USER'S MANUAL

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XTCä TRANSMITTERS

SERIES 344 TERMPERATURE TRANSMITTERS

USER'S MANUAL

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CHANGES FOR ISSUE 1, OCTOBER 1996

Section 8.3.2 At “Maximum Loop Voltage”, reference to Ex N use added.

Section 8.3.6 Ex N requirement added.

The cover date has been changed, however, page dates were not changed at this time. Change bars were placed on revised pages in the outside margins.

1.0 INTRODUCTION

This User's Manual is for the XTC™ Model 344 Smart Temperature Transmitter. It covers both the Transmitter-Controller and Transmitter only versions.

NOTE

> Throughout this Manual the term Transmitter will include both versions except when the Transmitter-Controller is specifically stated and when discussing unique Transmitter-Controller features, such as the Controller function block.

All information needed to bench test, install, configure, system test, and service a transmitter is included in this User's Manual. Figure 1-1 shows the basic Model 344. Figure 1-2 shows the two terminal strips for loop, sensor, display, and test equipment connections.

IMPORTANT

> Save this User's Manual for installing, configuring, operating and servicing a Model 344 transmitter.

1.1 SECTION CONTENTS

Nine sections make up this Manual. A brief description of each section follows.

Section 1, INTRODUCTION, describes each section in this Manual and provides a brief description of the Model 344 Smart Temperature Transmitter line.

Section 2, XTC COMMUNICATOR (MXC), describes use of the MXC to test, configure, and calibrate a transmitter.

Section 3, INITIAL TRANSMITTER SETUP, provides procedures to perform a bench test of the transmitter to ensure proper operation of all functions. Start-up configuration is described here. If desired, go to Section 5 to perform a complete configuration.

Section 4, INSTALLATION, furnishes specific information for mechanical and electrical installation.

Section 5, ON-LINE AND OFF-LINE OPERATION, describes on-line and off-line configuration, and the use of the transmitter's zero and full-scale pushbuttons.

Section 6, CALIBRATION AND MAINTENANCE, provides calibration procedures for analog and digital modes. It also furnishes preventive maintenance, troubleshooting, and assembly replacement procedures. A spare and replacement parts list is provided at the back of this Manual.

Section 7, CIRCUIT DESCRIPTION, contains an assembly level circuit description to support transmitter servicing.

Section 8, MODEL DESIGNATION AND SPECIFICATIONS, furnishes tables describing transmitter model numbers, and it contains mechanical, functional, performance, and environmental specifications. Hazardous area certifications are also listed.

Before installing or servicing a transmitter, read the information on the nameplate and ensure that the correct model is at hand and that the correct procedures are followed.

Section 9, GLOSSARY, contains definitions of various transmitter related terms.

APPENDIX A describes transmitter function blocks and the parameters available.

APPENDIX B contains hazardous area installation drawings and information needed for barrier selection.

WARRANTY contains the product warranty statements and information concerning servicing of the product during the warranty period.

PARTS LIST shows an exploded view of the transmitter and a list of on-hand spare parts and field replaceable parts.

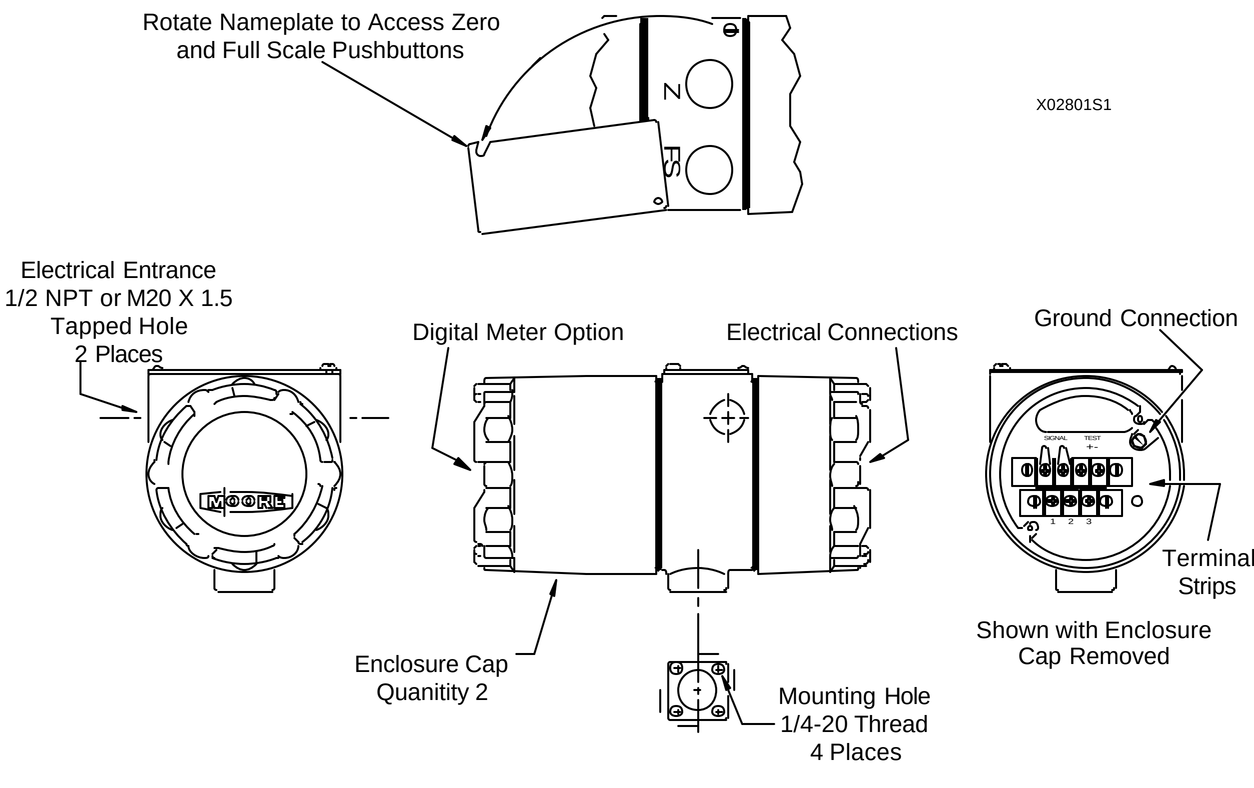


FIGURE 1-1 Basic Model 344

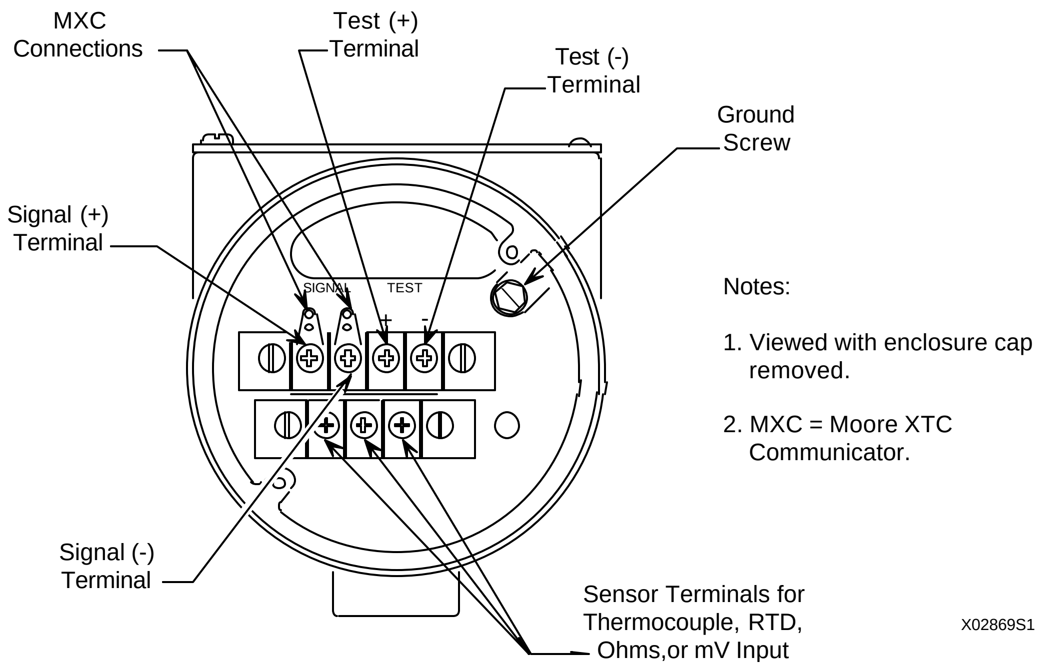


FIGURE 1-2 Terminal Connections

1.2 PRODUCT DESCRIPTION

The Model 344 Temperature Transmitter, shown in Figure 1-1, is a microprocessor-based measurement and control device which combines accurate, reliable temperature measurement and a PID controller in one unit. The Transmitter accepts an RTD, thermocouple, millivolt, slide wire or resistance sensor input. It contains a custom ASIC (Application Specific Integrated Circuit) which contains standard temperature calibration curves for J, K, E, T, R, S, B and N type thermocouples and US/DIN curves for 100, 200, and 500 ohm Platinum RTDs. The sensed signal is linearized and corrected for ambient temperature changes by the microprocessor and then converted to an equivalent 4-20 mA or HART® (Highway Addressable Remote Transducer) digital output signal.

The analog output signal, HART digital communications, and 24 Vdc power (typical) are carried on a twisted-pair 2-wire cable. The HART digital communication signals are superimposed (AC coupled) onto the 4-20 mA loop current allowing simultaneous communication with the Transmitter without compromising loop integrity. A digital meter is available when local indication of transmitter output is required. Loop wiring connections made to the electrical terminals shown in Figure 1-2.

A transmitter can be configured to operate in either an analog mode or a digital mode, for a Point-To-Point or a Multi-Drop network respectively.

ANALOG MODE: A single transmitter is connected to a controller, recorder or other field device. A loop known as a Point-To-Point Network interconnects the instruments. The transmitter's output is the process variable and it is sent to a controller or recorder using a standard 4-20 mA analog current.

The HART protocol is used for communication between the transmitter and a Moore XTC Communicator (MXC), a personal computer running MXTC Configuration Software or other remote device. A typical communication can be to: transfer a new and edited configuration, remotely monitor the process variable, or service a transmitter.

DIGITAL MODE: One to fifteen transmitters can be parallel connected to a Multi-Drop Network using only twisted-pair cable. The HART protocol is employed to send all process variable information to a HART-compatible controller, recorder, or other device.

A mounting bracket is included and permits either pipe mounting (2" pipe) or wall mounting. When attached to a thermowell, the Transmitter can be mounted directly to a process vessel, chamber, or flow pipe.

1.3 CONFIGURATION

A smart transmitter must be configured before being used on-line or off-line. Each transmitter is shipped with either a default configuration or, if specified at time of order, a custom configuration defined by the user. A default configuration may need to be edited by the user before the transmitter is used in a loop.

1.4 PRODUCT SUPPORT

Product support can be obtained from the Moore Products Co. Technical Information Center (TIC). TIC is a customer service center that provides direct phone support on technical issues related to the functionality, application, and integration of all products supplied by Moore Products Co.

