Instruction

MI 020-463
January 2008

RTT15-T
I/A Series® Temperature Transmitter with HART® Protocol

Invensys®
FOXBORO®

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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, or HART® communications protocol. This instruction (MI 020-463) describes the transmitter with HART 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
MI 020-484	Instruction – HART Model 275 Communicator Messages
PL 008-662	Parts List – RTT15 Temperature Transmitters
MAN 4250	HART Communicator Product Manual (supplied with the communicator)

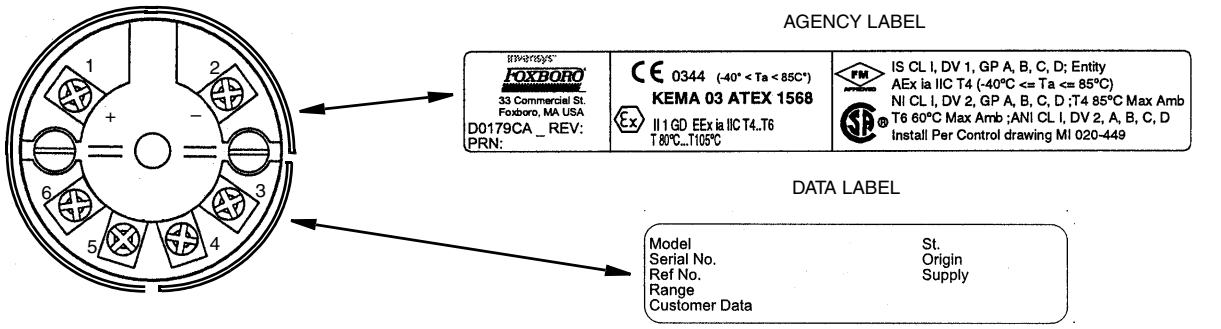
Transmitter Identification

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.

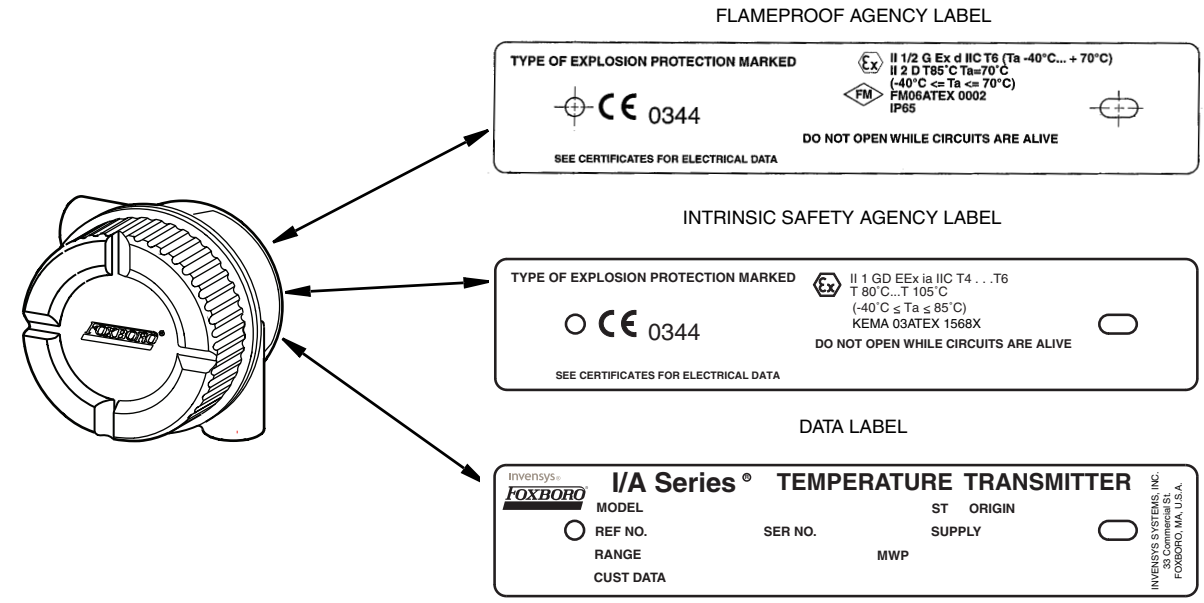
NOTE

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 7.
2. Figure 3 shows typical labels for the L1 Display Option.

BASIC MODULE (Code B)



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



WEATHERPROOF CONNECTION HEAD (Codes C and E)

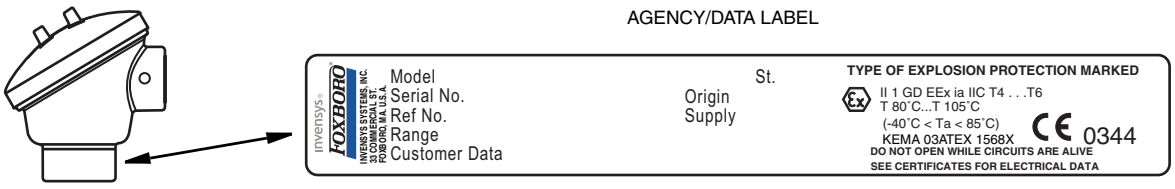


Figure 1. Typical Identification Labels (1 of 2)

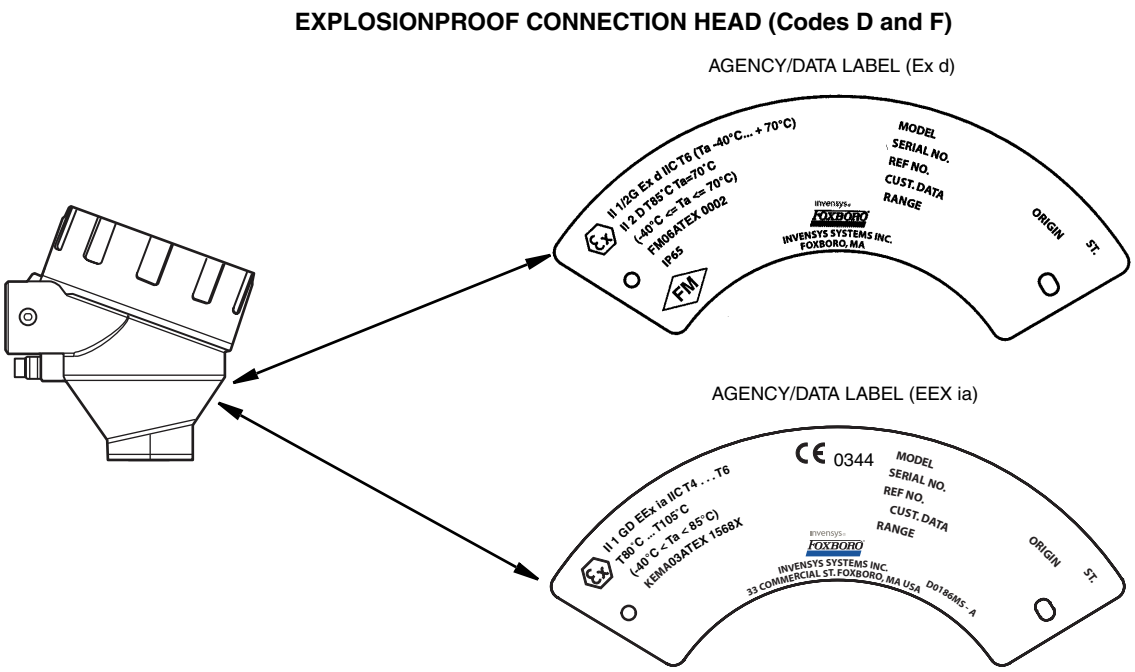


Figure 2. Typical Identification Labels (2 of 2)

