


**I/A Series<sup>®</sup> Temperature Transmitters**  
**Model RTT15-H with HART<sup>®</sup> 7 Protocol**  
**Model RTT15-T with HART 5 Protocol**



i n v e n s i s

**Foxboro<sup>®</sup>**



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# 1. Introduction

## General Description

The RTT15 Temperature Transmitter is a microprocessor-based temperature transmitter that receives input signals from thermocouples, RTDs, resistance (ohms), or millivolt sources. It is available as a basic module or in numerous housing configurations. It is available with FOUNDATION fieldbus™, PROFIBUS®, HART® Version 7, or HART Version 5 communication protocol. This instruction manual (MI 020-463) describes transmitters with HART 7 and HART 5 communication. For instructions on the FOUNDATION fieldbus and PROFIBUS versions, see MI 020-462.

## Reference Documents

For additional and related information, refer to the documents listed in Table 1.

*Table 1. Reference Documents*

Document	Description
DP 020-462	Dimensional Print – RTT15 Temperature Transmitters
PL 008-662	Parts List – RTT15 Temperature Transmitters
MAN 4250	HART Communicator Product Manual (supplied with the communicator)

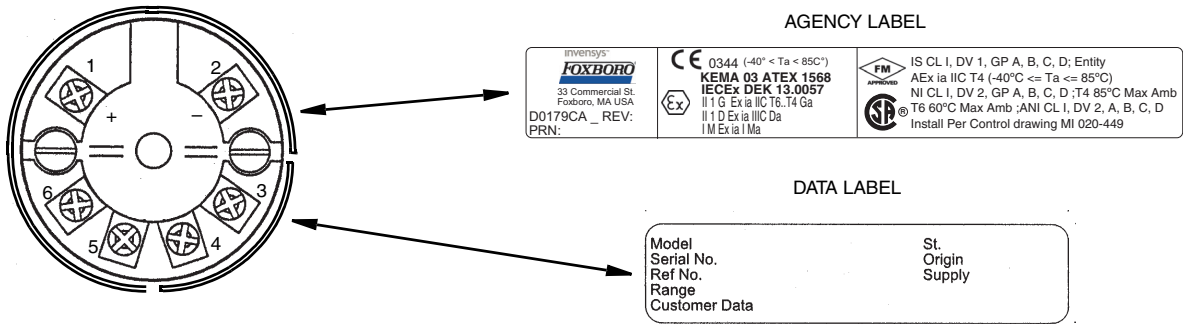
## Transmitter Identification

See Figure 1 for typical agency and data labels. For transmitters enclosed in a housing, the basic unit agency label is located on the basic unit and the applicable agency and data labels are externally mounted on the transmitter housing.

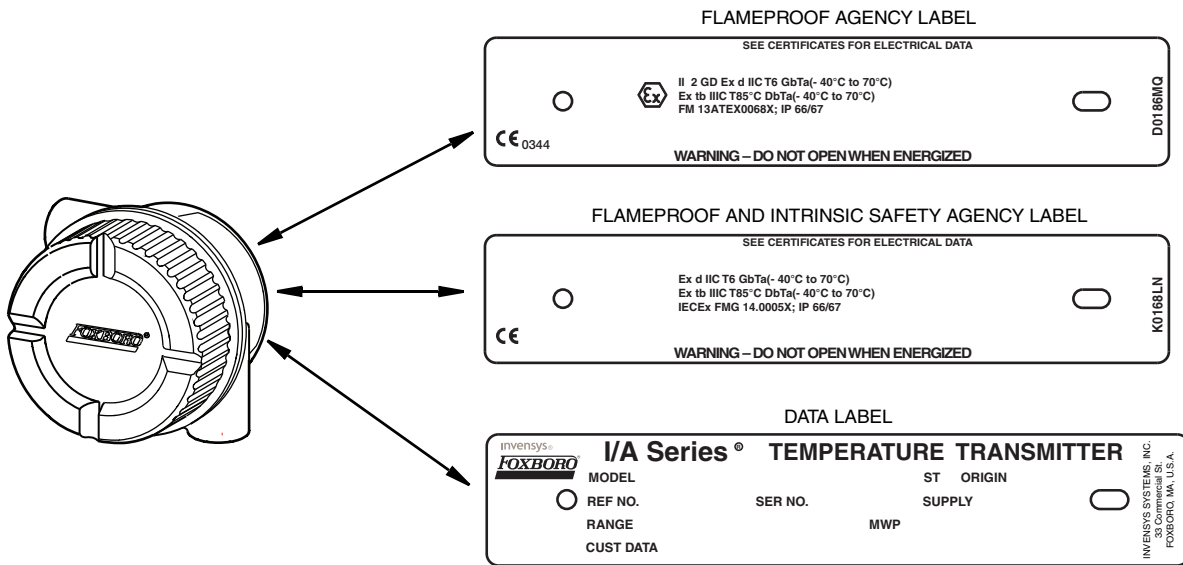
— **NOTE** —

1. Figure 1 shows typical data plates. For a recapitulation of the specific information that applies to each agency certification, see “Electrical Certification Rating” on page 14.
2. Figure 3 shows typical labels for the L1 Display Option.

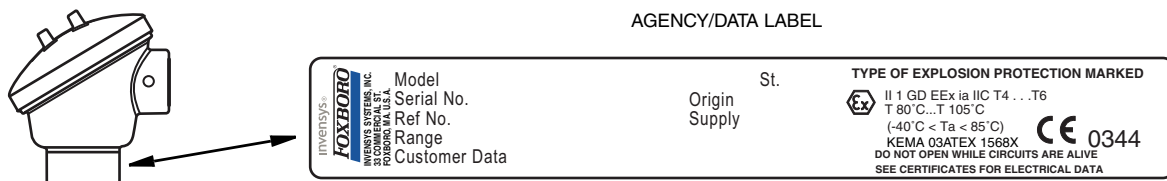
**Figure 1. Typical Identification Labels (1 of 2)**  
**BASIC MODULE (Code B)**



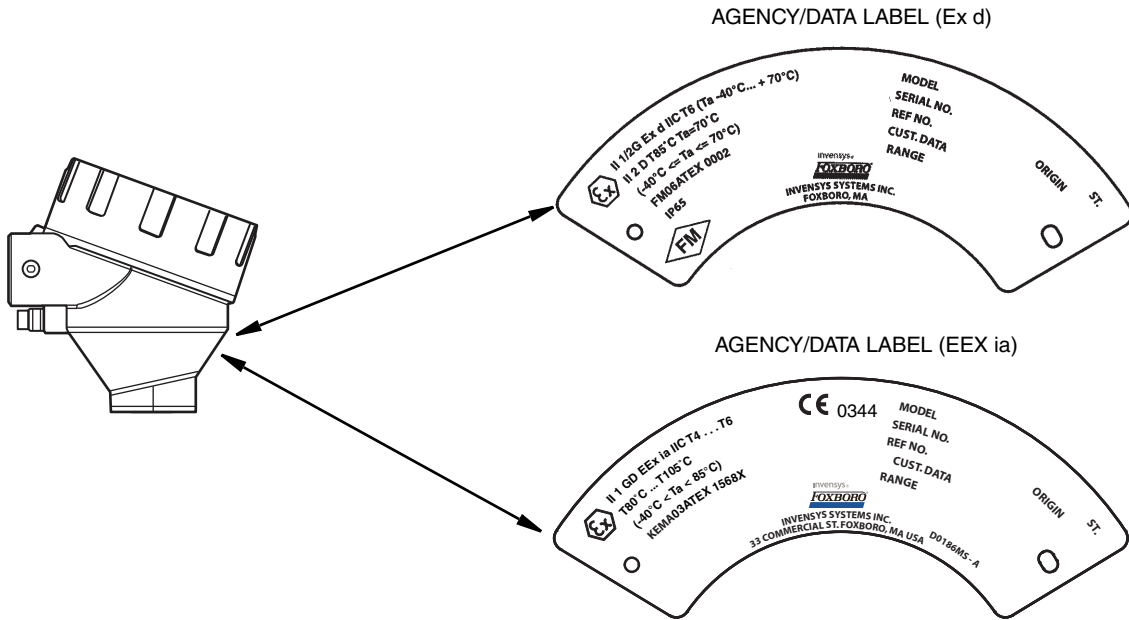
**UNIVERSAL HOUSING (Code L, M, S, T, W, and Y)**



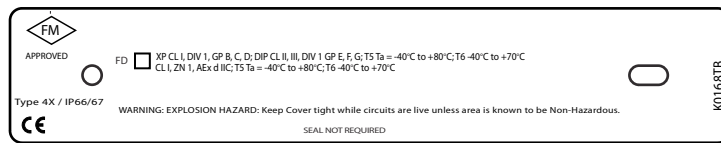
**WEATHERPROOF CONNECTION HEAD (Codes C and E)**



**Figure 2. Typical Identification Labels (2 of 2)**  
**EXPLOSIONPROOF CONNECTION HEAD (Codes D and F)**



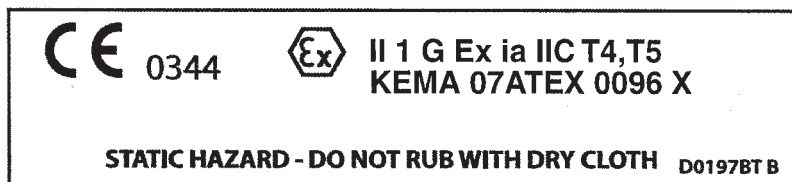
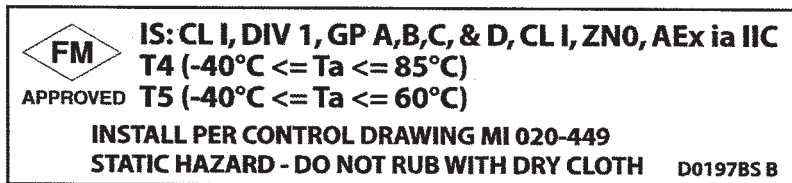
**Figure 3. Typical Identification Labels for L1 Display Option**  
**LABEL FOR UNIVERSAL HOUSING**



**DISPLAY DATA LABEL**



**DISPLAY AGENCY LABELS**



# Standard Specifications

**Ambient Temperature Limits:** -40 and +85°C (-40 and +185°F)

**Supply Voltage Limits:** 8 and 30 V dc

8 and 28 V dc when certified as intrinsically safe

12 and 28 V dc with optional display L1

**Vibration Limits:** 40 m/s<sup>2</sup> (4 “g”) from 2 to 500 Hz

**Span and Range Limits - RTD Input**

RTD Type	Span Limits		Range Limits	
	°C	°F	°C	°F
Platinum, 100 Ω	10 and 1,050	50 and 1,890	-200 and +850	-328 and +1,562
Nickel, 100 Ω	10 and 310	50 and 558	-60 and +250	-76 and +482

**Span and Range Limits - T/C Input**

TC Type	Span Limits		Range Limits	
	°C	°F	°C	°F
B	100 and 1,820	212 and 3,308	0 and 1,820	32 and 3,308
E	50 and 1,100	122 and 1,980	-100 and +1,000	-148 and +1,832
J	50 and 1,300	122 and 2,340	-100 and +1,200	-148 and +2,192
K	50 and 1,552	122 and 2,794	-180 and +1,372	-292 and +2,502
L	50 and 1,100	122 and 1,980	-200 and +900	-328 and +1,652
N	50 and 1,480	122 and 2,664	-180 and +1,300	-292 and +2,372
R	100 and 1,810	212 and 3,258	-50 and +1,760	-58 and +3,200
S	100 and 1,810	212 and 3,258	-50 and +1,760	-58 and +3,200
T	50 and 600	122 and 1,080	-200 and +400	-328 and +752
U	50 and 800	122 and 1,440	-200 and +600	-328 and 1,112
W3	100 and 2,300	212 and 4,140	0 and 2,300	32 and 4,172
W5	100 and 2,300	212 and 4,140	0 and 2,300	32 and 4,172

**Span and Range Limits - Millivolt Input**

Span Limit: 2.5 and 1,600 mV

Range Limit: -800 and + 800 mV

**Span and Range Limits - Resistance (ohms) Input**

Span Limit: 25 and 7,000 Ω

Range Limit: 0 and 7,000 Ω

### Transmitter Housing Specifications

Housing Code	Material and Finish	IEC/NEMA Rating	Explosionproof & Flameproof	Mounting Configuration	Field Wiring Entrances on Housing <sup>(a)</sup>
B	Encapsulated plastic	N/A <sup>(b)</sup>	NO	Basic Module <sup>(c)</sup> (DIN Form B pkg.)	None
C	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral bare sensor	One entrance 1/2 NPT
D	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral bare sensor	One entrance 1/2 NPT
E	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral sensor and well	One entrance 1/2 NPT
F	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral sensor and well	One entrance 1/2 NPT
L	Low copper aluminum alloy; epoxy coated	IP66/67 NEMA 4X	YES	Universal housing with integral sensor and well	One entrance 1/2 NPT
M	Stainless steel	IP66/67 NEMA 4X	YES	Universal housing with integral sensor and well	One entrance 1/2 NPT
S	Low copper aluminum alloy; epoxy coated	IP66/67 NEMA 4X	YES	Universal housing for surface or pipe mounting, remote sensor <sup>(d)</sup>	Two entrances 1/2 NPT
T	Stainless steel	IP66/67 NEMA 4X	YES	Universal housing for surface or pipe mounting, remote sensor <sup>(d)</sup>	Two entrances 1/2 NPT
W	Low copper aluminum alloy; epoxy coated	IP66/67 NEMA 4X	YES	Universal housing with integral bare sensor	One entrance 1/2 NPT
Y	Stainless steel	IP66/67 NEMA 4X	YES	Universal housing with integral bare sensor	One entrance 1/2 NPT

a. Optional conduit threads or thread adapters available; see Model Code.

b. Not applicable; the basic module, although encapsulated, has exposed terminals not protected from the environment.

c. The basic module is typically used for replacement and spares; it can also be mounted to a surface or to a DIN rail using a clip (Option -D1).

d. Surface or pipe mounted using mounting set options -M1 or -M2.

#### **WARNING**

**For all RTT15 Transmitters with an aluminum housing:** When used in a potentially explosive atmosphere requiring apparatus of equipment category 1 G, the transmitter must be installed so that, even in the event of rare instances, an ignition source due to impact or friction between the enclosure and iron/steel is excluded. This shall be considered during installation, particularly if the equipment is installed in a zone 0 location.

**Housing Connections (2): 1/2 NPT****— NOTE —**

Universal housings with optional PG 13.5 connections are available except in transmitters that are certified for explosionproof/flameproof installations.

**Communication Rate:** 1200 baud

**Communication Distance**

**Analog Mode:** 3050 m (10,000 ft)

**Multidrop Mode:** 1525 m (5000 ft)

**Variable Assignments**

*Table 2. Suggested HART Variable Assignments*

Setup	Primary	Secondary	Tertiary	Fourth
RTD 2-, 3-, 4-wire	RTD			Electronic Temp
Differential RTD 2-wire	RTD Diff	RTD 1	RTD 2	Electronic Temp
Average RTD 2-wire	RTD Avg	RTD 1	RTD 2	Electronic Temp
TC with Internal or Constant CJC	TC			CJC Temp
TC with External CJC	TC			CJC Temp
Differential TC with Internal or Constant CJC	TC Diff	TC 1	TC 2	CJC Temp
Average TC with Internal or Constant CJC	TC Avg	TC 1	TC 2	CJC Temp
Differential TC with External CJC	TC Diff	TC 1	TC 2	CJC Temp
Average TC with External CJC	TC Avg	TC 1	TC 2	CJC Temp
mV	mV			Electronic Temp
Differential mV	mV Diff	mV 1	mV 2	Electronic Temp
Average mV	mV Avg	mV 1	mV 2	Electronic Temp

## Electrical Certification Rating

The electrical certification is printed on the agency label which is located on the basic module and on the transmitter housing (if applicable). The Electrical Safety Design Code is also included as part of the model code on the data label which is located on the basic module or on the transmitter housing (if applicable). See Figure 1 for an example of typical agency and data labels. For a complete explanation of the model code, see PL 008-662.

## Electrical Safety Specifications

### — NOTE

These transmitters have been designed to meet the electrical safety descriptions listed in Table 3 (for transmitters without L1 display) and Table 4 (for transmitters with L1 display). For detailed information or status of testing laboratory approvals/certifications, contact Invensys.