To contact TIC for support, either call 215-646-7400, extension 4TIC (4842) or leave a message in the bulletin board service (BBS) by calling 215-283-4958. The following information should be at hand when contacting TIC for support:

- Caller ID number, or name and company name

  When someone calls for support for the first time, a personal caller number is assigned. This number is mailed in the form of a caller card. Having the number available when calling for support will allow the TIC representative taking the call to use the central customer database to quickly identify the caller’s location and past support needs.

- Product part number or model number and version

- If there is a problem with a product’s operation:
  - Is the problem intermittent or constant?
  - What steps were performed before the problem occurred?
  - What steps have been performed since the problem occurred?
  - What symptoms accompany the problem? Is an error message displayed?
  - What is the installation environment? For example:
    - type of plant and process, involved loop, control strategy, and related equipment.
    - workstation or personal computer manufacturer and model, amount of memory, and operating system.

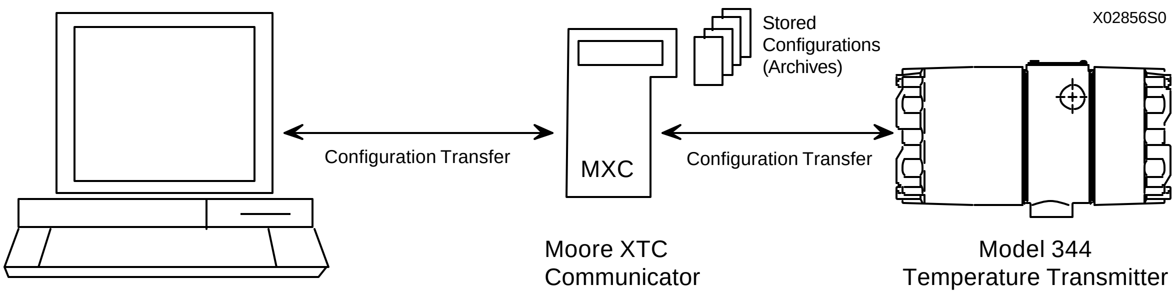
For product support outside of North America, contact your nearest Moore Products Co. subsidiary.

2.0 XTC COMMUNICATOR

The Moore XTC Communicator (MXC) is a HART protocol-based, hand-held instrument capable of communicating with HART conformant instruments from Moore Products Co. and from other manufacturers. It provides full access to on-line and off-line configuration data and to monitoring of process variables. An MXC is shown in Figure 2-1.

When used with HART-conformant field instruments, the MXC can:

- Store up to 100 instrument configurations in its non-volatile memory.
- Download a stored configuration from the MXC to an on-line instrument (e.g., a transmitter).
- Upload a configuration from an on-line instrument to the MXC
- Store configurations created at and downloaded from a personal computer running Moore XTC Configuration Software.
- Communicate with a field instrument from any point in the loop.*



Personal Computer

The MXC and the field instruments with which it communicates use the HART protocol for remote communications. HART uses Frequency Shift Keying (Bell 202 standard) to superimpose digital signaling on the standard 4-20 mA analog signal. Since there is no net energy change, the analog signal will not be disturbed and loop integrity is maintained.

An MXC can be used on-line and off-line. On-line, it can display process data from a field instrument or transfer a configuration between the MXC and a field instrument. Off-line, it is used to create a configuration or to edit a configuration stored in the MXC. Off-line, an MXC can communicate with a personal computer to transfer configurations between the MXC and personal computer.

In the following sections, MXC hardware and software will be described. Included in this description will be the display, keypad, wiring, and power requirements. In addition, at the end of this section, major MXC menu screens are shown in Figure 2-2 and Model 344 parameters accessible through the MXC are shown.

* Between the sense resistor and instrument in a non-hazardous area installation. Between the sense resistor and a barrier in a hazardous area installation.

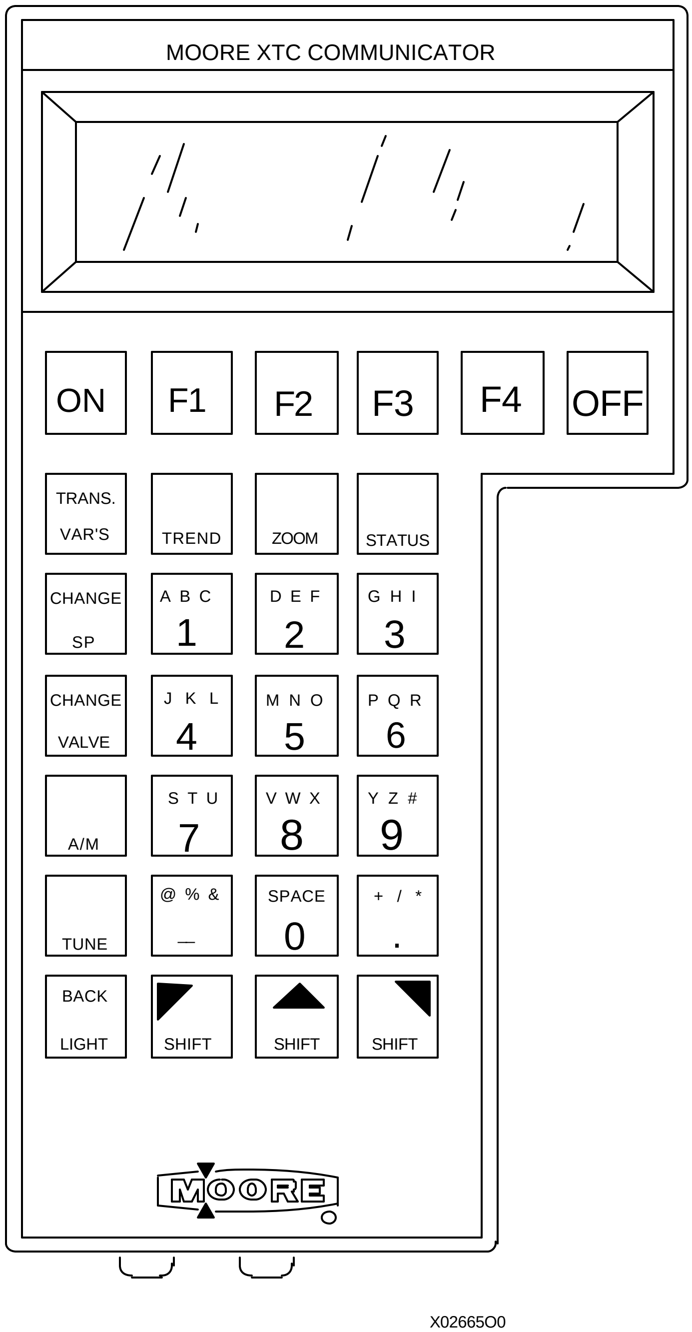


Figure 2-1 Moore XTC Communicator (MXC)

2.1 DISPLAY

The MXC has a 5 by 8 dot matrix Liquid Crystal Display (LCD) with four lines of twenty characters each to show configuration parameters, operating status, on-line variables, and trends. The LCD has a back light that can be turned on for viewing in dimly lighted areas.

```
SELECT BLOCK TO EDIT
-  SENSOR INPUT  -
                       SEL-
PREV  NEXT    END     ECT
```

All MXC screens have a similar layout. As shown here, most configuration screens use the top two lines to describe the current screen, and the lower two lines to show the selections available from this screen. Selections are entered by pressing keys on the MXC keypad. Some on-line variable and trend screens are slightly different from that shown here, but they will always have a selection to access the next screen.

A blinking infinity symbol (∞) at the lower right corner of the screen indicates that the MXC is communicating with a field instrument or a personal computer. No keyboard keys should be pressed until the symbol is cleared upon completion of the communication.

2.2 KEYPAD DESCRIPTION

The thirty-key keypad is shown in Figure 2-1. It contains dedicated keys, alphanumeric keys with shift keys, and function keys. These keys are color coded as follows:

- Red - dedicated ON key
- Black - dedicated OFF key
- Gray - function keys and dedicated keys (for controller block, on-line monitoring, and MXC functions)
- White - dedicated alphanumeric, symbol, and shift keys

A dedicated key performs a given function no matter what screen is showing. A function key is dependent upon the action being performed and the MXC's firmware; available selections are shown on the screen's bottom two lines.

2.2.1 Dedicated Keys

ON - This key powers up the MXC and initiates the MXC self-test. Press and hold the key until the Moore logo appears and then release it. If the MXC fails self-test, a warning message will be displayed.

The MXC will now show the options available: communicate with a field instrument or personal computer or do off-line configuration. These topics are discussed further in Section 5.

To conserve battery power, the MXC will shut off after 10 minutes if no keypad key is pressed. This auto-shut-off is disabled when the MXC is on-line (e.g., displaying a process variable).

OFF - This key powers down the MXC. It may be used at any time. During configuration, however, care should be taken so important information is not discarded. When the MXC is in certain modes and communicating with a field instrument or personal computer, it will query the user as to whether or not it should be turned off in this mode.

BACK LIGHT - This key turns on the LCD back light for easier viewing of the display in a dimly lighted area. The back light is activated by pressing the key and is deactivated by again pressing the key.

NOTE

The back light consumes significant power. To extend battery life, use the back light only when needed.

TRANS. VAR'S. - The Transmitter Variables key is a quick access key that is pressed to display a screen showing the transmitter's on-line parameters: measured variable (MV), current output (I), process variable (PV) and their respective units. Exit this screen by again pressing the TRANS. VAR'S. key or by pressing the F4 key, for END. If the transmitter is configured as a transmitter-controller you will be prompted to choose either transmitter variables or controller variables. Controller variables include process variable, setpoint and valve.

TREND - The TREND key is another quick access key that is pressed to trend a variable and show up to thirteen samples. Any one of the following variables can be trended: the measured variable (MV), the current output (I), or the process variable (PV). The trend sampling rate can be set to 1-300 seconds between samples. Exit this screen by again pressing the TREND key or by pressing the F4 key, for END.

ZOOM - The ZOOM key is a quick access key that allows a closer examination of a variable chosen in the Trend screen. This key functions only when a Trend screen is displayed.

ZOOM magnifies a range of values equal to 10% of the span. The midscale value is user selected. For example, when viewing a range of 0-100% in the Trend screen, the value of 50% is chosen to zoom on. The Trend screen now shows a range of 45-55%. Exiting the Zoom screen again displays the Trend screen. Exit the Trend screen to return to the Main Menu.

STATUS - The STATUS key is a quick access key that is pressed to display the Status screen. This screen will show the instrument tag name, model number, software revision number, serial number, and functional statuses such as fixed current mode and error conditions. Exit the Status Screen by again pressing the Status key or by pressing the F4 key.

CHANGE SP, CHANGE VALVE, A/M, and TUNE Keys - These are dedicated keys that are reserved for use with XTC Model 340 and 344 Transmitter-Controllers. These keys are inactive when communicating with an instrument that does not have a controller function block.

CHANGE SETPOINT - Press the CHANGE SP key to view and change the value of the online-setpoint of the controller in either automatic or manual mode. If the controller is in MANUAL with tracking setpoint, then the setpoint cannot be changed. The SP is displayed in the same units as the transmitter display configured in the operator’s display function block. Press the “CHANGE SP” key again, or F3, to exit this mode.

CHANGE VALVE - This key allows you to view and change the position of the valve. If the controller is in AUTO, the valve cannot be changed. Press the “CHANGE VALVE” key again, or F3, to exit this mode.