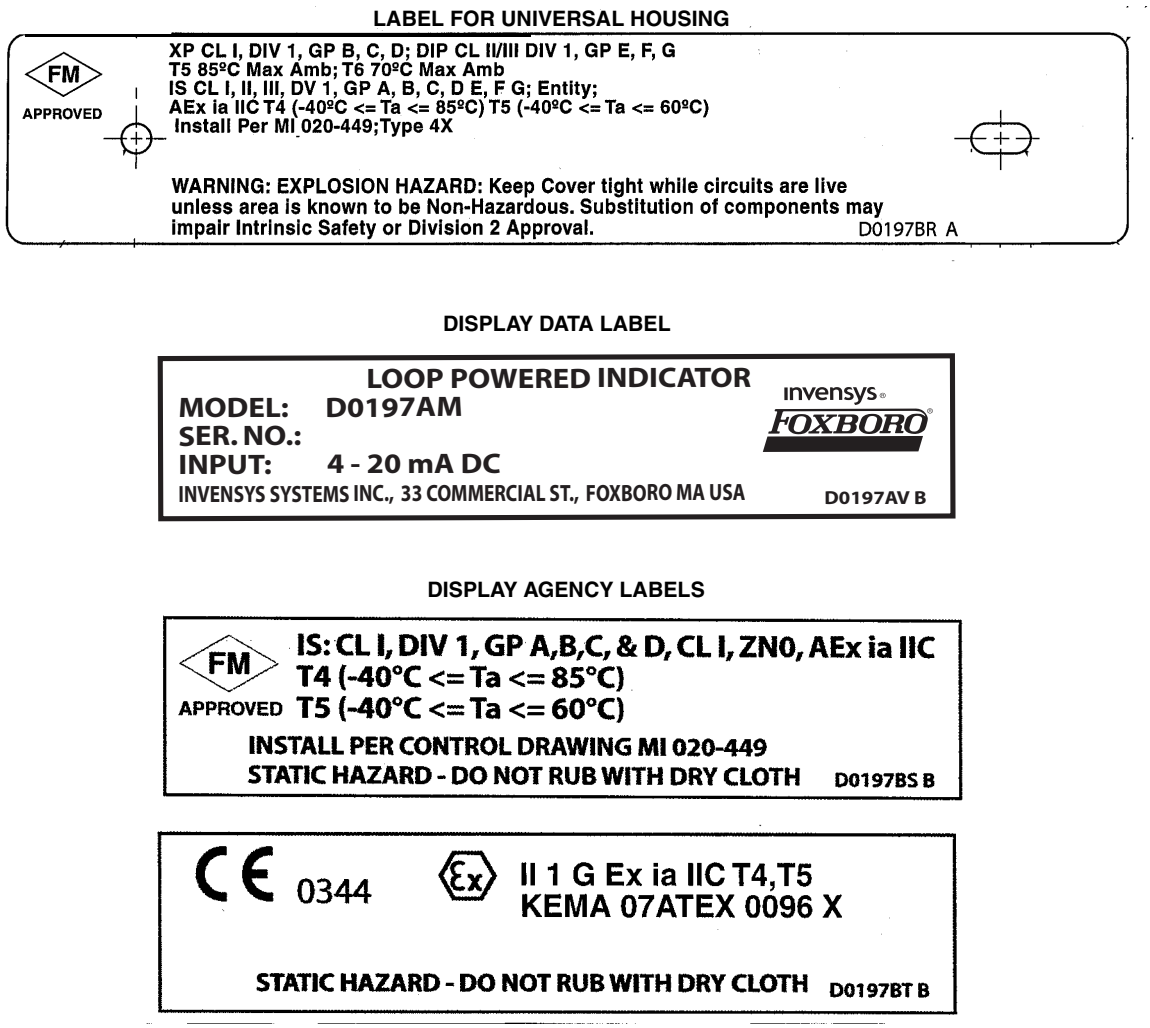


Figure 3. Typical Identification Labels for L1 Display Option

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
12 and 30 V dc with optional display L2

Vibration Limits: 40 m/s^2 (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 1050	50 and 1890	-200 and +850	-328 and +1562
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 1420	212 and 2556	400 and 1820	752 and 3308
E	50 and 1100	122 and 1980	-100 and +1000	-148 and +1832
J	50 and 1300	122 and 2340	-100 and +1200	-148 and +2192
K	50 and 1552	122 and 2794	-180 and +1372	-292 and +2502
L	50 and 1100	122 and 1980	-200 and +900	-328 and +1652
N	50 and 1480	122 and 2664	-180 and +1300	-292 and +2372
R	100 and 1810	212 and 3258	-50 and +1760	-58 and +3200
S	100 and 1810	212 and 3258	-50 and +1760	-58 and +3200
T	50 and 600	122 and 1080	-200 and +400	-328 and +752
U	50 and 800	122 and 1440	-200 and +600	-328 and 1112
W3	100 and 2300	212 and 4140	0 and 2300	32 and 4172
W5	100 and 2300	212 and 4140	0 and 2300	32 and 4172

Span and Range Limits - Millivolt Input

Span Limit: 2.5 and 1600 mV
Range Limit: -800 and + 800 mV

Span and Range Limits - Resistance (ohms) Input

Span Limit: 25 and 7000 Ω
Range Limit: 0 and 7000 Ω

Housing Specifications

Housing Code	Material and Finish	IEC/NEMA Rating	Explosionproof and Flameproof	Mounting Configuration
B	Encapsulated plastic	IP68 (a)	NO	Basic Module (b) (c) DIN Form B Package
C	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral bare sensor
D	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral bare sensor
E	Low copper aluminum alloy	IP65 NEMA 4	NO	Weatherproof connection head with integral sensor and well
F	Low copper aluminum alloy; painted	IP65 NEMA 4X	YES	Explosionproof connection head with integral sensor and well
L	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing with integral sensor and well
M	Stainless steel	IP66 NEMA 4X	YES	Universal housing with integral sensor and well
S	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing for surface or pipe mounting (c)
T	Stainless steel	IP66 NEMA 4X	YES	Universal housing for surface or pipe mounting (c)

Housing Code	Material and Finish	IEC/NEMA Rating	Explosionproof and Flameproof	Mounting Configuration
W	Low copper aluminum alloy; epoxy coated	IP66 NEMA 4X	YES	Universal housing with integral bare sensor
Y	Stainless steel	IP66 NEMA 4X	YES	Universal housing with integral bare sensor

(a) IEC IP68 applies to the encapsulated electronics only, and not to the six protruding input/output terminals.

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

(c) Surface or pipe mounted using mounting set options -M1 or -M2.

⚠ WARNING

For all RTT15-T 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.

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. 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 description listed in Table 3. For detailed information or status of testing laboratory approvals/certifications, contact Invensys Foxboro.

Table 3. Electrical Safety Specifications

Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions[a,b]	Electrical Safety Design Code
ATEX (KEMA) intrinsically safe, II 1 GD, EEx ia, IIC.	C, E, D, F, L, M, S, T, W, Y	KEMA03ATEX1568X Temperature Class T4, Ta = -40 to +85°C; T6, Ta = -40 to +60°C. See Note (e) for electrical parameters.	E
ATEX (FM) flameproof, II 1/2 G, Ex d, IIC.	F, L, M, S, T	FM06ATEX0002 Temperature Class T6. Ta = -40 to +70°C. See Note (c).	D
ATEX (FM) flameproof, II 2 G, Ex d, IIC.	D, W, Y	FM06ATEX0002 Temperature Class T6. Ta = -40 to +70°C.	
ATEX (FM) flameproof, II 2 D.	D, F, L, M, S, T, W, Y	FM06ATEX0002 T85°C, Ta = 70°C max. ambient. See Note (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
CSA Class I, Division 2, Groups A, B, C, and D.		Temperature Class T6 at 60°C maximum ambient.	

Table 3. Electrical Safety Specifications (Continued)

Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions[a,b]	Electrical Safety Design Code
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.	C
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. See Note (c).	C
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
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.	
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.[d]	D, F, L, M, S, T, W, Y	Temperature Class T5 at 85°C and T6 at 70°C maximum ambient. See Note (c).	
IECEx flameproof, Ex d IIC	L, M, S, T, W, Y	IECEx FMG07.0001X Temperature Class T6. Ta = 70°C.	V

(a) Optional indicator L1 is only certified with: Housing codes L, M, S, T, W, and Y; ATEX and FM Intrinsically safe versions of the transmitter. See Table 4.

(b) Optional indicator L2 is only certified with: Housing codes D, F, L, M, S, T, W, and Y; ATEX, CSA, FM, and IECEx explosionproof/flameproof versions of the transmitter.

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

(d) Also includes Group A for Housing Codes D and F).