*Table 3. Electrical Safety Specifications without Optional L1 Display <sup>(a)</sup>*

Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe, II 1 GD, Ex ia IIC.	C, E, D, F, L, M, S, T, W, Y	KEMA03ATEX1568 Temperature Class T4, Ta = -40 to +85°C; T6, Ta = -40 to +60°C. <sup>(b)</sup>	E
ATEX flameproof, II 2 GD, Ex d, IIC, Ex tb IIIC T85C Db.	L, M, S, T, W, Y	FM13ATEX0068X Temperature Class T6. Ta = -40 to +70°C. <sup>(c)</sup>	D
ATEX flameproof, II 2 GD, Ex d IIC.	D, F	FM06ATEX0002 Temperature Class T6. Ta = -40 to +70°C, T85°C.	
CSA intrinsically safe, Class I, Division 1, Groups A, B, C, and D. Also, zone certified intrinsically safe Class I, Zone 0, Ex ia IIC.	B, C, E	Temperature Class T4 at 85°C maximum ambient. Connect per MI 020-449.	C <sup>(d)</sup>
CSA Class I, Division 2, Groups A, B, C, and D.		Temperature Class T6 at 60°C maximum ambient.	
CSA Intrinsically safe, Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1. Also zone certified intrinsically safe Class I, Zone 0, Ex ia IIC.	D, F, L, M, S, T, W, Y	Temperature Class T4 at 85°C and T6 at 60°C maximum ambient. Connect per MI 020-449.	
CSA suitable for Class I, Division 2, Groups A, B, C, D, F and G. Also zone certified Class I, Zone 2, Ex nA II.		Temperature Class T4 at 85°C, T5 at 75°C, and T6 at 60°C maximum ambient.	
CSA Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class II, Division 1, Groups E, F, and G; and Class III, Division 1. Also zone certified Class I, Zone 1, Ex d IIC.	D, F, L, M, S, T, W, Y	Temperature Class T4 at 85°C and T6 at 40°C maximum ambient. <sup>(c)</sup>	

**Table 3. Electrical Safety Specifications without Optional L1 Display <sup>(a)</sup> (Continued)**

Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions	Electrical Safety Design Code
FM intrinsically safe for Class I, Division 1, Groups A, B, C, and D.	B, C, E	Temperature Class T4 at 85°C and T6 at 60°C maximum ambient. Connect per MI 020-449.	F <sup>(d)</sup>
FM Zone certified intrinsically safe Class I, Zone 0, AEx ia IIC.		Temperature Class T4 at 85°C maximum ambient.	
FM nonincendive for Class I, Division 2, Groups A, B, C, and D.		Temperature Class T4 at 85°C maximum ambient.	
FM intrinsically safe for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1.	D, F, L, M, S, T, W, Y	Temperature Class T4 at 85°C and T6 at 60°C maximum ambient. Connect per MI 020-449. <sup>(b)</sup>	
FM Zone certified intrinsically safe, Class I, Zone 0, AEx ia IIC.		Temperature Class T4 at 85°C maximum ambient. <sup>(b)</sup>	
FM nonincendive, Class I, Division 2, Groups A, B, C, and D; Suitable for Class II, Division 2, Groups F and G.		Temperature Class T4 at 85°C maximum ambient.	
FM Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class II, Division 1, Groups E, F, and G; Class III Division 1. <sup>(e)</sup>	D, F, L, M, S, T, W, Y	Temperature Class T5 at 80°C and T6 at 70°C maximum ambient. <sup>(c)</sup>	
IECEX flameproof, Ex d IIC, Ex tb IIIC T85C Db.	L, M, S, T, W, Y	IECEX FMG14.0005X Temperature Class T6. Ta = -40 to +70°C.	V
IECEX Ex ia IIC.	B, C, E, D, F, L, M, S, T, W, Y	IECEX DEK13.0057 Temperature Class T4, Ta = -40 to +85°C; T6, Ta = -40 to +60°C.	T

a. See Table 4 for certifications with L1 display. Optional indicator L1 is certified only with housing codes L, M, S, T, W, and Y.

b. Supply and Input Circuit (Terminals 1 and 2):  $U_i=30$  V;  $I_i=120$  mA;  $P_i=0.84$  W;  $C_i=1.0$  nF;  $L_i=10$   $\mu$ H  
Sensor Circuit (Terminals 3, 4, 5, and 6):  $U_o=9.6$  V;  $I_o=28$  mA;  $P_o=67$  mW;  $C_o=3.5$  nF;  $L_o=35$   $\mu$ H

c. Certifications do not apply for Housing Codes F, L, or M if thermowell is not supplied with transmitter (Code NA).

d. At the time of printing, the HART 7 (-H) module is certified for Electrical Safety Design Codes C and F with Housing Code B only. Contact Invensys for availability of additional CSA and FM certifications with HART version 7 (-H).

e. Also includes Group A for Housing Codes D and F.



Table 4. Electrical Safety Specifications with Optional L1 Display


Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions <sup>(a)</sup>	Electrical Safety Design Code
ATEX intrinsically safe, II 1 GD, Ex ia IIC.	L, M, S, T, W, Y	KEMA03ATEX1568 Temperature Class T4, Ta = -40 to +85°C; T6, Ta = -40 to +60°C.	E
ATEX flameproof, II 2 GD, Ex d, IIC, Ex tb IIIC T85C Db.	L, M, S, T, W, Y	FM13ATEX0068X Temperature Class T6. Ta = -40 to +70°C. <sup>(b)</sup>	D
CSA Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class II, Division 1, Groups E, F, and G; and Class III, Division 1. Also zone certified Class I, Zone 1, Ex d IIC.	L, M, S, T, W, Y	Temperature Class T4 at 85°C and T6 at 40°C maximum ambient. <sup>(b)</sup>	C <sup>(c)</sup>
FM intrinsically safe for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1.	L, M, S, T, W, Y	Temperature Class T4 at 85°C and T6 at 60°C maximum ambient. Connect per MI 020-449.	F <sup>(c)</sup>
FM Zone certified intrinsically safe, Class I, Zone 0, AEx ia IIC.		Temperature Class T4 at 85°C maximum ambient.	
FM nonincendive, Class I, Division 2, Groups A, B, C, and D; Suitable for Class II, Division 2, Groups F and G.		Temperature Class T4 at 85°C maximum ambient.	
FM Explosionproof, Class I, Division 1, Groups B, C, and D; dust-ignitionproof, Class II, Division 1, Groups E, F, and G; Class III Division 1.	L, M, S, T, W, Y	Temperature Class T5 at 80°C and T6 at 70°C maximum ambient. <sup>(b)</sup>	
IECEX flameproof, Ex d IIC, Ex tb IIIC T85C Db.	L, M, S, T, W, Y	IECEX FMG14.0005X Temperature Class T6. Ta = -40 to +70°C.	V

a. Supply and Input Circuit (Terminals 1 and 2):  $U_i=28$  V;  $I_i=120$  mA;  $P_i=0.84$  W;  $C_i=2.0$  nF;  $L_i=10$   $\mu$ H  
Sensor Circuit (Terminals 3, 4, 5, and 6):  $U_o=9.6$  V;  $I_o=28$  mA;  $P_o=67$  mW;  $C_o=3.5$  nF;  $L_o=35$   $\mu$ H


b. Certifications do not apply for Housing Codes L or M if thermowell is not supplied with transmitter (Code NA).

c. Contact Invensys for availability of CSA and FM certification with HART version 7 (-H).


## ATEX Warning

—  **WARNING** —  
Do not open while circuits are energized.


## IECEX Warning

—  **WARNING** —  
Do not open when energized or when an explosive atmosphere may be present.


## FM and CSA Warnings

—  **WARNING** —  
Substitution of components may impair intrinsic safety or Division 2 approvals.

### *For Explosionproof Certifications:*

—  **WARNING** —  
Keep cover tight while circuits are energized unless area is known to be nonhazardous.

## ATEX and FM Warnings for L1 Display

—  **WARNING** —  
Static Hazard - Do Not rub with dry cloth.

## ATEX Compliance Documents

Directive 94/9/EC - Equipment or Protective Systems Intended for Use in Potentially Explosive Atmospheres.

Also, compliance with the essential health and safety requirements has been assured by compliance with the following documents as stated in the compliance certificate:

KEMA03ATEX1568

EN 60079-0:2009; EN 60079-11:2007; EN 60079-26:2007; EN 61241-11:2006.

FM06ATEX0002

EN 60079-0:2004; EN 60079-1:2004; EN50281-1-1:1998 + A1:2002;  
EN 60079-26: 2004; EN 60529:1991 + A1: 2000.

FM 13ATEX0068X

II 2 GD Ex d IIC T6 GbTa(-40°C to 70°C)  
Ex tb IIIC T85°C DbTa(-40°C to 70°C)

EN 60079-0:2009; EN 60079-1:2007; EN 60079-31:2009

## IECEX Compliance Documents

### **IECEX DEK 13.0057**

Ex ia IIC T6 to T4 Ga

Ex ia IIIC Da

IEC 60079-0:2007-10 (Edition 5); IEC 60079-11:2011 (Edition 6);

IEC 60079-26:2006 (Edition 2); IEC 61241-11:2005 (Edition 1)

### **IECEX FMG 14.0005X**

Ex d IIC T6 Gb Ta = -40°C to 70°C

Ex tb IIIC T85°C Db Ta = -40°C to 70°C

IEC 60079-0:2007-10 (Edition 5); IEC 60079-1:2007 (Edition 6);

IEC 60079-31:2013 (Edition 2)

IEC 60079-0 (Fourth Edition):2004

IEC 60079-1 (Fifth Edition):2003



## 2. Installation

The following material provides information and procedures for installing the RTT15 Transmitter. For dimensional information, refer to DP 020-462.

Installation shall be carried out in accordance with the applicable code of practice (typically IEC 60079-14) by suitably-trained personnel.

There are no special checking or maintenance conditions. All explosion-protected equipment should be periodically inspected in accordance with the applicable code of practice (typically IEC 60079-17). The interval between inspections should not normally exceed 3 years, unless justification for a longer interval is given.

With regard to explosion safety, it is not necessary to check for correct operation.

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— **NOTE** —

Use a suitable thread sealant on all connections.

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— **! CAUTION** —

Bare sensor or thermowell mounting to the 316 ss housing should not be used in high vibration areas.

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— **! CAUTION** —

The RTT15 is only certified for use in ambient temperatures marked on the equipment and should not be used outside this range.

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— **! CAUTION** —

The maximum process pressure indicated on the marking must not be exceeded.

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— **! CAUTION** —

The maximum permitted ambient temperature of the RTT15 Temperature Transmitter is 80°C. To avoid the effects of process temperature and other thermal effects, care shall be taken to ensure that the electronics housing temperature does not exceed an ambient temperature of 80°C.

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### Mounting

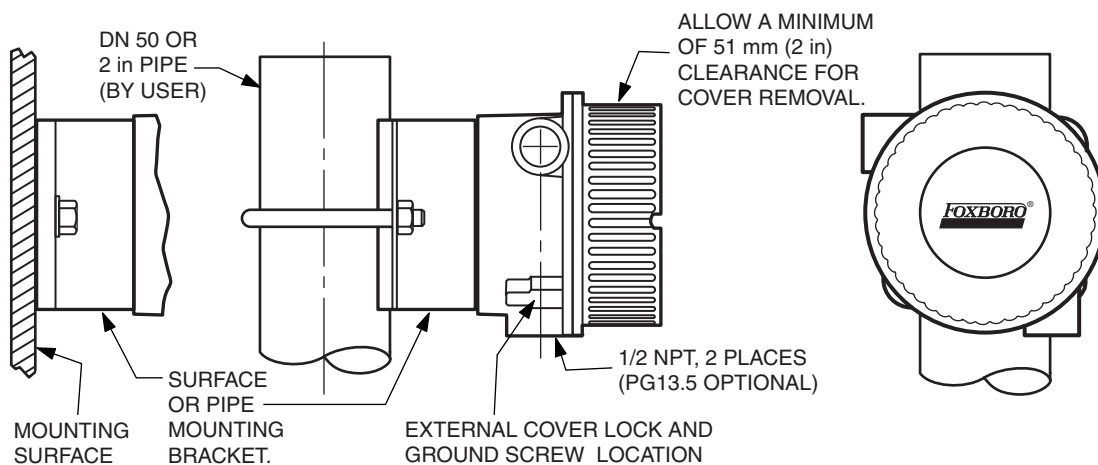
The basic transmitter can be mounted on a DIN rail or to a flat surface. The transmitter in a field housing can be pipe mounted, surface mounted, mounted directly to a bare sensor, or thermowell mounted. See Figures 4 through 6. For extremely high process temperatures, a remote mounted sensor is recommended. Also, the mounting stability can influence how the sensor is attached to the transmitter. If the process vessel is highly insulated and the thermowell has considerable lagging, a remote mounted transmitter attached to a 50 mm (2 inch) pipe is recommended. When mounting the transmitter, take into account the necessary room to remove the cover.

## ATEX Requirements

1. For all versions, the sensor circuit is not infallibly galvanically isolated from the input circuit. However, the galvanic isolation between the circuits is capable of withstanding a test voltage of 500 Vac during 1 minute.
2. With enclosure codes C, D, E, F, L, M, S, T, W and Y, the cable entries and blanking elements shall be used that are suitable for the application and correctly installed.
3. For all versions with an ambient temperature  $\geq 60^{\circ}\text{C}$ , heat resistant cables shall be used with a rating of at least 20 K above the ambient temperature.
4. With enclosure code B, the transmitter must be mounted in an enclosure in order to provide a degree of ingress protection of at least IP20.
5. With enclosure code B, the transmitter may only be installed in a potentially explosive atmosphere caused by the presence of combustible dust when mounted in a metal enclosure according to DIN 43729 that is providing a degree of protection of at least IP6X in accordance with EN 60529.

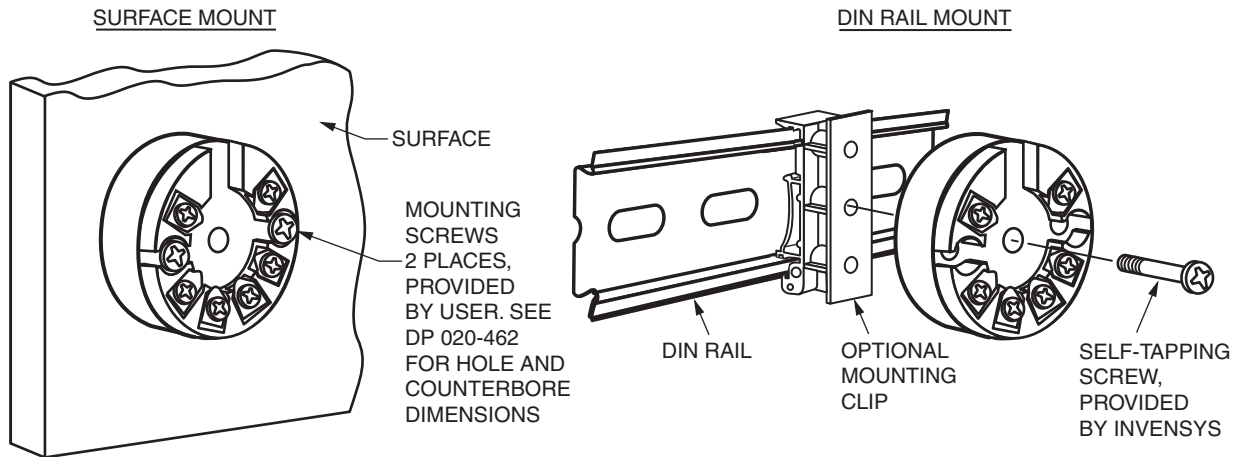
## Surface or Pipe Mount with Remote Sensor

*Figure 4. Surface or Pipe Mount with Remote Sensor (Housing Codes S and T)*



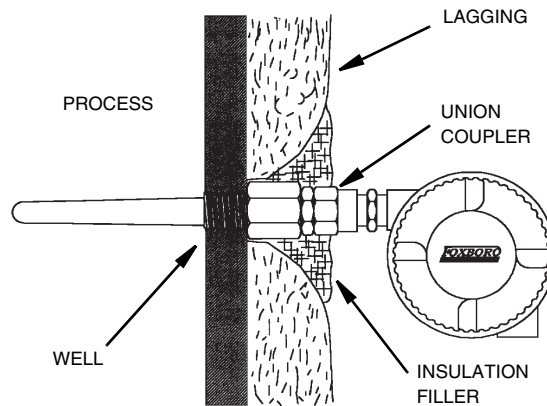
# Basic Module Mount

Figure 5. Basic Module Mount (Housing Code B)



# Thermowell Mount

Figure 6. Thermowell Mount (Housing Codes E, F, L, and M)



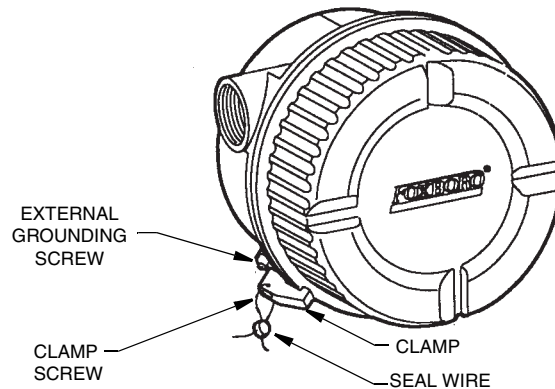
## Cover Locks

A cover lock is provided as standard with certain agency certifications and as part of the Custody Transfer Lock and Seal option. The type of lock varies with the housing used.

