Transmation 2000 Series Universal Temperature Transmitters

Models 2500T/2800T/2850T/2900T/2950T and –EXP Versions

A Pyragon Product

User's Guide and Reference Manual #100856-901

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PYRAGON, INC.
95 Mount Read Blvd., #149
Rochester, NY 14611 USA
Phone: 1.800.688.6551 • 1.585.697.0444
Fax: 1.585.697.0445 • Email: sales@pyragon.com

PREFACE

This document contains the information necessary to install, wire, configure, operate, and service 2000 Series Universal Temperature Transmitters.*

The information contained in this document is furnished for customer use only. This information is subject to change without notice.

*Transmation 2000 Series is a Pyragon product.

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HART is a registered trademark of the HART Communication Foundation.

Windows is a registered trademark of Microsoft Corporation, Inc.

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SECTION 1. GENERAL INFORMATION

1.1 INTRODUCTION

NOTE

Do not discard this user's guide. The information provided in this document is essential to safe equipment operation and maintenance. To prevent possible personal injury or equipment damage through misuse, the procedures outlined in this document should be performed by qualified service personnel.

This document describes the 2000 Series Universal Temperature Transmitters. The 2000 Series consists of the Model 2500T, Model 2800T and Model 2900T analog two-wire transmitters, and the Model 2850T and 2950T digital two-wire transmitters.

Standard features of the 2000 Series transmitters include isolation, RFI protection, a wide ambient temperature range, outstanding accuracy, and agency approvals as noted.

The 2000 Series transmitters combine digital accuracy and unparalleled versatility with standard 4 to 20 mA output. Each unit can accommodate eight thermocouple types, 12 RTD types, millivolts, and ohms.

The Model 2500T transmitter is calibrated and configured via any PC that supports RS-232. Simple software screens facilitate all configuration and calibration procedures. In addition, the Model 2950T utilizes the HART® protocol to allow remote testing and calibration with enhanced accuracy.

Configuration and calibration of the Model 2800T, Model 2850T, Model 2900T, and Model 2950T transmitters is easily accomplished via two front pushbuttons, so unit removal or disassembly is eliminated. All calibration/ configuration functions are contained within the transmitter; an expensive programming communicator is not required. The built-in digital display provides an indication of inputs, engineering units, zero and span ranges, linearization, and burnout as well as error conditions and programming prompts.

A variety of mounting options extend the flexibility of the Series 2000 transmitters, including surface mount, SNAPTRACK®, DIN rail, or NEMA 4X non-metallic multiple unit enclosure.

1.2 SPECIFICATIONS

Unless otherwise indicated, all specifications are referred to an ambient temperature of 23°C ± 1°C (73°F ± 2°F).

Input Types: Configurable to any of the services and ranges indicated in Table 1.1

Input Span Limits: Any span within range limits

Input Resolution:
Temperature: 0.1°
mV: 1 μV
Ohms: 0.01Ω

Maximum Output Range: 3.7 to 22 mA DC

Calibrated Output Range: 4 to 20 mA DC

Output Resolution: 0.002 mA

Table 1.1 Input Types, Range Limits, and Accuracy

Input Type	Range Limits		Digital Accuracy [1]		D/A Accuracy [2]
	°C	°F	°C	°F	
mV	-100 to 100 mV [3]		±0.015 mV		±0.035% of span
Ohms/RTD 2 or 3 wire	0 to 1000Ω		±0.35Ω		±0.035% of span
B T/C (NIST)	250°/1820°C	482°/3308°F	±0.8°C	±1.44°F	±0.035% of span
E T/C (NIST)	-200°/1000°C	-328°/1832°F	±0.2°C	±0.36°F	±0.035% of span
J T/C (NIST)	-180°/1200°C	-292°/2192°F	±0.3°C	±0.54°F	±0.035% of span
K T/C (NIST)	-180°/1372°C	-292°/2501°F	±0.5°C	±0.90°F	±0.035% of span
N T/C (NIST)	0°/1200°C	32°/2192°F	±0.4°C	±0.72°F	±0.035% of span
R T/C (NIST)	-50°/1768°C	-58°/3214°F	±0.6°C	±1.08°F	±0.035% of span
S T/C (NIST)	-50°/1768°C	-58°/3214°F	±0.6°C	±1.08°F	±0.035% of span
T T/C (NIST)	-200°/400°C	-328°/752°F	±0.2°C	±0.36°F	±0.035% of span
Platinum (DIN 43760) 50Ω, 100Ω, or 200Ω	-200°/850°C	-328°/1562°F	±0.2°C	±0.36°F	±0.035% of span
Platinum (DIN 43760) 500Ω	-200°/260°C	-328°/500°F	±0.2°C	±0.36°F	±0.035% of span
Platinum (JIS C 1604) 100Ω	-200°/650°C	-328°/1202°F	±0.2°C	±0.36°F	±0.035% of span
Platinum (Burns 0.003902) 100Ω or 200Ω	-200°/650°C	-328°/1202°F	±0.2°C	±0.36°F	±0.035% of span
Platinum (Burns 0.003902) 500Ω	-200°/260°C	-328°/500°F	±0.2°C	±0.36°F	±0.035% of span
Nickel (Bristol's 7NA) 110Ω	-105°/310°C	-157°/590°F	±0.2°C	±0.36°F	±0.035% of span
Nickel (Minco) 120Ω	-80°/320°C	-112°/608°F	±0.2°C	±0.36°F	±0.035% of span
Copper (Minco) 10Ω	-200°/260°C	-328°/500°F	±0.3°C	±0.54°F	±0.035% of span
Copper (China 0.00428) 50Ω	-50°/150°C	-58°/302°F	±0.3°C	±0.54°F	±0.035% of span

[1] Total digital accuracy for thermocouple only: sum of Digital Accuracy ± 0.3°C (cold junction accuracy).

[2] Total analog accuracy is the sum of the Digital Accuracy and the D/A Accuracy.

[3] Range limits for the Model 2800T, 2850T, 2900T, and 2950T are -9.999 to 99.999 mV.

RTD Excitation Current: 200 µA typical

Update Rate: Once per second minimum

Input Impedance: T/C or mV: >10 megohms

Common Mode Rejection: >120 dB @ 50/60 Hz

Normal Mode Rejection: >60 dB @ 50/60 Hz

Input/Output Isolation: 500 VAC

Operating Temperature Range/Humidity: -40°C to 85°C (-40°F to 185°F); 5% to 95% RH non-condensing

Storage Temperature Range: -50°C to 100°C (-58°F to 212°F)

Temperature Effect:

T/C: ±0.2 µV/°C ± 0.005% of Input Reading/°C ± CJC
mV: ±0.2 µV/°C ± 0.005% of Input Reading/°C
Ohms/RTD: ±0.002Ω/°C ± 0.005% of Input Reading/°C
CJC (Cold Junction Compensation): 0.005°C/°C

Loop Supply Voltage: 13V + (Load Resistance x 20 mA) minimum, 48V maximum (30V maximum for Model 2800T and 2900T)

Power Supply Effects: 0.005% of span/volt

Non-Destructive Input: 30 volts peak

RFI Effect: <1% with no abnormal behavior at 10 V/m @ 450 MHz

Stability: 0.1% or 0.1°C, whichever is greater, for six months with constant reference conditions

NIST Traceability: The calibration of Pyragon DC voltage, current, and resistance products are traceable to the National Institute of Standards and Technology via calibration standards which have been certified by NIST and are subject to a program of periodic recertification

Approvals: The Model 2800T and Model 2900T are approved for use as non-incendive for Class I, Division 2, Group A, B, C, and D hazardous (classified) indoor locations. The approval parameters are:

NI /I /2 / ABCD — 100669-104 / A; Nonincendive Field Wiring
Max Nonincendive Field Wiring Parameters:
V Max = 30.0 V, I Max = 130 mA, C i =0 µF, L i = 0 µH
Universal Temperature Transmitter Model 2800T

NI /I /2 / ABCD — 100671-105/A
Nonincendive Field Wiring Parameters:
V Max = 30.0 V, I Max = 130 mA, C i =0 µF, L i = 0 µH
Universal Temperature Transmitter Model 2900T

The Model 2500T-EXP, Model 2800-EXP, Model 2900-EXP, and Model 2950T-EXP are approved as explosion proof for Class I, Division 1, Groups B, C, and D; dust-ignition proof for Class II/III, Division 1, Groups E, F, and G hazardous (classified) locations, indoors and outdoors (NEMA Type 4). The approval parameters are:

XP /I /1/ BCD; DIP / II,III /1 /EFG
Temperature Transmitter Models 2500T-EXP-a, 2800-EXP, 2900-EXP, and 2950T-EXP
a = Number of modules (1 or 2)

Transmitter Housing:

Model 2500T: UL-94 polycarbonate

Model 2800T and 2850T: Injection molded, high impact, conductive plastic; meets flammability requirements of UL94 V-O, rated for continuous service at 85°C (185°F)

Model 2900T and 2950T: Aluminum and injection molded, high impact, conductive plastic; meets flammability requirements of UL94 V-O, rated for continuous service at 85°C (185°F)

Connectors:

Model 2500T: Captive screw clamps for 16 AWG conductor maximum, one RJ-22 phone jack for configuration

Model 2800T and 2850T: 6-place cage-clamp terminal block with non-exposed terminations for 14-24 AWG conductor

Model 2900T and 2950T: 6-place screw-clamp terminal block with non-exposed terminations for 12-22 AWG conductor

Transmitter Dimensions (HWD):

Model 2500T: 76 mm x 23 mm x 112 mm (3" x .9" x 4.4"), not including mounting hardware

Model 2800T and 2850T: 81 mm x 45 mm x 97 mm (3.2" x 1.75" x 3.8"), not including mounting hardware

Model 2900T and 2950T: 81 mm x 71 mm x 66 mm (3.2" x 2.8" x 2.6"), not including mounting hardware

Weight:

Model 2500T: 115 gm (4 ounces)

Model 2800T and 2850T: 300 gm (8 ounces)

Model 2900T and 2950T: 300 gm (8 ounces)

Mounting:
Standard: Surface mounting
Optional:
Adapter for SNAPTRACK®
Adapter for 32 mm or 35 mm DIN rail
Adapter for conduit housing with 89 mm (3.5") inside diameter

1.3 ACCESSORIES

Accessories available from Pyragon for use with the 2000 Series transmitters are listed according to model in Table 1.2.