AUTO/MANUAL - The A/M key toggles the controller between automatic and manual control.

Press the "MANUAL", key F1, or "AUTO", key F2 to change state. Press "A/M" key again, or F4, to exit this mode.

TUNE - This key allows tuning of the controller. The first screen displays the controller action, DIRECT or REVERSE. The controller action may be viewed from the TUNE key, but it must be changed in the configuration mode. Press F4 to continue.

The Proportional Gain (PG), Time Integral (TI) and Time Derivative (TD) can be changed from this screen. Press F1, F2 or F3 to display the current value and edit the parameter. Press "CONT", key F4 to continue.

The Derivative Gain (DG) and Manual Reset (MR) can be changed from this screen. Press F1 or F2 to display the current value and edit the parameter. Press F4 to go to the previous screen. Press the "TUNE" key again, or F3, to exit this mode.

ALPHANUMERIC Keys - Twelve white keys with alphanumeric characters and symbols are located toward the center of the keypad area. Pressing a 1-9, 0, -, or . key will display that character on the screen. These keys also have alphabetic characters and symbols that require the use of a SHIFT key. These numbers, letters and symbols are typically used in writing a range, damping value, tagname, message, or descriptor.

SHIFT Keys - Three shift keys are located below the alphanumeric keys. They are used to access a letter or symbol located in the upper left, center, or right portion of an alphanumeric key. To select an alphabetic character or upper symbol, press the proper SHIFT key (left, center, or right arrow) and then press the desired alphanumeric or symbol key.

2.2.2 Function Keys

F1, F2, F3, and F4 - The function keys are the gray keys located just below the MXC display. The function or action performed by each key is shown on the bottom two lines of the display, immediately above each key. For example, when the MXC is first turned on and the Main Menu screen appears, the following selections are aligned with the function keys: F1 - FIND XMTR, F2 - ARCH FUNC, F3 - TEST MXC, and F4 - END. To make a selection, press the corresponding Function key and the next screen will appear. These keys are used extensively when configuring or monitoring a field instrument.

```
SELECT FUNCTION

FIND  ARCH  TEST
XMTR  FUNC  MXC   END
```

2.3 LOOP CONNECTION

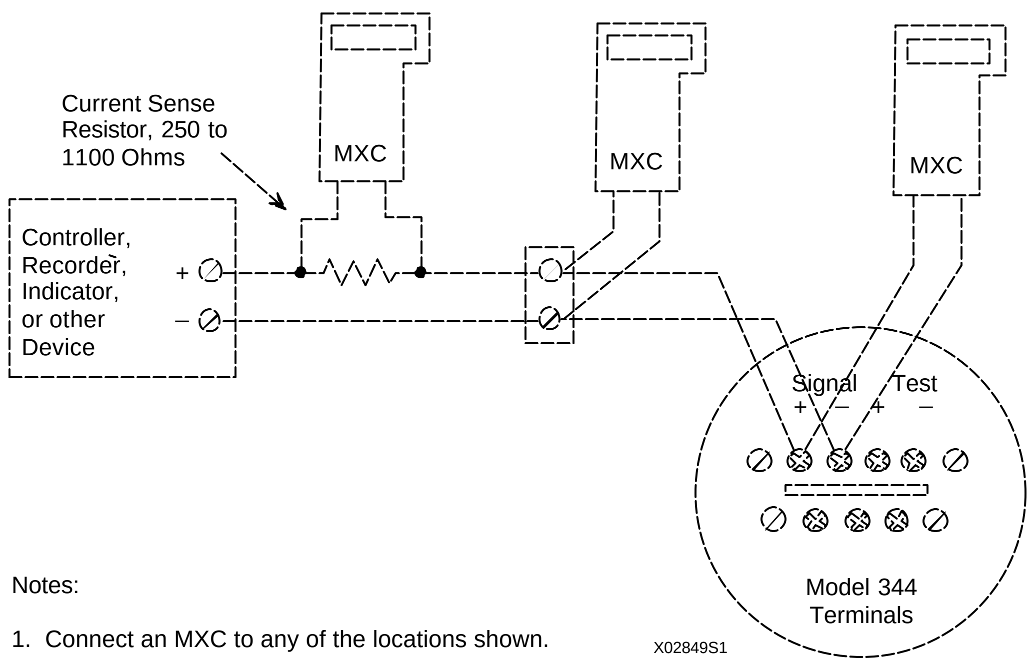
The MXC is quickly connected into a transmitter loop. A 40" (1m) cable with a dual banana plug on one end and two mini-grabber clips on the other is provided. The dual banana plug is inserted into the bottom of the MXC. The mini-grabber clips are connected to the Model 344's signal terminals or to the loop's current sense resistor, usually at a receiving instrument such as a Model 352 Single-Loop Digital Controller (see notes below). This is a non-polar connection. The MXC can now communicate with the transmitter from the control room or a field location. The diagram below shows a basic loop with the MXC connected at various locations.

NOTE

The HART protocol requires a network (loop) resistance between 250Ω and 1100Ω to support communications. See Section 4.3.5 to determine resistance value.

IMPORTANT

In a hazardous area installation, connect the MXC on the safe side of the barrier, between the current sense resistor and the barrier.



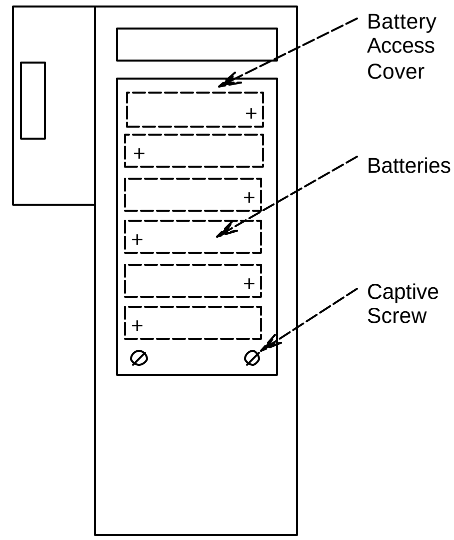
Notes:

1. Connect an MXC to any of the locations shown.

2. Connect the MXC only in a non-hazardous area.

2.4 POWER

Six "AA" alkaline batteries are supplied with the MXC. Remove the rear cover to access the battery compartment, as shown in the figure. Typical operating time of the MXC with new batteries and the back light off is approximately 80 hours; with new batteries and the back light on, approximately 30 hours.



A Low Battery indicator (L_B) is displayed in the lower right corner of the LCD when about one-half of the battery charge is spent. Fresh batteries should then be available for installation.

NOTE

If the MXC fails due to low batteries, data in the On-Line Memory section of the MXC will be lost. The MXC should not be used to troubleshoot critical loops while the low battery indicator is showing.

The MXC will automatically conserve battery life when in the configuration mode. After approximately ten minutes with no keys on the keypad being pressed, the MXC will shut itself off. This will not occur while the MXC is monitoring variables from a field instrument.

2.5 MXC SOFTWARE VERSION

To read an MXC's software version, perform the following steps.

1. Press and hold the MXC's ON key until the MOORE logo appears on the display.

2. Watch the MXC display. The MXC's software version will be momentarily displayed.

3. Press the OFF key or continue on to configure or monitor a transmitter.

2.6 MXC MENU SCREENS AND PARAMETER MAP

Major MXC menu screens are shown in Figure 2-2. The screen's name appears in the left column. These screens are shown in block form in Figure 2-3.

Figure 2-3 is a Parameter Map which shows general configuration and calibration flow. Detailed configuration procedures are given in Section 5 of this Manual. Calibration is described in Section 6.

Main Menu

```
SELECT FUNCTION

FIND   ARCH   TEST
XMTR   FUNC   MXC    END
```

On-Line Menu

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP   CAL/   CON -
OVRD   TEST   FIG    END
```

On-Line Configuration Menu

```
CONFIGURATION MODE

EDIT   EDIT
ARCH   CONF          END
```

Calibrate/Test Menu

```
CALIBRATE / TEST

       CAL   TEST   END
```

Function Block Menu

```
SELECT BLOCK TO EDIT
-  SENSOR INPUT  -
                     SEL-
PREV   NEXT   END    ECT
```

Configuration Complete Menu

```
CONFIGURATION
COMPLETE
              RE-    DOWN
QUIT   SAVE   VIEW   LOAD
```

Loop Override Menu