### Universal Housing (Codes S, T, L, M, W, and Y)

To lock the cover on this housing, screw the cover onto the housing as far as possible, place the clamp as shown below and tighten the clamp screw. Insert the seal wire through the clamp and crimp the seal if applicable.

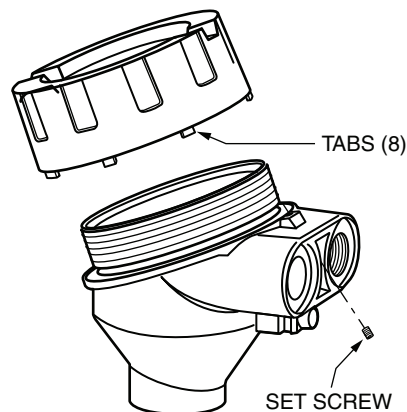
*Figure 7. Universal Housing Cover Lock*



### Explosionproof Connection Head (Codes D and F)

To lock the cover on this housing, screw the cover onto the housing as far as possible and then screw the set screw into place. Make sure that the set screw is located between any two of the eight small tabs on the cover.

*Figure 8. Explosionproof Connection Head Cover Lock*





# Wiring

Your transmitter must be installed to meet all local installation regulations, such as hazardous location requirements and electrical wiring codes. Persons involved in the installation must be trained in these code requirements. To maintain agency certification, your transmitter must also be installed in accordance with the agency requirements.

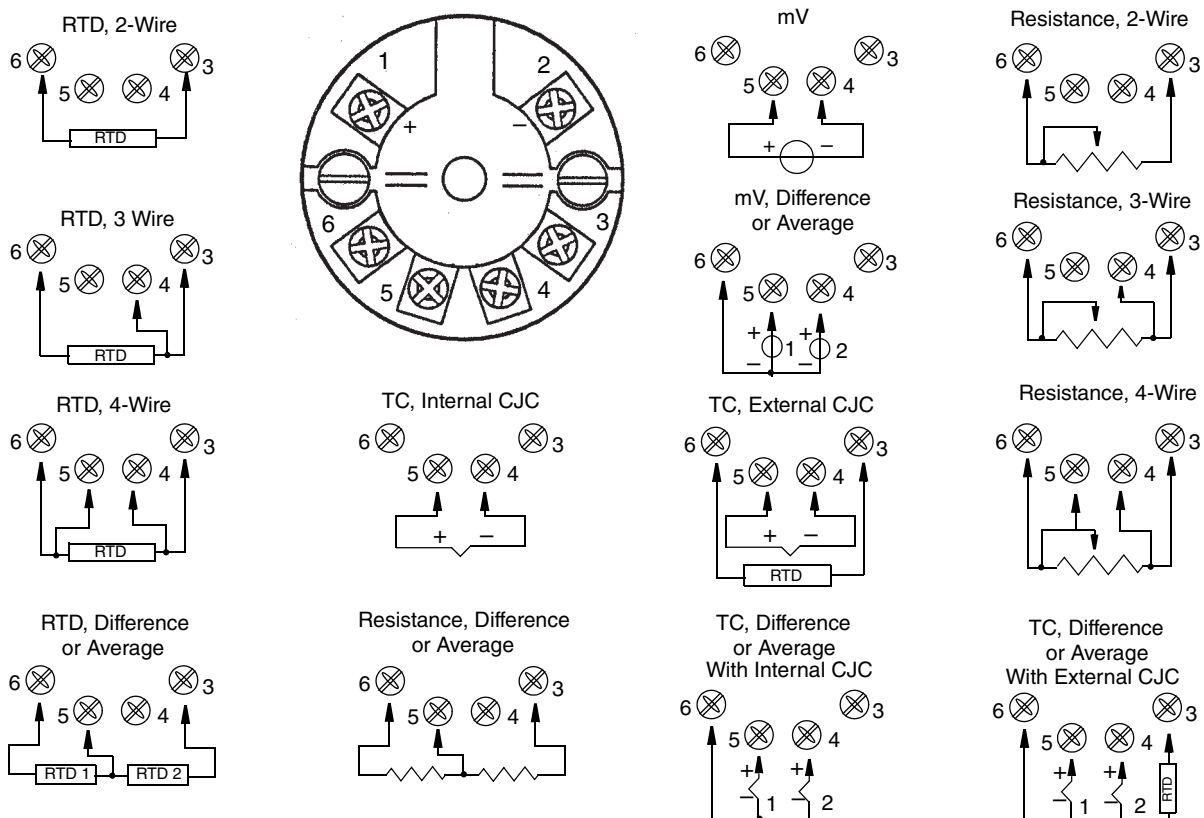
**! WARNING**  
 On transmitters with Housing Code L, M, S, T, W, and Y to maintain IEC IP66/67 and NEMA Type 4X protection, any unused conduit opening must be plugged with a metal plug. In addition, the threaded housing cover must be installed. Hand tighten cover as much as possible so that the O-ring is fully captured.

**NOTE**  
 Invensys recommends the use of transient/surge protection in installations prone to high levels of electrical transients and surges.

## Input Connections

There are six terminals on the basic module for input and output connections. Terminals 1 and 2 are for measurement output and terminals 3 through 6 are for RTD, TC, ohm, or mV sensor inputs. Dual inputs for average and difference measurement must be of the same linearization type (for example, a thermocouple cannot be used with an RTD).

Figure 9. Input Connections



## Loop Wiring

When wiring the transmitter, the supply voltage and loop load must be within specified limits. The supply output load vs. voltage relationship is:

$R_{\text{max}} = (V - 8) / 0.023$  and is shown in Figure 10.

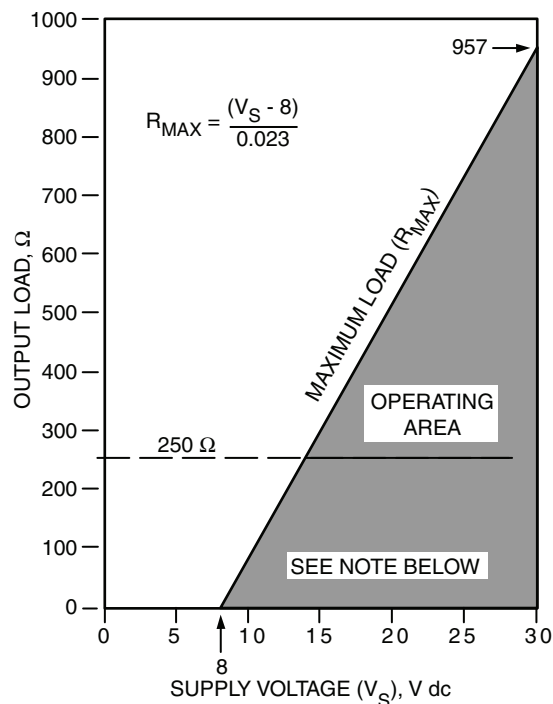
Any combination of supply voltage and loop load resistance in the shaded area can be used. To determine the loop load resistance (transmitter output load), add the series resistance of each component in the loop, excluding the transmitter. The power supply must be capable of supplying 23 mA of loop current.

---

— **NOTE** —

1. The maximum voltage is 28 V dc for transmitters certified as intrinsically safe.
  2. A transmitter with the optional L1 display requires an additional 4 volts.  
However, the total voltage with the optional L1 display must not exceed 28 volts.
- 

*Figure 10. Supply Voltage and Loop Load*



**NOTE**

The transmitter will function with an output load less than 250 Ω provided that a HART Communicator or PC-based Configurator is not connected to it. Use of a HART Communicator or PC-based Configurator requires 250 Ω minimum load.

**Examples:**

- ◆ For a loop load resistance of 500  $\Omega$  the supply voltage can be any value from 21.7 to 30 V dc.
- ◆ For a supply voltage of 24 V dc, the loop load resistance can be any value from 250 to 696  $\Omega$  (zero to 696  $\Omega$  without a HART Communicator connected to the transmitter).

To wire one or more transmitters to a power supply, proceed with the following steps.

1. Remove the cover from the transmitter field terminals compartment.
2. Run signal wires (0.50 mm<sup>2</sup> or 20 AWG, typical) to the transmitter. Use twisted single pair to protect the 4 to 20 mA output and/or remote communications from electrical noise. Maximum recommended length for signal wires is:
  - ◆ 3050 m (10,000 ft) **using single pair cable** and adhering to requirements of HART physical layer implementation defined in HART Document HCF\_SPEC-53. Use CN=1 when calculating max. lengths.
  - ◆ 1525 m (5000 ft) in a multidrop mode (15 devices recommended maximum). Screened (shielded) cable could be required in some locations.

**— NOTE**

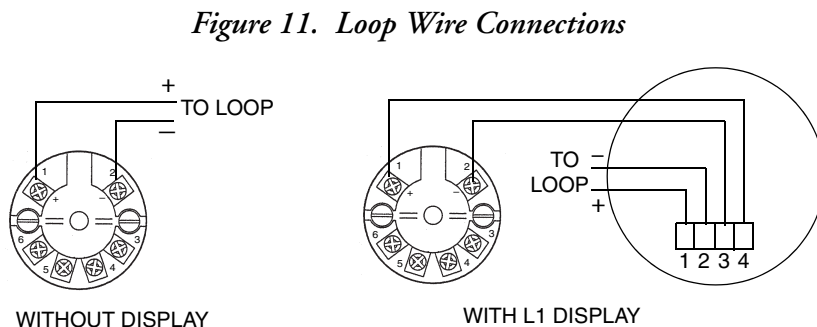
Do not run transmitter wires in same conduit as mains (ac power) wires.

3. If shielded cable is used, earth (ground) the shield at the power supply **only**. Do not ground the shield at the transmitter.
4. If housing is used, plug any unused conduit connection with a metal plug.
5. Connect an earth (ground) wire to the earth terminal in accordance with local practice.

**— ! CAUTION**

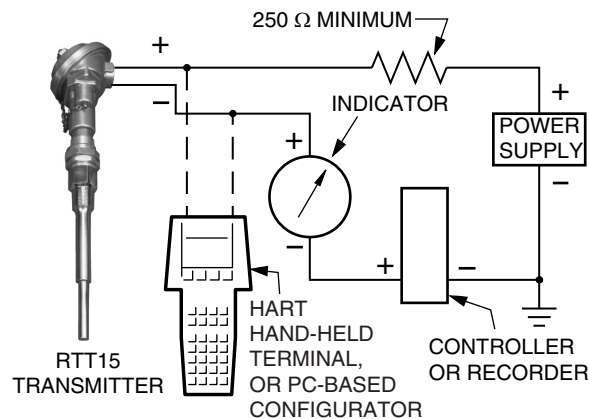
If the signal circuit must be earthed (grounded), it is preferable to do so at the negative terminal of the dc power supply. To avoid errors resulting from earth loops or the possibility of short-circuiting groups of instruments in a loop, there should be only one earth in a loop.

6. Referring to Figure 11, connect the power supply and receiver loop wires to
  - ◆ The “+” and “-” terminal connections on the transmitter (with no display)
  - ◆ The “1” and “2” terminals on the display (with L1 display).

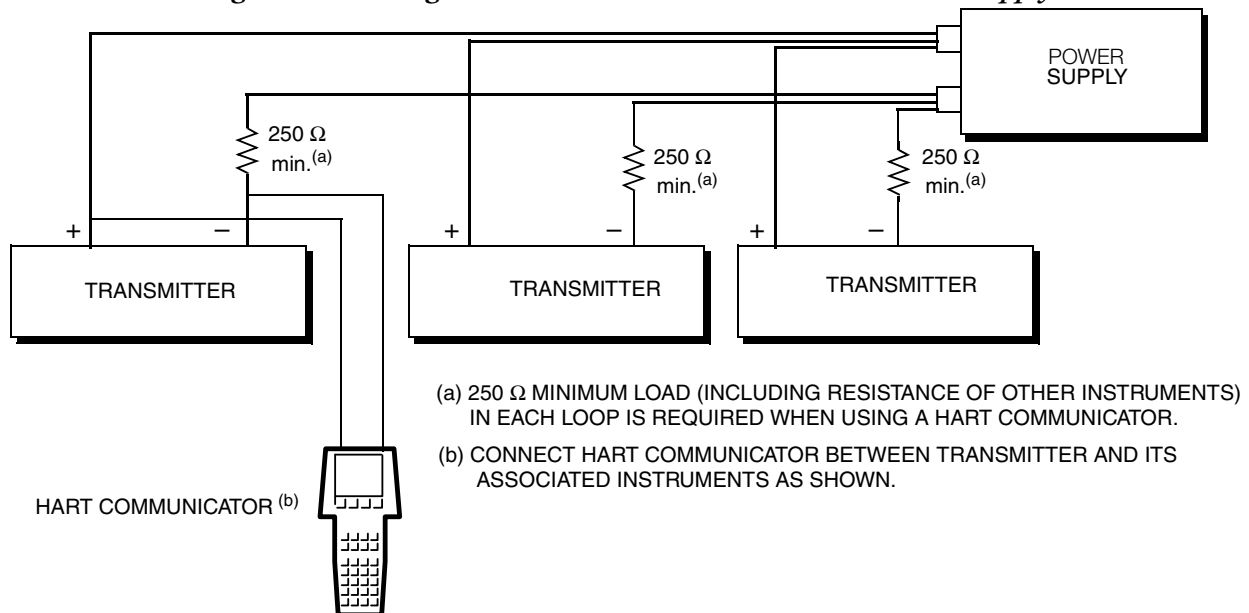


7. Connect receivers (such as controllers, recorders, indicators) in series with power supply and transmitter as shown in Figure 12.
8. If a housing is used, install the cover onto the housing.
9. If wiring additional transmitters to the same power supply, repeat Steps 1 through 8 for each additional transmitter. The setup with multiple transmitters connected to a single power supply is shown in Figure 13.
10. The HART Communicator can be connected in the loop between the transmitter and the power supply as shown in Figure 12 and Figure 13. Note that a minimum of  $250\ \Omega$  must separate the power supply from the HART Communicator.

*Figure 12. Transmitter Loop Wiring*



*Figure 13. Wiring Several Transmitters to a Common Power Supply*



## Multidrop Communication

“Multidropping” refers to the connection of several transmitters to a single communications transmission line. Communications between the host computer and the transmitters takes place digitally with the analog output of the transmitter deactivated. With the HART communications protocols, multiple transmitters can be connected on a single twisted pair of wires or over leased telephone lines.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Multidrop installations are not recommended where Intrinsic Safety is a requirement. Communication with the transmitters can be accomplished with any HART compatible modem and a host implementing the HART protocols. Each transmitter is identified by a unique address (1 to 15 for HART 5, or 1 to 63 for HART 7) and responds to the commands defined in the protocols.

Figure 14 shows a typical multidrop network. Do not use this figure as an installation diagram. Refer to the HART Communications Foundation (<http://www.hartcomm.org/>) for specific requirements for multidrop applications.

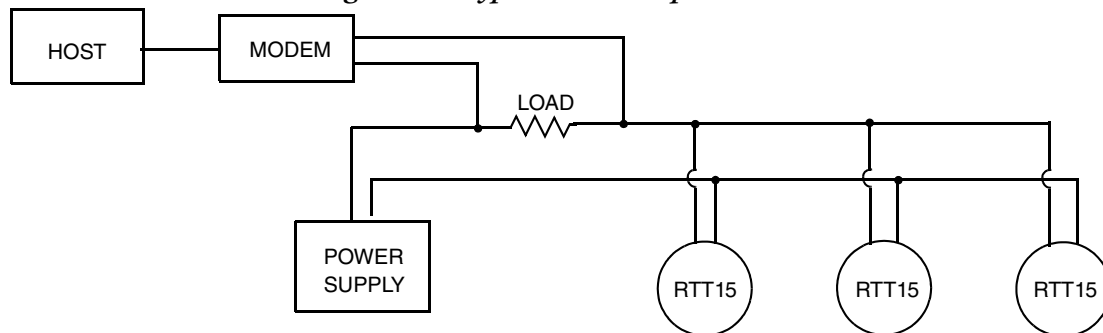
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**— NOTE**

The L1 Display Option does not function in multidrop mode.

---

*Figure 14. Typical Multidrop Network*



## Wiring to an I/A Series<sup>®</sup> System

Connect terminals 1 and 2 of the RTT15 basic module to FBM214. For other system wiring details, refer to the installation instructions provided with the I/A Series system.



# 3. Operation and Configuration

## Operation

### Using a HART Communicator

With HART version 5, the measurement process variable (PV), electronics temperature (Electr), output value in mA (PV AO), and process variable in percent of range (PV % rng) are displayed in the main Online menu.

With HART version 7, the Online menu displays the Sensor 1 value (Snsr 1 Value), Sensor 2 value (Snsr 2 Value), electronics or CJC value (EI/CJC value), average value (Avg Value), differential value (Diff Value), loop current (Loop current), and process variable in percent of range (PV % rng).

### Using the Optional L1 Display

The measurement process variable is displayed on the LED display. The display toggles between the measurement and the units of measurement if units were configured. The display reads LO when the input current is below the configured low value. It reads HI when the input current is above the configured high value.