(e) 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 µH;
Sensor Circuit (Terminals 3, 4, 5, and 6)
U_o=9.6V; I_o=28 mA; P_o=67 mW; C_o=3.5 nF; L_o=35 µH

Table 4. Electrical Safety Specifications (with L1 Display Option)

Agency Certification, Type of Protection, and Area Classification	With Housing Codes	Application Conditions	Electrical Safety Design Code
ATEX (KEMA) intrinsically safe, II 1 G, Ex ia, IIC.	L, M, S, T, W, Y	KEMA07ATEX0096X Temperature Class T4, Ta = -40 to +85°C; T5, Ta = -40 to +60°C. See Note (a) for electrical parameters.	E
FM intrinsically safe for Class I, Division 1, Groups A, B, C, and D	L, M, S, T, W, Y	Temperature Class T4 at 85°C and T5 at 60°C maximum ambient. Connect per MI 020-449.	F

(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 µH;
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 µH

ATEX Warning

⚠ WARNING
Do not open while circuits are alive.

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 alive 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 50014: 1997; EN 50281-1-1:1998; EN 50284:1999; EN 50020: 2002

FM06ATEX0002

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

IECEx Compliance Documents

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.

NOTE

Use a suitable thread sealant on all connections.

⚠ CAUTION

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

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. For Type RTT15-T 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 ≥ 60°C, heat resistant cables shall be used with a rating of at least 20 K above the ambient temperature.
4. For Type RTT15-T with enclosure codes B, the transmitter must be mounted in an enclosure in order to provide a degree of ingress protection of at least IP20.
5. For Type RTT15-T with enclosure codes 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

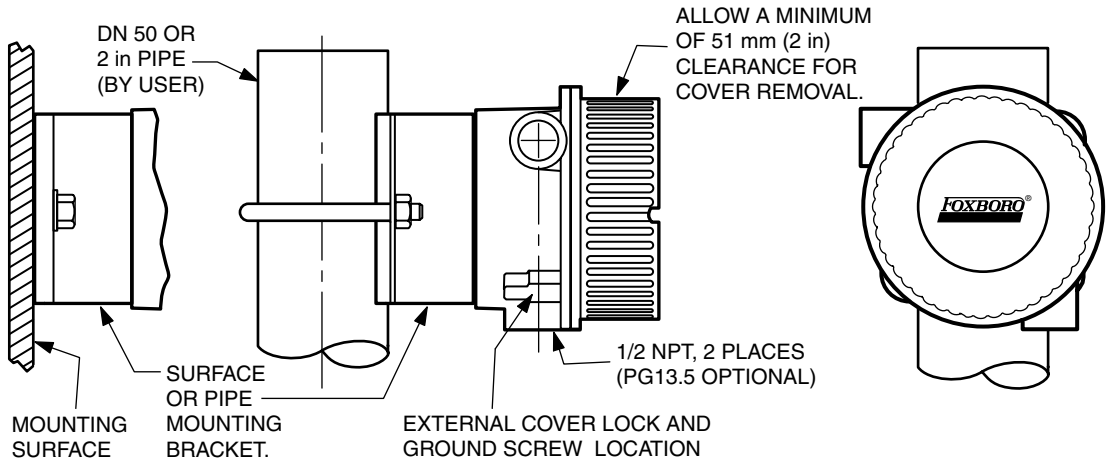


Figure 4. Surface or Pipe Mount with Remote Sensor (Housing Codes S and T)

Basic Module Mount

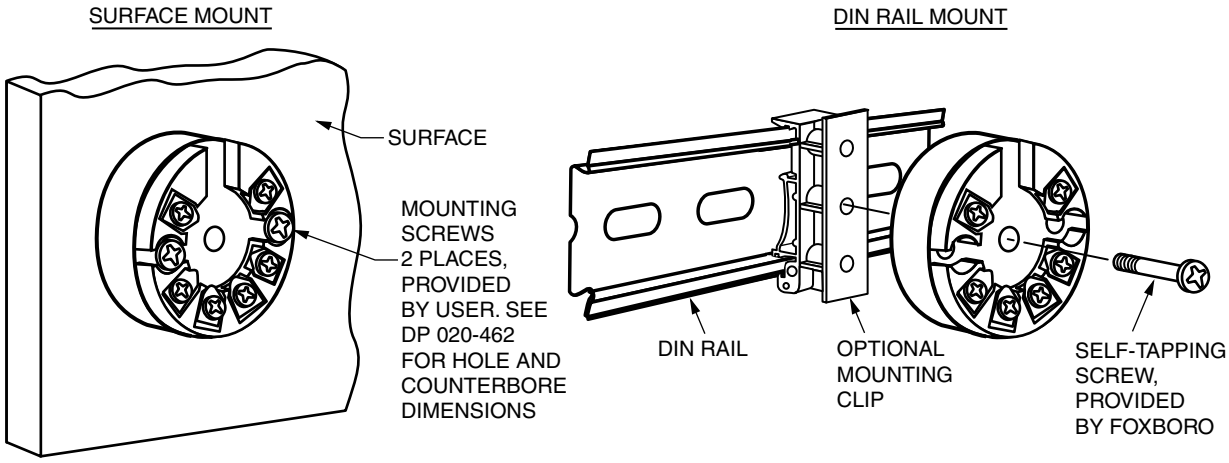


Figure 5. Bare Sensor Mount (Housing Code B)

Thermowell Mount

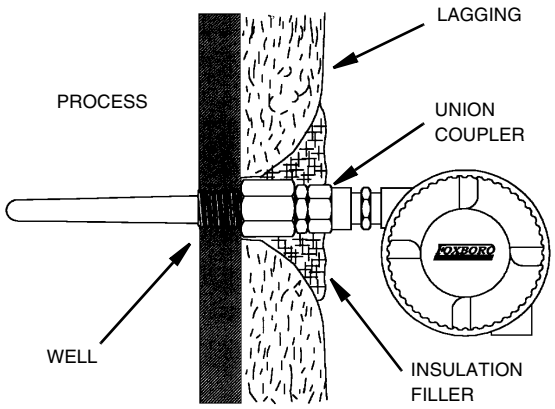


Figure 6. Thermowell Mount (Housing Codes E, F, L, and M)

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.

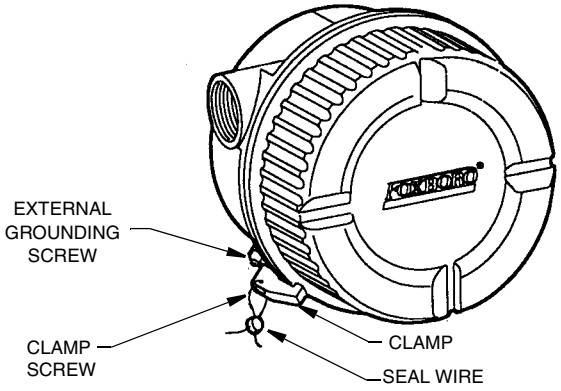


Figure 7. Universal Housing Cover Lock

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.

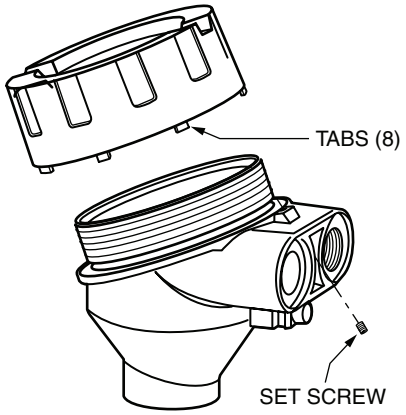


Figure 8. Explosionproof Connection Head Cover Lock

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 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

Foxboro 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).

