HPP** Hockey-puck housing for mounting in standard connection heads **LH1NS** LH1 head with two entry ports: ½-inch NPT conduit and process–black VALOX(357U) cover **LH1MS** LH1 head with two entry ports: M20 cable and ½-inch NPT process–black VALOX(357U) cover **LH1CS** LH1 head with two entry ports: M20 cable and G½ (BSP) process–black VALOX(357U) cover **LH2NS** Explosion-Proof LH2 head with two entry ports: ½-inch NPT conduit and process–black metal cover **LH2MS** Explosion-Proof LH2 head with two entry ports: M20 cable and ½-inch NPT process–black metal cover **CH6** Polypropylene connection head **P** suffix indicates enclosure comes equipped with base and U-bolts for mounting on a 2-inch pipe (i.e. LH1NS**P**)

To order, specify: Unit / Input / Output / Power [Housing]
Model Number Example: THZ / PRG / 4-20MA / 12-42DC [DIN]
THZ / PRG / 4-20MA / 12-30DC [HPP]

Additional Parts

Each THZ order comes with one copy of our Configuration Software on 3½-inch floppy disks (Windows® '95, '98, and NT compatible). The HART RS-232 Modem and the HART Communicator must be purchased separately.

Additional parts are available as follows:

Part Number 235-829-02	**PC-Programming Kit** Includes one copy of our THZ/TDZ Intelligent PC Configuration Software and one HART-to-RS232 Cable with HART modem.
Part Number 235-75120-05	**Intelligent PC Configuration Software** (One copy comes free with each order)
Part Number 803-048-26	**HART-to-RS232 Smart Interface Cable with HART Modem**

How to Determine if Your HART Communicator Has a THZ Device Driver

To determine if your HART Communicator has the THZ DD, press "1" to select "Offline" and press "1" again to select "New Configuration". Select "Moore Industries" from the list of companies. The "THZ/TDZ" option will appear if you have the proper DD installed. To update your HART communicator with the latest THZ DD, call our Interface Solution Center nearest you.

Also Programs with the Generic HART DD

Even if your communicator is not up to date, most of the THZ's important programming features can be accessed without the THZ DD by using the "Generic" HART DD available on HART Communicators. Or you can order the THZ factory-configured by Moore Industries with all of the THZ parameters that are not accessible through the generic DD.

Certifications

Factory Mutual Research Corporation (FMRC)
FM Global
Explosion-Proof [HPP in LH2 M/N] –
Class I, Division 1, Groups A*, B, C, D
Class II & III, Division 1, Groups E, F, G
NEMA 4X; **IP66**
THZ HPP Unit
Intrinsically Safe –
Class I, II, III, Division 1, Groups A-G
T4A @ 40°C$_{Max. Amb.}$ and T3C @ 60°C$_{Max. Amb.}$
Non-Incendive –
Class I, Division 2, Groups A, B, C, D
Suitable for: Class II & III, Division 2, Groups F, G
T4A @ 40°C$_{Max. Amb.}$ and T3C @ 60°C$_{Max. Amb.}$

CE Conformant–EMC Directive 89/336/EEC
EN 50081-2, 1993 and EN 50082-2, 1995

Pending *(Consult factory for status)*
European Approvals by HSE-EECS/BASEEFA:
CENELEC/ATEX-94/9/EC Directive
Type N – [HPP in LH2 M/N] Ex N IIC, **IP66**.
THZ HPP Unit Only
Intrinsically Safe –
Ex II 2G EEx ia IIC; T4A @ 60°C$_{Max. Amb.}$

*Group A only: Seal all conduits within 18".