Table 1.2 Accessories

Accessory Name	Part Number			
	2500T	2800T/2850T	2900T	2950T
Surface Mount Bracket	N/A	500148-089	N/A	N/A
Universal Mounting Bracket (Surface or SNAPTRACK)	N/A	N/A	100671-210	100671-210
SNAPTRACK Mounting Adapter [1]	N/A	500108-299	100671-210	100671-210
32 mm DIN Rail Mounting Bracket [2]	N/A	100665-651	100671-212	100671-212
35 mm DIN Rail Mounting Bracket [2]	Included	100665-652	100671-212	100671-212
PC-Based Configuration/ Calibration Software (Model 2500T)	100856-953	N/A	N/A	N/A
HART Protocol PC-Based Configuration/Calibration Software (Model 2950T)	100857-052	N/A	N/A	100857-052
HART modem (Model 2950T)	100857-205	N/A	N/A	100857-205
NEMA 4X Non-Metallic Multiple Unit Enclosure	See Figure 2.4 on page 2-6	See Figure 2.4 on page 2-6	See Figure 2.4 on page 2-6	See Figure 2.4 on page 2-6
2" Pipe Stand Mounting Kit	N/A	759257-254	759257-254	759257-254

[1] SNAPTRACK mounting channel is ordered separately; specify length (P/N 759276-xxx).

[2] DIN rail mounting channel is ordered separately; specify type and length (P/N 759265-xxx).

SECTION 2. INSTALLATION

2.1 MOUNTING

A variety of mounting options are available for 2000 Series transmitters. The six standard mounting configurations (refer to Table 2.1 below) include surface mount, SNAPTRACK, DIN rail (32 mm and 35 mm), NEMA 4 explosion-proof conduit housing, or NEMA 4X non-metallic multiple unit enclosure. Special mounting configurations are also supported; contact the Factory for details.

Table 2.1 Mounting Options

NOTE: *Special mounting configurations are also supported; contact the Factory for details.*

Mounting Option	Transmitter Model			
	2500T	2800T/2850T	2900T	2950T
Surface Mount	N/A	Available	Available	Available
SNAPTRACK	N/A	Available	Available	Available
Din Rail (32 mm)	N/A	Available	Available	Available
Din Rail (35 mm)	Standard	Available	Available	Available
NEMA 4 Explosion-Proof Conduit Housing	2500T-EXP*	2800-EXP*	2900-EXP*	2950T-EXP*
NEMA 4X Non-Metallic Multiple Unit Enclosure	Available	Available	Available	Available

**-EXP versions include all hardware necessary to mount transmitter in housing.*

Consult the instructions listed below for the mounting configuration to be utilized. Mounting dimensions are provided in Figure 2.1 (Model 2500T), Figure 2.2 (Model 2800T and 2850T), Figure 2.3 (Model 2900T and 2950T), Figure 2.4 (NEMA 4X Non-Metallic Multiple Unit Enclosure), and Figure 2.5 (NEMA 4 Explosion-Proof Conduit Housing as used with the –EXP models).

For best transmitter performance, observe the following:

- Select a mounting site for the transmitter that is dry, free of dust and corrosives, with an ambient temperature within the specified range and a mounting surface that is not subject to excessive vibration.

- Verify that the transmitter power source is free of excessive noise and transients.

2.1.1 Surface Mounting

Secure the mounting bracket to the designated mounting surface using suitable fastening hardware.

2.1.2 SNAPTRACK® Mounting

Using suitable fastening hardware, secure the SNAPTRACK mounting channel to the designated mounting surface. Position the transmitter mounting bracket between the rails and press firmly until both ends of the bracket "snap" into place. To remove the unit, spread the channel rails slightly and tip the transmitter out.

2.1.3 DIN Rail Mounting

Using suitable fastening hardware, secure the DIN rail to the designated mounting surface. Insert the DIN rail mounting adapter into the mounting bracket, then "snap" the bracket onto the DIN rails.

2.1.4 NEMA 4X Non-Metallic Multiple Unit Enclosure Mounting

It is recommended that DIN rail be used to secure a transmitter in the housing as instructed in Section 2.1.5. Alternately, mount the transmitter directly to the backplane attached to the rear of the housing using suitable fastening hardware.

2.1.5 NEMA 4 Explosion-Proof Conduit Housing Mounting (For Use With –EXP Models)

To secure a transmitter in a conduit housing, position the transmitter at an angle that permits all wiring to be routed unobstructed through both ports. Insert the conduit housing mounting adapter into the mounting bracket. Insert the assembly into the conduit housing and press firmly until both edges of the mounting adapter retaining spring snap into place. To remove the transmitter, insert a screwdriver under each edge of the retaining spring and "rock" the unit out.

Figure 2.1 Model 2500T Mounting Dimensions

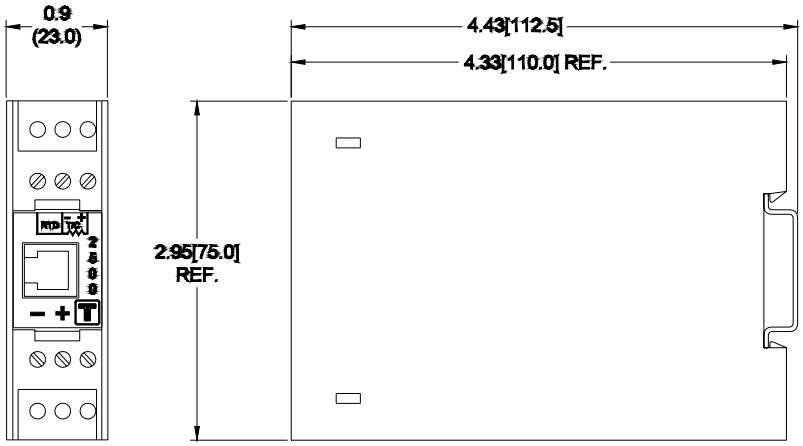

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Figure 2.2 Model 2800T and 2850T Mounting Dimensions

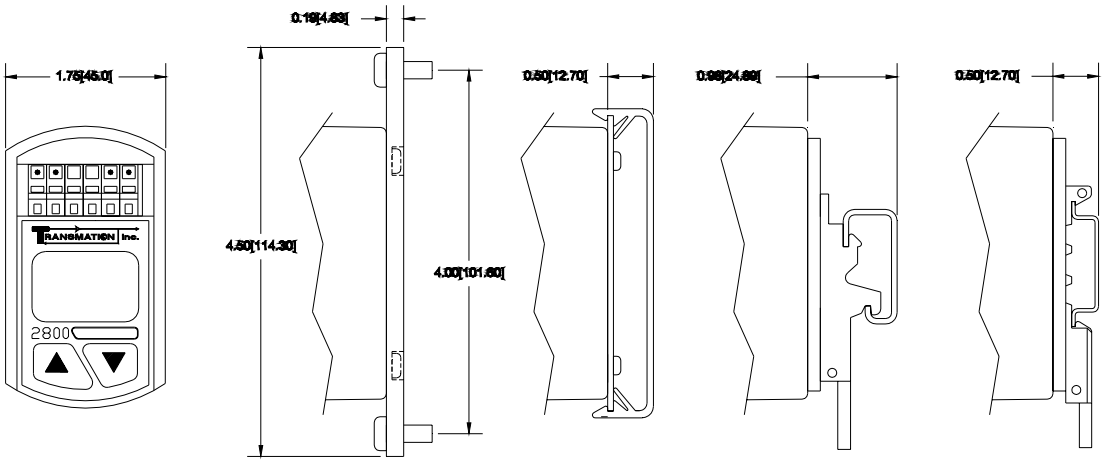

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Figure 2.3 Model 2900T and 2950T Mounting Dimensions