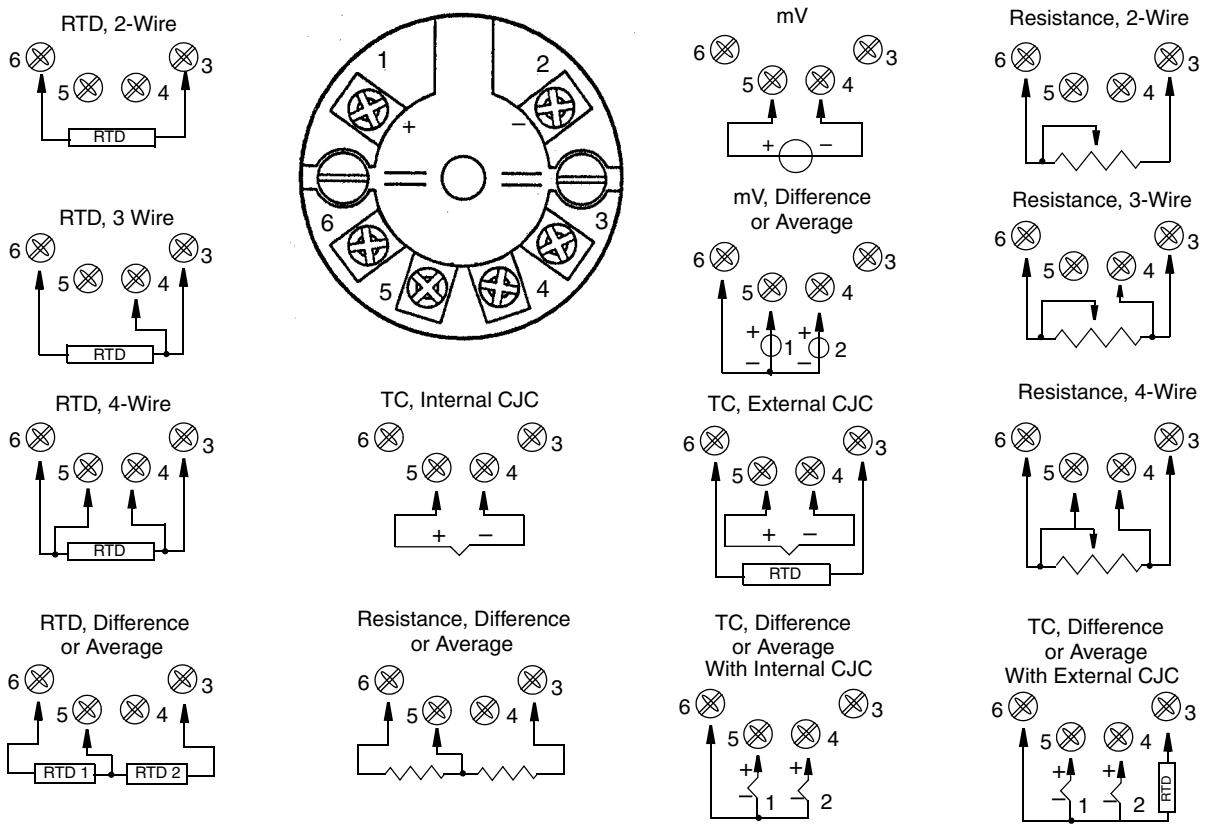


Figure 9. Input Connections

Loop Wiring

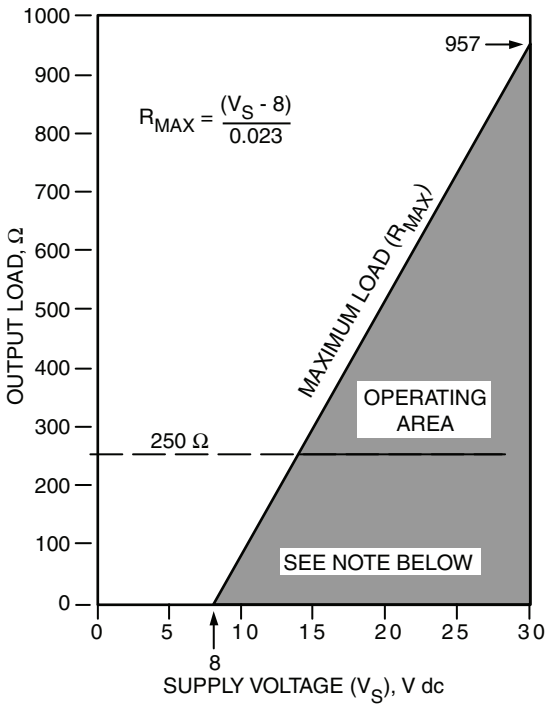
When wiring the transmitter, the supply voltage and loop load must be within specified limits. The supply output load vs. voltage relationship is:

R_{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 either of the optional displays requires an additional 4 volts. However, the total voltage must not exceed 28 volts with optional L1 display or 30 volts with optional L2 display.



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.

Figure 10. Supply Voltage and Loop Load

Examples:

1. For a loop load resistance of 500 Ω, the supply voltage can be any value from 21.7 to 30 V dc.
2. For a supply voltage of 24 V dc, the loop load resistance can be any value from 250 to 696 Ω (zero to 696 Ω 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^2 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 (15 devices maximum) mode. 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 (if no display)
   - The "1" and "2" terminals on the display (if with L1 display).
   - The "+" and "C" terminals on the display (if with L2 display).

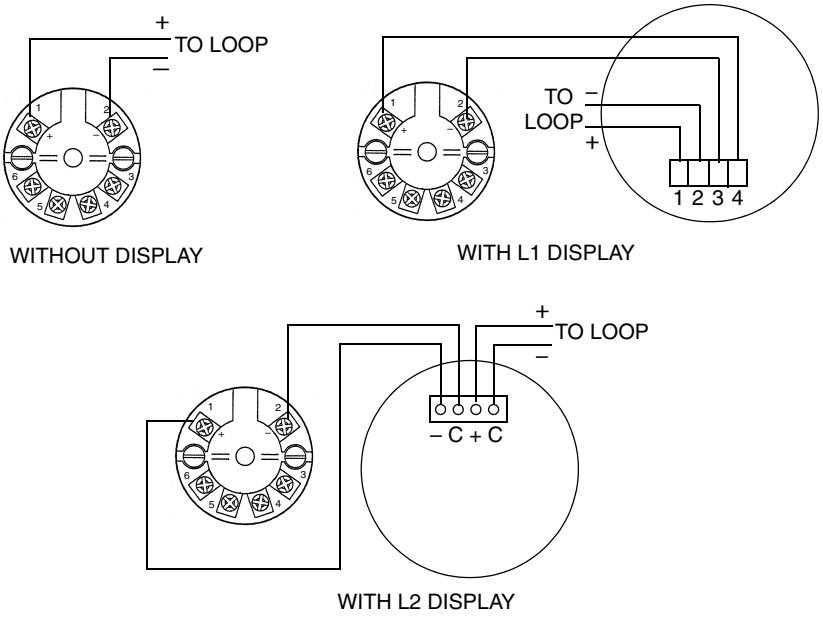


Figure 11. Loop Wire Connections

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 the two figures below. Note that a minimum of 250 Ω must separate the power supply from the HART Communicator.