Table 1. *Input Types, Ranges, Minimum Span and Maximum Range Specifications, and Accuracy of the THZ.*

Input	Type	α*	Ω	Conformance Range	Minimum Span	Input Accuracy	Maximum Range
RTD (2-, 3-, 4-Wire)	**Platinum**	0.003850	100	-200 to 850°C -328 to 1562°F	10°C (18°F)	±0.1°C (±0.18°F)	-240 to 960°C -400 to 1760°F
			200				
			300				
			400				
			500				
			1000				
		0.003902	100	-100 to 650°C -148 to 1202°F			-150 to 720°C -238 to 1328°F
			200				
			400				
			500				
			1000				
		0.003916	100	-200 to 510°C -328 to 950°F			-240 to 580°C -400 to 1076°F
	Nickel	0.00672	120	-80 to 320°C -112 to 608°F			-100 to 360°C -148 to 680°F
	Copper	0.00427	9.035	-50 to 250°C -58 to 482°F		±0.85°C (±1.53°F)	-65 to 280°C -85 to 536°F
Ω	**Direct Resistance**	n/a	0-4000Ω	0-4000Ω	10Ω	±0.4Ω	0-4000Ω
	Potentiometer		4000Ω	0-100%	10%	±0.1%	0-100%
T/C	**J**	n/a	n/a	-180 to 760°C -292 to 1400°F	35°C 63°F	±0.25°C (±0.45°F)	-210 to 770°C -346 to 1418°F
	K	n/a	n/a	-150 to 1370°C -238 to 2498°F	40°C 72°F	±0.3°C (±0.54°F)	-270 to 1390°C -454 to 2534°F
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C 63°F	±0.2°C (±0.36°F)	-270 to 1013°C -454 to 1855.4°F
	T	n/a	n/a	-170 to 400°C -274 to 752°F	35°C 63°F	±0.25°C (±0.45°F)	-270 to 407°C -454 to 764.6°F
	R	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F
	S	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F
	B	n/a	n/a	400 to 1820°C 752 to 3308°F	75°C 135°F	±0.75°C (±1.35°F)	200 to 1836°C 392 to 3336.8°F
	N	n/a	n/a	-130 to 1300°C -202 to 2372°F	45°C 81°F	±0.4°C (±0.72°F)	-270 to 1316°C -454 to 2400.8°F
	C	n/a	n/a	0 to 2300°C 32 to 4172°F	100°C 180°F	±0.8°C (±1.44°F)	0 to 2338°C 32 to 4240.4°F
Millivolts	**DC**	n/a	n/a	-50 to 1000mV	4mV	15µV	-50 to 1000mV

Sensor-to-Transmitter Matching
Up to ±0.014°C (±0.025°F) system accuracy*.

*High-accuracy measurements are achieved by using a 4-wire, 1000Ω platinum RTD with a span of 100°F (50°F minimum) calibrated in our sensor-matching calibration bath. See page 5 or contact our factory for additional information.