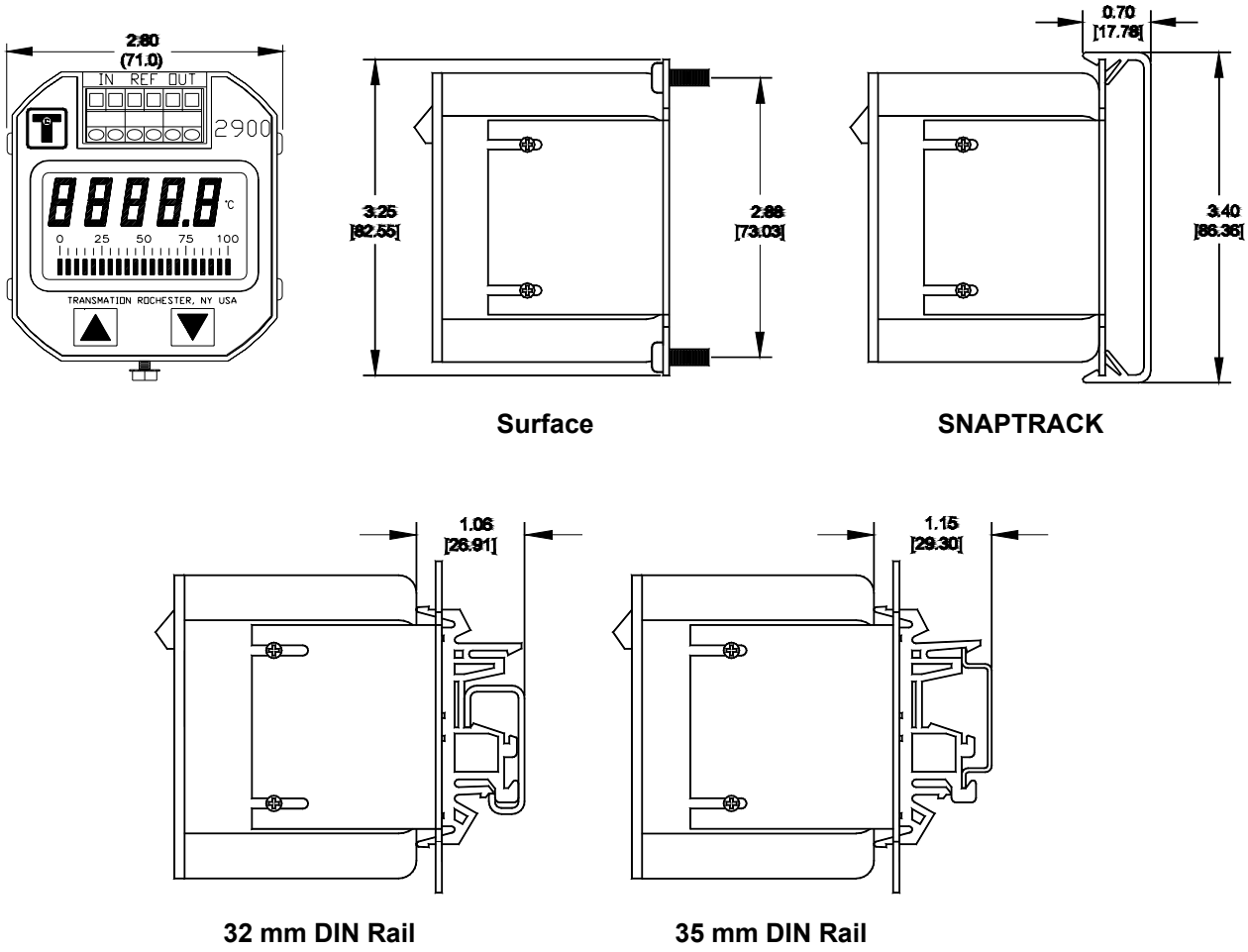

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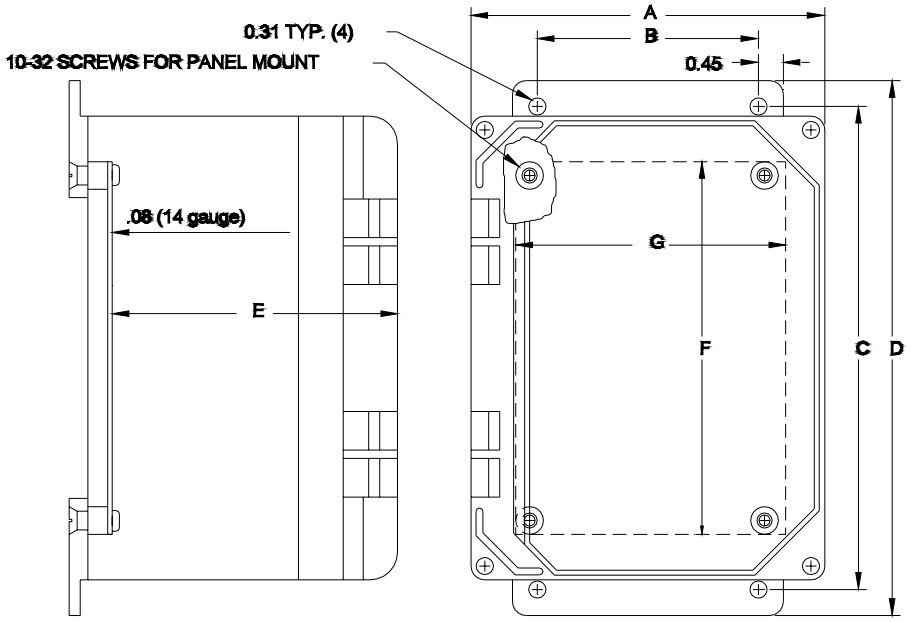
Figure 2.4 NEMA 4X Non-Metallic Multiple Unit Enclosure Mounting Dimensions



DIN Rail Mounting

Part No.	Size	A		B		C		D		E		F		G	
100669-718	6 x 4 x 4	4.40"	108 mm	2.00"	51 mm	6.75"	171 mm	7.69"	195 mm	4.79"	122 mm	4.88"	124 mm	2.88"	73 mm
100669-719	8 x 6 x 4	6.40"	157 mm	4.00"	102 mm	8.75"	222 mm	9.69"	246 mm	4.79"	122 mm	6.75"	171 mm	4.88"	124 mm
100669-720	8 x 8 x 4	8.40"	213 mm	6.00"	152 mm	8.75"	222 mm	9.69"	246 mm	4.79"	122 mm	6.75"	171 mm	6.88"	175 mm
100669-721	12 x 10 x 6	10.40"	264 mm	8.00"	203 mm	12.75"	324 mm	13.69"	348 mm	6.79"	172 mm	10.75	273 mm	8.88"	226 mm

SNAPTRACK Mounting

Part No.	Size	A		B		C		D		E		F		G	
100669-728	6 x 4 x 4	4.40"	108 mm	2.00"	51 mm	6.75"	171 mm	7.69"	195 mm	4.79"	122 mm	4.88"	124 mm	2.88"	73 mm
100669-729	8 x 6 x 4	6.40"	157 mm	4.00"	102 mm	8.75"	222 mm	9.69"	246 mm	4.79"	122 mm	6.75"	171 mm	4.88"	124 mm
100669-730	8 x 8 x 4	8.40"	213 mm	6.00"	152 mm	8.75"	222 mm	9.69"	246 mm	4.79"	122 mm	6.75"	171 mm	6.88"	175 mm
100669-731	12 x 10 x 6	10.40"	264 mm	8.00"	203 mm	12.75"	324 mm	13.69"	348 mm	6.79"	172 mm	10.75	273 mm	8.88"	226 mm

***NOTE:** Contact the Factory for mounting density according to model.*

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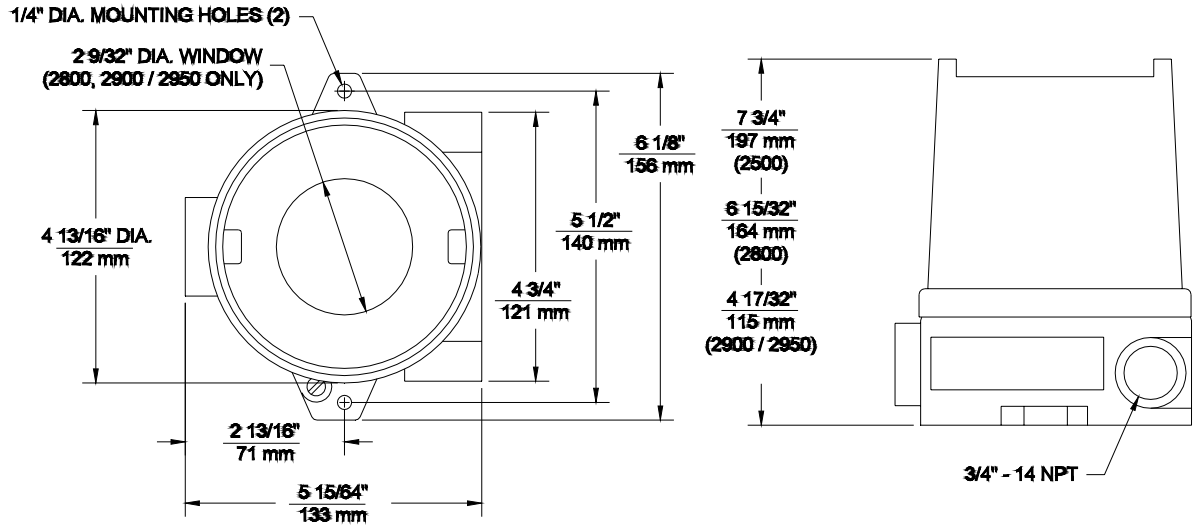
Figure 2.5 NEMA 4 Explosion-Proof Conduit Housing Mounting Dimensions (For Use With –EXP Models)



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2.2 ELECTRICAL CONNECTIONS

Regardless of the mounting configuration employed, the electrical connections are basically identical. Follow the instructions listed below to connect the signal and power wiring to the terminal block. Be sure to observe the terminal block labels as illustrated in Figure 2.6 when performing the electrical connections.

1. Consult the connection diagrams (Figure 2.7 through Figure 2.10) for information on making the correct electrical connections to the terminal block.

2. Orient the leads according to the output configuration to be used. Strip back the insulation 1/4" on each lead.

3. **For Model 2800T/2850T transmitters, perform the following:**

   - Insert the supplied white lever into the terminal block. Apply downward pressure on the end of the lever until the clamp mechanism opens. A small screwdriver may be used in place of the white lever to actuate the clamp mechanism. Insert the screwdriver into the aperture at the bottom of the terminal block and apply pressure inwards until the clamp mechanism opens.

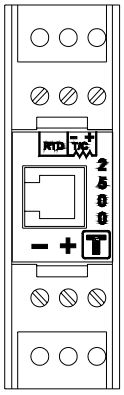
   - Insert the appropriate wire into the terminal block and release the lever. Verify that the clamp mechanism securely grips the bared section of the wire.

   For Model 2500T, 2900T, and 2950T transmitters, perform the following:

   - Insert the appropriate wire into the proper terminal block aperture.

   - Using a small screwdriver, tighten the corresponding terminal block screw clamp. Verify that the clamp mechanism securely grips the bared section of the wire.

Figure 2.6 Terminal Block Identification



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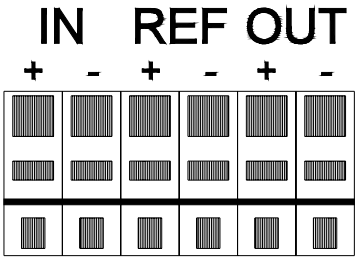
Model 2500T



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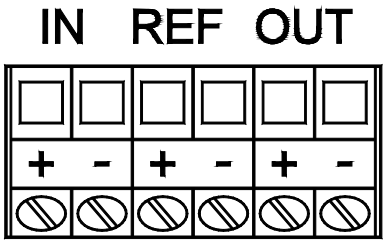
Model 2800T and 2850T



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Model 2900T/2950T

Figure 2.7 Single Loop Connection with Single DC Supply

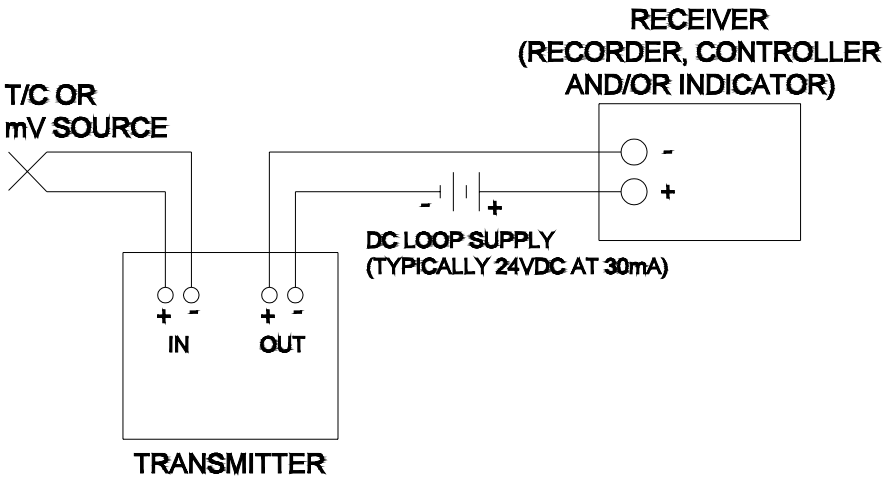

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Figure 2.8 Single Loop Connection Powered by Receiver's Built-in DC Supply

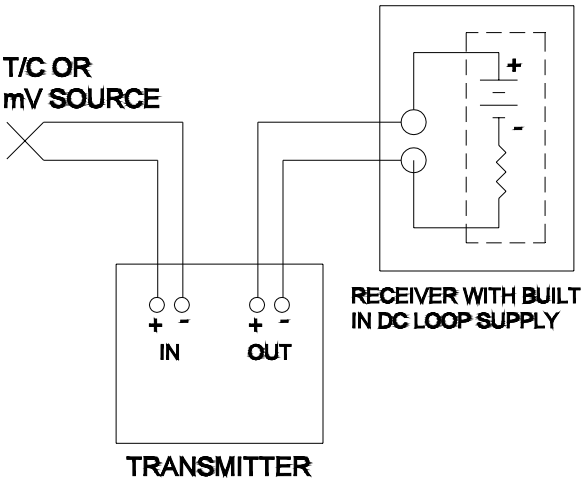

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Figure 2.9 Multiple Loop Connection with Single DC Supply