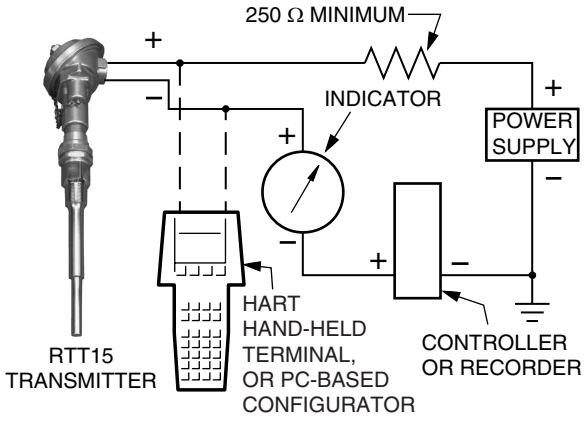


Figure 12. Transmitter Loop Wiring

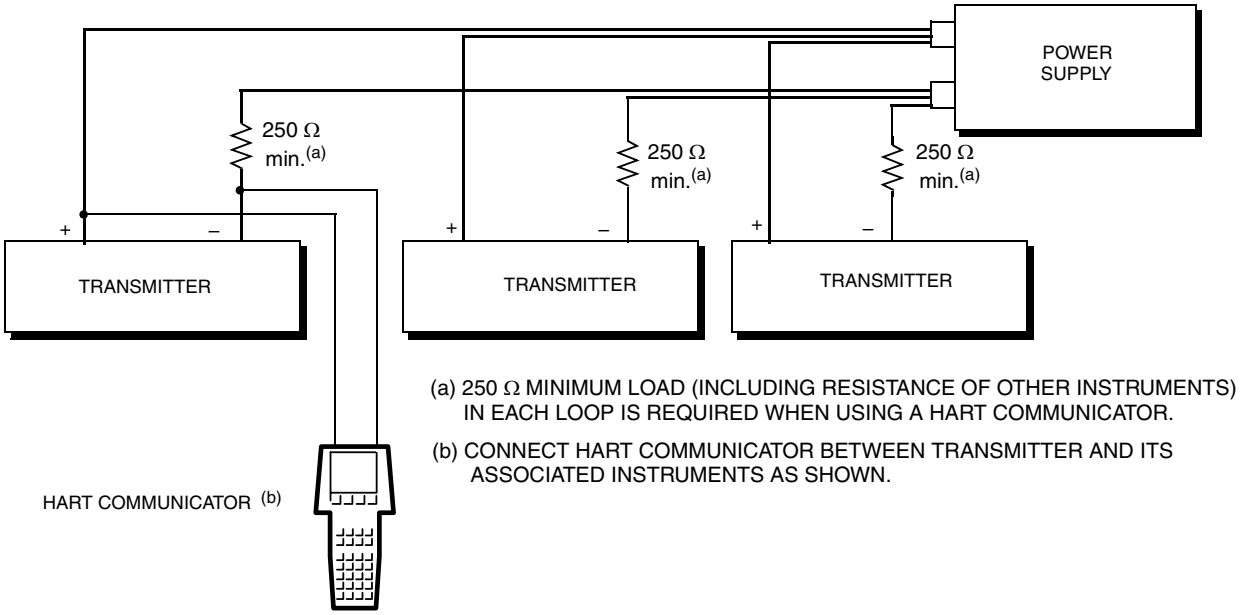


Figure 13. Wiring Several Transmitters to a Common Power Supply

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 protocol, up to 15 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 protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Figure 14 shows a typical multidrop network. Do not use this figure as an installation diagram. Contact the HART Communications Foundation, (512) 794-0369, with specific requirements for multidrop applications.

NOTE

L1 and L2 Display Options do not function in multidrop mode.

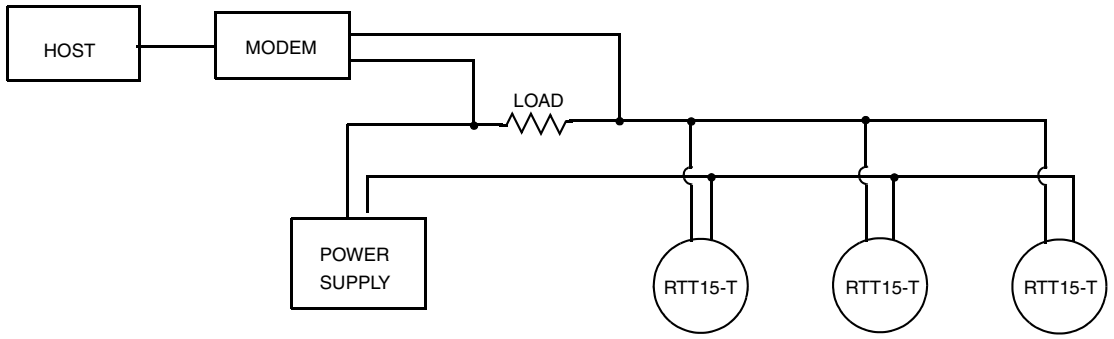


Figure 14. Typical Multidrop Network

Wiring to an I/A 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

The measurement process variable (**PV**), electronics temperature (**Electr**), output value in mA (**PV AO**), and process variable in percent of range (**PV % range**) are displayed in the main **Online** menu.

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 a unit was 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 31 for instructions on how to configure your display.

Using the Optional L2 Display

The measurement process variable is displayed on the LED display. The display reads **LO** when the input current is below the **Li** configured low value (4.0 or 3.6 mA). It reads **HI** when the input current is above the configured **Li** high value 20.0 or 20.4 mA).

— NOTE

See “Configuring the Optional L2 Display” on page 34 to set the overrange limits.

In the rare instance that the upper and lower range limits are set to the maximum values of -1999 and +9999 and the current is below 4.0 mA or above 20 mA, the display reads “**- - - -**”.

Calibration

Your RTT15 temperature transmitter is a highly stable transmitter that was previously calibrated at the factory and 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 select **Device Setup** from the Online menu. Then use the following path:

Device Setup > Diag/Service > Calibration >D/A Trim

Rerange

To rerange your transmitter, connect the HART Communicator to your transmitter and select **Device Setup** from the Online menu. Then use the following path to set the lower range value (**PV LRV**), upper range value (**PV URV**), and unit (**PV Unit**):

Device Setup > Basic Setup > Range Values

Configuration

To configure your transmitter, connect the HART Communicator to your transmitter and select **Device Setup** from the Online menu. You can then select **Diag/Service** to perform diagnostic procedures, **Basic Setup** or **Detailed Setup** to perform configuration changes, or **Review** to see the present configuration and status of your device. See "Online Menu" on page 24 and "Explanation of Parameters and Fast-Key Path" on page 26 for details.

⚠ WARNING

If your transmitter has an optional display, changing the engineering units or range in your transmitter requires that you also make like 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 sensor. However, when 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**. In the sub-parameters **Br sensor** and **Sh sensor** you can set the output to go to a specific value between 3.5 and 23 mA. The sub-parameter **NAMUR down**, sets the output to go to 3.5 mA. 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** and **Spcl T/C** unless your transmitter was supplied with custom RTD or thermocouple curves.

4. When configuring your transmitter for use with a 2-wire RTD, you have to 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 in the sub-parameter **Enter Value**. 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**.

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:

   RTD Factor = 100/RTD Nominal Resistance

   For Example, if you have a Pt1000 RTD, the calculation is:

   RTD Factor = 100/1000 = 0.1

6. If your transmitter was ordered with custom factory configuration to enter a custom curve or Callender-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 Foxboro for a custom configuration.