— **NOTE** —

See “Configuring the Optional L1 Display” on page 57 for instructions on how to configure your display.

## Calibration

Your RTT15 temperature transmitter is a highly stable transmitter that was previously calibrated at the factory. There is no need to recalibrate the digital value of the measurement. Therefore, no calibration feature is provided.

## 4 to 20 mA Output Trim

A D/A trim function is used to trim 4 and 20 mA output values to match the output of a plant standard measurement device. To trim this output, connect the HART Communicator to your transmitter and access the Online menu. Then use the following path:

For HART 5: Device Setup > Diag/Service > Calibration > D/A Trim (1,2,3,2)

For HART 7: Device Setup > Diag/Service > Calibration > D/A Trim (1,3,2,2)

With HART 7, you can also set trim separately for each device variable:

Device Setup > Diag/Service > Calibration > Device Variable Trim (1,3,2,4)

## Rerange

To rerange your transmitter, connect the HART Communicator to your transmitter and access the Online menu. Then use the following path to set the lower range value (PV LRV), upper range value (PV URV), and units (PV Unit):

For HART 5: Device Setup > Basic Setup > Range Values (1,3,2)

For HART 7: Device Setup > Setup > Range Variables > Range Configuration (1,4,3,1)

## Configuration

To configure your transmitter, connect the HART Communicator to your transmitter and select **Device Setup** from the Online menu.

With HART 5 electronics, you can then select **Diag/Service** to perform diagnostic procedures, **Basic Setup** or **Detailed Setup** to perform configuration changes, or **Review** to view the present configuration and status of your device. See “HART 5 Online Menu and Parameters” on page 34 for details.

With HART 7 electronics, you can then select **Dynamic Variables** to work with dynamic variables, **Diag/Service** to perform diagnostic procedures, **Setup** to perform configuration changes, or **Review** to view the present configuration and status of your device. See “HART 7 Online Menu and Parameters” on page 41 for details.

### — **WARNING** —

If your transmitter has an optional display, changing the engineering units or range in your transmitter requires that you also make similar changes in the configuration of your display.

## Configuration Notes

1. You can configure your transmitter to test for a broken sensor and/or a shorted RTD sensor. However, if the sensor is a thermocouple, do **not** configure the transmitter to test for a shorted sensor.  
If this feature is used, you can set the output to go to a predetermined value if a broken or shorted sensor is detected. This can be done in three ways in the parameters **Broken sensor** and **Shorted sensor**:
  - a. In the sub-parameters **Br sens** and **Sh sens** (with HART 5) or **Broken Snsr Value** and **Shorted Snsr Value** (with HART 7), you can set the output to go to a specific value between 3.5 and 23 mA.
  - b. The sub-parameter **NAMUR down** sets the output to go to 3.5 mA.
  - c. The sub-parameter **NAMUR up** sets the output to go to 23 mA.
2. You can also configure the output of your transmitter to go to a predetermined value if the measurement exceeds the range limits. The parameter **AO lo lim** allows you to set the output in an underrange situation to a value between 3.5 and 23 mA. Likewise, in **AO up lim** you can set the output in an overrange situation to a value between 3.5 and 23 mA. Or you can set the output in underrange and overrange situations to go to



NAMUR values of 3.8 and 20.5 mA with the parameter **Set limits=NAMUR**. Note that the value of **AO up lim** must be higher than the value of **AO down lim**.

3. In the pick list of sensor types, do **not** specify **Spcl RTD** or **Spcl T/C** unless your transmitter was supplied with custom RTD or thermocouple curves.
4. If your transmitter was ordered with custom factory configuration to enter a custom curve or Callendar-Van Dusen (CVD) coefficients, the HART Communicator can be used to select **Spcl RTD** or **Spcl T/C** to invoke the custom configuration. However, the DD for the HART Communicator does not include the function to develop the custom curve or to enter the CVD coefficients. Refer to Invensys for a custom configuration.
5. When configuring your transmitter for use with a 2-wire RTD, you must enter the cable resistance in the parameter **Cable resistance** so that it is not included in the measurement. To do this, enter the total value for both leads.

With HART version 5, if you do not know the resistance, you can have the transmitter measure and enter the resistance for you via the sub-parameter **Measure Value**.

6. With HART version 5, Platinum and nickel RTDs used with your transmitter can have a nominal resistance between 10 and 1000 ohms. For other than 100-ohm RTDs, a factor must be entered in the parameter **RTD Factor**. This factor is calculated as follows:

$$\text{RTD Factor} = 100/\text{RTD Nominal Resistance}$$

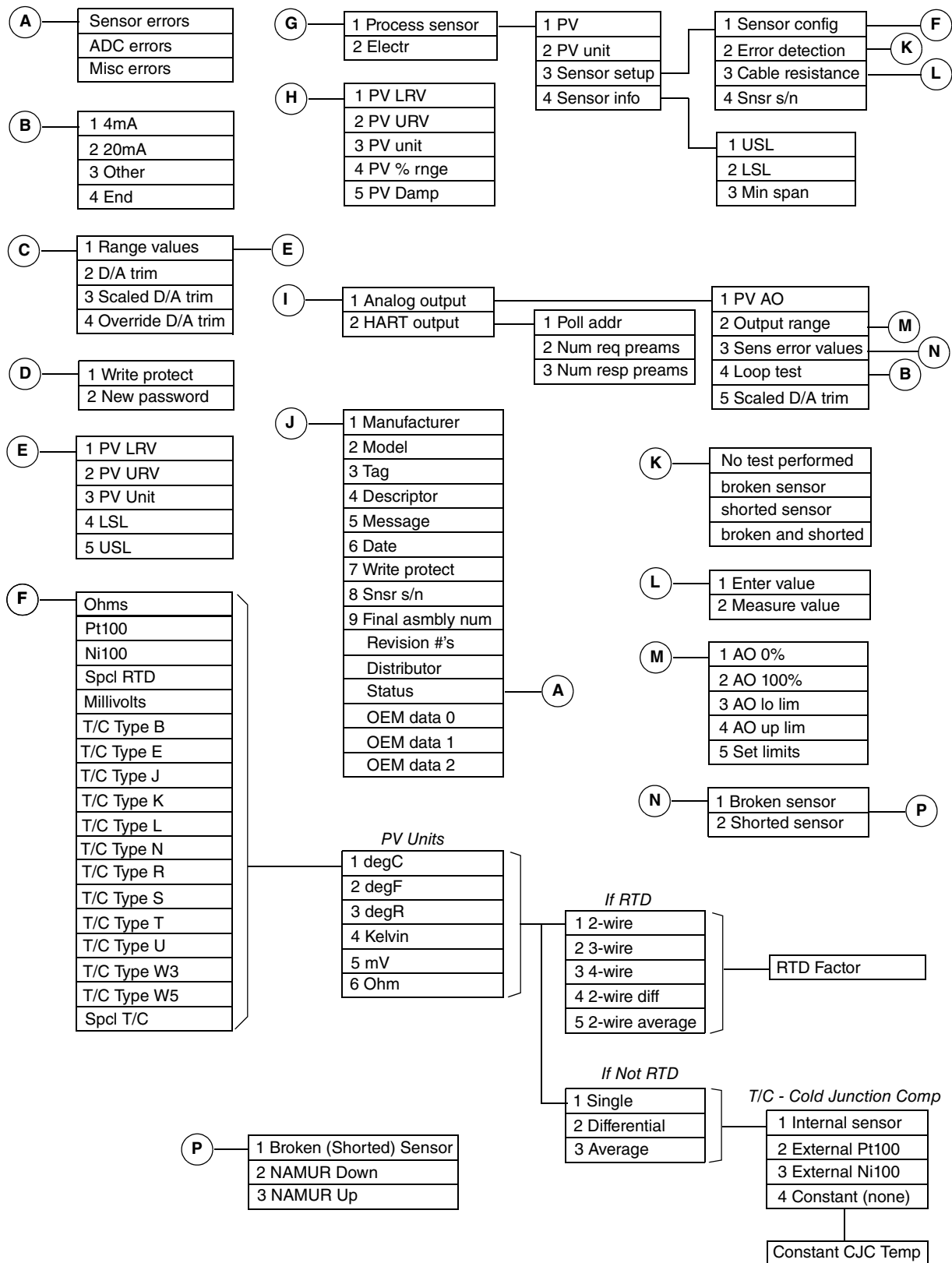
For example, for a Pt1000 RTD, the calculation is:

$$\text{RTD Factor} = 100/1000 = 0.1$$

With HART version 7, no calculation is needed. Simply select the RTD type; for example, **Pt200 RTD**.



Figure 16. RTT15-T Temperature Transmitter Online Menu (2 of 2)



## HART 5 Parameters and Fast-Key Paths

*Table 5. HART 5 Online Parameters and Fast-Key Paths*

Parameter	Fast-Key Path	Explanation
# ADC data	1,5,3	Shows if too few bits received from AD converter. On indicates an error; Off indicates OK.
#-wire	1,3,3	If RTD, select 2-wire, 3-wire, 4-wire, 2-wire diff, or 2-wire average.
4mA	1,2,2,1	Loop test procedure to set 4 mA as the signal value to check other devices in the control loop.
20mA	1,2,2,2	Loop test procedure to set 20 mA as the signal value to check other devices in the control loop.
ADC errors	1,2,1	Shows if there are A/D converter or input stage errors. On indicates an error; Off indicates OK.
ADC init	1,5,3	Shows if the transmitter input did not initialize correctly. On indicates an error; Off indicates OK.
Analog output	1,4,3,1	Path to configure the Analog Output parameters.
AO 0%	1,4,3,1,2,1 1,5,2	In Detailed Setup, enter the mA output for 0% of range. In Review, shows the mA output at 0% of range.
AO 100%	1,4,3,1,2,2 1,5,2	In Detailed Setup, enter the mA output for 100% of range. In Review, shows the mA output at 100% of range.
AO lo lim	1,4,3,1,2,3 1,5,2	Output if measurement goes below the PV LRV. In Detailed Setup, enter a value between 3.5 and 23 mA (must be less than AO up lim). In Review, shows the current AO lo lim.
AO up lim	1,4,3,1,2,4 1,5,2	Output if measurement exceeds the PV URV. In Detailed Setup, enter a value between 3.5 and 23 mA (must be greater than AO lo lim). In Review, shows the current AO up lim.
Average	1,3,3	If not RTD, select if average measurement.
Basic Setup	1,3	Path to configure the basic setup parameters.
Br sens	1,5,2	Shows the mA value in case of a broken sensor.
broken and shorted	1,4,1,1,3,2	Select to test for both broken and shorted sensor.
broken sensor	1,4,1,1,3,2 1,4,3,1,3,1	In Error Detection, select to test for a broken sensor. In Sens Error Values, enter value that output goes to in case of a broken sensor (between 3.5 and 23 mA) or select NAMUR down (3.5 mA) or NAMUR up (23 mA).
Cable resistance	1,4,1,1,3,3	Path to enter or measure the cable resistance.
Calibration	1,2,3	Path to conducting several calibration procedures.
CJC electr sens	1,5,3	Shows if a CJC or electronic sensor temperature error exists. On indicates an error; Off indicates OK.

*Table 5. HART 5 Online Parameters and Fast-Key Paths (Continued)*

Parameter	Fast-Key Path	Explanation
Constant	1,3,3	Select if CJC is a constant.
Constant CJC Temp	1,3,3	Enter the CJC constant in temperature units.
Const CJC value	1,5,1	Shows the Const CJC value.
D/A trim	1,2,3,2	Procedure to trim the 4 and 20 mA output values of the transmitter to match the output of a plant standard measurement device.
Date	1,4,4,6 1,5,3	In Detailed Setup, enter the date (mm/dd/yyyy). In Review, shows the date of the last configuration.
Descriptor	1,4,4,4 1,5,3	In Detailed Setup, enter the descriptor (16 characters maximum). In Review, shows the descriptor.
Detailed Setup	1,4	Path to configure the Detailed Setup parameters.
Device information	1,4,4 1,5,3	In Detailed Setup, path to configure the Device Information parameters. In Review, path to view the Device Information parameters.
Device Setup	1	Path to all parameters.
Diag/Service	1,2	Path to access the Diag/Service parameters.
Differential	1,3,3	If not RTD, select if differential measurement.
Distributor	1,5,3	Shows the name of the distributor (Foxboro).
Downscl ADC	1,5,3	Shows if there are input stage errors. On indicates an error; Off indicates OK.
Downscl RAM xor	1,5,3	Shows if there is an error when calculating RAM checksum. On indicates an error; Off indicates OK.
EEP ack error	1,5,3	Shows if EEPROM did not acknowledge. On indicates an error; Off indicates OK.
EEP xor	1,5,3	Shows if there is an error when calculating EEPROM checksum. On indicates an error; Off indicates OK.
EEP-read err	1,5,3	Shows if there is an error when reading from EEPROM. On indicates an error; Off indicates OK.
Electr	3	Shows the electronics temperature.
End	1,2,2,4	Procedure to end a loop test.
Enter value	1,4,1,1,3,3,1	Enter the value of cable resistance for 2-wire RTD.
Error detection	1,4,1,1,3,2	Select procedure to check for a sensor error.
External Ni100	1,3,3	Select if CJC is via a Ni100 sensor.
External Pt100	1,3,3	Select if CJC is via a Pt100 sensor.
Final asmbly num	1,4,4,9 1,5,3	In Detailed Setup, enter the final assembly number. In Review, shows the final assembly number.
Fld dev rev	1,5,3	Shows the field device revision level.
Hardware rev	1,5,3	Shows the hardware revision level.

*Table 5. HART 5 Online Parameters and Fast-Key Paths (Continued)*

Parameter	Fast-Key Path	Explanation
HART output	1,4,3,2	Path to configure the HART Output parameters.
Input info	1,5,1	Path to view the current input information.
Internal Sensor	1,3,3	Select if CJC is via the internal sensor.
Loop Test	1,2,2	Procedure to conduct a loop test.
LSL	1,5,1	Shows the lower sensor limit.
Manufacturer	1,5,3	Shows the manufacturer (Foxboro).
Meas typ	1,5,1	Shows the measurement input type.
Measure value	1,4,1,1,3,3,2	Procedure to measure the value of cable resistance for 2-wire RTD.
Message	1,4,4,5 1,5,3	In Detailed Setup, enter an optional message (32 characters maximum). In Review, shows any message entered.
Millivolts	1,3,3	Select if the measurement input type is millivolts.
Min span	1,5,1	Shows the minimum span.
Misc errors	1,2,1	Shows if errors other than sensor errors or ADC errors exist. On indicates an error; Off indicates OK.
Missing meas	1,5,3	Shows if a measurement was missed. On indicates an error; Off indicates OK.
Model	1,5,3	Shows the basic model number (RTT15).
New password	1,2,4,2	Enter the new write protect password.
Ni100	1,3,3	Select if the measurement input type is Ni100 RTD.
No test performed	1,4,1,1,3,2	Select to not perform sensor error detection test.
Num req preams	1,4,3,2,2	Shows the number of preambles to be sent in a request message from the transmitter.
Num resp preams	1,4,3,2,3	Enter number of preambles to be sent in a response message from the transmitter.
OEM # bit 1 - 7		Not used
OEM data #		Not used
Ohms	1,3,3	Select if the measurement input type is ohms.
Other	1,2,2,3	Loop test procedure to enter a mA value as a signal source to check other devices in the control loop.
Output condition	1,4,3	Path to configure output condition parameters.
Output info	1,5,2	Path to view the current output information.
Output range	1,4,3,1,2	Path to configure output range parameters.
Override D/A trim	1,2,3,4	Procedure to override any configured D/A trim and restore factory setting.
Poll addr	1,4,3,2,1	Specify 0 in the standard point to point, 2-wire analog mode. Specify an address from 1 through 15 for multidrop operation.
Process sensor	1,4,1,1	Path to process sensor parameters.
Process variables	1,1	Path to view the value of the process variables.