Figure 9. *Dimensions of the DIN-style THZ.*

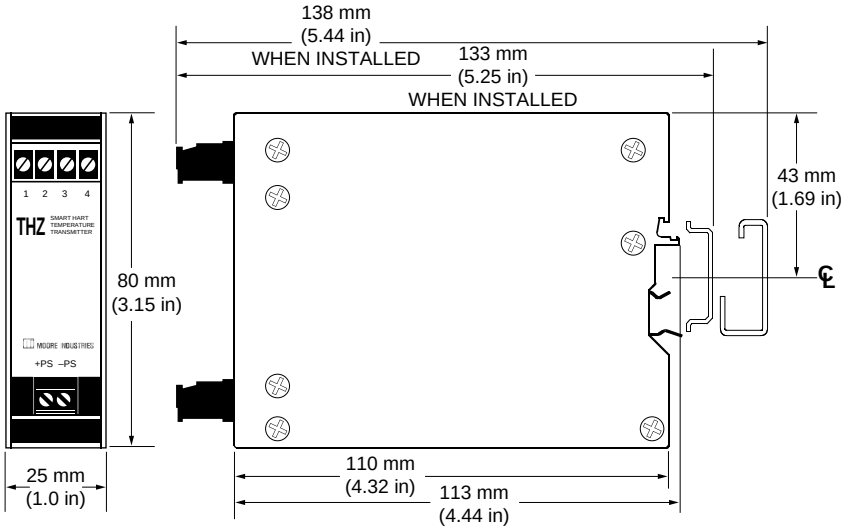


Figure 10. *Dimensions of the THZ HPP unit.*

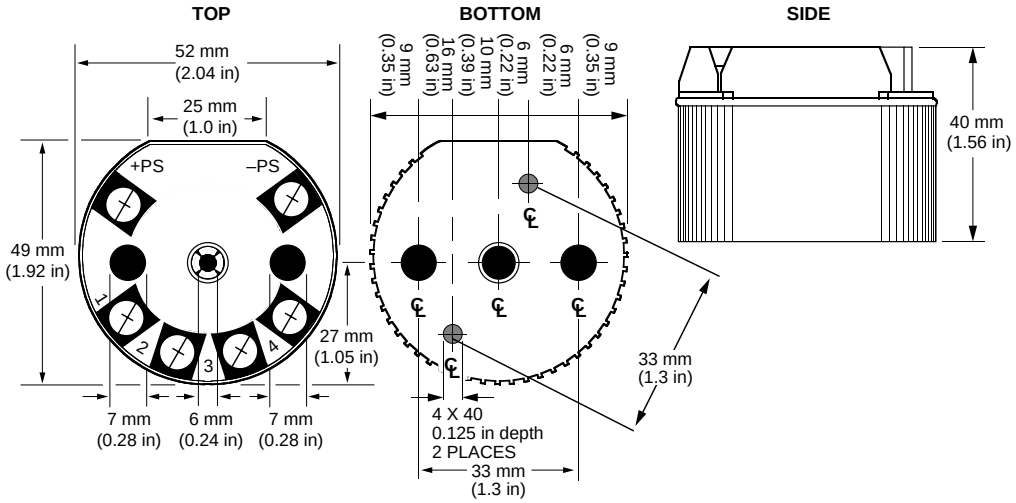


Figure 11. *Sensor Connections for the THZ.*

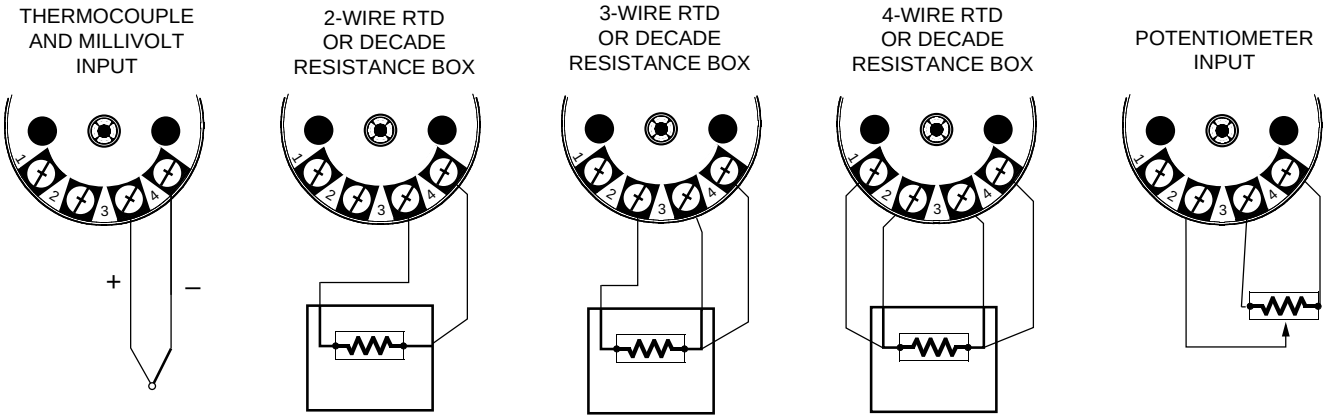


Figure 12. *Dimensions of the HPP THZ in a LH Housing.*