```
LOOP OVERRIDE - CHOOSE
CURRENT OUTPUT LEVEL
4 MA   20 MA   OTHR   END
```

MXC screens X02781S0

FIGURE 2-2 Major MXC Menu Screens

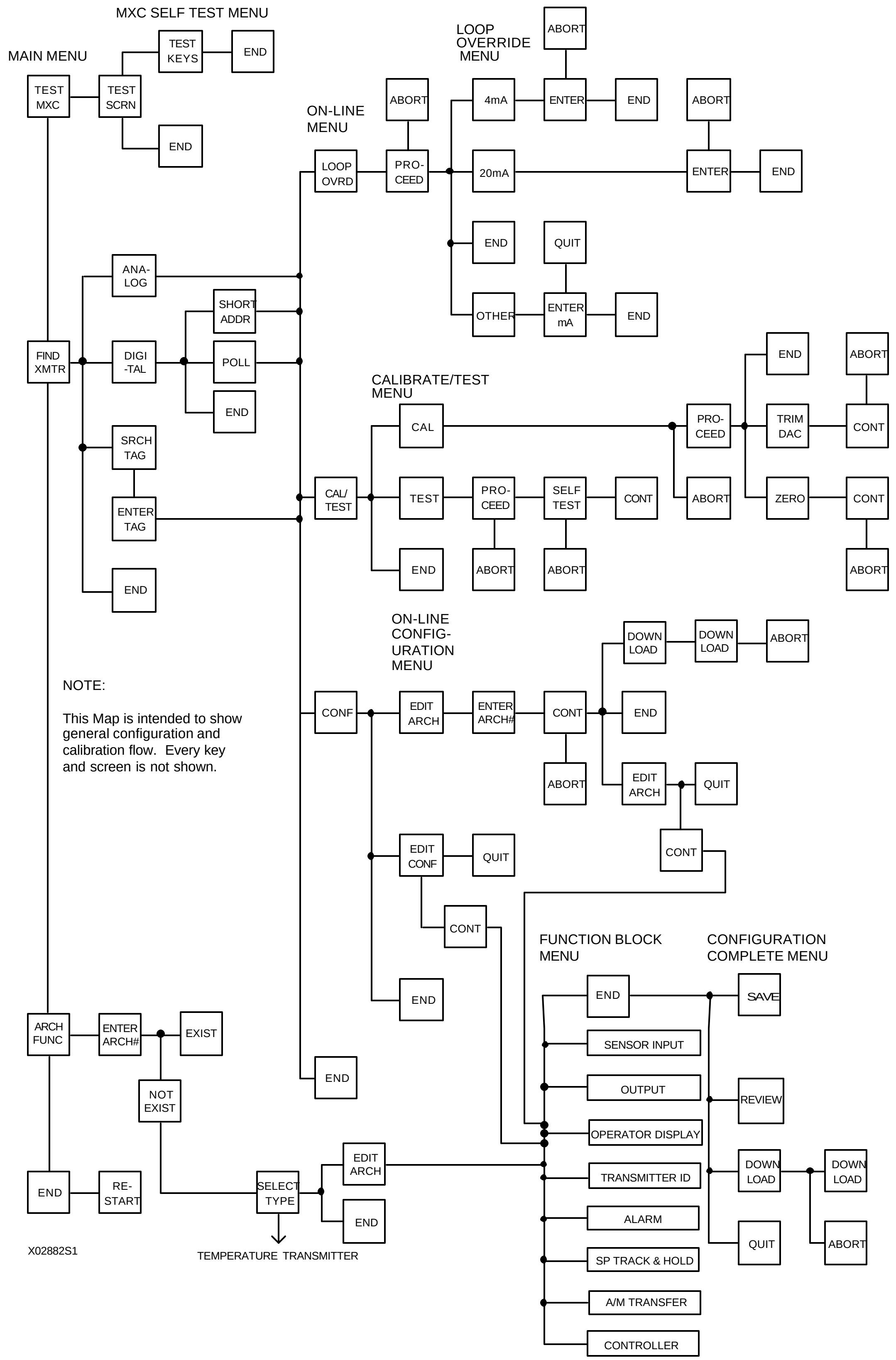


FIGURE 2-3 Parameter Map, MXC/Model 344

3.0 INITIAL TRANSMITTER SET-UP

Before operating a Model 344 on-line, the instrument should be commissioned using the MXC and set-up either at the bench or in the field. Commissioning consists of checking that the transmitter and the loop are operational and that all configuration information is correct. This section contains step-by-step procedures describing commissioning of the transmitter. For an in-depth discussion of transmitter configuration, refer to Section 5.1 On-Line Operation.

3.1 COMMISSIONING TRANSMITTER ON THE BENCH OR IN THE FIELD

A Model 344 can be commissioned either before or after installation into the loop. Commissioning on the bench before installation is suggested. A complete transmitter functional test can be performed and configuration procedures can be practiced. If commissioning after installation, install the transmitter as described in Section 4 and then return to this section. Configuration data for the transmitter will be needed.

To commission the transmitter on the bench, make the connections shown in Figure 3-1. To commission the transmitter in the field, make the connections shown in Figure 3-2 or those shown in Section 4.3.3, Figure 4-1, 4-2, or 4-3. Connect the MXC in the loop either across the current sense resistor or, often more conveniently, across the two signal terminals of the Model 344 (non-hazardous area only).

3.1.1 Test Equipment Needed

TEST EQUIPMENT	DESCRIPTION (see Specifications, Section 8.3.2)
Power Supply	12 to 42 Vdc, see Section 4.3.4
Multimeter:	Accuracy of at least .05% to check calibration
Current	Range: 4 to 20 mA to measure loop current
Voltage	Range: 10-40 Vdc to measure power supply and loop voltage
Current Sense Resistor	250 to 1100Ω to support HART digital communications
Configuration Device	Moore XTC Communicator (MXC)
User Configuration	Configuration data for transmitter under test

NOTE

Test equipment should be 2 to 10 times more accurate than the desired transmitter accuracy.

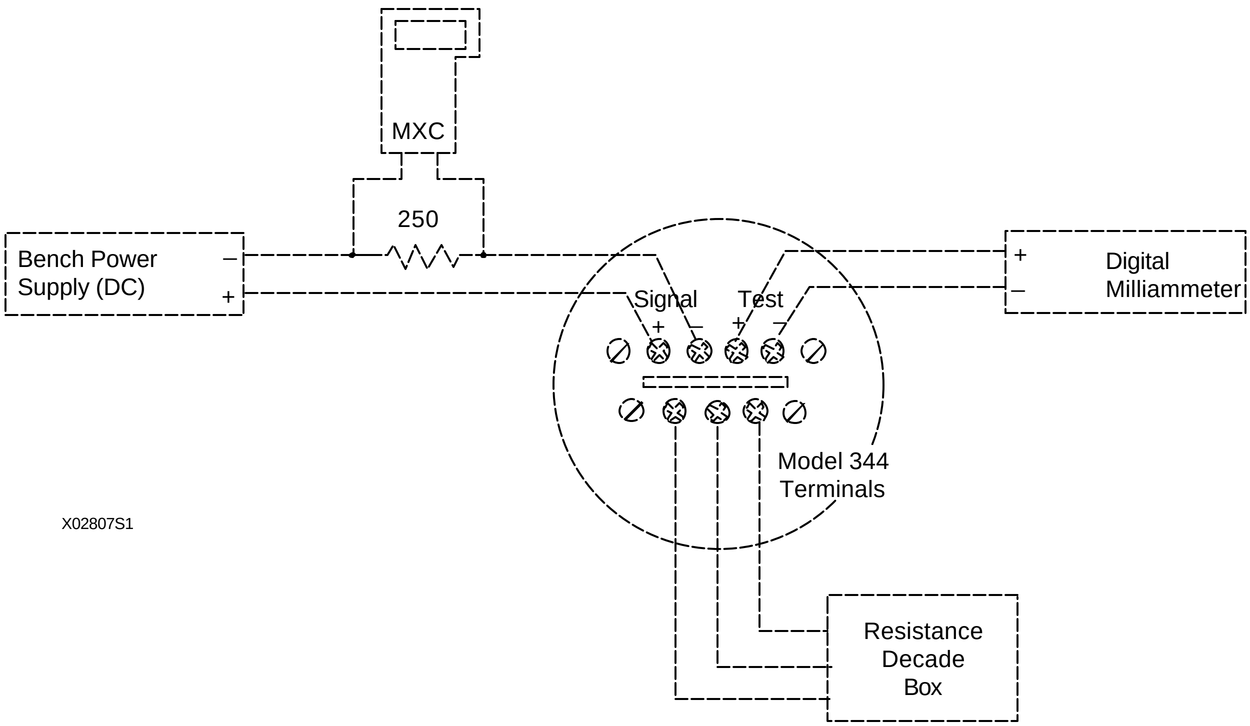


FIGURE 3-1 Bench Test Connections

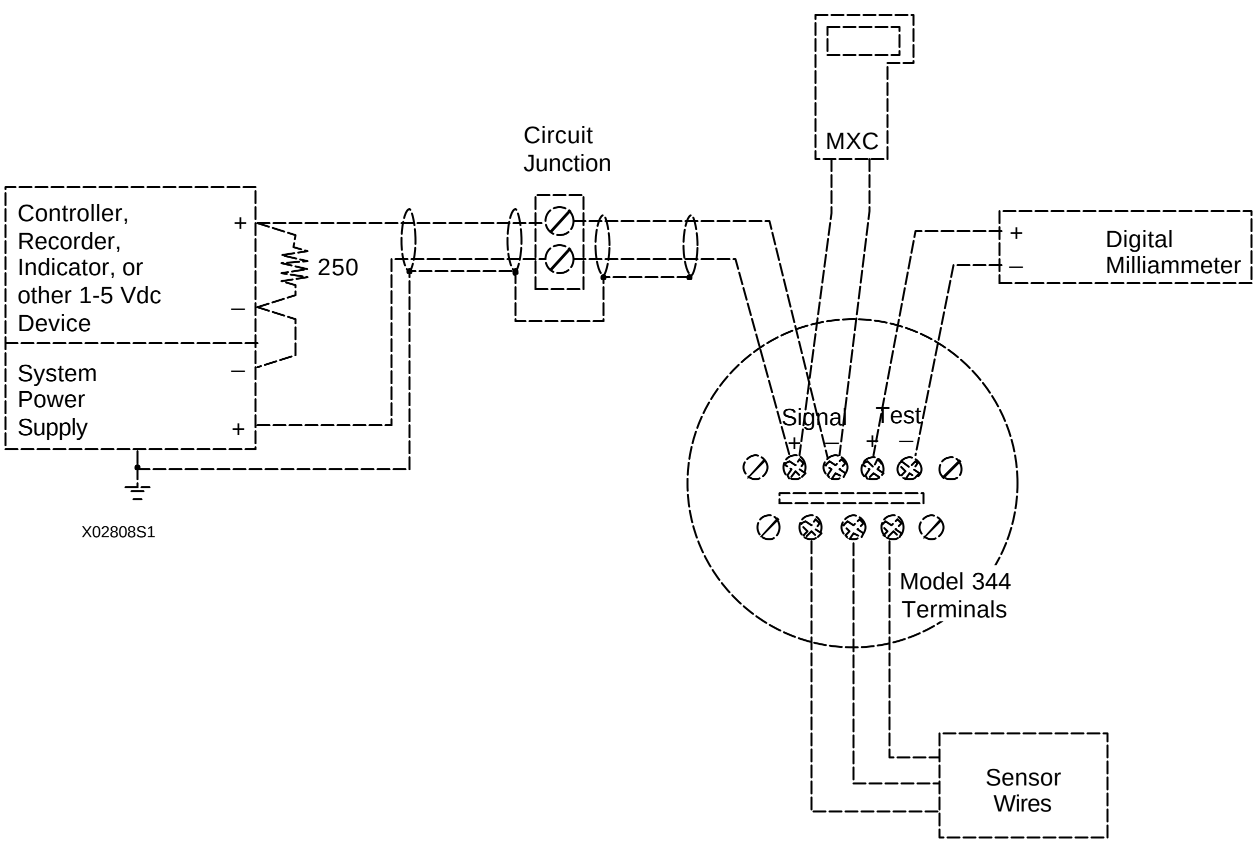


FIGURE 3-2 Typical Field Test Connections

3.2 ESTABLISHING COMMUNICATION

1. Connect the transmitter as shown in either Figure 3-1 or 3-2.

2. Apply power to the loop.

```
     SELECT FUNCTION

FIND   ARCH   TEST
XMTR   FUNC   MXC    END
```

3. Press and momentarily hold the MXC's ON key. The first screen that will appear after the initial power up screens is the Main Menu, shown adjacent. Press FIND XMTR (F1) to have the MXC initially establish communication with the Model 344.

```
SEARCH FOR WHAT TYPE
OF TRANSMITTER?
ANA-   DIG-   SRCH
LOG    ITAL    TAG    END
```

4. From the next screen, select either Analog, Digital, or Search Tag to begin communication with the transmitter. Read the following and then press one of the four following keys (F1, F2, F3, or END).

   ANALOG (F1) - Press to search for an analog mode transmitter. Analog mode is used when there is one transmitter in the loop and it has an address of zero. If all Point-to-Point Network connections are correct, when the MXC finds a transmitter with an address of “0”, the MXC will display the ID and TAG. Go to Step 6.

   If a problem exists in the Transmitter or Network Wiring, the MXC will show “NO TRANSMITTER FOUND”. Go to Section 6.3 Troubleshooting to confirm and resolve wiring problems.

   DIGITAL (F2) - Press to search for a digital (multi-drop) mode transmitter. Digital mode allows up to 15 transmitters to be connected to the loop. Each transmitter in a loop is assigned a unique address between 1 and 15. Go to Step 5.

```
ENTER TAG TO SEARCH
WITH:  ▫
                    EN-
<      >     QUIT   TER
```

   SRCH TAG (F3) - Press to search for a specific transmitter. Search can be used when the transmitter is in either Analog or Digital mode. Type the tagname (8 character alphanumeric string) of the transmitter that is to be configured or interrogated and press ENTER (F4). To edit the tagname, use the arrow keys to select any character that needs to be changed. Go to Step 6.

   If a problem exists in a transmitter or loop wiring the MXC will show “NO TRANSMITTER FOUND”.

   END - Press to return to the previous screen.

NOTE

Analog and Digital modes are discussed in detail in Section 4.