*Table 5. HART 5 Online Parameters and Fast-Key Paths (Continued)*

Parameter	Fast-Key Path	Explanation
Pt100	1,3,3	Select if the measurement input type is Pt100 RTD.
PV	2	Shows the primary variable value in units configured.
PV % rng	5	Shows the primary variable value in percent of range.
PV AO	4	Shows the analog output value of the primary variable.
PV Damp	1,3,4	In Basic or Detailed Setup, enter the damping value in seconds.  In Review, shows the damping value.
	1,4,2,5	
	1,5,1	
PV LRV	1,3,2,1	In Basic Setup, enter the lower range value.  In Detailed Setup, enter the lower range value.  In Review, shows the lower range value.
	1,4,2,1	
	1,5,1	
PV unit	1,3,2,3	In Basic Setup, select the unit of the primary variable.  In Detailed Setup, select the unit of the primary variable.  In Review, shows the unit of the primary variable.
	1,4,2,3	
	1,5,1	
PV URV	1,3,2,2	In Basic Setup, enter the upper range value.  In Detailed Setup, enter the upper range value.  In Review, shows the upper range value.
	1,4,2,2	
	1,5,1	
Range values	1,3,2	Path to configuring PV LRV, PV URV, and PV Unit.
Read max/min log	1,2,5	Shows the max/min log.
Reset max/min log	1,2,6	Resets the max/min log to actual measured values.
Review	1,5	Path to view the present input, output, and device information.
Revision #'s	1,4,4	Shows the hardware, software, universal, and filed device revision levels.
RTD factor	1,3,3	In Basic or Detailed Setup, enter the RTD factor.  In Review, shows the RTD factor.
	1,5,1	
Scaled D/A trim	1,2,3,3	Procedure to trim the scaled mA output values of the transmitter to match the output of a plant standard measurement device.
Sens error values	1,4,3,1,3	Shows errors due to broken or shorted sensors.
Sensor1	1,5,3	Shows if Sensor 1 is On or Off.
Sensor2	1,5,3	Shows if Sensor 2 is On or Off.
Sensor config	1,3,3	Select the measurement input type from the choices listed.
Sensor errors	1,2,1	Shows if Sensor errors exist. On indicates an error; Off indicates OK.
Sensor info	1,4,1,1,4	Shows USL, LSL, and Min Span.
Sensor limits unit	1,5,1	Shows the sensor limits unit.
Sensor setup	1,4,1,1,3	Path to sensor setup parameters.
Sensors	1,4,1	Path to configure sensor parameters.
Set limits = NAMUR	1,4,3,1,2,5	Sets the Analog Output to 3.8 mA if the measurement is below the PV URV and to 20.5 mA if the measurement exceeds the PV URV.

*Table 5. HART 5 Online Parameters and Fast-Key Paths (Continued)*

Parameter	Fast-Key Path	Explanation
Sh sens	1,5,2	Shows the mA value in case of a shorted sensor.
Shorted sensor	1,4,1,1,3,2 1,4,3,1,3,2	In Error Detection, select to test for a broken sensor. In Sens Error Values, enter value that output goes to in case of a shorted sensor (between 3.5 and 23 mA) or select NAMUR down (3.5 mA) or NAMUR up (23 mA).
Signal condition	1,4,2	Path to configure signal condition parameters.
Single	1,3,3	If not RTD, select if single (not differential or average) measurement.
Snsr s/n	1,3,5 1,4,4,8 1,5,1	Shows the sensor serial number.
Snsr typ	1,5,1	Shows the sensor type.
Software rev	1,5,3	Shows the software revision level.
Spcl T/C	1,3,3	Select if the measurement input type is a special T/C.
Spec RTD	1,3,3	Select if the measurement input type is a special RTD.
Status	1,2,1	Path to view any sensor, ADC, or miscellaneous errors.
T/C Type [...]	1,3,3	If the measurement input type is a thermocouple, select the applicable T/C Type.
Tag	1,3,1 1,4,4 1,5,3	The primary identifier when communicating with the transmitter in the HART 5 protocol (8 characters maximum). In Basic Setup and Detailed Setup, enter the Tag. In Review, shows the Tag.
Universal rev	1,5,3	Shows the universal command set revision level.
USL	1,5,1	Shows the upper sensor limit.
Watchdog tmout	1,5,3	Shows if the main processor has restarted due to a watchdog timeout. On indicates an error; Off indicates OK.
Write protect	1,2,4,1 1,4,4,7 1,5,3	In Diag/Service, enter the write protection password (8 characters). In Detailed Setup, shows if the device is write protected. In Review, shows if the device is write protected
Write protection	1,2,4	Path to entering or changing the write protection password.



# HART 7 Online Menu and Parameters

## HART 7 Online Menu

Figure 17. RTT15-H Temperature Transmitter Online Menu (1 of 4)

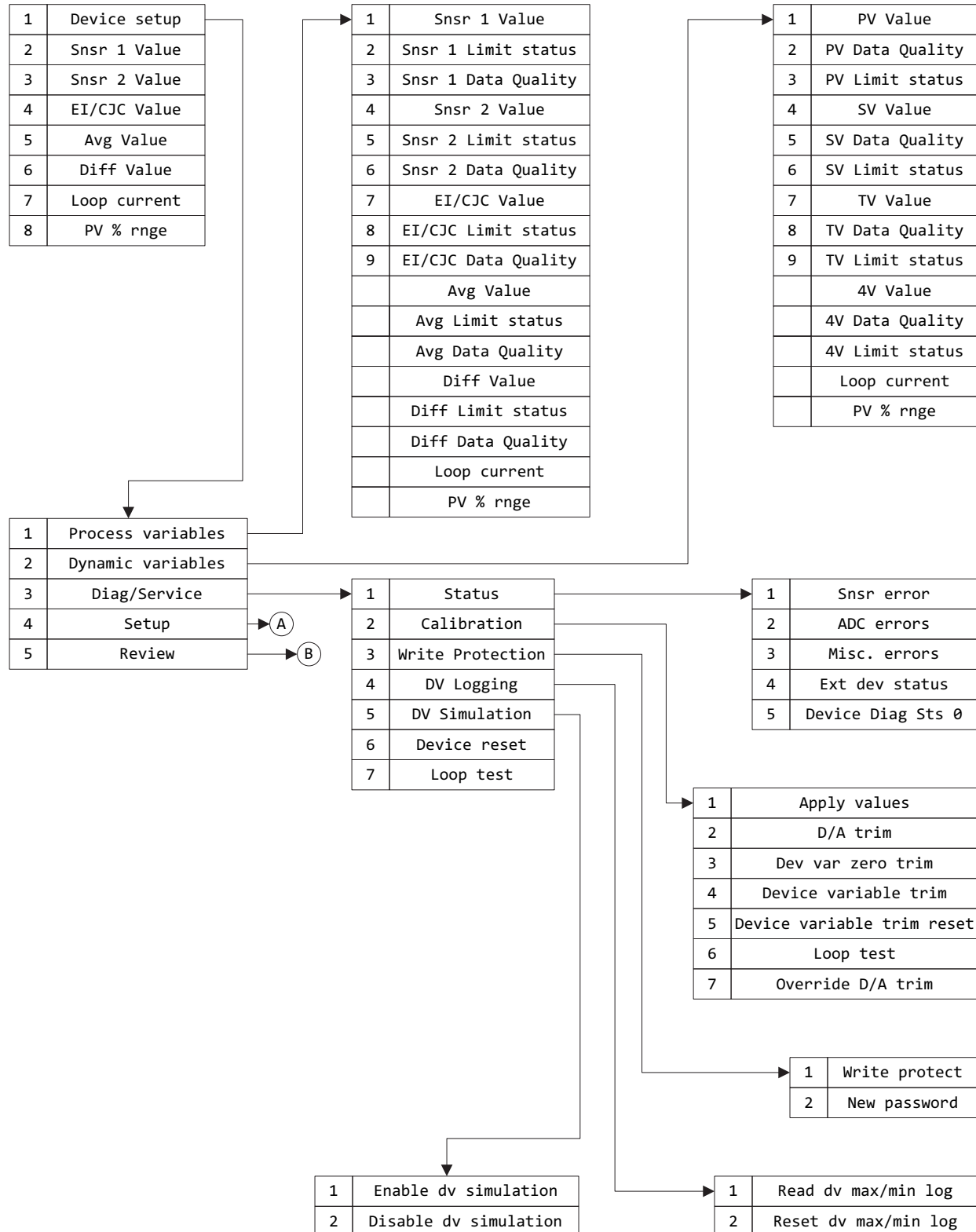


Figure 18. RTT15-H Temperature Transmitter Online Menu (2 of 4)

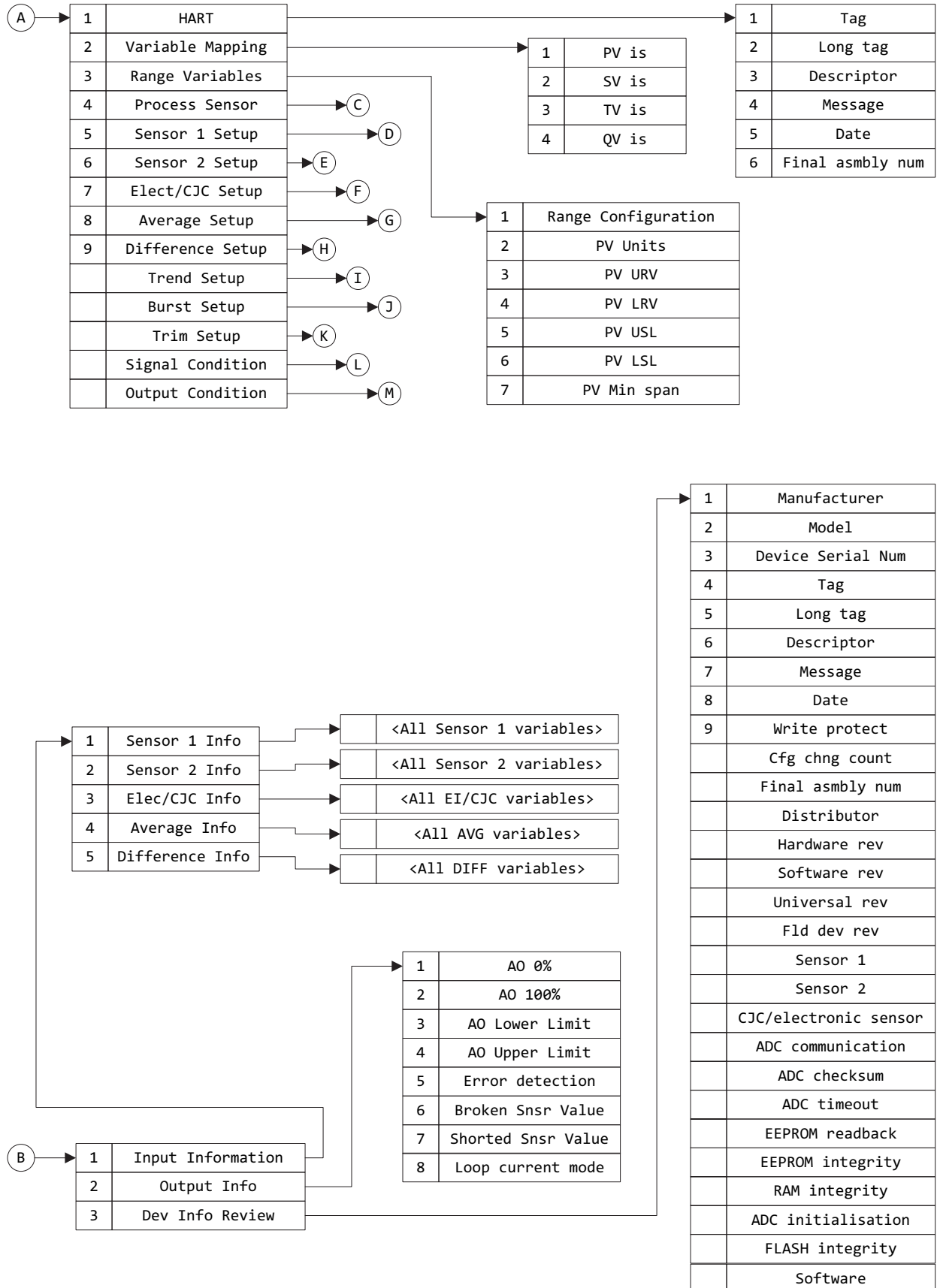


Figure 19. RTT15-H Temperature Transmitter Online Menu (3 of 4)

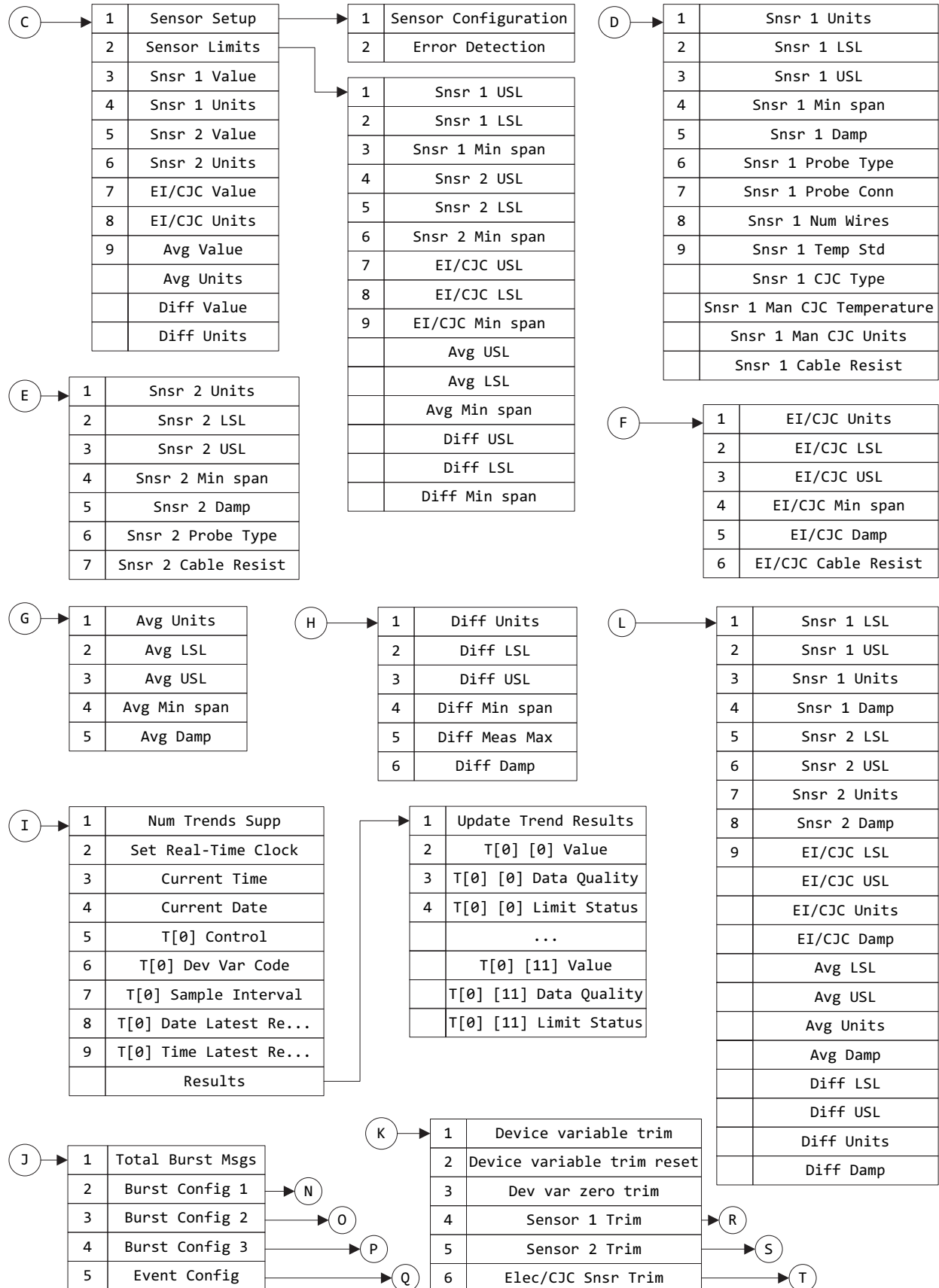
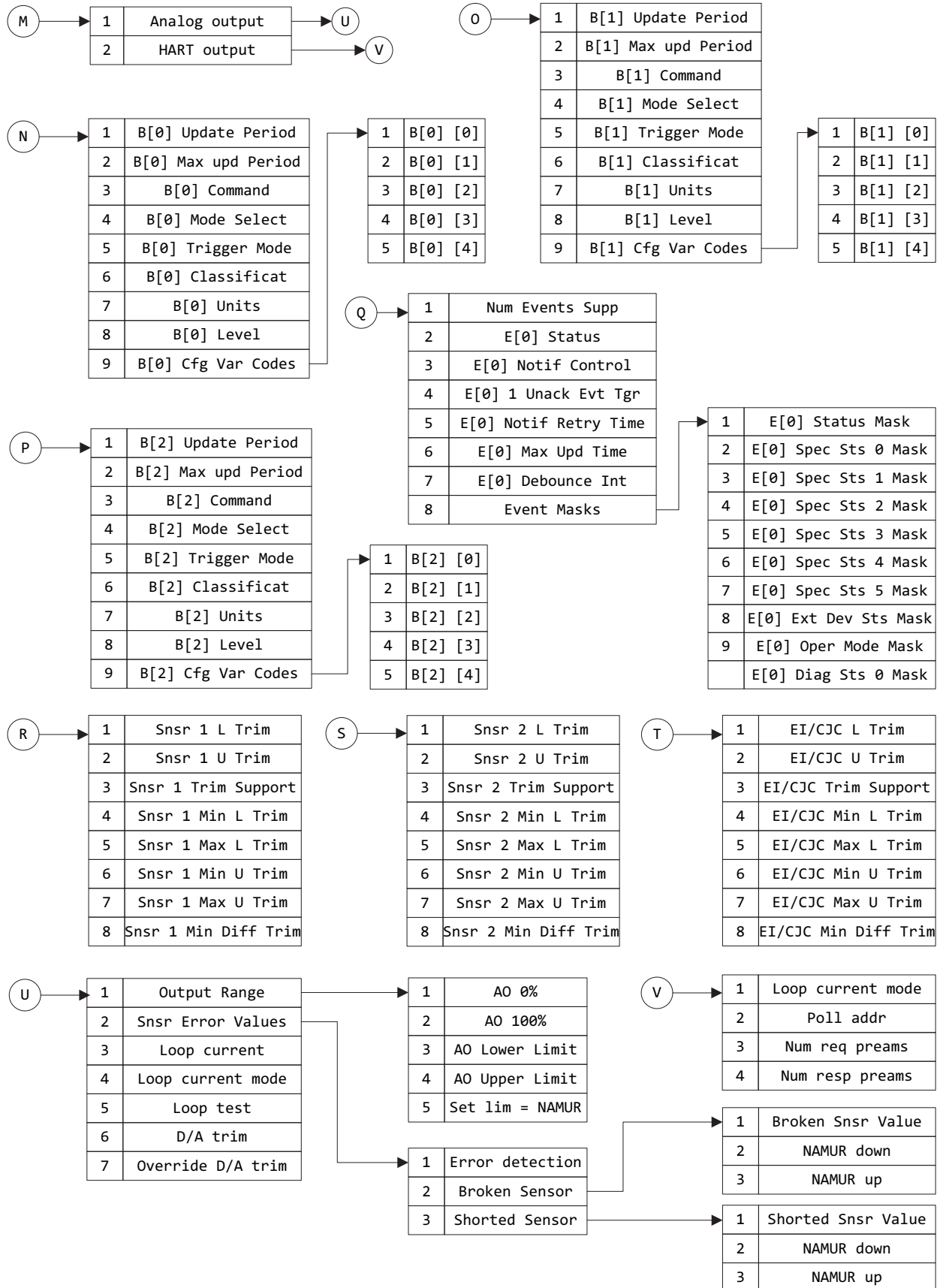


Figure 20. RTT15-H Temperature Transmitter Online Menu (4 of 4)



## HART 7 Parameters and Fast-Key Paths

A “-” in in the fast-key path indicates that a numeric selection is not available for the option. Refer to the menu diagrams to locate the appropriate selection.