Online Menu

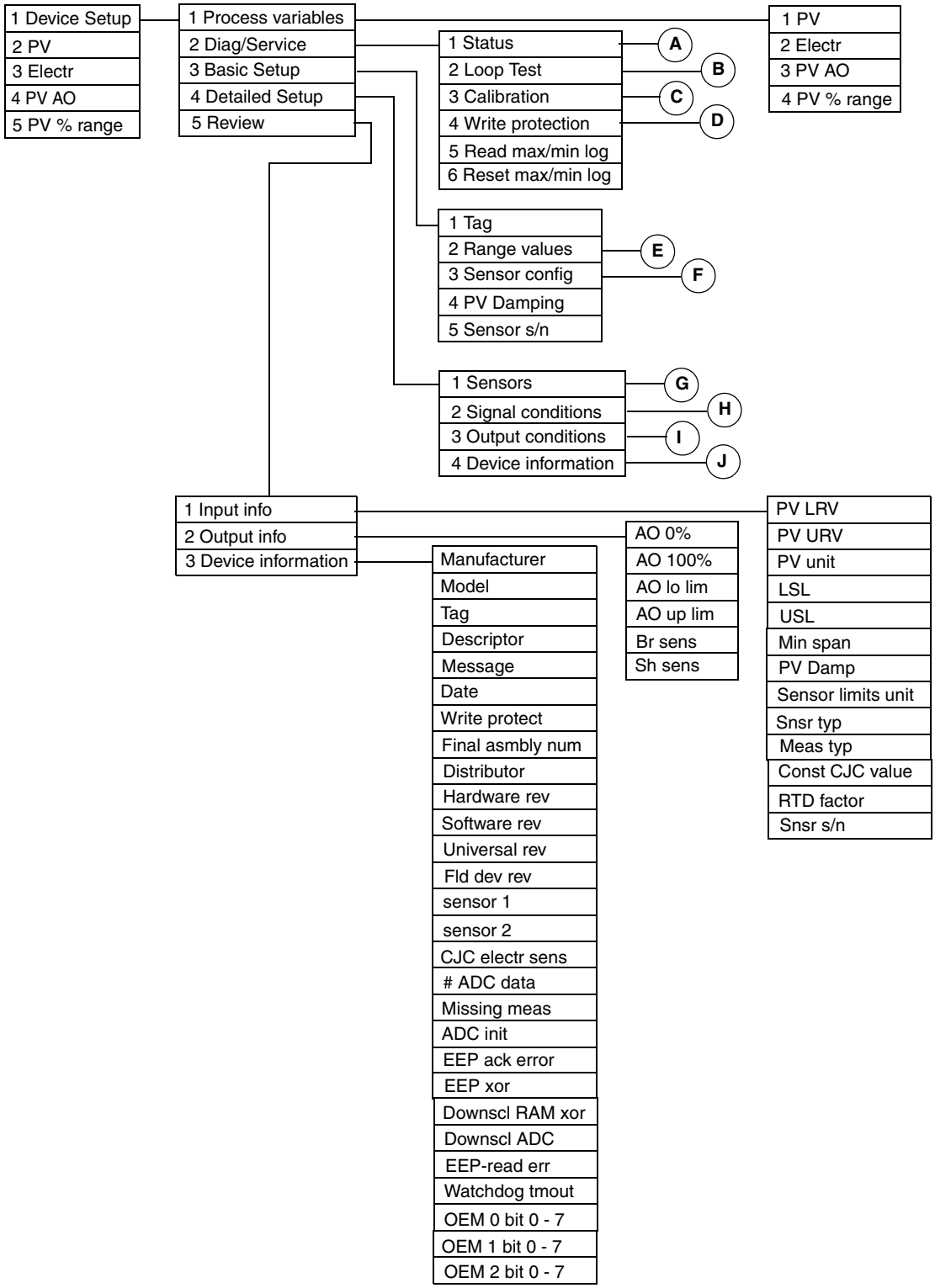


Figure 15. RTT15 Temperature Transmitter Online Menu

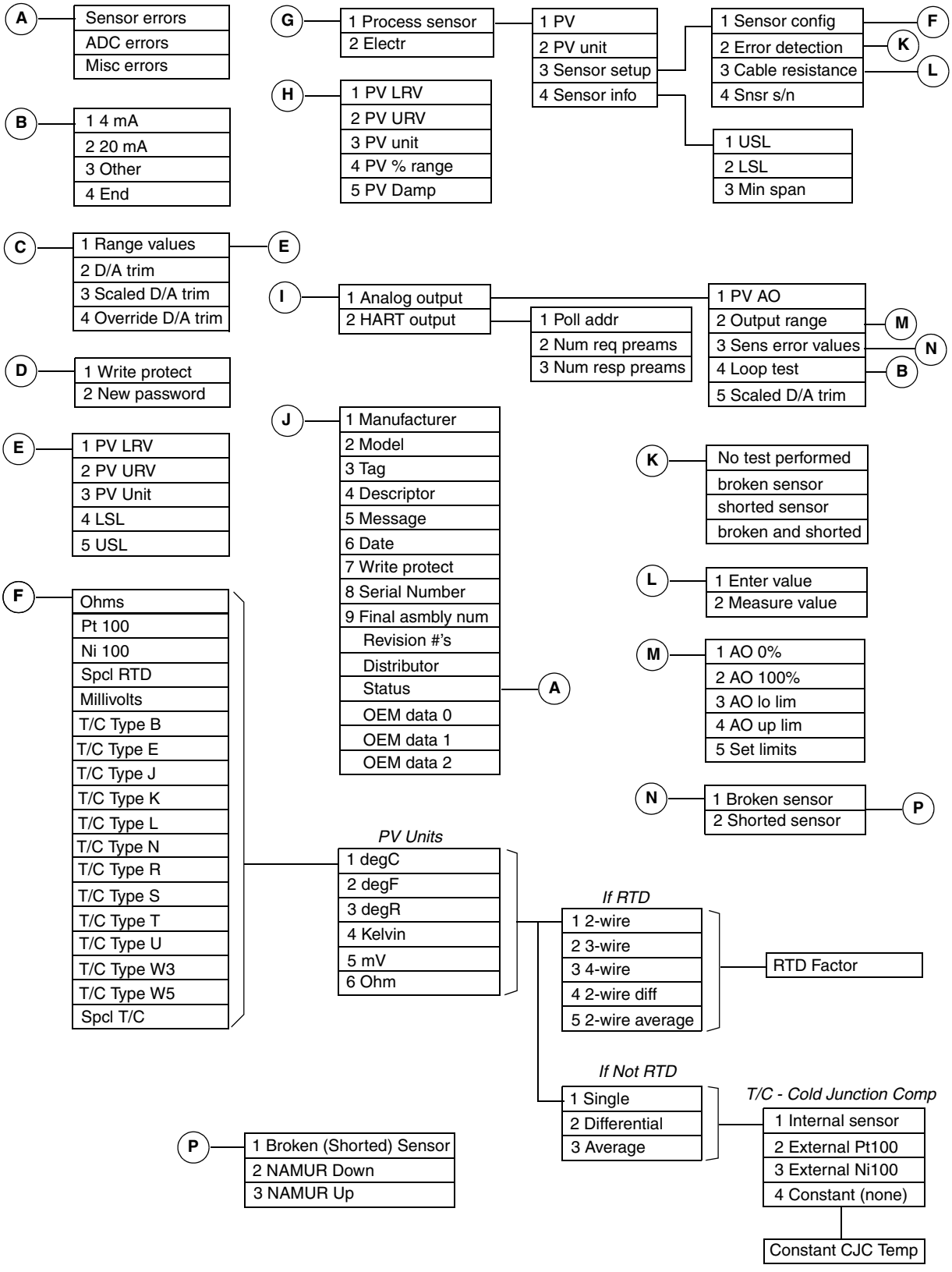


Figure 16. RTT15 Temperature Transmitter Online Menu (continued)

Explanation of Parameters and Fast-Key Path

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.
4 mA	1,2,2,1	Loop test procedure to set 4 mA as the signal value to check other devices in the control loop.
20 mA	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 smaller 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 larger 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 type procedures.
CJC electr sens	1,5,3	Shows if a CJC or electronic sensor temperature error exists. On indicates an error; Off indicates OK.
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.

Parameter	Fast-Key Path	Explanation
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.
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).

Parameter	Fast-Key Path	Explanation
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.
Ni 100	1,3,3	Select if the measurement input type is Ni 100 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 conditions	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.
Pt 100	1,3,3	Select if the measurement input type is Pt 100 RTD.
PV	2	Shows the primary variable value in units configured.
PV % range	5	Shows the primary variable value in percent of range.
PV AO	4	Shows the analog output value of the primary variable.
PV Damp	1,4,2,5 1,5,1	In Detailed Setup, enter the damping value in seconds. In Review, shows the damping value.
PV Damping	1,3,4	Enter the damping value in seconds.

Parameter	Fast-Key Path	Explanation
PV LRV	1,3,2,1 1,4,2,1 1,5,1	In Basic Setup, enter the lower range value. In Detailed Setup, enter the lower range value. In Review, shows the lower range value.
PV unit	1,3,2,3 1,4,2,3 1,5,1	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.
PV URV	1,3,2,2 1,4,2,2 1,5,1	In Basic Setup, enter the upper range value. In Detailed Setup, enter the upper range value. In Review, shows the upper range value.
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 1,5,1	In Basic or Detailed Setup, enter the RTD factor. In Review, shows the RTD factor.
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.
Sensor 1	1,5,3	Shows if Sensor 1 is On or Off.
Sensor 2	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 s/n	1,3,5	Shows the sensor serial number.
Sensor setup	1,4,1,1,3	Path to sensor setup parameters.
Sensors	1,4,1	Path to configure sensor parameters.
Serial number	1,4,4,8	Shows the sensor serial number.
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 23 mA if the measurement exceeds the PV URV.
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 conditions	1,4,2	Path to configure signal condition parameters.

Parameter	Fast-Key Path	Explanation
Single	1,3,3	If not RTD, select if single (not differential or average) measurement.
Snsr s/n	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 B	1,3,3	Select if the measurement input type is T/C Type B.
T/C Type E	1,3,3	Select if the measurement input type is T/C Type E.
T/C Type J	1,3,3	Select if the measurement input type is T/C Type J.
T/C Type K	1,3,3	Select if the measurement input type is T/C Type K.
T/C Type L	1,3,3	Select if the measurement input type is T/C Type L.
T/C Type N	1,3,3	Select if the measurement input type is T/C Type N.
T/C Type R	1,3,3	Select if the measurement input type is T/C Type R.
T/C Type S	1,3,3	Select if the measurement input type is T/C Type S.
T/C Type T	1,3,3	Select if the measurement input type is T/C Type T.
T/C Type U	1,3,3	Select if the measurement input type is T/C Type U.
T/C Type W3	1,3,3	Select if the measurement input type is T/C Type W3.
T/C Type W5	1,3,3	Select if the measurement input type is T/C Type W5.
Tag	 1,3,1 1,5,3	The primary identifier when communicating with the transmitter (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.

Configuring the Optional L1 Display

⚠ CAUTION

Changing the engineering units or range in your transmitter requires that you also make like 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 17 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**.