```
SHORT OR LONG FORM
ADDRESS?
SHRT   LONG
ADDR   ADDR   POLL   END
```

5. The MXC will next prompt for a digital method of searching. Press one of the following keys.

   SHRT ADDR (F1) - Press and then enter the short address (1-15) stored during configuration.

```
ENTER TRANSMITTER
ADDRESS (1-15) ▫
                     EN-
 <           END     TER
```

IMPORTANT

The factory default setting for the short address is 0, analog mode.

```
ENTER TRANSMITTER
ADDRESS: ▫
                     EN-
 <           END     TER
```

   LONG ADDRESS (F2) - Press and then enter the long address stored in memory at the factory. (The long address, the Dev. ID shown in the On-Line Menu and the XMTR. ID shown by polling are the same.) This address can not be altered.

```
     SEARCHING FOR
      TRANSMITTER
                         ∞
      PLEASE WAIT
```

   POLL (F3) - Press to instruct the MXC to look for any live addresses on the multi-drop network (1-15). While the MXC is searching for one or more transmitters, it will display SEARCHING. The MXC will then display the long and short addresses of all live transmitters on the network; select one by pressing the SELECT (F4) key.

```
XMTR ID: 210100044F
TAG: MPCO 340  ADD: 01
LAST   NEXT          SEL-
XMTR   XMTR   END    ECT
```

   To view each of the live transmitters, press the LAST XMTR and NEXT XMTR keys to scroll forward and backward. Each screen will show the transmitter ID number (i.e. device ID or long address in hexadecimal), tagname, and short address. Check IDs against user documentation to confirm that all transmitters are present

   If a problem exists in a transmitter or its wiring it will be excluded from the poll. If a major fault exists in the network wiring, the MXC will display the warning message “NO TRANSMITTER FOUND”. Go to section 6.3 Troubleshooting to confirm and resolve wiring problems.

6. Communication has now been established between the transmitter and MXC and the transmitter's configuration has been uploaded to the MXC's On-Line Memory.

```
WOULD YOU LIKE TO
SAVE TRANSMITTER
DATA  IN
ARCHIVES        NO     YES
```

```
ENTER ARCHIVE NUMBER
(0-99):
                      EN-
 <      >     END     TER
```

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP   CAL/   CON -
                      END
OVRD   TEST    FIG
```

The next screen to appear is used to save the configuration to an archive. If the configuration is to be edited, press YES (F4) to save the configuration in case a mistake is made. The next screen will prompt for an archive number (0-99). The archive number chosen will be the location where the MXC stores the transmitter's configuration data. Archiving will be discussed in more detail in the Off-Line portion of section 5.

The MXC can now be used to calibrate or configure the transmitter, monitor loop parameters, or test loop functionality. Section 5 of this Manual describes configuring and monitoring of the transmitter, and calibration is described in Section 6. The screen selections to choose the options of configuration, calibration, and loop checkout are found on the On-Line menu screen.

3.3 TESTING THE TRANSMITTER, MXC, AND THE LOOP

The test routines available through the MXC are used to verify that the Transmitter, the MXC, and the loop are all working properly. Whenever a problem with any of the instruments or the loop is suspected, test the equipment to make sure there are no component failures. The test functions can be accessed in two locations in the MXC, and these are described below.

3.3.1 MXC Testing

```
      SELECT FUNCTION

FIND  ARCH   TEST
XMTR  FUNC   MXC    END
```

```
MXC SELF TEST

TEST  TEST
KEYS  SCRN           END
```

```
PRESS ANY KEY TO
CONFIRM CONTACT
_ _ _ _ _ _ _ _ _ _ □      END
                          TEST
```

1. Press and momentarily hold the MXC's ON key. The Main Menu will appear.

2. Press TEST MXC (F3) to display the MXC Self Test screen.

3. Press one of the following keys.

   TEST KEYS - Press to test MXC keys. At the next screen, press any key on the keyboard and the screen will display a character associated with that key. The screen will show up to 10 characters before erasing the oldest.

```
MXC SCREEN TEST
ABOUT TO BEGIN
```

```
MXC SCREEN TEST
  COMPLETED
```

TEST SCRN - Press to test all screen segments. When this key is pressed, the MXC displays the "Begin" message to the left, then lights all the segments, turns them all off, displays the "Completed" message, and then returns to the original test screen.

END - Press to exit the test mode and return to the Main Menu screen.

3.3.2 Transmitter Testing

Although the Transmitter continuously performs an on-line self test, a more extensive self test can be performed after communication with the MXC has been established.

```
CALIBRATE / TEST

        CAL    TEST   END
```

```
TEST - PERFORMS
DIAGNOSTIC TEST ON
TRANS-          A-     PRO-
MITTER          BORT   CEED
```

```
WARNING!  SELF TEST
MAY BUMP TRANSMITTER
OUTPUT          A-
                BORT   CONT
```

```
TRANSMITTER PASSED
TRANSMITTER SELFTEST
                       CONT
```

1. At the On-Line Menu, press CAL/TEST (F2) to display the Calibrate and Test selections.

2. At the Calibrate/Test Menu, press TEST. A Test caution screen will appear. Press one of the following:

   ABORT - Press to return to the Calibrate/Test Menu.

   PROCEED - Press to continue the self test. A warning screen will be displayed then a message states that the test is occurring. After the test, the MXC will show whether or not the transmitter has passed or failed the self test.

   If the MXC indicates that the Transmitter has:
   Passed - Press CONT then END.
   Failed - Check installation wiring thoroughly. Go to Section 6 for troubleshooting suggestions.

3. When the MXC displays the Transmitter's ID (On-Line Menu), press the STATUS Key to check for Transmitter errors. If an error is present, the ERROR Key (F2) will be displayed. Press ERRORS (F2) to check for ROM, RAM, EEPROM, TIMER and SENSOR errors. Refer to Section 6.3 Troubleshooting to confirm and resolve the error.

4. If the alarm function is enabled, press ALARM (F1) to check the ALARM OUT OF SERVICE status.

3.3.3 Loop Testing

Testing the loop involves making sure that the Transmitter is sending out the proper current signal and that the other elements in the loop are receiving this signal. The Loop Override mode is used to test the loop.

```
LOOP OVERRIDE SETS
TRANSMITTER OUTPUT
TO ENTER-
ED VALUE      END      CONT
```

```
WARNING!  SELF TEST
MAY BUMP TRANSMITTER
OUTPUT        A-
              BORT     CONT
```

```
LOOP OVERRIDE - CHOOSE
CURRENT OUTPUT LEVEL
4 MA  20 MA  OTHR  END
```

1. At the On-Line Menu, press LOOP OVRD. The adjacent screen will be displayed. Press CONT and then PROCEED.

2. Choose either 4 mA or 20 mA from the menu, or choose OTHR to enter another value. After a value is entered, the Transmitter will output the value chosen. Read the analog current value on a:
   - Recorder or control station in the loop
   - Milliammeter connected in series in the loop
   - Milliammeter connected to the TEST terminals (Figures 3-1 and 3-2)
   - Analog Voltage may be read on a voltmeter connected across the sense resistor.

NOTE

This is intended as a functional test. To check calibration accuracy a DMM of at least .05% accuracy must be used.

If the transmitter is not working properly, try to recalibrate it (see Section 6.1).

3.4 REVIEW CONFIGURATION DATA

Before placing the Transmitter on-line, check that the proper configuration information has been stored.

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP   CAL/   CON -
OVRD   TEST   FIG     END
```

1. Establish communication between the Transmitter and MXC.

2. Using the MXC screens, compare the uploaded configuration with user's configuration documentation.

1) At the On-Line Menu, press CONFIG to access the function blocks. Continue through the menu sequence until reaching the Function Block Menu.

2) Check the information in the eight function blocks listed below. Edit values as needed while reviewing.

3. Archive the revised configuration in the MXC

4. Download the configuration to the Transmitter.

TRANSMITTER FUNCTION BLOCKS*

SENSOR INPUT
- Input Type
- Measured Variable Units
- Range Lo & Hi
- Damping
- Burnout Direction

OPERATOR DISPLAY
- Process Variable Units
- Range Lo & Hi
- Auto Rerange
- Local Display Code

TRANSMITTER ID
- Tag
- Descriptor
- Message
- Date
- Device Serial Number
- Short Address

OUTPUT
- Failsafe Level

ALARM
- Alarm 1 Enable/Disable
- Alarm 1 SP
- Alarm 1 Type
- Alarm 2 Enable/Disable
- Alarm 2 SP
- Alarm 2 Type
- Self Clearing NaKS
- Alarms Out of Service

SP TRACK & HOLD
Tracking Setpoint
PUSP

A/M TRANSFER
Power-Up Mode
Automatic Only
Power-Up Valve

CONTROLLER BLOCK
Controller ON/OFF
Controller Type
Action
Prop. Gain
Time-Integral
Time-Derivative
Derivative Gain
Manual Reset
Manual Reset Track

* For more detailed information on these function blocks, refer to Section 5 and Appendix A.

3.5 CHECKING TRANSMITTER OUTPUT

At this point, check to be sure that the transmitter is reading the proper sensor input in the proper units.

1. Set the sensor input to the transmitter to a known value either by adjusting the process variable to a field mounted transmitter or the simulated input to a bench test transmitter.

```
VIEW WHICH VARIBLES

XMTR  CONT            END
```

2. With the On-Line Menu displayed, press the gray TRANS.VAR's key on the MXC keypad to display the VIEW WHICH VARIABLES screen.