*Table 6. HART 7 Online Parameters and Fast-Key Paths*

Parameter	Fast-Key Path	Explanation
4V Data Quality	1,2,-	Displays the data quality (good, poor, bad, or manual/fixed) of the quaternary (fourth) variable measurement.
4V Limit status	1,2,-	Displays the limit status (not limited, low limited, high limited, or constant) of the quaternary (fourth) variable measurement.
4V Value	1,2,-	Displays the value of the quaternary (fourth) variable in configured units.
ADC checksum	1,3,1,2 1,5,3,-	Indicates if there are A/D converter checksum errors. ON indicates an error; OFF indicates OK.
ADC communication	1,3,1,2 1,5,3,-	Indicates if there are A/D converter communication errors. ON indicates an error; OFF indicates OK.
ADC errors	1,3,1,2	Displays a list of potential A/D converter errors (checksum, communication timeout). ON indicates an error; OFF indicates OK.
ADC initialisation	1,3,1,3 1,5,3,-	Indicates if the transmitter input did not initialize correctly. ON indicates an error; OFF indicates OK.
ADC timeout	1,3,1,2 1,5,3,-	Indicates if there are A/D converter timeout errors. ON indicates an error; OFF indicates OK.
Analog output	1,4,-,1	Menu to configure parameters for analog output.
AO 0%	1,4,-,1,1,1 1,5,2,1	In Setup, enter the mA output for 0% of range. In Review, displays the mA output at 0% of range.
AO 100%	1,4,-,1,1,2 1,5,2,2	In Setup, enter the mA output for 100% of range. In Review, displays the mA output at 100% of range.
AO Lower Limit	1,4,-,1,1,3 1,5,2,3	Output if measurement goes below the PV LRV. In Setup, enter a value between 3.5 and 23 mA (must be less than AO Upper Limit). In Review, displays the current AO lower limit.
AO Upper Limit	1,4,-,1,1,4 1,5,2,4	Output if measurement exceeds the PV URV. In Setup, enter a value between 3.5 and 23 mA (must be greater than AO Lower Limit). In Review, displays the current AO upper limit.
Apply values	1,3,2,1	Procedure to set the 4mA or 20mA value based on the output of another device.
Average Info	1,5,1,4	Path to display data related to the measurement average.
Average Setup	1,4,8	Menu to configure parameters for the measurement average.
Avg Class	1,5,1,4,-	Displays the classification of the device variable, if applicable.
Avg Damp	1,4,8,5 1,4,-,-	Enter or review the damping value, in seconds, for the measurement average.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Avg Data Quality	1,1,-	Displays the data quality (good, poor, bad, or manual/fixed) of the measurement average.
Avg Device family	1,5,1,4,-	Displays the device family for this device variable. For the RTT15, this should be "Temperature."
Avg Limit status	1,1,-	Displays the limit status (not limited, low limited, high limited, or constant) of the measurement average.
Avg LSL	1,4,4,2,- 1,4,8,2 1,4,-,-	Displays the lower sensor limit for the average.
Avg Min span	1,4,4,2,- 1,4,8,4	Displays the minimum span for the average.
Avg Snsr s/n	1,5,1,4,6	Displays the serial number of the sensor, if applicable.
Avg Units	1,4,4,- 1,4,8,1 1,4,-,-	Select the units for the average.
Avg Upd Period	1,5,1,4,-	Displays the update period for the measurement average.
Avg USL	1,4,4,2,- 1,4,8,3 1,4,-,-	Displays the upper sensor limit for the average.
Avg Value	5 1,1,- 1,4,4,9	Displays the average of the Sensor 1 and Sensor 2 values.
B[x] [y]	1,4,-,-,-	Select a variable to be monitored for the corresponding burst channel, where [x] is the burst channel and [y] is the configuration variable code. Each burst channel can monitor up to five variables.
B[x] Cfg Var Codes	1,4,-,-,9	Menu of variables for burst channel [x]. Each burst channel can monitor and report up to five variables.
B[x] Classificat	1,4,-,-,6	Classification of the device variable for trigger level, if applicable, for burst channel [x].
B[x] Command	1,4,-,-,3	Select a command for burst channel [x].
B[x] Level	1,4,-,-,8	Enter the trigger level number for burst channel [x].
B[x] Max upd Period	1,4,-,-,2	Enter the maximum update period, in seconds, for burst channel [x].
B[x] Mode Select	1,4,-,-,4	Select "Off" to disable burst mode channel [x], or "Wired HART Enabled" to enable it.
B[x] Trigger Mode	1,4,-,-,5	Select "Continuous" for burst channel [x] to send messages periodically, regardless of status; or select "Window," "Rising," "Falling," or "On change" to trigger burst messages only in specified conditions.
B[x] Units	1,4,-,-,7	Select units for burst channel [x].
B[x] Update Period	1,4,-,-,1	Enter the update period, in seconds, for burst channel [x].
Broken and shorted sensor	1,4,-,1,2,1,-	In Error Detection, select to test for a broken and shorted sensor.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Broken Sensor	1,4,-,1,2,1,- 1,4,-,1,2,2	In Error Detection, select to test for a broken sensor. In Snsr Error Values, this is a menu of parameters associated with a broken sensor.
Broken Snsr Value	1,4,-,1,2,2,1 1,5,2,6	In Setup, enter the value (between 3.5 and 23 mA) to output if there is a broken sensor; or select NAMUR down (3.5 mA) or NAMUR up (23 mA). In Review, displays the mA value to output when there is a broken sensor.
Burst Config 1	1,4,-,2	Menus to configure Burst Mode Channels 1, 2, and 3, respectively. Each burst channel can have its own trigger and command.
Burst Config 2	1,4,-,3	
Burst Config 3	1,4,-,4	
Burst Setup	1,4,-	Menu of Burst Mode functions. Burst Mode allows messages to be sent automatically, without being requested by the host.
Calibration	1,3,2	Menu of calibration options.
Cfg chng count	1,5,3,-	Displays the number of times the configuration has changed.
CJC/electronic sensor	1,3,1,1 1,5,3,-	Indicates if an internal sensor/external CJC sensor error exists. ON indicates an error; OFF indicates OK.
Current Date	1,4,-,4	Displays the current date. Use Set Real-Time Clock in Trend Setup to set the date and time.
Current Time	1,4,-,3	Displays the current time. Use Set Real-Time Clock in Trend Setup to set the date and time.
D/A trim	1,3,2,2 1,4,-,1,6	Procedure to trim the 4 and 20 mA output values of the transmitter to match the output of a plant standard measurement device.
Date	1,4,1,5 1,5,3,8	In Setup, enter the date (mm/dd/yyyy). In Review, displays the date of the last configuration.
Descriptor	1,4,1,3 1,5,3,6	In Setup, enter the descriptor (16 characters maximum). In Review, displays the descriptor.
Dev Info Review	1,5,3	Menu to display miscellaneous internal device information.
Dev var zero trim	1,3,2,3 1,4,-,3	Procedure to zero the trim for a specific device variable.
Device Diag Sts 0	1,3,1,5	Displays a list of potential errors/diagnostic flags pertaining to the RTT15 status: Simulation active, Non-volatile memory error, Volatile memory error, Watchdog reset exec..., Voltage conditions o..., Environmental conditions, and Electronic failure. ON indicates an error; OFF indicates OK.
Device reset	1,3,6	Procedure to reset the RTT15 transmitter, equivalent to turning the power off and back on.
Device Serial Num	1,5,3,3	Displays the serial number of the RTT15 transmitter.
Device setup	1	Menu to all device setup, diagnostic, and review parameters.
Device variable trim	1,3,2,4 1,4,-,1	Procedure to trim the 4mA and 20mA values of a specific device variable to match a plant standard reference.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Device variable trim reset	1,3,2,5 1,4,-,2	Procedure to reset trim for a specific device variable.
Diag/Service	1,3	Menu to access the device diagnostic and servicing functions.
Diff Class	1,5,1,5,-	Displays the classification of the device variable, if applicable.
Diff Damp	1,4,9,6 1,4,-,-	Enter or review the damping value, in seconds, for the measurement differential.
Diff Data Quality	1,1,-	Displays the data quality (good, poor, bad, or manual/fixed) of the measurement differential.
Diff Device family	1,5,1,5,-	Displays the device family for this device variable. For the RTT15, this should be "Temperature."
Diff Limit status	1,1,-	Displays the limit status (not limited, low limited, high limited, or constant) of the measurement differential.
Diff LSL	1,4,4,2,- 1,4,9,2 1,4,-,-	Displays the lower sensor limit for the measurement differential.
Diff Meas Max	1,4,9,5	Enter the maximum value for the measurement differential.
Diff Min span	1,4,4,2,- 1,4,9,4	Displays the minimum span for the measurement differential.
Diff Snsr s/n	1,5,1,5,6	Displays the serial number of the sensor, if applicable.
Diff Units	1,4,4,- 1,4,9,1 1,4,-,-	Select the units for the measurement differential.
Diff Upd Period	1,5,1,5,-	Displays the update period for measurement differential.
Diff USL	1,4,4,2,- 1,4,9,2 1,4,-,-	Displays the upper sensor limit for the measurement differential.
Diff Value	6 1,1,- 1,4,4,-	Displays the difference between the Sensor 1 and Sensor 2 values.
Difference Info	1,5,1,5	Path to display data related to the measurement differential.
Difference Setup	1,4,9	Menu to configure parameters for the measurement differential.
Disable dv simulation	1,3,5,2	Select to exit device variable simulation mode.
Distributor	1,5,3,-	Displays the name of the distributor (Foxboro).
DV Logging	1,3,4	Menu to read and reset the device min/max log.
DV Simulation	1,3,5	Menu to enable/disable device variable simulation.
Dynamic variables	1,2	Menu to display value, limit status, and data quality for the dynamic variables (PV, SV, TV, QV).
E[0] 1 Unack Evt Tgr	1,4,-,5,4	Displays the time stamp of the first unacknowledged event.
E[0] Debounce Int	1,4,-,5,7	Enter the debounce interval, in seconds, for the event.
E[0] Diag Sts 0 Mask	1,4,-,5,8,-	Displays a list of diagnostic status items pertaining to the RTT15 status. Select an item and click ON or OFF to include or exclude it from the event mask.