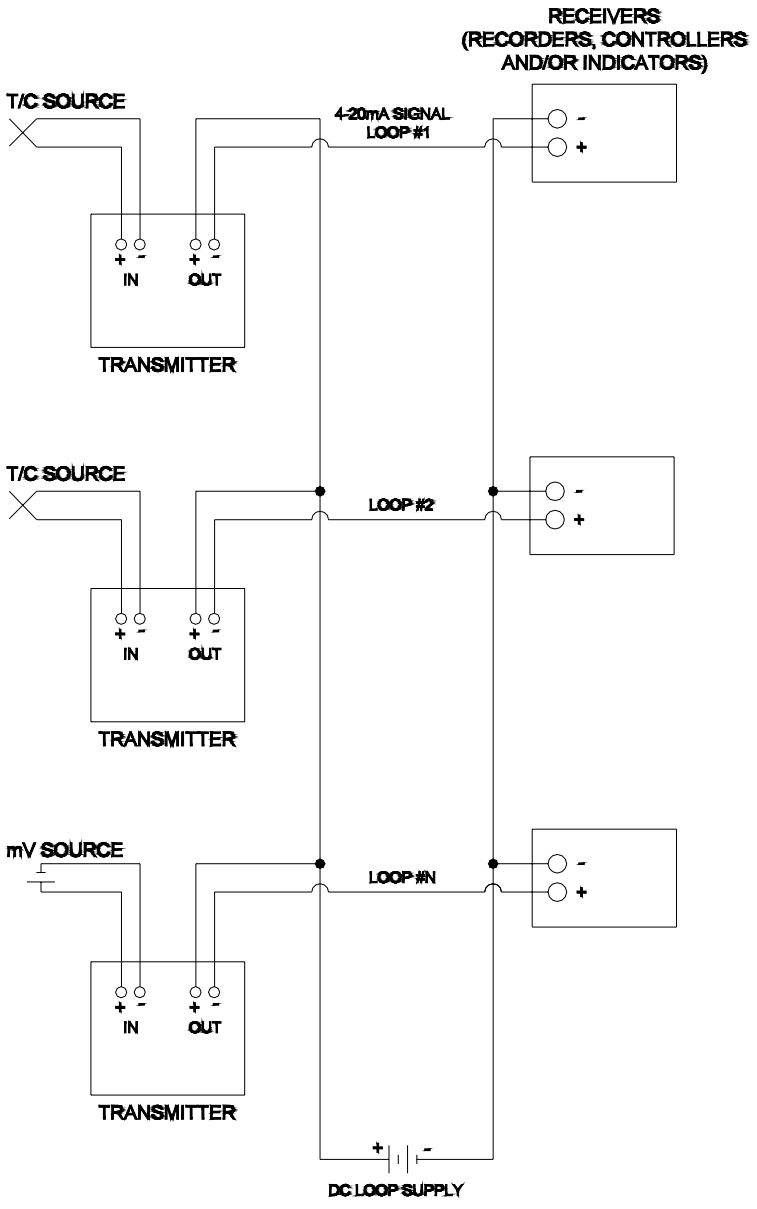

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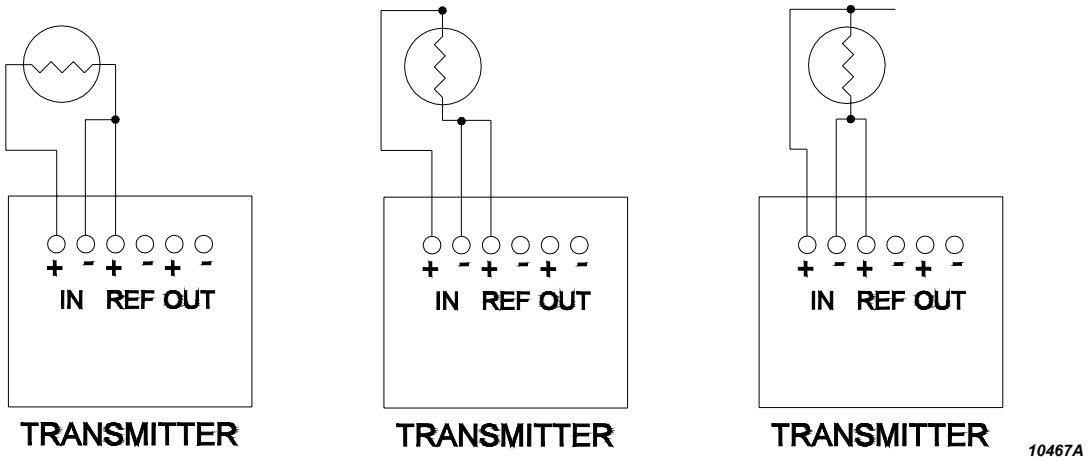
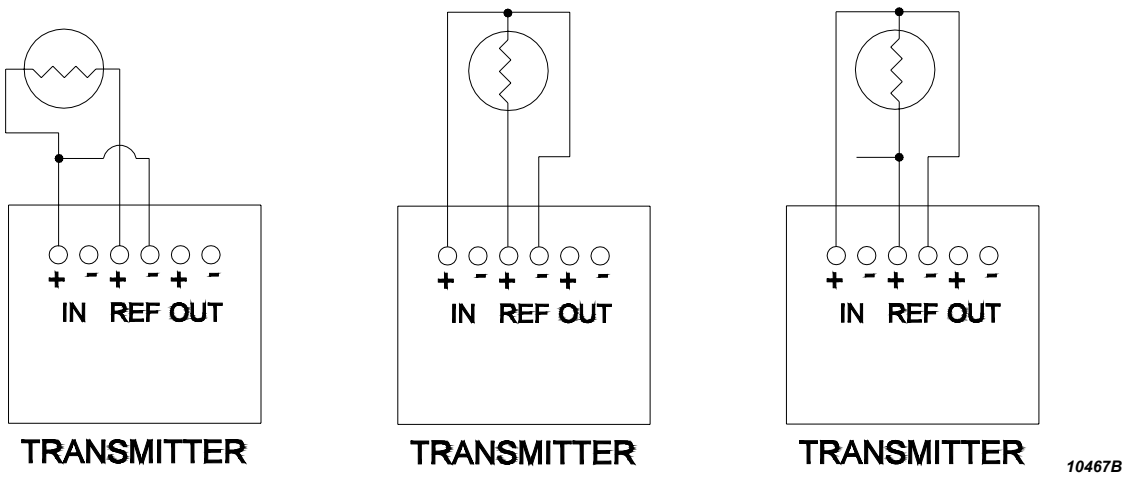
Figure 2.10 RTD Connections (For Rev. 2)



Two-Wire RTD **Three-Wire RTD** **Four-Wire RTD**

Figure 2.11 RTD Connections (Old Style)



Two-Wire RTD **Three-Wire RTD** **Four-Wire RTD**

SECTION 3. CONFIGURATION / CALIBRATION

3.1 OVERVIEW

Three methods of configuring and calibrating the 2000 Series transmitters are available: PC-based, pushbutton, or HART protocol. The actual method is dependent on the model. The Model 2500T can be configured/calibrated using any personal computer via RS-232. The Model 2800T and 2900T features quick and simple configuration and calibration via the front-panel pushbuttons. The Model 2850T and 2950T can utilize the HART protocol for increased convenience and accuracy.

To calibrate or configure a transmitter, determine the method to be used based on the model, then refer to the appropriate set of instructions. To perform a PC-based configuration or calibration on a Model 2500T, refer to Section 3.2. To configure/calibrate a Model 2800T, 2850T, 2900T, or 2950T via the front-panel pushbuttons, consult Section 3.3. For information on utilizing the HART protocol with a HART modem to configure/calibrate a 2850T or 2950T, refer to Section 3.4.

To ensure optimum transmitter operation, annual calibration is recommended.

3.2 PC-BASED CONFIGURATION/CALIBRATION (MODEL 2500T, 2850T, 2950T)

3.2.1 Overview

The software configuration programs for the Model 2500T transmitter is supplied on two high density 3.5" diskettes. Two versions of the program are provided, one for DOS and one for Windows®.

Serial communication between the PC running the configuration software and the transmitter is accomplished via RS-232 protocol. The port on the transmitter is a standard RJ-22 plug-in telephone connector.

Using the configuration software, the following parameters may be set on the transmitter:

- **Input Units:** Select millivolts, ohms, °C, or °F. If °C or °F is selected, the input class (sensor type) must also be selected from the options provided on the screen.

- **Input Range Values:** Set the lower range value (corresponding to 4.0 mA output) and the upper range value (corresponding to 20.0 mA output). Minimum and maximum limits to these values are displayed on the screen for the input units and type selected.

- **Damping:** A time delay (in seconds) to minimize the effect of rapid input signal changes.

- **Linearization:** Turn linearization on or off. When on, the transmitter output will be linear with temperature for thermocouple and RTD inputs. When off, the output will be linear with the actual input signal value (millivolts or ohms).

- **Burnout Detection:** Enable or disable a transmitter response to sensor burnout. When enabled, select upscale or downscale response to burnout. Burnout detection should be disabled during calibration.

In addition to these parameters, information about the transmitter for later reference and display may be stored. You may enter and store (in the transmitter's memory) its tag and a description. The transmitter hardware version, software version, and serial number are automatically displayed when communications are established with your PC.

3.2.2 Software Installation

3.2.2.1 DOS Installation

To install the DOS-based program to a hard drive, perform the following:

1. Insert diskette #2 into a 3.5" floppy drive.
2. While operating in DOS, make the floppy drive the active drive.
3. At the DOS prompt, type "install" and press Enter.

   The configuration program will then automatically be installed in a newly created directory named TRANSMAT\XMITTERS (or another directory you specify) on a hard drive you select.
4. Follow the on-screen instructions to complete the installation.
5. Once the program is installed, remove the diskette from the floppy drive.

3.2.2.2 Windows 3.11 Installation

To install the Windows 3.11-based program to a hard drive, perform the following:

1. Start Windows 3.11.
2. Insert diskette #1 into a 3.5" floppy drive.
3. From the Program Manager, go to the File menu and select *Run*.
4. In the Command Line text box, type "a:\setup", then click *OK*.

   The configuration program will then automatically be installed in a newly created directory named TRANSMAT\XMITTERS (or another directory you specify) on a hard drive you select.
5. Follow the on-screen instructions to complete the installation. When instructed, insert diskette #2 into the floppy drive.
6. Once the program is installed, remove the diskette from the floppy drive.