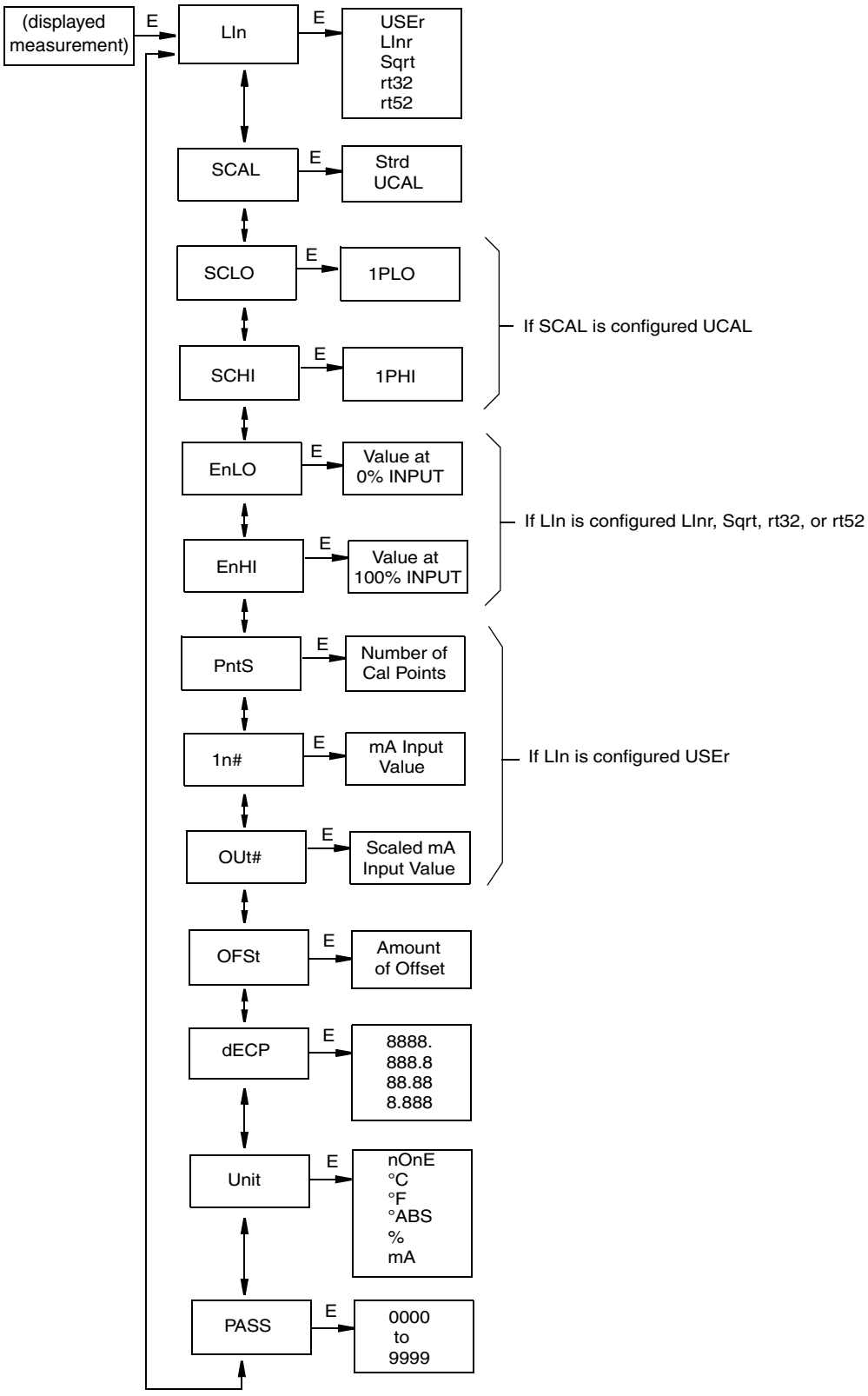


Figure 17. L1 Display Structure

Configuring the Optional L2 Display

⚠ CAUTION

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

Use the structural diagram of the L2 display configuration located in Figure 18 with this procedure.

NOTE

1. Use the **Enter** (**E**) button to access a parameter and to enter a change.
2. Use the Up and Down arrow buttons to select a picklist choice or to change a value. When making a large change in a value, hold the arrow key down. The value first goes through the unit numbers, then the tens numbers, then the hundreds numbers and lastly the thousands numbers.
3. You can return to the measure mode at any time in this procedure by pressing the Up and Down arrow buttons simultaneously.

1. Press and hold the **Enter** button to enter configuration mode. The first parameter, **dp** is displayed.
2. Press **Enter** to select the number of places to the right of the decimal point. The allowable placement is dependent on the Upper Range Value **(SPAn**) you will configure in Step 4.
   - For a **SPAn** above 999, you must select 0.
   - For a **SPAn** of 100 through 999, you can select 0 or 1.
     If you select 1, enter a **SPAn** 10 times the actual upper range value in Step 4.
   - For a **SPAn** of 10 through 99, you can select 0, 1, or 2.
     If you select 1, enter a **SPAn** 10 times the actual upper range value in Step 4.
     If you select 2, enter a **SPAn** 100 times the actual upper range value in Step 4.
   - For a **SPAn** of 1 through 9, you can select 0, 1, 2, or 3.
     If you select 1, enter a **SPAn** 10 times the actual upper range value in Step 4.
     If you select 2, enter a **SPAn** 100 times the actual upper range value in Step 4.
     If you select 3, enter a **SPAn** 1000 times the actual upper range value in Step 4.

   Use the Up and Down arrow buttons to select the number of places to the right of the decimal point. and then the **Enter** button to enter your selection.
3. Use the Up and Down arrow buttons to go to **ZEro** to set the value at 4 mA.
   Press **Enter** to see/change the current value
   Use the Up and Down arrow buttons to set the value between -1999 and +9999.
   Press the **Enter** button to enter your value.
4. Use the Up and Down arrow buttons to go to **SPAn** to set the value at 20 mA.
   Press **Enter** to see/change the current value
   Use the Up and Down arrow buttons to set the value between -1999 and +9999.

— NOTE

See Step 1 to determine if you need to enter a multiple (10x, 100x, or 1000x) of the value.

Press the **Enter** button to enter your value.

5. Use the Up and Down arrow buttons to go to **Li** to set the overrange limits.
   Press **Enter** to see/change the current limits
   Use the Up and Down arrow buttons to select 0 or 1.
   - For limits of 4 and 20 mA, select 0
   - For limits of 3.6 and 20.4 mA, select 1

   Press the **Enter** button to enter your selection.

— NOTE

"Using the Optional L2 Display" on page 21 describes the display reading when the overrange limits are exceeded.

6. Use the Up and Down arrow buttons to go to **St** to set the display update rate (sample time).
   Press **Enter** to see/change the current time
   Use the Up and Down arrow buttons to select a value between 1 and 10 seconds.
   Press the **Enter** button to enter your selection.
7. Use the Up and Down arrow buttons to go to **Unit** to set the unit of measure.
   Press **Enter** to see/change the current unit
   Use the Up and Down arrow buttons to select non E (no units), °C, °F, °K, or %.
   Press the **Enter** button to enter your selection.

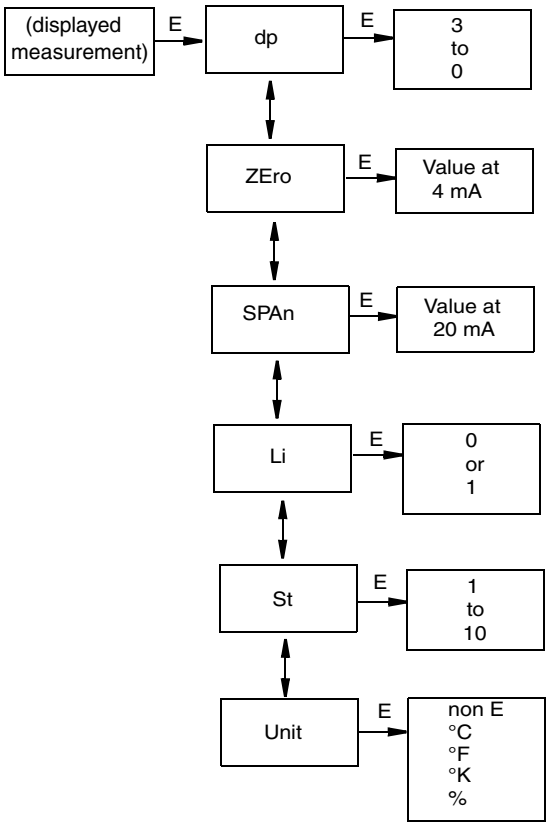


Figure 18. L2 Display Structure

4. Maintenance

The RTT15-T 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.