**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
E[0] Ext Dev Sts Mask	1,4,-,5,8,8	Displays a list of extended device status items. Select an item and click ON or OFF to include or exclude it from the event mask.
E[0] Max Upd Time	1,4,-,5,6	Enter the maximum update time, in seconds, for the event.
E[0] Notif Control	1,4,-,5,3	Select a notification control method for the event: Off; Enable event notification on token-passing data link layer; Enable event notification on TDMA data link layer; Enable event notification on TDMA and token-passing data link.
E[0] Notif Retry Time	1,4,-,5,5	Enter the time, in seconds, to wait before retrying a failed notification for the event.
E[0] Oper Mode Mask	1,4,-,5,8,9	Reserved; always "0".
E[0] Spec Sts [x] Mask	1,4,-,5,8,-	Displays a list of six (where x=0 to 5) device-specific status items. Select an item and click ON or OFF to include or exclude it from the event mask.
E[0] Status	1,4,-,5,2	Displays a list of event categories. ON indicates that an event in this category has occurred; OFF indicates that it has not.
E[0] Status Mask	1,4,-,5,8,1	Displays a list of device status items. Select a status and click ON or OFF to include or exclude it from the event mask.
EEPROM integrity	1,3,1,3 1,5,3,-	Indicates if there are EEPROM integrity errors. ON indicates an error; OFF indicates OK.
EI/CJC Cable Resist	1,4,7,6	Enter the cable resistance for the internal sensor/external CJC sensor.
EI/CJC Class	1,5,1,3,-	Displays the classification of the device variable, if applicable.
EI/CJC Damp	1,4,7,5 1,4,-,-	Enter or review the damping value, in seconds, for the internal sensor/external CJC sensor.
EI/CJC Data Quality	1,1,9	Displays the data quality (good, poor, bad, or manual/fixed) of the internal sensor/external CJC sensor measurement.
EI/CJC Device family	1,5,1,3,-	Displays the device family for this device variable. For the RTT15, this should be "Temperature."
EI/CJC L Trim	1,4,-,6,1	Displays the lower trim point for the internal sensor/external CJC sensor.
EI/CJC Limit status	1,1,8	Displays the limit status (not limited, low limited, high limited, or constant) of the internal sensor/external CJC sensor measurement.
EI/CJC LSL	1,4,4,2,8 1,4,7,2 1,4,-,9	Displays the lower sensor limit for the internal sensor/external CJC sensor.
EI/CJC Max L Trim	1,4,-,6,5	Displays the maximum lower trim point for the internal sensor/external CJC sensor.
EI/CJC Max U Trim	1,4,-,6,7	Displays the maximum upper trim point for the internal sensor/external CJC sensor.
EI/CJC Min Diff Trim	1,4,-,6,8	Displays the minimum differential for the internal sensor/external CJC sensor.
EI/CJC Min L Trim	1,4,-,6,4	Displays the minimum lower trim point for the internal sensor/external CJC sensor.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
EI/CJC Min span	1,4,4,2,9 1,4,7,4	Displays the minimum span for the internal sensor/external CJC sensor.
EI/CJC Min U Trim	1,4,-,6,6	Displays the minimum upper trim point for the internal sensor/external CJC sensor.
EI/CJC Snsr s/n	1,5,1,3,6	Displays the serial number of the sensor, if applicable.
EI/CJC Trim Support	1,4,-,6,3	Indicates whether upper, lower, or both trim points are supported for the internal sensor/external CJC sensor.
EI/CJC U Trim	1,4,-,6,2	Displays the upper trim point for the internal sensor/external CJC sensor.
EI/CJC Units	1,4,4,8 1,4,7,1 1,4,-,-	Select the units for the internal sensor/external CJC sensor.
EI/CJC Upd Period	1,5,1,3,-	Displays the update period for the internal sensor/external CJC sensor.
EI/CJC USL	1,4,4,2,7 1,4,7,3 1,4,-,-	Displays the upper sensor limit for the internal sensor/external CJC sensor.
EI/CJC Value	4 1,1,7 1,4,4,7	Displays the internal sensor/external CJC temperature in configured units.
Elec/CJC Info	1,5,1,3	Path to display data related to the internal sensor/external CJC sensor device variable.
Elec/CJC Snsr Trim	1,4,-,6	Displays the values of all trim parameters for the internal sensor/external CJC sensor.
Elect/CJC Setup	1,4,7	Menu to configure parameters for the internal sensor/external CJC sensor.
Enable dv simulation	1,3,5,1	To begin device simulation, select a device description (DD) from the alphabetical list.
Error detection	1,4,4,1,2 1,4,-,1,2,1 1,5,2,5	In Setup, menu of procedures to check for sensor errors. In Review, displays the error.
Event Config	1,4,-,5	Menu to configure events for Burst Mode. Using events to trigger burst messages provides immediate notification of urgent or critical conditions.
Event Masks	1,4,-,5,8	Menu to configure event masks. Use event masks to filter the device status changes that trigger burst messages.
Ext dev status	1,3,1,4	Displays a list of diagnostic flags/potential errors related to (extended) device status: Maintenance required, Device variable alert, and Critical power failure. ON indicates an error; OFF indicates OK.
Final asmbly num	1,4,1,6 1,5,3,-	In Setup, enter the final assembly number. In Review, displays the final assembly number.
FLASH integrity	1,3,1,3 1,5,3,-	Indicates if there are FLASH integrity errors. ON indicates an error; OFF indicates OK.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Fld dev rev	1,5,3,-	Displays the field device revision level.
Hardware rev	1,5,3,-	Displays the hardware revision level.
HART	1,4,1	Menu to configure basic informational HART 7 parameters.
HART output	1,4,-,2	Menu to configure the HART output parameters.
Input Information	1,5,1	Menu to display the current input information.
Long tag	1,4,1,2 1,5,3,5	Primary identifier when communicating with the transmitter in the HART 7 protocol (32 characters maximum).  In Setup, enter the Long Tag.  In Review, displays the Long Tag.  See also "Tag." To toggle between Tag and Long Tag on the HART Communicator display, use the HART Tag parameter in the Configure HART Application utility on the HART main menu.
Loop current	7 1,1,- 1,2,- 1,4,-,1,3	Displays the loop current.
Loop current mode	1,4,-,1,4 1,4,-,2,1 1,5,2,8	In Setup, select Enabled or Disabled to enable or disable loop current mode (for multi-drop).  In Review, indicates whether loop current mode is enabled or disabled.
Loop test	1,3,2,6 1,3,7 1,4,-,1,5	Procedure to conduct a loop test.
Manufacturer	1,5,3,1	Displays the manufacturer (Foxboro).
Message	1,4,1,4 1,5,3,7	In Setup, enter an optional message (32 characters maximum).  In Review, displays the message entered previously.
Misc. errors	1,3,1,3	Displays a list of potential errors other than sensor errors or A/D converter errors (EEPROM, FLASH, RAM, software). ON indicates an error; OFF indicates OK.
Model	1,5,3,2	Displays the basic model number (RTT15).
NAMUR down	1,4,-,1,2,2,2 1,4,-,1,2,3,2	Sets the output value for a broken or shorted sensor to 3.5 mA. This enables broken/shorted sensor detection.
NAMUR up	1,4,-,1,2,2,3 1,4,-,1,2,3,3	Sets the output value for a broken or shorted sensor to 23 mA. This enables broken/shorted sensor detection.
New password	1,3,3,2	Enter the new password (8 characters) for write protection.
Num Events Supp	1,4,-,5,1	Displays the number of events the device supports.
Num req preams	1,4,-,2,3	Displays the number of preambles to be sent in a request message from the transmitter.
Num resp preams	1,4,-,2,4	Displays the number of preambles to be sent in a response message from the transmitter.
Num Trends Supp	1,4,-,1	Displays the number of trends the device supports.
Output Condition	1,4,-	Menu to configure analog and HART output condition parameters.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Output Info	1,5,2	Menu to display the current output information.
Output Range	1,4,-,1,1	Menu to configure output range parameters.
Override D/A trim	1,3,2,7 1,4,-,1,7	Procedure to override any configured D/A trim and restore factory setting.
Poll addr	1,4,-,2,2	Specify 0 in the standard point to point, 2-wire analog mode. Specify an address from 1 through 15 for multidrop operation.
Probe Break Detect...	1,5,1,1,5 1,5,1,2,5 1,5,1,3,5 1,5,1,4,5 1,5,1,5,5	Indicates whether or not this device variable is affected by a broken probe. ON indicates that a broken probe was detected; OFF indicates OK.
Process Sensor	1,4,4	Menu to access sensor configuration, value, and limit parameters.
Process variables	1,1	Menu to display value, limit status, and data quality for the device variables (Sensor 1, Sensor 2, Avg, Diff, and IE/CJC).
PV % rng	8 1,1,- 1,2,-	Displays the value of the primary (process) variable in percent of range.
PV Data Quality	1,2,2	Displays the data quality (good, poor, bad, or manual/fixed) of the primary (process) variable.
PV is	1,4,2,1	Select the device variable to map to the primary (process) variable.
PV Limit status	1,2,3	Displays the limit status (not limited, low limited, high limited, or constant) of the primary (process) variable.
PV LRV	1,4,3,4	Displays the lower range value for the primary (process) variable.
PV LSL	1,4,3,6	Displays the lower sensor limit for the primary (process) variable.
PV Min span	1,4,3,7	Displays the minimum span for the primary (process) variable.
PV Units	1,4,3,2	Select units for the primary (process) variable.
PV URV	1,4,3,3	Displays the upper range value for the primary (process) variable.
PV USL	1,4,3,5	Displays the upper sensor limit for the primary (process) variable.
PV Value	1,2,1	Displays the value of the primary (process) variable in configured units.
QV is	1,4,2,4	Select the device variable to map to the quaternary (fourth) variable.
RAM integrity	1,3,1,3 1,5,3,-	Indicates if there are RAM integrity errors. ON indicates an error; OFF indicates OK.
Range Configuration	1,4,3,1	Enter the lower and upper range values that will correspond to the 4mA and 20mA signals.
Range Variables	1,4,3	Menu to configure ranges, units, URV, LRV, USL, LSL, and minimum span for the primary (process) variable.
Read dv max/min log	1,3,4,1	Displays the minimum and maximum logged value for each device variable.
Reset dv max/min log	1,3,4,2	Resets the max/min log to actual measured values.
Results	1,4,-,-	View the 12 most recent trend results.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Review	1,5	Menu to display the established input, output, and device information.
sEEPROM readback	1,3,1,3 1,5,3,-	Indicates if there are EEPROM readback errors. ON indicates an error; OFF indicates OK.
Sensor 1	1,5,3,-	Indicates if a Sensor 1 error exists. ON indicates an error; OFF indicates OK.
Sensor 1 Info	1,5,1,1	Path to display data related to the Sensor 1 device variable.
Sensor 1 Setup	1,4,5	Menu to configure parameters for Sensor 1.
Sensor 1 Trim	1,4,-,4	Displays the values of all trim parameters for Sensor 1.
Sensor 2	1,5,3,-	Indicates if a Sensor 2 error exists. ON indicates an error; OFF indicates OK.
Sensor 2 Info	1,5,1,2	Path to display data related to the Sensor 2 device variable.
Sensor 2 Setup	1,4,6	Menu to configure parameters for Sensor 2.
Sensor 2 Trim	1,4,-,5	Displays the values of all trim parameters for Sensor 2.
Sensor Configuration	1,4,4,1,1	Procedure to set up the measurement input parameters.
Sensor Limits	1,4,4,2	Menu to configure USL, LSL, and min span limits for device variables (sensors, EI/CJC, average, and difference).
Sensor Setup	1,4,4,1	Menu to configure sensors and error detection parameters.
Set lim = NAMUR	1,4,-,1,1,5	Sets the analog output to 3.8 mA if the measurement is below the PV URV, and to 20.5 mA if the measurement exceeds the PV URV.
Set Real-Time Clock	1,4,-,2	Enter the date in mm/dd/yyyy format; then enter the time in hh/mm/ss format. This enables accurate time stamps for burst mode, events, and trends.  If time is not set, time stamps will be relative to the power-up time.
Setup	1,4	Menu to define basic HART parameters, map variables, establish ranges, and configure sensors; set up trend, burst mode, and trim; and work with signal and output conditions.
Shorted Sensor	1,4,-,1,2,1,- 1,4,-,1,2,3	In Error Detection, select to test for a shorted sensor.  In Snsr Error Values, this is a menu of parameters associated with a shorted sensor.
Shorted Snsr Value	1,4,-,1,2,3,1 1,5,2,7	In Setup, enter the value (between 3.5 and 23 mA) to output if there is a shorted sensor; or select NAMUR down (3.5 mA) or NAMUR up (23 mA).  In Review, displays the mA value to output when there is a shorted sensor.
Signal Condition	1,4,-	Menu to configure and review signal condition parameters.
Snsr 1 Cable Resist	1,4,5,-	Enter the cable resistance for Sensor 1.
Snsr 1 CJC Type	1,4,5,-	To indicate the method of cold junction compensation, select Internal CJC Temperature Measurement, External CJC Temperature Measurement Pt100, External CJC Temperature Measurement Ni100, or Fixed CJC Temperature.
Snsr 1 Class	1,5,1,1,-	Displays the classification of the device variable, if applicable.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Snsr 1 Damp	1,4,5,5 1,4,-,4	Enter or review the damping value, in seconds, for Sensor 1.
Snsr 1 Data Quality	1,1,3	Displays the data quality (good, poor, bad, or manual/fixed) of the Sensor 1 measurement.
Snsr 1 Device family	1,5,1,1,-	Displays the device family for this device variable. For the RTT15, this should be "Temperature."
Snsr 1 L Trim	1,4,-,4,1	Displays the lower trim point for Sensor 1.
Snsr 1 Limit status	1,1,2	Displays the limit status (not limited, low limited, high limited, or constant) of the Sensor 1 measurement.
Snsr 1 LSL	1,4,4,2,2 1,4,5,2 1,4,-,1	Displays the lower sensor limit for Sensor 1.
Snsr 1 Man CJC Te...	1,4,5,-	Manually enter a cold junction compensation temperature in the selected units.
Snsr 1 Man CJC Units	1,4,5,-	Select units for manual cold junction compensation on Sensor 1.
Snsr 1 Max L Trim	1,4,-,4,5	Displays the maximum lower trim point for Sensor 1.
Snsr 1 Max U Trim	1,4,-,4,7	Displays the maximum upper trim point for Sensor 1.
Snsr 1 Min Diff Trim	1,4,-,4,8	Displays the minimum differential for Sensor 1.
Snsr 1 Min L Trim	1,4,-,4,4	Displays the minimum lower trim point for Sensor 1.
Snsr 1 Min span	1,4,4,2,3 1,4,5,4	Displays the minimum span for Sensor 1.
Snsr 1 Min U Trim	1,4,-,4,6	Displays the minimum upper trim point for Sensor 1.
Snsr 1 Num Wires	1,4,5,8	Select the number of wires for Sensor 1.
Snsr 1 Probe Conn	1,4,5,7	Displays the type of probe connection, e.g., "Single."
Snsr 1 Probe Type	1,4,5,6	Select the probe type (RTD, TC, etc.) for Sensor 1.
Snsr 1 Snsr s/n	1,5,1,1,6	Displays the serial number of Sensor 1.
Snsr 1 Temp Std	1,4,5,9	Displays the temperature equipment calibration standard in use.
Snsr 1 Trim Support	1,4,-,4,3	Indicates whether upper, lower, or both trim points are supported for Sensor 1.
Snsr 1 U Trim	1,4,-,4,2	Displays the upper trim point for Sensor 1.
Snsr 1 Units	1,4,4,4 1,4,5,1 1,4,-,3	Select the units for the Sensor 1 measurement.
Snsr 1 Upd Period	1,5,1,1,-	Displays the update period for Sensor 1.
Snsr 1 USL	1,4,4,2,1 1,4,5,3 1,4,-,2	Displays the upper sensor limit for Sensor 1.
Snsr 1 Value	2 1,1,1 1,4,4,3	Displays the Sensor 1 value in configured units.
Snsr 2 Cable Resist	1,4,6,7	Enter the cable resistance for Sensor 2.
Snsr 2 Class	1,5,1,2,-	Displays the classification of the device variable, if applicable.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
Snsr 2 Damp	1,4,6,5 1,4,-,8	Enter or review the damping value, in seconds, for Sensor 2.
Snsr 2 Data Quality	1,1,6	Displays the data quality (good, poor, bad, or manual/fixed) of the Sensor 2 measurement.
Snsr 2 Device family	1,5,1,2,-	Displays the device family for this device variable. For the RTT15, this should be "Temperature."
Snsr 2 L Trim	1,4,-,5,1	Displays the lower trim point for Sensor 2.
Snsr 2 Limit status	1,1,5	Displays the limit status (not limited, low limited, high limited, or constant) of the Sensor 1 measurement.
Snsr 2 LSL	1,4,4,2,5 1,4,6,2 1,4,-,5	Displays the lower sensor limit for Sensor 2.
Snsr 2 Max L Trim	1,4,-,5,5	Displays the maximum lower trim point for Sensor 2.
Snsr 2 Max U Trim	1,4,-,5,7	Displays the maximum upper trim point for Sensor 2.
Snsr 2 Min Diff Trim	1,4,-,5,8	Displays the minimum differential for Sensor 2.
Snsr 2 Min L Trim	1,4,-,5,4	Displays the minimum lower trim point for Sensor 2.
Snsr 2 Min span	1,4,4,2,6 1,4,6,4	Displays the minimum span for Sensor 2.
Snsr 2 Min U Trim	1,4,-,5,6	Displays the minimum upper trim point for Sensor 2.
Snsr 2 Probe Type	1,4,6,6	Select the probe type (RTD, TC, etc.) for Sensor 2.
Snsr 2 Snsr s/n	1,5,1,2,6	Displays the serial number of Sensor 2, if applicable.
Snsr 2 Trim Support	1,4,-,5,3	Indicates whether upper, lower, or both trim points are supported for Sensor 2.
Snsr 2 U Trim	1,4,-,5,2	Displays the upper trim point for Sensor 2.
Snsr 2 Units	1,4,4,6 1,4,6,1 1,4,-,7	Select the units for the Sensor 2 measurement.
Snsr 2 Upd Period	1,5,1,2,-	Displays the update period for Sensor 2.
Snsr 2 USL	1,4,4,2,4 1,4,6,3 1,4,-,6	Displays the upper sensor limit for Sensor 2.
Snsr 2 Value	3 1,1,4 1,4,4,5	Displays the Sensor 2 value in configured units.
Snsr error	1,3,1,1	Displays a list of potential sensor errors (Sensor 1, Sensor 2, EI/CJC). ON indicates an error; OFF indicates OK.
Snsr Error Values	1,4,-,1,2	Menu of parameters associated with errors, broken sensors, and shorted sensors.
Software	1,3,1,3 1,5,3,-	Indicates if there are software integrity errors. ON indicates an error; OFF indicates OK.
Software rev	1,5,3,-	Displays the software revision level.
Status	1,3,1	Menu to display errors and other status information.

**Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)**

Parameter	Fast-Key Path	Explanation
SV Data Quality	1,2,5	Displays the data quality (good, poor, bad, or manual/fixed) of the secondary variable.
SV is	1,4,2,2	Select the device variable to map to the secondary variable.
SV Limit status	1,2,6	Displays the limit status (not limited, low limited, high limited, or constant) of the secondary variable.
SV Value	1,2,4	Displays the value of the secondary variable in configured units.
T[0] Control	1,4,-,5	Select a trending mode, or select Disable to stop trending. Trending modes are: single data point trending; average trending, where the trend sample is stored as the average of all updated values within the trend period; and filtered trending, which uses a time constant of one-third the sample rate to smooth the data.
T[0] Date Latest Re...	1,4,-,8	Displays the date of the most recent trend result.
T[0] Dev Var Code	1,4,-,6	Select the device variable for trending.
T[0] Sample Interval	1,4,-,7	Enter the time interval between samples in hh:mm:ss format.
T[0] Time Latest Re...	1,4,-,9	Displays the time of the most recent trend result.
T[0][x] Data Quality	1,4,-,-,-	Displays the data quality of the trend result, where [x] identifies the sequential order of the trend.
T[0][x] Limit Status	1,4,-,-,-	Displays the limit status of the trend result, where [x] identifies the sequential order of the trend.
T[0][x] Value	1,4,-,-,-	Displays the value of the trend result, where [x] identifies the sequential order of the trend.
Tag	1,4,1,1 1,5,3,4	Primary identifier when communicating with the transmitter in the HART protocol if Long Tag is not used. Limited to 8 characters for compatibility with HART 5.  In Setup, enter the Tag.  In Review, displays the Tag.  See also "Long Tag." To toggle between Tag and Long Tag on the HART Communicator display, use the HART Tag parameter in the Configure HART Application utility on the HART main menu.
Total Burst Msgs	1,4,-,1	Displays the number of burst message channels supported by the device.
Trend Setup	1,4,-	Menu of trend setup options. Trending allows the transmitter to store up to twelve trend samples that are calculated from a group of device readings during the sample period.
Trim Setup	1,4,-	Menu of trim setup options. Trimming helps to compensate for errors when calculating the digital value.
TV Data Quality	1,2,8	Displays the data quality (good, poor, bad, or manual/fixed) of the tertiary (third) variable.
TV is	1,4,2,3	Select the device variable to map to the tertiary (third) variable.
TV Limit status	1,2,9	Displays the limit status (not limited, low limited, high limited, or constant) of the tertiary (third) variable.
TV Value	1,2,7	Displays the value of the tertiary (third) variable in configured units.