3.2.2.3 Windows 95 Installation

To install the Windows 95-based program to a hard drive, perform the following:

1. Start Windows 95.
2. Insert diskette #1 into a 3.5" floppy drive.
3. Click on *Start*, then click *Run*.
4. In the Command Line text box, type "a:\setup", then click *OK*.

   The configuration program will then automatically be installed in a newly created directory named PROGRAM FILES\TRANSMAT\ XMITTERS (or another directory you specify) on a hard drive you select.
5. Follow the on-screen instructions to complete the installation. When instructed, insert diskette #2 into the floppy drive.
6. Once the program is installed, remove the diskette from the floppy drive.

3.2.3 Software Operation

3.2.3.1 DOS Operation

To run the software in DOS from the hard drive, perform the following:

1. Operate your PC in DOS.
2. Select the TRANSMAT\XMITTERS directory (or the directory you specified during software installation).
3. For the Model 2500T, type "cnfdos", then press Enter. For the Model 2850T and 2950T, type "hartdos", then press Enter.

3.2.3.2 Windows Operation

To run the software in Windows from the hard drive, perform the following:

1. Start Windows.
2. Double-click on the TRANSMAT program group icon.
3. Double-click on the desired program name (CNFWIN for the Model 2500T; HARTWIN for the Model 2850T and 2950T).

3.2.4 Configuration

Follow the procedure described below to configure a Model 2500T transmitter.

NOTE

Prior to configuring a transmitter, configure the communication port of your PC to use either Com 1 or Com 2 (the default setting is Com 2). The configuration software may be set to respond to either port as described in Step 4 below.

1. Using a suitable cable, connect the RS-232 port of the transmitter to the serial port of your PC. For a Model 2850T and 2950T transmitter, connect a HART modem as instructed in Section 3.4.
2. Apply power to the transmitter.
3. Launch the configuration software. The Information Display screen illustrated in Figure 3.1 on page 3-7 will be generated.
4. From the Options menu, select *Comm. Port*. Use the up and down arrow keys to highlight the proper communication port, then press Enter.
5. To verify proper communications, click the *ON* radio button next to the Update Value field. A numerical process value at the top of the Information Display screen will be generated. If communications are not successfully established, make sure that the correct communication port is selected (refer to Step 4).

6. Begin the transmitter configuration process by clicking the *Load from Xmtr* command button. The current configuration of the transmitter will be displayed. This configuration may be accepted or modified as described below.

   - **Enter Tag Information:** When the configuration software is started, the cursor defaults to the Tag field. Enter tag information for the transmitter by typing up to nine alphanumeric characters.

   - **Enter Descriptor Information:** Enter any descriptive information for the transmitter by clicking in the Descriptor field and typing alphanumeric characters.

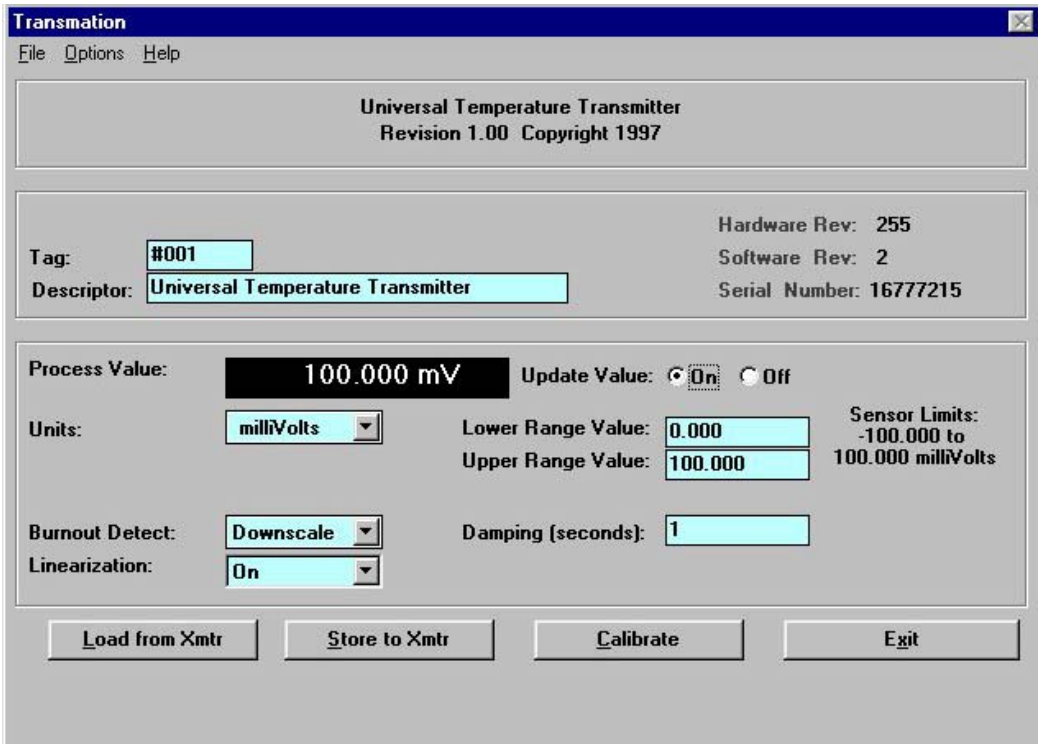
NOTE

The three fields at the right of the tag information fields contain information obtained from the transmitter. This information cannot be changed.

   - **Select the Process Value Units:** Click on the arrow to the right of this field to display a drop-down menu of available units. Click on the desired unit to select it. The drop-down menu will close and the selected unit will be displayed in the field.

   - **Select the Input Class:** When the Process Value Units are °C or °F, the Class field just below the Units field becomes active. Click on the arrow to the right of this field to display a drop-down menu of available temperature sensor classes (types). Eight thermocouple and 12 RTD types are listed. Click in the scroll bar to the right of the drop-down menu to view all the options. Click on the desired sensor type to select it. The drop-down menu will close and the selected class will be displayed in the field.

Figure 3.1 Configuration Information Display Screen



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- **Set the Range Values:** To set the Lower Range Value (input value at 4.0 mA output) and Upper Range Value (input value at 20.0 mA output), click in the field and type in the value. As a guide, the minimum and maximum values (limits) for the selected input are automatically listed to the right of these fields. Note that the resolution for each input type is shown in the format of these numbers, so entered data should be in the same format. For example, the limit values for a type J thermocouple are -180.0° to 1200.0°C. The values you enter should have the same resolution (i.e., 0.1°C).

- **Set Burnout Detect Action:** In the Windows program, click on *Upscale* or *Downscale* to enable the desired environment. In the DOS program, click on the arrow to the right of this field to display a drop-down menu. Click *Disabled* for no input burnout protection; click *Enabled* for burnout protection. When *Enabled* is selected, a new field appears to the right. Click on the arrow to the right of this field to display the choice of upscale or downscale burnout. Click on the desired detection mode to select it. The drop-down menu will close and the selected option will be displayed in the field.

- **Set Linearization:** Click on the arrow to the right of this field to display a drop-down menu. Click *Off* for output linear to input values (mV or ohms); click *On* for output linear to input temperature for thermocouple and RTD inputs. The drop-down menu will close and the selected option will be displayed in the field.

7. When the Information Display screen displays the desired transmitter configuration, click the *Store to Xmtr* command button to write the configuration to the transmitter. The configuration values will become effective immediately.

NOTE

No configuration changes will be saved until the Store to Xmtr *command button is clicked.*

8. The configuration process is now complete.

3.2.5 Configuration Setup Backup/Retrieval

3.2.5.1 Saving Configuration Setups to Disk

The Windows-based program allows transmitter configuration data to be saved to a file on disk. The data is saved as ASCII text in a comma delimited format.

To save transmitter configuration setup data to a disk file for future use, perform the following:

1. Using a suitable cable, connect the RS-232 port of the transmitter to the serial port of your PC.
2. Launch the configuration software. The Information Display screen illustrated in Figure 3.1 on page 3-7 will be generated.
3. As required, insert a diskette into the floppy drive.
4. From the File menu, select *Open File to Store*.
5. Enter the destination drive, directory pathname, and file name, then press Enter.
6. Connect the transmitter.
7. Click on the *Load From Xmtr* command button.
8. Click on the *Store Next Record* command button.

NOTE

A file may contain configuration setup data for multiple transmitters. Repeat Steps 6-8 for each transmitter.

9. From the File menu, select *Close File* or *Exit*.
10. As required, remove the diskette from the floppy drive.

3.2.5.2 Retrieving Configuration Setups From Disk

The Windows-based program allows transmitter configuration setups to be retrieved from a data file on disk. To retrieve the data from disk, perform the following:

1. Using a suitable cable, connect the RS-232 port of the transmitter to the serial port of your PC.
2. Launch the configuration software. The Information Display screen illustrated in Figure 3.1 on page 3-7 will be generated.
3. As required, insert the diskette containing the proper data file(s) into the floppy drive.
4. From the File menu, select *Open File to Load*.
5. Enter the source drive, directory path, and file name, then press Enter.
6. Connect the transmitter.
7. Click on the *Store to Xmtr* command button.
8. If the file contains data for multiple transmitters, perform the following:
    a. Click on the *Load Next Record* command button.
    b. Connect the transmitter.
    c. Click on the *Save to Xmtr* command button.
    d. Repeat Steps a-c for each transmitter.
9. From the File menu, select *Close File* or *Exit*.
10. As required, remove the diskette from the floppy drive.

3.2.6 Calibration

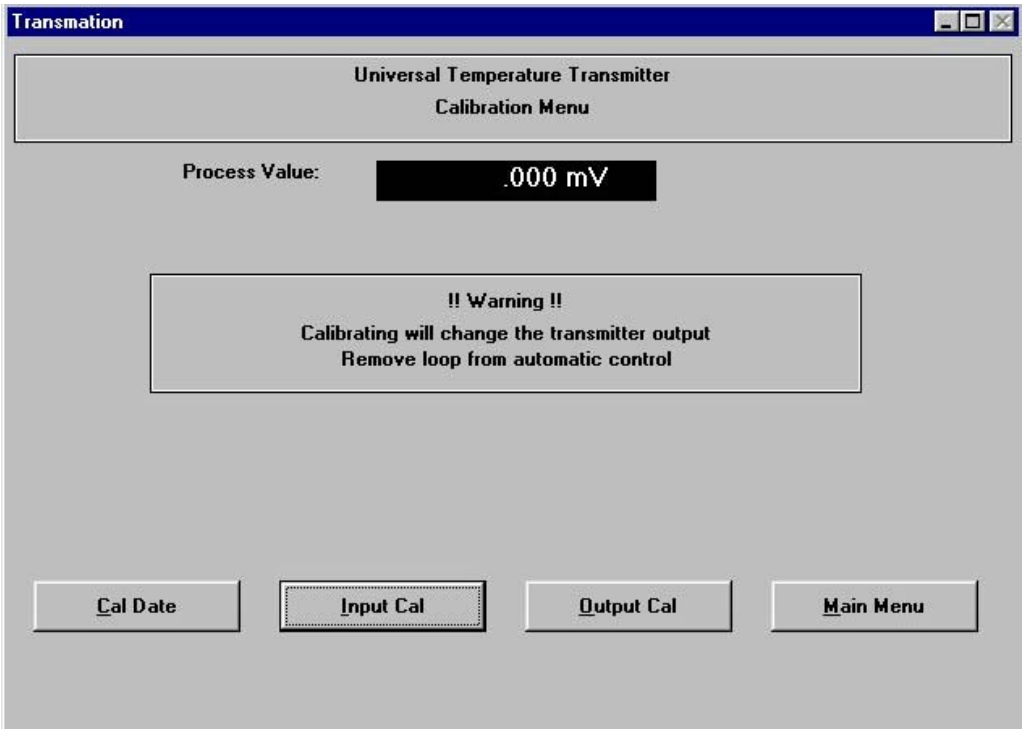
Follow the procedures outlined below to calibrate a Model 2500T transmitter. To ensure proper accuracy, perform the configuration procedure described in Section 3.2.4 before attempting calibration.