```
P: 63.301%
S: 50.000%
V: 10.000%

                      END
```

3. Press one of the following keys depending upon controller activation:

   Controller Block ON: Press CONT (F2) to display the controller variables.
   P - Process
   S - Setpoint
   V - Valve

```
M: 76.534 deg F
I:  4.8377 mA
P: 76.534 deg F

                      END
```

   Controller Block OFF: Press XMTR (F1) to display the process variables.
   M - Measured Variable
   I - Current (mA)

P - Process Variable

4. Check these Transmitter Variables to ensure the readings are correct.

5. Press END (F4) to return to the main menu.

4.0 INSTALLATION

This Section describes installation of a Model 344 Temperature Transmitter. Topics include: receipt of shipment, installation considerations, and mechanical and electrical installation.

IMPORTANT

The installation must conform to the National Electrical Code and all other applicable construction and electrical codes.

Refer to the installation drawings in Appendix B when locating a Transmitter in a hazardous area.

4.1 EQUIPMENT DELIVERY AND HANDLING

4.1.1 Factory Shipment

Prior to shipment, a Transmitter is fully tested and inspected to ensure proper operation. It is then packaged for shipment. Most accessories are shipped separately.

4.1.2 Receipt of Shipment

Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be immediately recorded on the carrier's copy of the delivery slip.

Each carton should be carefully unpacked and its contents checked against the enclosed packing list. At the same time, each item should be inspected for any hidden damage that may or may not have been accompanied by exterior carton damage.

If it is found that some items have been damaged or are missing, notify Moore Products Co. immediately and provide full details. In addition, damages must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

4.1.3 Storage

If a Transmitter is to be stored for a period prior to installation, review the environmental specifications in Section 8.3.5.

4.2 ENVIRONMENTAL CONSIDERATIONS

Many industrial processes create severe environmental conditions. The conditions at each transmitter location must be within the specifications stated in Section 8.3.5.

The Transmitter is designed to perform in harsh conditions, however, it is prudent to locate a Transmitter to minimize the effects of heat, vibration, shock, and electrical interference.

CAUTION

Exceeding the specified operating temperature limits can adversely affect performance and may cause damage.

4.3 INSTALLATION CONSIDERATIONS

Sections 4.3.1 and 4.3.2 outline basic considerations needed to achieve a successful mechanical/electrical installation. The remaining sections then provide detailed pre-installation information.

4.3.1 Mechanical

- Select the sensor input: thermocouple, millivolt, RTD, or resistance. Refer to Section 8.2 for sensor accessories.

- Determine if an optional digital meter for local monitoring of transmitter output is required. Refer to Section 8.1 for model designation or 8.2 for accessory part numbers.

- Determine physical mounting of Transmitter. Consider:
  - Using supplied bracket for pipe or wall mounting. Refer to Sections 4.4.1 and 4.4.2.
  - Transmitter-to-process mounting. Refer to Section 4.4.3.
  - Clearance for installation and maintenance and for reading the optional digital meter. Refer to Figure 8-3.
  - Need to rotate optional digital meter for viewing ease. Refer to Section 4.4.4.

  Refer to Figure 8-3 for transmitter dimensions and the figures in Section 4.4 for typical mechanical installations. Refer to Section 8.3 for mechanical and environmental specifications.

- Determine if an explosion-proof or intrinsically safe installation is required. Refer to Transmitter nameplate for electrical classifications and Sections 8.1, 8.3, and 4.6.

  An intrinsically safe installation requires user-supplied intrinsic safety barriers that must be installed in accordance with barrier manufacturer's instructions for the specific barriers used.

  Transmitter certification is based on the "Entity" concept in which the user selects barriers that permit the system to meet the entity parameters.

- Determine conduit routing. Refer to Section 4.4.5.

- Prepare installation site drawings showing the following:
  - Location of the Master Device (e.g. MXC or controller)
  - Location and identification of each Transmitter
  - Routing plan of signal cable(s)
  - Location of any signal cable junctions for connecting the MXC

4.3.2 Electrical

- Determine Transmitter operating mode (analog or digital) and type of Network needed; refer to Section 4.3.3.

- Determine minimum power supply requirements. Refer to Section 4.3.4.

- Select twinaxial cable type and determine maximum cable length. Refer to Section 4.3.5.

- Determine the need for network junctions. Refer to Section 4.3.6.

- Intrinsically Safe installations will need barriers. Refer to Section 4.3.7.

- Consider the effect of connecting additional equipment (e.g., recorder, loop powered display) to the network. Refer to Section 4.3.8.

- Select sensor cable type. Refer to Section 4.3.9.

- Consider the accuracy limitation of a 2-wire RTD. Refer to Section 4.3.10.

- Read Section 4.3.11 for grounding and shielding recommendations.

4.3.3 Transmitter Operating Mode and Network Type

A Transmitter will output either an analog current or an equivalent digital signal, depending upon the selected operating mode. The operating mode also determines the type of Network (Point-To-Point or Multi-Drop) to be installed, as shown in Table 4.1 and the following subsections. Select the operating mode during Transmitter configuration as described in the following subsections and Section 5.

TABLE 4.1 Operating Mode and Network

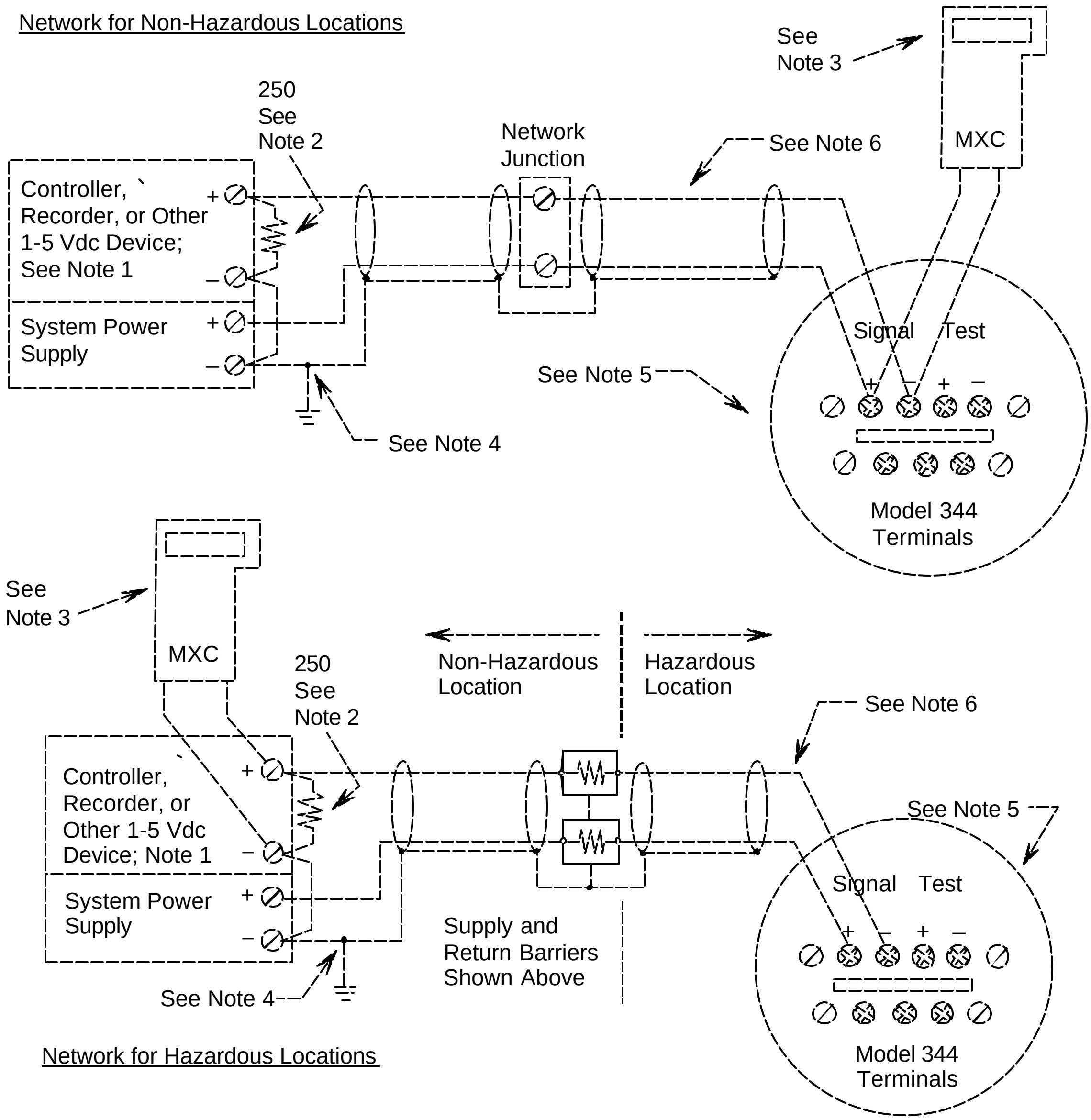
OPERATING MODE	NETWORK TYPE	NETWORK FIGURE(S)
Analog	Point-To-Point	4-1 and 4-2
Digital	Multi-Drop	4-3

4.3.3.1 Analog Mode

- The Transmitter outputs a 4-20 mA signal for input to devices such as controllers and recorders.
- Analog operation employs a Point-To-Point Network comprising a Transmitter, Primary/Secondary Master, and other non-signaling devices. Transmitter short address is 0 (zero).
- Use the optional Digital Meter for local indication of transmitter output.
- The Transmitter is factory configured for analog mode unless otherwise ordered.
- Use an MXC for configuration, diagnostics, and reporting the current process variable.

4.3.3.2 Digital Mode

- The number of Allowable Network Elements is:
  Primary and Secondary Masters - 1 each
  Transmitters - 1 to 15
- The process variable is transmitted digitally. The analog output of each transmitter is "parked" at 4 mA.
- The HART communication source can be a Primary or Secondary Master. A Primary Master can be used for data acquisition, maintenance, or control purposes. A Secondary Master, the MXC for example, may be used for configuration, diagnostics, and reporting current process variable.
- Use the optional Digital Meter for local indication of transmitter output.
- Place the transmitter in the digital mode by assigning it a SHORT ADDRESS from 1 to 15 when configuring the TRANSMITTER ID BLOCK with the MXC (see Section 5).



Notes:

1. The System Power Supply is shown separate from the host input device. In practice, it may be part of the host input device. The host input device can be either a HART or non-HART signaling device, a Primary Master or a Secondary Master.
2. Network resistance equals the sum of the barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.
3. Connect the MXC (a Secondary Master) to the loop only in the non-hazardous location. The MXC is a non-polar device.
4. Interconnect all cable shields and ground only at the power source.
5. For access to Model 344 terminals, remove shorter end cap.
6. Maximum loop cable length calculated by formula in Section 4.3.5.

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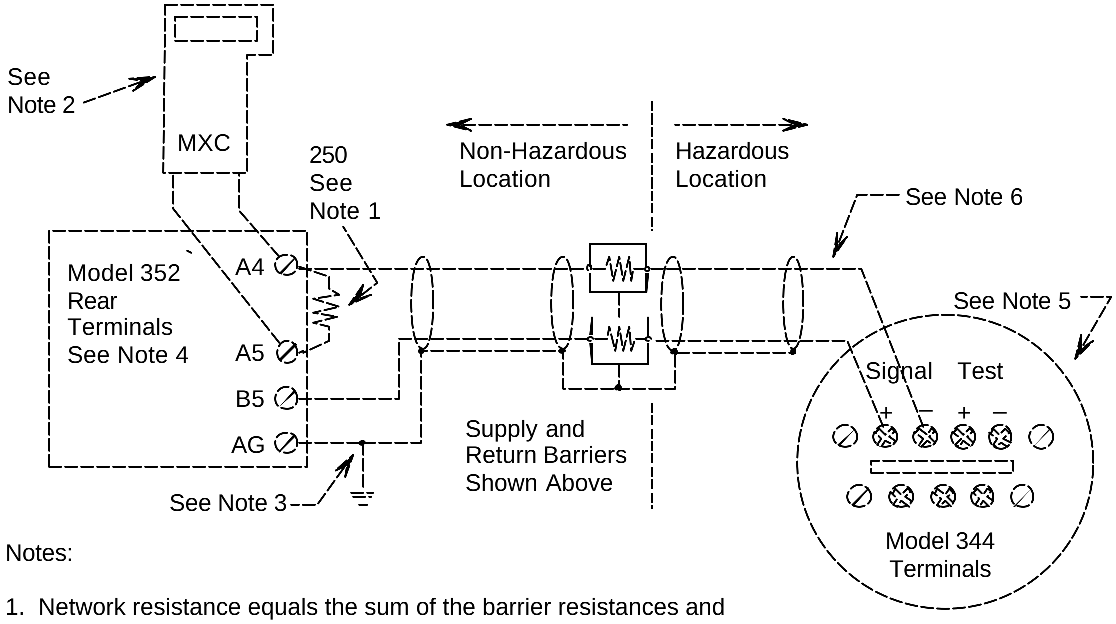
FIGURE 4-1 Point-To-Point Network (Analog Mode)



Notes:

1. Network resistance equals the sum of the barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.

2. Connect the M XC (a Secondary Master) to the loop only in the non-hazardous location. The MXC is a non-polar device.

3. Interconnect all cable shields and ground only at the power source.

4. Model 352 Rear Terminal Assignments
   A4 - Analog Input 1 (AI1+)
   A5 - Analog Input Common (AIC)
   B5 - Two-Wire Transmitter Power (+26 Vdc)
   AG - Case (Safety) Ground
   See Installation And Service Instruction SD352 or User's Manual UM352-1

5. For access to Model 344 terminals, remove enclosure end cap.

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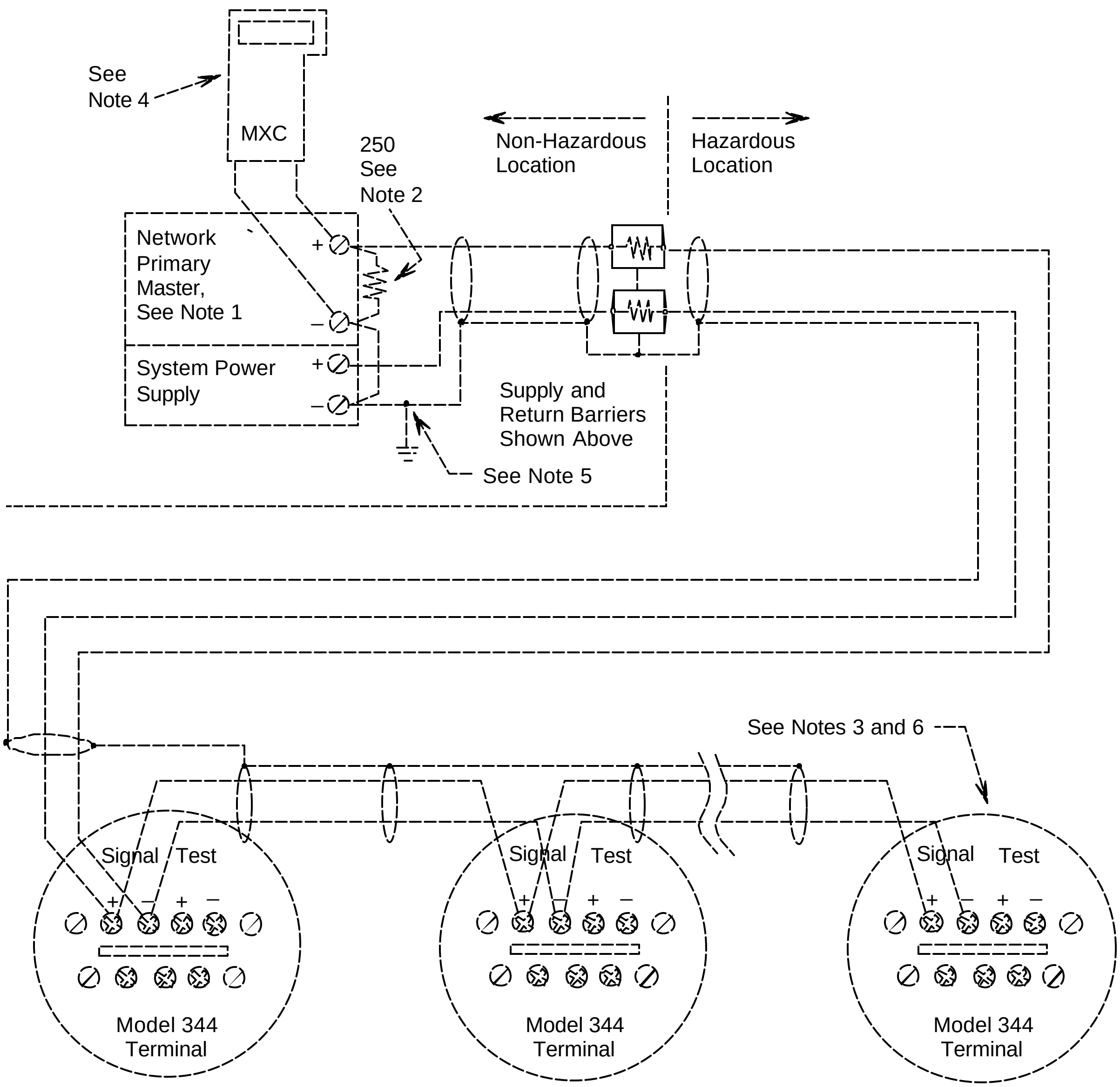