Table 6. HART 7 Online Parameters and Fast-Key Paths (Continued)

Parameter	Fast-Key Path	Explanation
Universal rev	1,5,3,-	Displays the universal command set revision level.
Update Trend Results	1,4,-,1	Refreshes the trend result information.
Variable Mapping	1,4,2	Menu to map device variables to dynamic variables (PV, SV, TV, QV). This may be useful when multiple sensors are in use.
Write protect	1,3,3,1 1,5,3,9	In Diag/Service, enter a password (8 characters) to establish write protection. In Review, indicates if the device is write-protected.
Write Protection	1,3,3	Menu to establish or change the write protection password.

## Configuring the Optional L1 Display

### — CAUTION

Changing the engineering units or range in your transmitter requires that you also make similar changes in the configuration of your optional display.

## Using the Pushbuttons

1. Press and hold the **Entr/ESC** button until the display blinks to access a parameter and to enter a change. Pressing and holding this button is referred to as **Enter** in the following procedure.
2. Use the **Back/Down** or **Next/Up** buttons to select a picklist choice or to change a value. When making a large change in a value, hold the button down. The value first goes through the unit numbers, then the tens numbers, then the hundreds numbers, and lastly the thousands numbers.
3. Press the **Entr/ESC** button (without holding it depressed) to return to the measure mode at any time in this procedure.

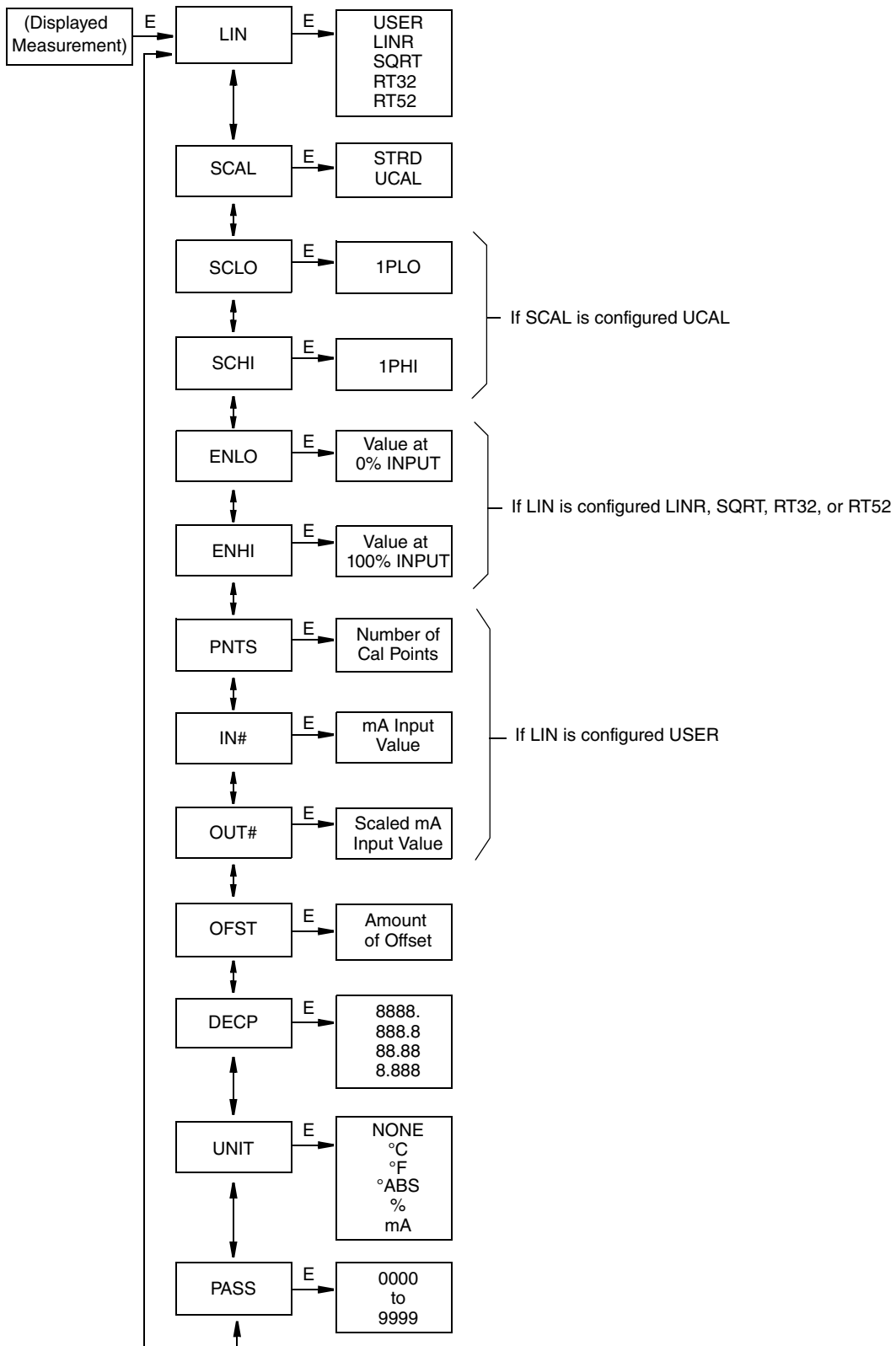
## Configuration Procedure

Use the structural diagram of the L1 display configuration located in Figure 21 with this procedure.

1. Press **Enter** to enter configuration mode.  
If a passcode was configured, **0000** is displayed. Change this to your passcode and **Enter**. If the passcode is incorrect the display reads **ERR**. If it is correct, the first parameter, **LIN**, is displayed.  
If a passcode was not configured, the first parameter, **LIN**, is displayed.
2. Press **Enter** to select the linearization type. Using the **Back/Down** or **Next/Up** buttons, select **USER** (custom), **LINR** (linear), **SQRT** ( $X^{1/2}$ ), **RT32** ( $X^{3/2}$ ), or **RT52** ( $X^{5/2}$ ). **Enter** your selection.

3. Use the **Back/Down** or **Next/Up** buttons to go to **SCAL** to select the input range calibration type. **Enter** your selection. Using the **Back/Down** or **Next/Up** buttons, select **STRD** (standard 4 to 20 mA) or **UCAL** (user input range). **Enter** your selection.
4. If you selected **UCAL**, use the **Back/Down** or **Next/Up** buttons to go to **SCLO**. Apply the current for 0 percent input. Press **Enter** to go to **1PLO**. Press **Enter** again.
5. If you selected **UCAL**, use the **Back/Down** or **Next/Up** buttons to go to **SCHI**. Apply the current for 100 percent input. Press **Enter** to go to **1PHI**. Press **Enter** again.
6. If you did **not** select **USER** as your linearization type, use the **Back/Down** or **Next/Up** buttons to go to **ENLO** to select the display at 0% input. **Enter** your selection. Using the **Back/Down** or **Next/Up** buttons, enter the display value at 0% input. Press **Enter**.
7. If you did **not** select **USER** as your linearization type, use the **Back/Down** or **Next/Up** buttons to go to **ENHI** to select the display at 100% input. **Enter** your selection. Using the **Back/Down** or **Next/Up** buttons, enter the display value at 100% input. Press **Enter**.
8. If you selected **USER** as your linearization type, use the **Back/Down** or **Next/Up** buttons to go to **PNTS** to set the number of points in your custom curve. **Enter** your selection. Enter the number of points from 3 to 21. **Enter** your selection. Use the **Back/Down** or **Next/Up** buttons to go to **IN1** to set the input value (mA) of your first point. Press **Enter**. Enter your value. Press **Enter**. Use the **Back/Down** or **Next/Up** buttons to go to **OUT1** to set the scaled value (mA) of your first point. Press **Enter**. Enter your value. Press **Enter**. Repeat Step 8 for each of your points.
9. Use the **Back/Down** or **Next/Up** buttons to go to **OFST** to add any desired offset to the scaled value. **Enter** your selection. Enter the offset value. Press **Enter**.
10. Use the **Back/Down** or **Next/Up** buttons to go to **DECP** to position the decimal point. **Enter** your selection. Using the **Back/Down** or **Next/Up** buttons, select **8888.**, **888.8**, **88.88**, or **8.888**. **Enter** your selection.
11. Use the **Back/Down** or **Next/Up** buttons to go to **UNIT** to select the displayed unit. **Enter** your selection. Using the **Back/Down** or **Next/Up** buttons, select **NONE**, **°C**, **°F**, **°ABS**, **%**, or **mA**. **Enter** your selection.
12. Use the **Back/Down** or **Next/Up** buttons to go to **PASS** to set a passcode. **Enter** your selection. Enter a passcode from 0001 to 9999. Press **Enter**.

Figure 21. L1 Display Structure





# 4. Maintenance

The RTT15 Transmitter basic unit has no moving parts and is a completely sealed unit. If there is a problem, refer to the following “Troubleshooting” section for possible corrective actions. |

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—  **CAUTION**

The transmitter is completely sealed unit and cannot be repaired. Any attempt to open the basic transmitter voids the warranty.

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—  **DANGER**

For nonintrinsically safe installations, to prevent a potential explosion in a Division 1 hazardous area, deenergize the transmitter before you remove the threaded housing cover. Failure to comply with this warning could result in an explosion resulting in severe injury or death.

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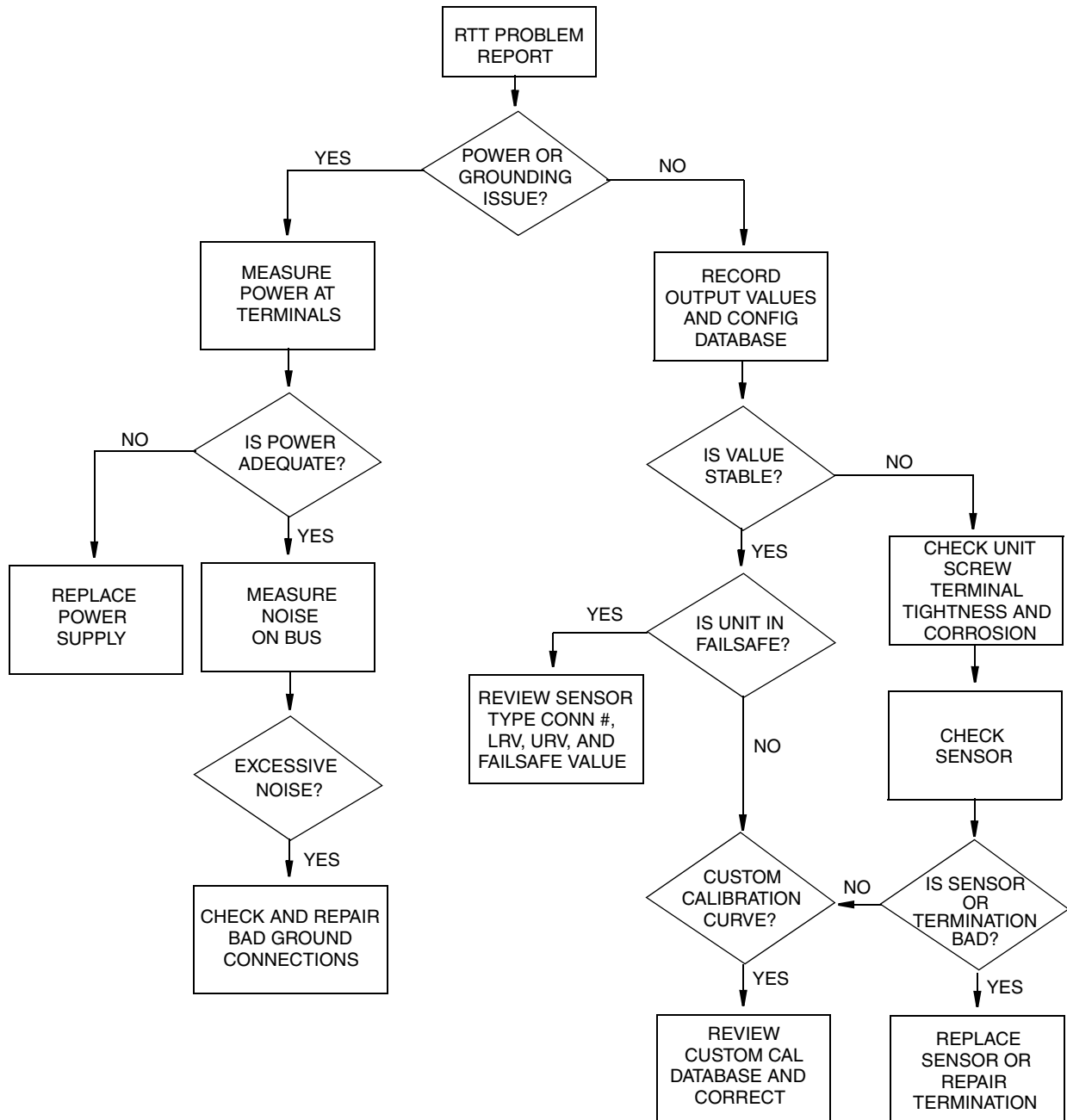
# Troubleshooting

*Table 7. Recommended Troubleshooting Steps Before Replacing Module*

Indication	Action
Erratic Measurement	Check Wiring Connections – Look for any loose connections or corroded terminals.
	Check Sensor – See instrument diagnostics <sup>(a)</sup> or use a multimeter to measure sensor.
	Check Grounding – Look for ground loops or noise on the bus with a digital scope.
	Check Power Supply – Check for adequate power levels.
	Check that the sensor type configured matches the sensor type being used.
Inaccurate Measurement	Check Sensor – See instrument diagnostics <sup>(a)</sup> or use a multimeter to measure sensor.
	Check Grounding – Look for ground loops or noise on the bus with a digital scope.
	Check Sensor Calibration – User multimeter to approximate sensor input or use a temperature bath for more accuracy.
	Check Transmitter Calibration – Use a decade box or millivolt input to simulate sensor output.
	Check Instrument Configuration – Check configured ranges and check for any unintentional rescaling.
Device Will Not Communicate	Check Instrument Configuration – Check for correct addressing, correct tagging, and so forth (digital communications).
	Check Power Supply – Check for adequate power levels. Check signal strength at I/O card.
	Check Grounding – Look for ground loops or noise on the bus with a digital scope.
	Check that there is a minimum of 250 $\Omega$ loop resistance between the power supply and the HART Communicator.
Transmitter Is in Failsafe	Check Sensor – See instrument diagnostics <sup>(a)</sup> or use a multimeter to measure sensor.
	Check Wiring Connections – Look for any loose connections or corroded terminals.
	Check Configuration (ranges, sensor type, and so forth).
	Check Transmitter Calibration – Use a decade box or millivolt input to simulate sensor output.

a. Using a HART Communicator or PC-Based Configurator.

Figure 22. Troubleshooting Diagram



# Replacing the Transmitter

## Units Without an Optional Display

1. Turn off the transmitter power source.
2. Remove the housing cover (if applicable).
3. Disconnect all wires from the transmitter noting which wire went to each terminal.
4. Remove the transmitter.
5. Install the new transmitter by reversing Steps 1-4 above.

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**! CAUTION**

When replacing housing cover, hand tighten it as much as possible so that O-ring is fully captured.

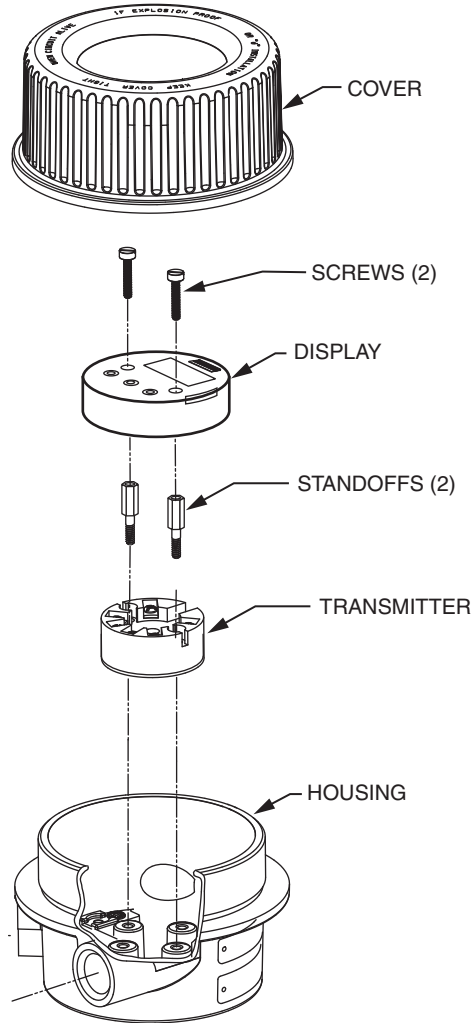
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## Units With an Optional Display

1. Turn off the transmitter power source.
2. Remove the housing cover.
3. Remove the two screws holding the display in place.
4. Disconnect all wires from the transmitter noting which wire went to each terminal.
5. Remove the transmitter by removing the two screws that secure it to the housing.
6. Install the new transmitter by reversing Steps 1-5 above.



Figure 23. Assembly With Optional Display



L1 DISPLAY  
WITH HOUSING CODES  
L, M, S, T, W, and Y

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