NOTE *Recalibration is not required after configuration or re-configuration.*

Linearization tables are built into the transmitter. This linearization works best when the calibration procedures specified below are followed exactly. Thermocouple linearization depends on calibration of both millivolt and thermocouple, while RTD linearization requires ohm calibration. Any attempt to improve linearity by using the process zero and span for calibration will only reduce the accuracy of the transmitter.

1. Using a suitable cable, connect the RS-232 port of the transmitter to the serial port of your PC.
2. Apply power to the transmitter.
3. Launch the configuration software. The Information Display screen illustrated in Figure 3.1 on page 3-7 will be generated.
4. To verify proper communications, click the *ON* radio button next to the Update Value label. A numerical process value at the top of the Information Display screen will be generated. If communications are not successfully established, make sure that the correct communication port is selected (refer to Step 4 in Section 3.2.4).
5. At the Information Display screen, disable burnout detection.
6. Begin the transmitter calibration process by clicking the *Calibrate* command button. The Calibration Menu (illustrated in Figure 3.2 on page 3-12) will be generated.

Figure 3.2 Calibration Menu



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7. Four command buttons are located at the bottom of the Calibration screen:

   - **Cal Date:** Displays the date of the most recent calibration of the transmitter.

   - **Input Cal:** Displays a screen used to calibrate the input signal to the transmitter as described in Section 3.2.6.1.

   - **Output Cal:** Displays a screen used to calibrate the output signal of the transmitter as described in Section 3.2.6.2.

   - **Main Menu:** Closes the Calibration Menu and returns the Main Menu.

8. As the Warning displayed at the center of the Calibration Menu states, calibration will change the transmitter output. To prevent potential control problems, remove the loop from automatic control before performing the calibration procedure.
9. To perform an input or output calibration, refer to the applicable procedure described in Section 3.2.6.1 or Section 3.2.6.2.

3.2.6.1 Input Calibration

1. Connect a precision input source of suitable accuracy to the transmitter input terminals.
2. Click on *Input Cal*. A screen will be displayed that prompts for a low input signal, one near to but not necessarily equal to the desired zero percent input (corresponding to 4 mA output).
3. Set the input signal to a value near to the zero percent value. For best results, use an input close to the lower input range limit (see Table 1.1 on page 1-3). An accurate way to measure this value external to the transmitter is required.
4. Enter the externally measured value in the field shown on the screen, then click *OK*.
5. Set the process input value near to, but not necessarily equal to, the desired high level (corresponding to 20 mA output) value. For best results, use an input close to the upper range limit (see Table 1.1 on page 1-3).
6. Enter the externally measured value in the field shown on the screen, then click *OK*.
7. The transmitter will automatically calibrate its input measurements based on these two known input values.

3.2.6.2 Output Calibration

1. Connect the output signal (current loop) to an accurate current measuring instrument.
2. Click on the *Output Cal* command button. A screen will be displayed that prompts for a low output signal, one near to but not necessarily equal to 4 mA.
3. Enter the externally measured value of this current in the field shown on the screen.
4. Repeat the process for the desired high level (20 mA) output value.
5. Enter the externally measured value of the output loop current in the field shown on the screen.
6. The transmitter will automatically calibrate its output current based on these two known output values.
7. Exit from this screen to return to the Main Menu.

3.3 PUSHBUTTON CONFIGURATION/CALIBRATION (MODEL 2800T, 2850T, 2900T, 2950T)

The Model 2800T, 2850T, 2900T, and 2950T transmitters may be easily configured and calibrated in the field by simply following the menu prompts that appear on the display and pressing the front panel arrow keys. To *select* (enter) a menu item or *store* data, press both arrow keys simultaneously. To *scroll* through available menu items or *adjust* a value, press either arrow key. A functional flowchart listing the available menu options is provided in Figure 3.3 on page 3-16.

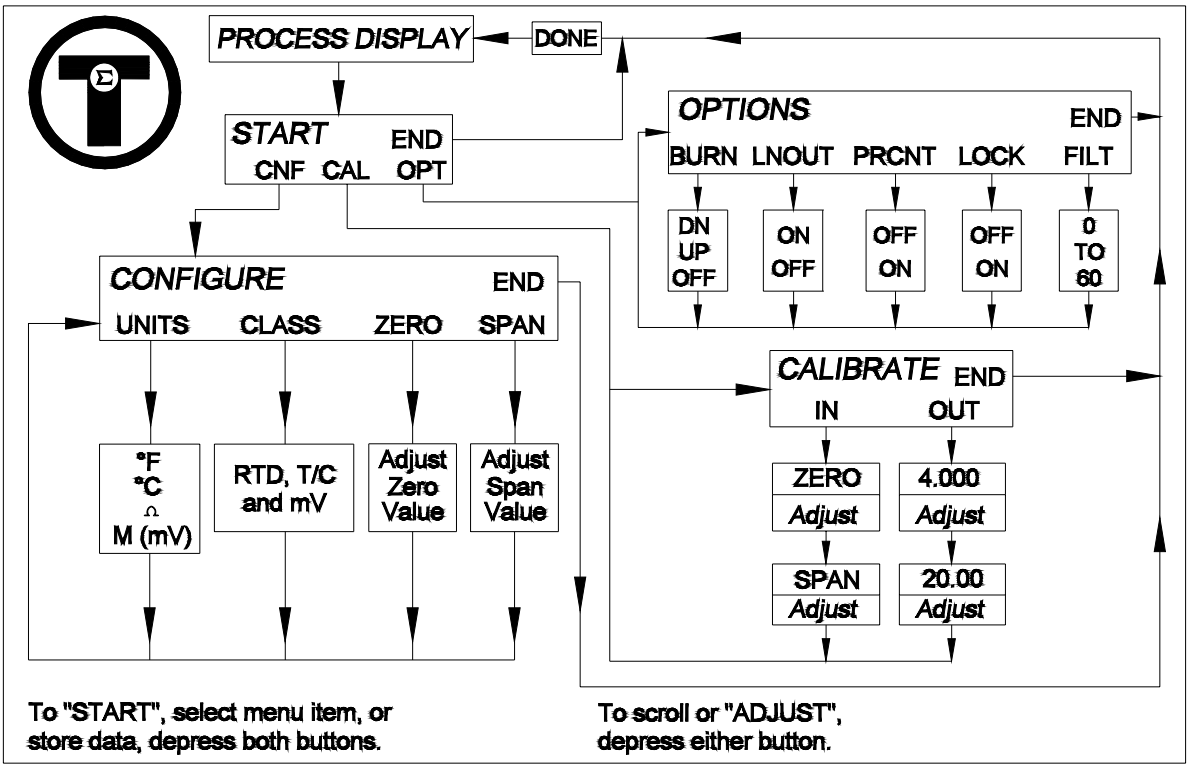
NOTE *Recalibration is not required after configuration or re-configuration.*

3.3.1 Pushbutton Configuration

Follow the procedures outlined below to configure a transmitter using the front-panel pushbuttons.

1. Simultaneously press both arrow keys to enter the SETUP mode (indicated by the SETUP legend).
2. Scroll through the menu options until **CNF** is displayed, then simultaneously press both arrow keys.
3. Scroll through the menu options until **UNITS** is displayed, then simultaneously press both arrow keys.
4. Scroll through the menu options until the desired unit of measure (**°F**, **°C**, **Ω**, **M**) is displayed, then simultaneously press both arrow keys.
5. Scroll through the menu options until **CLASS** is displayed, then simultaneously press both arrow keys.
6. Scroll through the menu options until the desired class-of-service is displayed, then simultaneously press both arrow keys.
7. Scroll through the menu options until **ZERO** is displayed, then simultaneously press both arrow keys.
8. Adjust the displayed zero value as desired, then simultaneously press both arrow keys.
9. Scroll through the menu options until **SPAN** is displayed, then simultaneously press both arrow keys.
10. Adjust the displayed span value as desired, then simultaneously press both arrow keys.
11. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.
12. Simultaneously press both arrow keys to reenter the SETUP mode.
13. Scroll through the menu options until **OPT** (OPTION) is displayed, then simultaneously press both arrow keys.

Figure 3.3 Functional Flowchart



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14. Scroll through the menu options until **BURN** (BURNOUT) is displayed, then simultaneously press both arrow keys.
15. Scroll until the desired burnout configuration (**UP**, **DN**, or **OFF**) is displayed, then simultaneously press both arrow keys.

NOTE *Burnout must be set to OFF for RTD configurations.*

16. Scroll through the menu options until **LNOUT** (LINEARIZED OUTPUT) is displayed, then simultaneously press both arrow keys.
17. Scroll until the desired linearization configuration (**ON** or **OFF**) is displayed, then simultaneously press both arrow keys. (***NOTE:*** **ON** = output linear with respect to temperature; **OFF** = output linear with respect to mV or ohm input.)
18. Scroll through the menu options until **PRCNT** (PERCENT) is displayed, then simultaneously press both arrow keys.
19. Scroll until the desired percent configuration (**ON** or **OFF**) is displayed, then simultaneously press both arrow keys. (***NOTE:*** **ON** = display indicates input as % of span; **OFF** = display indicates input in engineering units.)
20. Scroll through the menu options until **LOCK** (LOCKOUT) is displayed, then simultaneously press both arrow keys.
21. Scroll until the desired lockout configuration (**ON** or **OFF**) is displayed, then simultaneously press both arrow keys. (***NOTE:*** **ON** = lockout activated; **OFF** = lockout deactivated.)
22. Scroll through the menu options until **FILT** (FILTER) is displayed, then simultaneously press both arrow keys.
23. Press the up or down arrow key until the desired interval (i.e., 0 to 60 seconds) is displayed, then simultaneously press both arrow keys.
24. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.