6. Maximum loop cable length calculated by formula in Section 4.3.5.

FIGURE 4-2 Model 352 SLDC and Model 344 Connections (Analog Mode)



Notes:

1. The System Power Supply is shown separate from the host input device. In practice, it may be part of the host input device. The host input device can either be a HART or non-HART signaling device, a Primary Master or Secondary Master.

2. Network resistance equals the sum of the barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.

3. A maximum of 15 transmitters may be connected. All must be configured for digital mode.

4. Connect the MXC (a Secondary Master) to the loop only in the non-hazardous location. The MXC is a non-polar device.

5. Interconnect all cable shields and ground only at the power source.

6. For access to Model 344 terminals, remove enclosure end cap.

FIGURE 4-3 Multi-Drop Network (Digital Mode)

4.3.4 Power Supply Requirements

A power supply is needed to power the Transmitter(s). The power supply can be:

- A separate stand-alone supply capable of powering several Transmitters. It can be mounted in a control room or in the field. Follow the power supply manufacturer's recommendations with regard to mounting and environmental considerations.

- Located in a controller (such as a Primary Master) or other station able to safely provide additional operating current and meet the power supply specifications of Section 8.3.2.

Determine needed power supply output voltage by calculating the Network Resistance and consulting Figure 4-4. It shows the minimum power supply voltage needed for the calculated Network Resistance.

The total Network Resistance is the sum of the Current Sense Resistance, end-to-end Barrier Resistance (if used), wire resistance, and any other resistances in the loop. The minimum Network Resistance (see Glossary) required to support HART communications is 250Ω. The maximum resistance is 1100Ω.

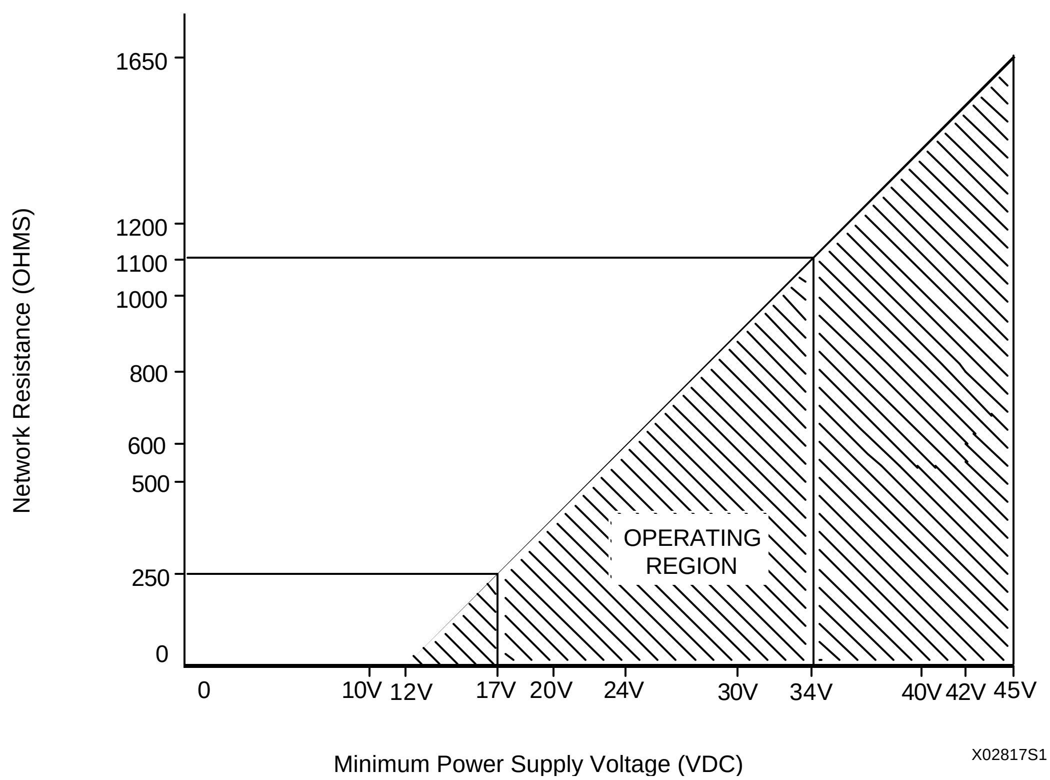


FIGURE 4-4 Supply Voltage Versus Network Resistance

4.3.4.1 Point-To-Point Network

Figure 4-4 defines an analog mode Transmitter's operating region for the allowable ranges of supply voltage and network resistance. Perform the following simple calculations to ensure that the power supply output voltage permits the Transmitter to remain within the indicated operating range.

1. Calculate the minimum power supply output voltage.

   The minimum network power supply voltage requirement is a function of Network Resistance and full scale current (22.5 mA), and is calculated by the following formula:

   Minimum Power Supply Output Voltage = 12 volts + (0.0225 x Network Resistance in ohms)

   Power supply output voltage must be greater than the calculated value. The minimum voltage across the input terminals of a Transmitter is 12 volts.

2. Calculate the maximum power supply output voltage.

   The maximum network power supply voltage is a function of Network Resistance and zero scale current (3.85 mA), and is calculated by the following formula:

   Maximum Power Supply Output Voltage = 42 volts + (0.00385 x Network Resistance in ohms)

   Power supply output voltage must be less than the calculated value. The maximum voltage across the input terminals of a Transmitter should never exceed 42 volts.

4.3.4.2 Multi-Drop Network

Perform the following simple calculations to ensure that the power supply output voltage permits the Transmitter to remain within its operating range.

1. Calculate the minimum power supply output voltage.

   Minimum network power supply voltage is a function of Network Resistance and the total current draw of all transmitters in the Network, and is calculated by the following formula:

   Minimum Supply Output Voltage = 12 volts + [(0.004 x number of transmitters on Network) x (Network Resistance)]

   Power supply output voltage must be greater than the calculated value. The minimum voltage across the input terminals of a Transmitter is 12 volts.

2. Calculate the maximum power supply output voltage.

   Maximum network power supply voltage is a function of Network Resistance and total current draw of all the transmitters in the Network, and is calculated by the following formula:

   Maximum Supply Output Voltage = 42 volts + [(0.004 x number of transmitters on Network) x (Network Resistance)]

Power supply output voltage must be less than the calculated value. The maximum voltage across the input terminals of a Transmitter should never exceed 42 volts.

The maximum number of Transmitters that can be connected to a Multi-Drop Network is fifteen. Each Transmitter is "parked" in a low current draw mode (4 mA) to conserve power. Ensure that the network power supply is capable of sourcing the total current consumed by the number of transmitters on the Network.

4.3.5 Cable Capacitance and Maximum Length

A cable length calculation is necessary when HART communication is to be employed. Cable capacitance directly affects maximum Network length.

4.3.5.1 Cable Capacitance

Cable type, conductor size, and recommended cable model numbers are stated in Section 8.3.3 Two-Wire Cable.

Cable capacitance is a parameter used in the calculation of the maximum length of cable that can be used to construct the Network. The lower the cable capacitance the longer the Network can be. Manufacturers typically list two capacitance values for an instrumentation cable:

1. Capacitance between the two conductors.
2. Capacitance between one conductor and the other conductor(s) connected to shield. This capacitance is the worst case value and is to be used in the cable length formula.

4.3.5.2 Maximum Cable Length Calculation

The maximum permissible single-pair cable length is 10,000 feet (3000 meters) or less as determined by the following formula:

$$L = \frac{65{,}000{,}000}{R \times C} - \frac{C_f + 10{,}000}{C}$$

Formula Definitions:

L: The maximum total length of cable permitted to construct the Network. L = Feet when C is in pF/ft. L = meters when C is in pF/meter.

R: The Network Resistance which is the ohmic sum of the Current Sense Resistance and Barrier Resistance (both Return and Supply), if any, in the Network and the resistance of the wire.

C: Cable capacitance per unit length between one conductor and the other conductor connected to the shield. C may be in pF/ft or pF/meter.

C_f: Total input terminal capacitance of Field Instruments; the Primary Master is excluded. C_f is given by the following formula:

$$C_f = (\text{sum of all } C_n \text{ values}) \times (5000)$$

Where C_n is an integer (e.g., 1, 2, 3) corresponding to the input terminal capacitance of a Field Instrument. C_n values are read from the following table. For Field Instruments without C_n values, use $C_n = 1$

FIELD INSTRUMENT CAPACITANCE	C_n VALUE
Less than 5000 pF	1
5000 pF to less than 10000 pF	2
10000 pF to less than 15000 pF	3
15000 pF to less than 20000 pF	4
20000 pF to less than 25000 pF	5
25000 pF to less than 30000 pF	6 (Model 344)

Example Calculation:

Assume a Network consists of a 344 and a Field Instrument ($C_n = 1$ and $C_n = 6$).

Let $R = 250\Omega$, $C = 40$ pF/ft., $C_f = (1 + 6) \times 5000 = 35{,}000$

$$\text{Then } L = \frac{65{,}000{,}000}{(250)(40)} - \frac{35{,}000 + 10{,}000}{40} = 5375 \text{ feet (1612.5 meters)}$$

4.3.6 Network Junctions

A Network Junction is shown in Figure 4-1. It is a wiring junction installed at a convenient point in the loop to facilitate wiring, testing, and troubleshooting. Typically the Junction is a conventional terminal block mounted on a panel with a protective cover, cabinet, or junction box to enclose and protect wiring terminals.

Multiple Junctions can be installed to provide field access terminals for the connection of an MXC.

Note the following:

- Network with Barriers - Locate a Junction anywhere along the Network in the non-hazardous area between a barrier and the Current Sense Resistor.

- Network without Barriers - A Junction may be located anywhere along the Network between the Current Sense Resistor and Transmitter.

- A Junction should be a simple electrical series connection containing NO repeaters or other devices (active or passive) that can degrade HART communications.

4.3.7 Safety Barriers

Installed safety barriers must comply with the following:

- Locate intrinsic safety barriers between the system power supply (e.g., Primary Master, if used) residing in the non-hazardous area and the transmitter(s) in the hazardous area.

- Combined or separate supply and return barriers may be used.

- For an intrinsically safe application, the DC voltage applied to the safe side of the barrier must be 0.6 Vdc less than the rated barrier working voltage.