⚠ CAUTION

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

⚠ 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.

Troubleshooting

Table 1: 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* 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

Table 1: Recommended Troubleshooting Steps Before Replacing Module

Inaccurate Measurement	Check Sensor - See instrument diagnostics* 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 Ω loop resistance between the power supply and the HART Communicator
Transmitter is in Failsafe	Check Sensor – See instrument diagnostics* 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

*Using a HART Communicator or PC-Based Configurator.

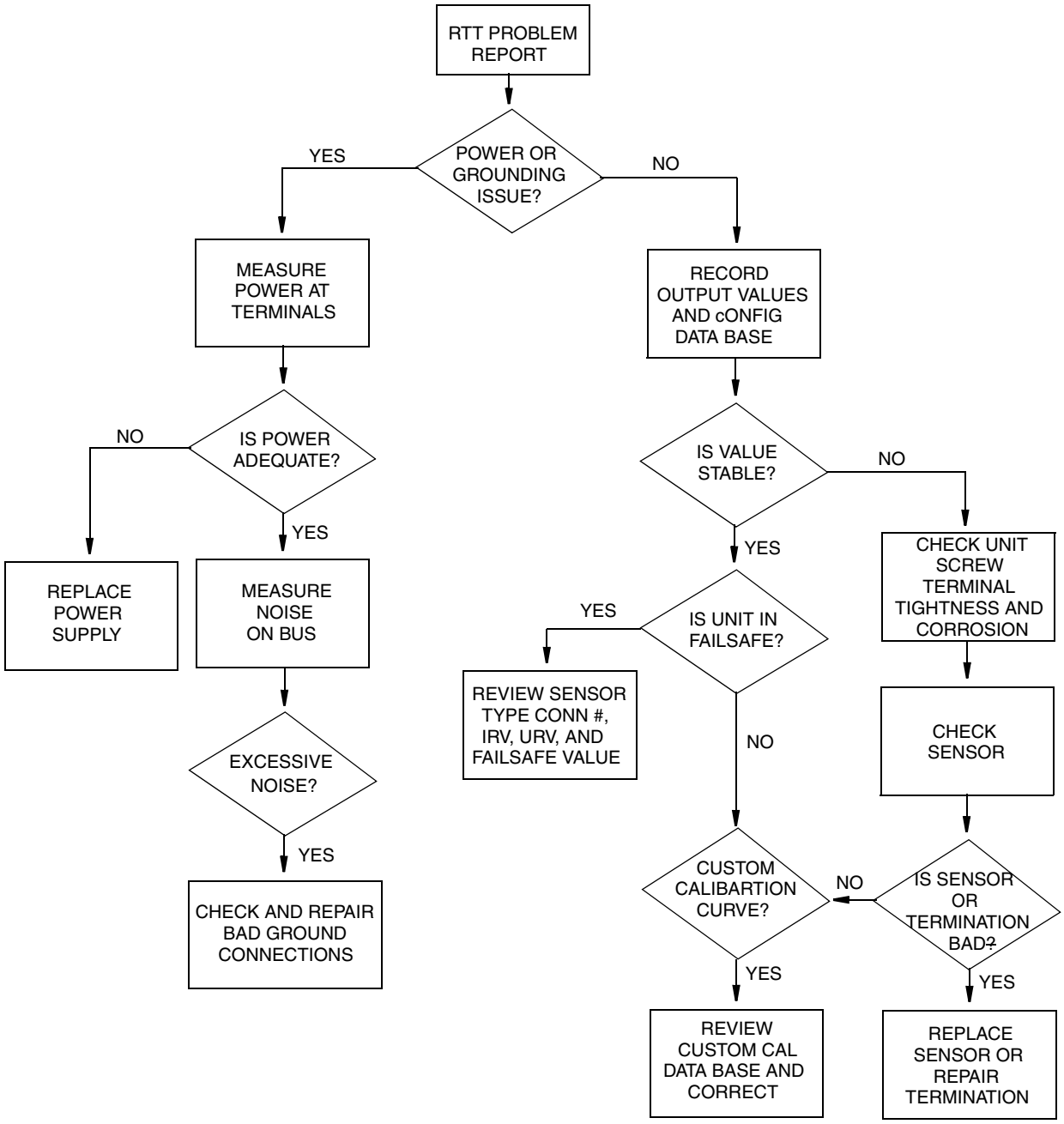


Figure 19. Troubleshooting Diagram

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.

⚠ CAUTION

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

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.

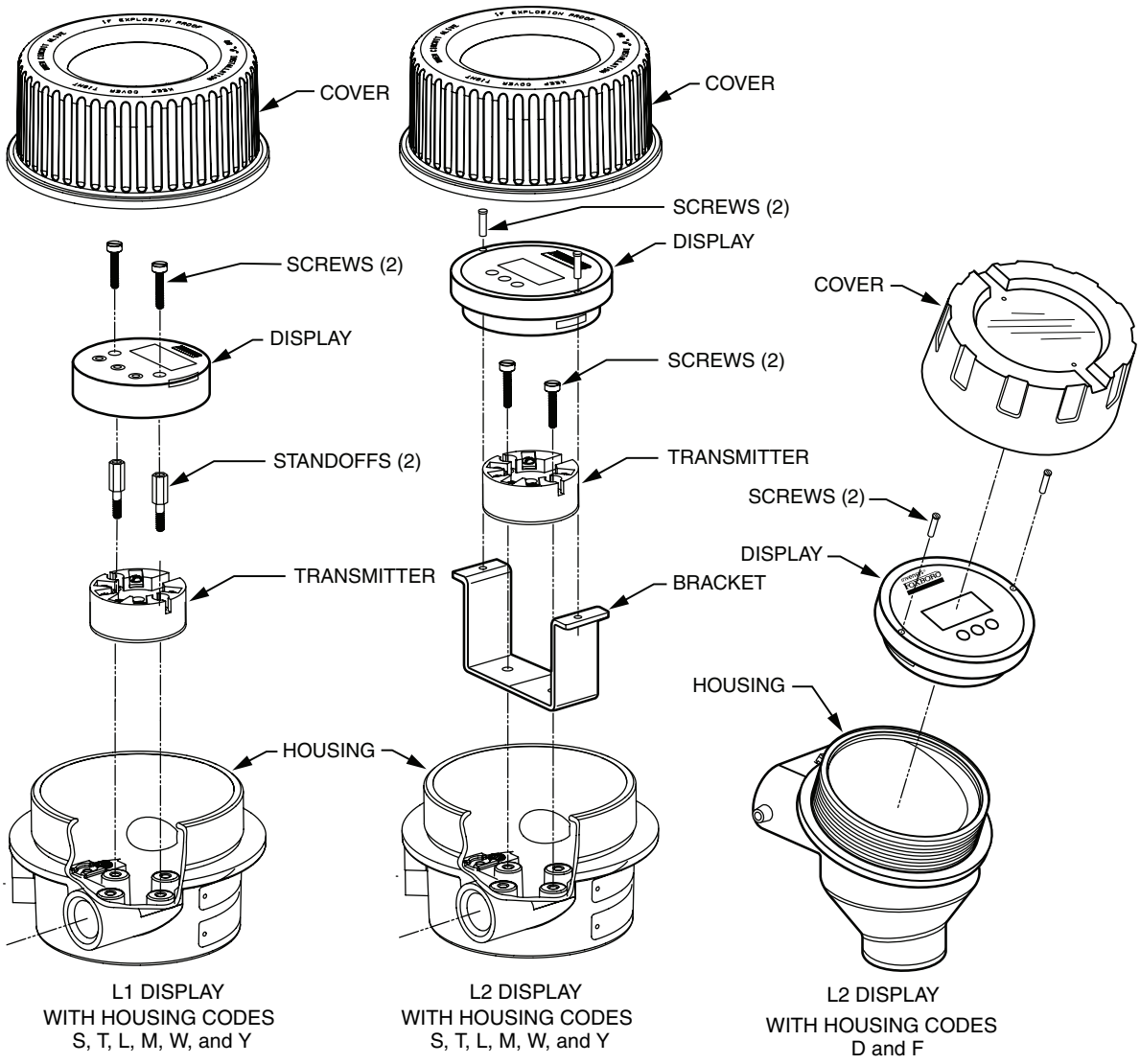


Figure 20. Assembly With Optional Display

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