NOTE

*No configuration changes will be saved until **END** is selected. If **END** is not selected, the transmitter will revert to the previous configuration after 75 seconds of inactivity.*

25. When **DONE** is displayed, the configuration process is complete.

3.3.2 Pushbutton Calibration

Follow the procedures outlined below to calibrate a transmitter using the front-panel pushbuttons. To ensure proper accuracy, perform the configuration procedure described in Section 3.3.1 before attempting the calibration.

NOTE

Linearization tables are built into each transmitter. This linearization works best when the calibration procedures specified below are followed exactly. Thermocouple linearization depends on calibration of both millivolt and thermocouple, while RTD linearization requires ohm calibration. Any attempt to improve linearity by using the process zero and span for calibration will only reduce the accuracy of the transmitter.

3.3.2.1 Millivolt Input Calibration

1. Connect a precision input source of suitable accuracy to the transmitter input terminals (a typical calibration connection is illustrated in Figure 3.4 on page 3-19).
2. Simultaneously press both arrow keys to enter the SETUP mode (indicated by the SETUP legend).
3. Scroll through the menu options until **CNF** is displayed, then simultaneously press both arrow keys.
4. Scroll through the menu options until **UNITS** is displayed, then simultaneously press both arrow keys.
5. Scroll through the menu options until **M** is displayed, then simultaneously press both arrow keys.
6. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.
7. Simultaneously press both arrow keys to reenter the SETUP mode.
8. Scroll through the menu options until **CAL** is displayed, then simultaneously press both arrow keys.
9. Scroll until **IN** is displayed, then simultaneously press both arrow keys.

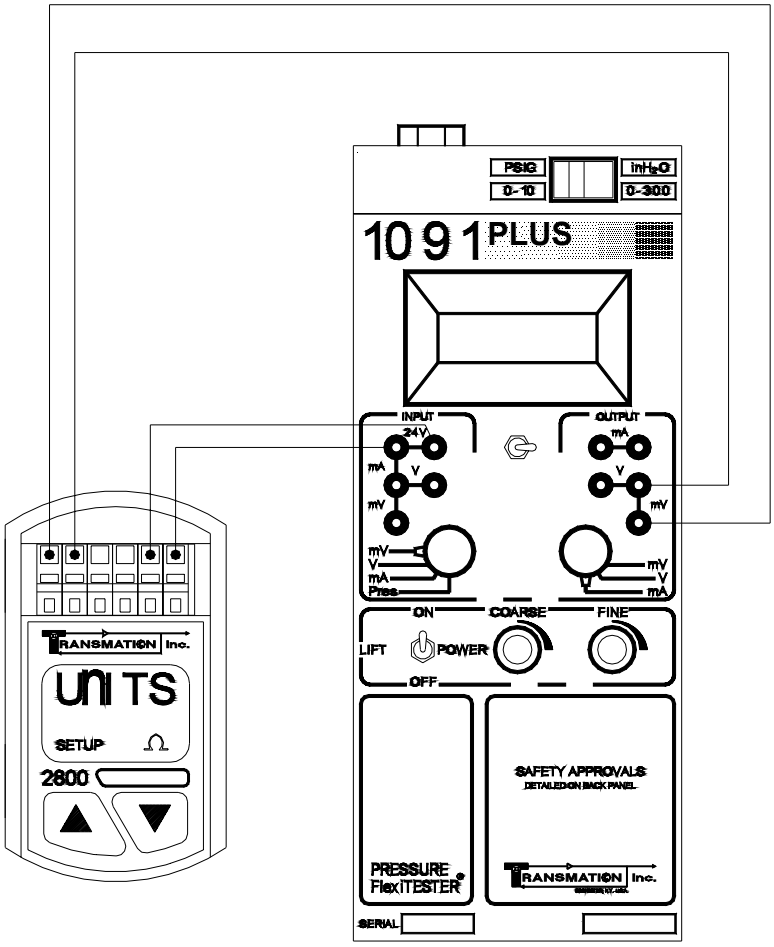
10. Scroll until **ZERO** is displayed, then simultaneously press both arrow keys.
11. Using the input source, apply an input of 0.000 mV. Press the arrow keys until **0.000** is displayed, then simultaneously press both arrow keys to store this zero value.
12. Scroll until **SPAN** is displayed, then simultaneously press both arrow keys.
13. Using the input source, apply an input of 99.000 mV (or close to 100 mV). Press the arrow keys until **99.000** is displayed, then simultaneously press both arrow keys to store this span value.
14. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.

NOTE

*No calibration changes will be saved until **END** is selected. If **END** is not selected, the transmitter will revert to the previous calibration status after 75 seconds of inactivity.*

15. When **DONE** is displayed, the millivolt input calibration is complete.

Figure 3.4 Typical Pushbutton Calibration Configuration



NOTE

A Model 1091Plus or equivalent may be used for most field calibration purposes; however, to duplicate factory calibration, a DVM and mV source of suitable accuracy must be used.

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3.3.2.2 Thermocouple Input Calibration

1. Perform the millivolt input calibration procedure described in Section 3.3.2.1.
2. Simultaneously press both arrow keys to enter the SETUP mode (indicated by the SETUP legend).
3. Scroll through the menu options until **CNF** is displayed, then simultaneously press both arrow keys.
4. Scroll through the menu options until **UNITS** is displayed, then simultaneously press both arrow keys.
5. Scroll through the menu options until **°C** is displayed, then simultaneously press both arrow keys.
6. Scroll through the menu options until **CLASS** is displayed, then simultaneously press both arrow keys.
7. Scroll through the menu options until **J** is displayed, then simultaneously press both arrow keys.
8. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.
9. Simultaneously press both arrow keys to reenter the SETUP mode.
10. Scroll through the menu options until **CAL** is displayed, then simultaneously press both arrow keys.
11. Scroll until **IN** is displayed, then simultaneously press both arrow keys.
12. Scroll until **ZERO** is displayed, then simultaneously press both arrow keys.
13. Using a precision temperature source, apply an input of 0°C. Press the arrow keys until **0.0** is displayed, then simultaneously press both arrow keys to store this zero value.
14. When **SPAN** is displayed, simultaneously press both arrow keys twice. **IN** should be displayed.

15. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.

NOTE

*No calibration changes will be saved until **END** is selected. If **END** is not selected, the transmitter will revert to the previous calibration status after 75 seconds of inactivity.*

16. When **DONE** is displayed, the thermocouple input calibration is complete.

3.3.2.3 Ohm Input Calibration

1. Simultaneously press both arrow keys to enter the SETUP mode (indicated by the SETUP legend).
2. Scroll through the menu options until **CNF** is displayed, then simultaneously press both arrow keys.
3. Scroll through the menu options until **UNITS** is displayed, then simultaneously press both arrow keys.
4. Scroll through the menu options until **Ω** is displayed, then simultaneously press both arrow keys.
5. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.
6. Simultaneously press both arrow keys to reenter the SETUP mode.
7. Scroll through the menu options until **CAL** is displayed, then simultaneously press both arrow keys.
8. Scroll until **IN** is displayed, then simultaneously press both arrow keys.
9. Scroll until **ZERO** is displayed, then simultaneously press both arrow keys.
10. Using a precision input source, apply an input of 5.00Ω (or close to 0Ω). Press the arrow keys until **5.00** is displayed, then simultaneously press both arrow keys to store this zero value.

11. Scroll until **SPAN** is displayed, then simultaneously press both arrow keys.
12. Using the precision input source, apply an input of 990.00Ω (or close to 1000Ω). Press the arrow keys until **990.00** is displayed, then simultaneously press both arrow keys to store this span value.
13. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.

NOTE

*No calibration changes will be saved until **END** is selected. If **END** is not selected, the transmitter will revert to the previous calibration status after 75 seconds of inactivity.*

14. When **DONE** is displayed, the ohm input calibration is complete.

3.3.2.4 Output Calibration

1. Connect a precision measuring device of suitable accuracy to the transmitter output terminals (a typical calibration connection is illustrated in Figure 3.4 on page 3-20).
2. Simultaneously press both arrow keys to enter the SETUP mode (indicated by the SETUP legend).
3. Scroll through the menu options until **CAL** is displayed, then simultaneously press both arrow keys.
4. Scroll through the menu options until **OUT** is displayed, then simultaneously press both arrow keys.
5. **4.000** will be displayed. Press the arrow keys to adjust the transmitter output current until 4.000 mA is indicated on the measuring device. Simultaneously press both arrow keys to store this value.

6. **20.000** will be displayed. Press the arrow keys to adjust the transmitter output current until 20.000 mA is indicated on the measuring device. Simultaneously press both arrow keys to store this value.
7. Scroll through the menu options until **END** is displayed, then simultaneously press both arrow keys.

NOTE

*No calibration changes will be saved until **END** is selected. If **END** is not selected, the transmitter will revert to the previous calibration status after 75 seconds of inactivity.*

8. When **DONE** is displayed, the output calibration is complete.

3.3.3 Model 2800T and 2900T Diagnostic Prompts

The Model 2800T and 2900T transmitters also provide self-diagnostic prompts for common error conditions. Prompts such as underrange (**UNDER**), overrange (**OVER**), or open inputs (**OPEN**) indicate that an input wiring error exists. Cold junction (**CJERR**) and reference (**ERREF**) error prompts indicate that a transmitter malfunction has occurred; consult the Factory.

3.4 HART® PROTOCOL CONFIGURATION / CALIBRATION (MODEL 2850T, 2950T)

The HART protocol permits remote configuration or calibration of a Model 2950T transmitter.

The user interface is described in Section 3.2. The only significant difference is that a HART modem is required and the RS-232 connection must be configured via the supplied configuration software to support the HART protocol. A typical PC-based connection using the HART modem is illustrated in Figure 3.5 on page 3-26.

The configuration software has the following requirements:

- Only one transmitter can be present in the loop.
- The PC running the configuration software must be the only master.
- The configuration software communicates with transmitters that have a HART polling address of 0.
- A HART modem is required to communicate with the transmitter. (A SMAR Model HI 311 modem is recommended; refer to Section 1.3 on page 1-7 for ordering information). A typical connection using the HART modem is illustrated in Figure 3.5 on page 3-26.
- The HART protocol requires a minimum loop resistance of 250 ohms.

A Universal Hand-Held Communicator is required to change the HART protocol parameters. A typical HART protocol connection is illustrated in Figure 3.6 on page 3-27.

Figure 3.5 Typical PC-Based Calibration Connection

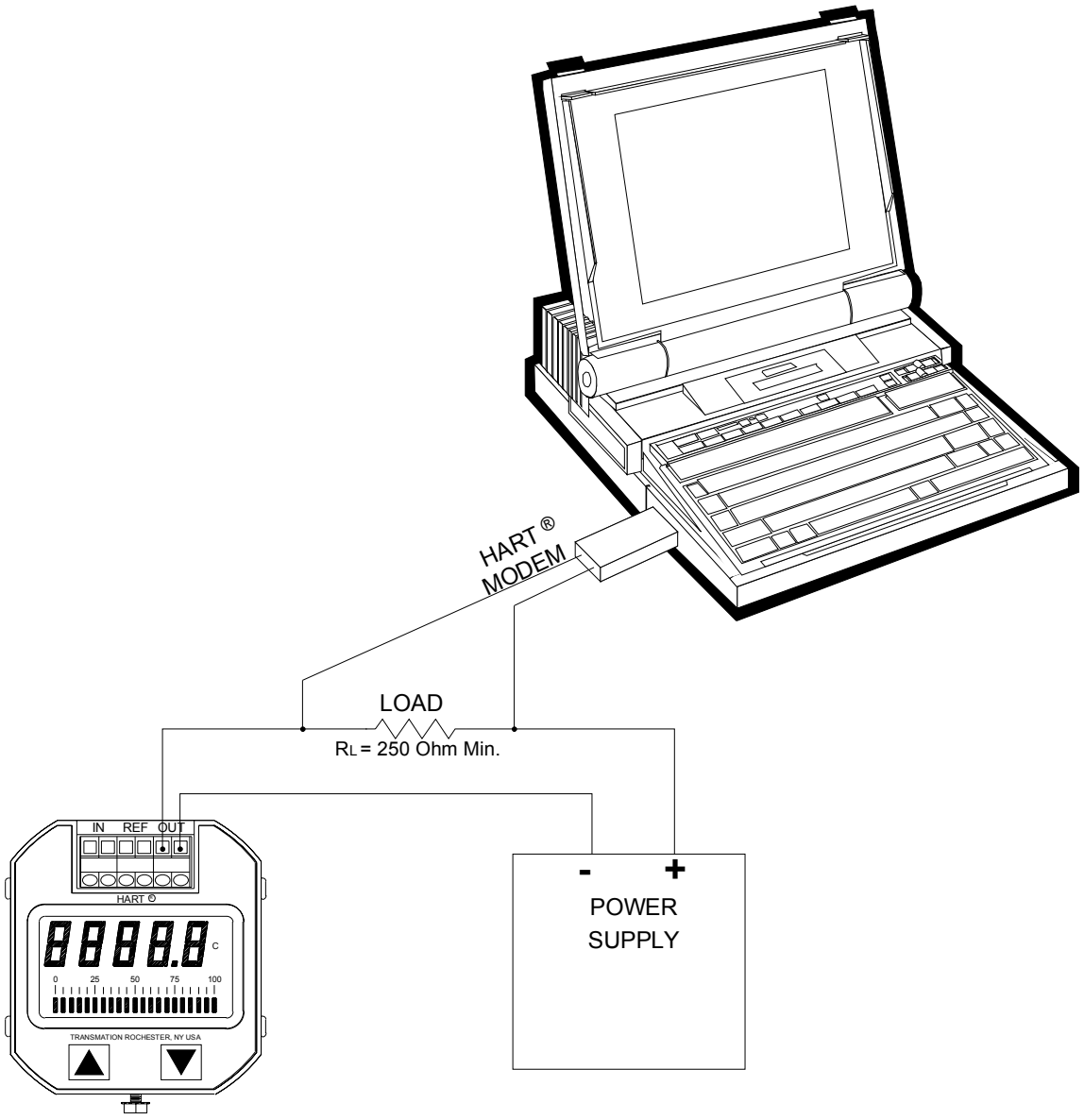

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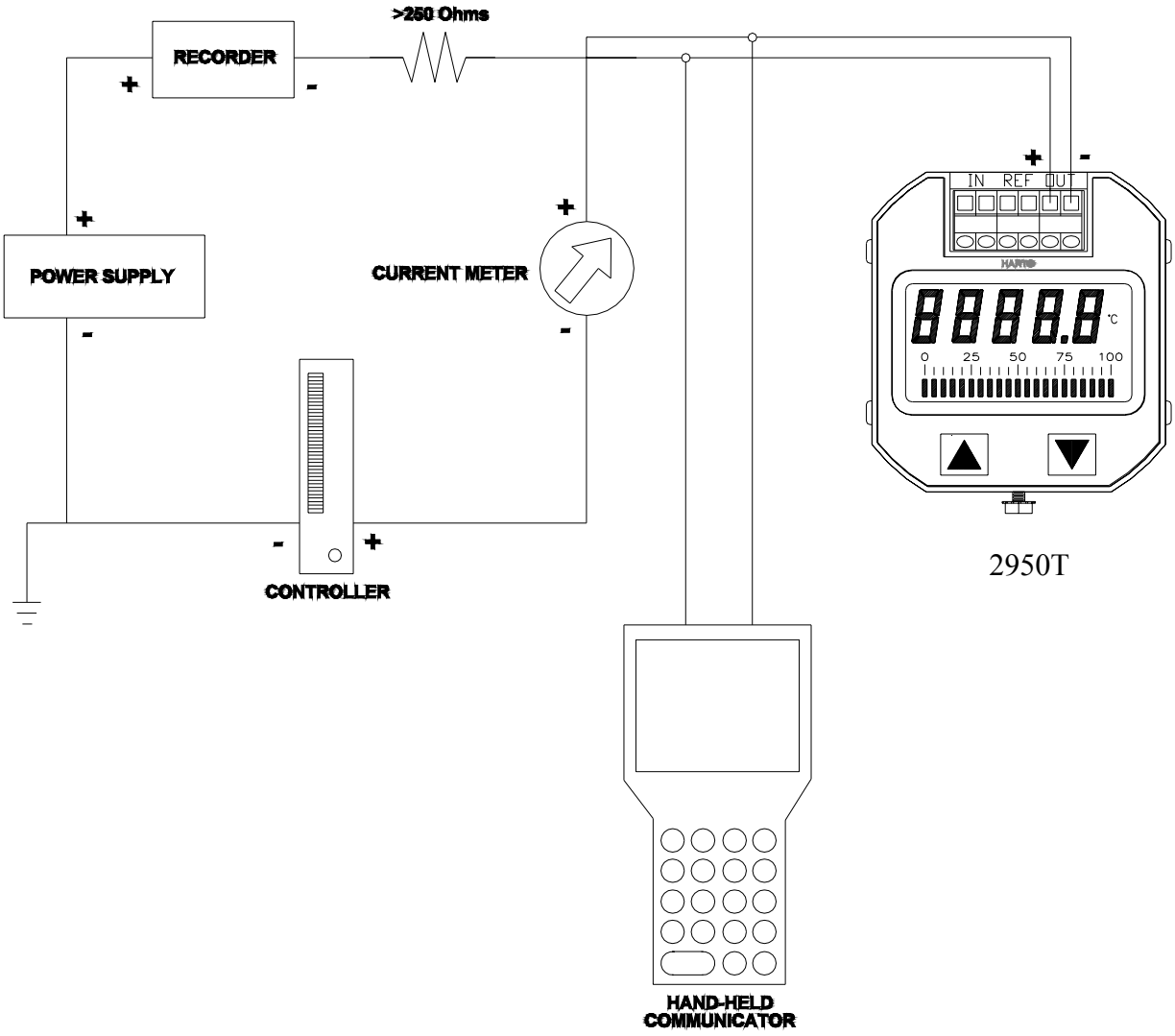
Figure 3.6 Typical HART® Protocol Connection



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SECTION 4. FACTORY SERVICE AND WARRANTY

4.1 FACTORY SERVICE

Should service become necessary, the instrument should be returned to the nearest service facility for repair or replacement. Please assist our service department by defining the symptoms precisely.

For technical help, contact:
PYRAGON, INC.
95 Mt. Read Blvd., #149
Rochester, NY 14611
Tel: 800-688-6551 or 585-697-0444
Fax 585-697-0445
Email: Help@pyragon.com

4.2 FIVE YEAR WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate and all repairs made by the Company to be free from defects in material or workmanship under normal use and service for a period of five years from the date of delivery to the Purchaser. Expendable items such as fuses, batteries, test leads, and carrying cases are not warranted. The Company will repair, at its option, without charge, F.O.B. the Company's factory, any equipment or part thereof found to be defective in material or workmanship if such item is returned to the Company's factory, transportation postpaid.

4.2.1 Limitation of Warranty and Liability

The liability of the Company (except as to title) shall in no case exceed the cost of correcting defects in products and shall not extend beyond five years from date of delivery. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery. The Company assumes no liability for the consequences of misuse of products by the Purchaser.

The foregoing is expressly in lieu of all other warranties whatsoever, express, implied, or statutory, including without limitation the implied warranties of merchantability and fitness for purpose. Any references by the Company to Purchaser's specifications and similar requirements is only to describe products, and no representation or other terms therein shall have any force or effect. Catalogs, circulars, and similar literature of the Company are issued for general information purposes only and shall not be deemed to modify the provision hereof.

The foregoing is the Company's only obligation and the Purchaser's only remedy for breach of warranty; and except for gross negligence, willful misconduct, and remedies permitted under any other clause of these Terms and Conditions, the foregoing is the Purchaser's only remedy hereunder by way of breach of contract, negligence or otherwise. In no event shall the Purchaser be entitled to incidental, special, or consequential damages. The Company does not authorize any agent or representative to warrant product fitness for any particular use or to make any other warranty, express or implied, or to assume any other liability, except as set forth herein.

4.2.2 Discrepancies in Shipment and Damage to Merchandise

Products manufactured by the Company are carefully packed and thoroughly inspected before leaving the Company's factory. Any claim for discrepancies will be honored only if reported within 15 days from receipt of shipment.

Responsibility for safe delivery of products is assumed by the carrier upon acceptance of the shipment. Consequently, claims for loss or damage sustained in transit must be filed with the carrier as follows: Written requests for inspection by the carrier's agent should be made within 15 days of the delivery date when concealed loss or damage is discovered. Concealed loss or damage means loss or damage which is not apparent until merchandise is unpacked; contents may be damaged in transit due to rough handling even though packaging may not show external damage. As to visible loss or damage, any external evidence of loss or damage must be noted on the freight bill or express receipt, and such document should be signed by the carrier's agent at the time of delivery. The Purchaser's failure to adequately describe such external evidence of loss or damage may result in the carrier's refusing to honor a damage claim. The carrier will supply a form for filing such a claim.

4.2.3 Miscellaneous

This Agreement shall be construed and interpreted under the laws of the State of New York. The parties hereby consent to the jurisdiction of the courts of the State of New York and agree that venue shall lie in Monroe County. The invalidity in whole or in part of any provision hereof shall not affect the validity of any other provision.

PYRAGON, INC.
95 Mount Read Blvd., #149
Rochester, NY 14611 USA
Phone: 1.800.688.6551 • 1.585.697.0444
Fax: 1.585.697.0445 • Email: sales@pyragon.com