- An Active Supply Barrier must be operated within its specified input working voltage.

- Barrier shunt impedance to ground shall not be less than 5000Ω for the HART range of frequencies (500 Hz to 2500 Hz).

- Barrier end-to-end resistance, stated by the manufacturer, is used in calculating the maximum Network cable length and minimum and maximum network voltages.

- The barrier shall be installed and wired in accordance with the manufacturers instructions.

Refer to Appendix B for hazardous area installation drawings.

4.3.8 Connection of Miscellaneous Hardware

Miscellaneous non-signaling hardware (e.g., recorders, current meters) may be connected to a Point-To-Point Network in accordance with the following list.

IMPORTANT

No non-signaling hardware (meters or measuring devices) may be connected to a Multi-Drop Network since the transmitters, in this mode, do not output an analog process variable.

- Miscellaneous hardware may be series or parallel connected to the Network according to its function.

- Miscellaneous hardware must be passive two-terminal devices.

- Miscellaneous hardware may not generate any type of noise or signals, other than noise that is inherent in resistive components.

- Individual miscellaneous hardware must meet the following requirements:

  - Capacitance to Ground .... 50 pF maximum
  - Resistance to Ground .... 1 MΩ minimum
  - Impedance if Series Connected .... Less than 10Ω
  - Impedance if Parallel Connected .... Greater than 50kΩ.

- The maximum number of miscellaneous devices per Network is 16. The combined electrical characteristics may not exceed the following:

  - Maximum capacitance to ground .... 800 pF
  - Minimum resistance to ground 62.5kΩ
  - Maximum series impedance 160Ω
  - Minimum parallel impedance 3125Ω

4.3.9 Determine Sensor Cable Requirements

If the Transmitter is mounted remotely from the sensor, the wire characteristics of the extension cable between the sensor and Transmitter will be different for thermocouple inputs than for RTD, ohm, or millivolt type inputs.

A. Thermocouple Sensor-to-Transmitter Extension Cable:

1) Select extension grade or thermocouple grade wire of the same calibration as the thermocouple: calibrations are T, J, E, K, R, S, N, B.

   - THERMOCOUPLE GRADE: Wire is made from same materials as thermocouple and subject to same limits of error as thermocouple.

   - EXTENSION GRADE: Noble and refractory thermocouple extension grade wire is made from inexpensive proprietary alloys that simulate the thermoelectric behavior of the actual thermocouple element over a limited range of temperatures.

     Base metal (T, J, K, E) thermocouple extension grade wire is made from the same materials as thermocouple wire; however, its use is restricted to a lower range of temperatures.

     For extension grade wire, the ambient temperature at the thermocouple head connection point may not exceed the temperature limits of the extension wire.

2) Cable Recommendation: FEP insulated and jacketed, twisted and shielded. Wire size should be 16 to 20 AWG.

B. RTD/Ohm Sensor-to-Transmitter Extension Cable

The Transmitter will compensate for the effect of lead wire resistance for 3 and 4-wire RTD's and for an Ohm (potentiometer) sensor when a 3-wire input connection is used. Input connections may be made with copper wire.

1) Cable Recommendation for RTD: Multi-conductor high temperature cable, overall braid shield with three copper TFE insulated conductors and TFE wrapped jacket. Wire size should be 24 to 16 (AWG).

2) Cable Recommendation for Ohm: Multi-conductor standard temperature instrumentation grade cable, overall braid shield, PVC insulated three copper conductors with PVC jacket. Wire size should be 24 to 16 (AWG).

C. Millivolt Sensor-to-Transmitter Extension Cable

Cable Recommendation: Multi-conductor standard temperature instrumentation grade cable, overall braid shield, PVC insulated twisted pair copper conductors with PVC jacket. Wire size should be 24 to 16 (AWG).

4.3.10 2-Wire RTD Accuracy Limitation

The use of a 2-wire RTD requires a careful analysis of the effects of extension lead wire resistance that can cause an error in temperature measurement.

A 2-wire RTD may be used when the resistance of the run of lead wire may be considered as an additive "constant temperature error" and the changes in lead resistance due to ambient temperature changes may be ignored.

The RTD sensor element is approximately one inch in length. The platinum wire at each end of the RTD is terminated in insulated copper lead wire. The lead wire extends beyond the sensor probe's protective metal sheath to a distance specified by the user. The lead wires are terminated in the Transmitter's terminal compartment when the probe assembly is mounted to the Transmitter. On a remote mounted Transmitter, the lead wires are terminated in the probe's connection head and extended by a second set of wires to the Transmitter.

The extension lead wire resistance is the sum of the resistances of both copper wires connecting the RTD element to the Transmitter.

Extension lead wire resistances will add to the resistance of the RTD causing a permanent somewhat higher temperature reading than actually exists at the RTD location. For example, if a 1 degree offset error is acceptable, then the maximum #24 AWG extension lead wire length permissible would be calculated for a 100 Ohm RTD (DIN Curve) as follows:

$$\text{Total length (L)} = \frac{\text{resistance change of RTD per 1°C}}{\text{resistivity of \#24 AWG per foot}}$$

$$L = \frac{0.39\ \text{ohms}}{0.0262\ \text{ohms per foot}} = 14.8\ \text{feet or } 7.4\ \text{feet for each lead.}$$

A 0.3° offset error is caused by an extension lead wire (#24) length of 2.23 feet.

As the calculations indicate, extension lead wire added to a 2-wire RTD can cause serious offset error. A 2-wire RTD should not be used without determining that the results are acceptable.

The effects of lead wire resistance are compensated for by the Transmitter when 3 and 4-wire RTDs are used.

4.3.11 Shielding and Grounding

The preferred method of grounding the loop cable shield is illustrated in Figures 4-1, 4-2, and 4-3.

The following guidelines represent proven grounding practices that will reduce magnetically coupled interference:

- Ground the cable shield at ONE point, as shown.
- Preferably, ground the cable shield at the Network power supply.
- When the cable shield is grounded at the power supply:

  a) The cable shield should remain open (not connected) at the Field Instrument (Transmitter).

  b) The shields of both cables at a Network Junction should be spliced. Alternatively, connect both to a terminal in the Box or Panel, provided that the terminal is isolated from ground.

- Point-To-Point Network

  Other permissible single point grounding schemes are:

  a) The cable shield may be grounded at the Ground Connection in the signal terminal compartment of the transmitter's electronic housing. It is recommended that a separate ground wire be run from this Ground Connection to building ground to ensure a dependable ground.

     The power supply (+) and (-) connections must be floated and the shields at Network Junctions must be connected as discussed above.

b) The cable shield(s) may be grounded at a Network Junction Box or Wiring Panel provided that the cable shields are connected to either a terminal or the Box or Panel frame, and the terminal or frame is grounded.
The power supply (+) and (-) connections must be floated and the cable shield at the transmitter must not be connected.

- Multi-Drop Network

If the Primary Master's power supply output is isolated from ground, the Network may be floated. The cable shield should be connected only to one point: the Primary Master's negative supply output.

- Sensor Cable

a) Shielded sensor cable should be used (remote mounted sensor) to minimize the effects of electric noise. The sensor wires should be twisted to minimize magnetic induced noise.

b) On a remote mounted thermocouple, if the thermocouple measuring junction is grounded to its sheath (which is also grounded), connect the sensor cable shield to ground as close as practical to the measuring junction.

c) On a remote mounted thermocouple, if a thermocouple measuring junction is ungrounded, ground the cable shield and the negative thermocouple wire to a common point as close as practical to the measuring junction.

d) Do not connect the cable shield to ground at the Transmitter's terminal compartment if the cable shield is grounded at the sensor assembly.

4.4 MECHANICAL INSTALLATION

This section describes the mechanical installation of a Transmitter and the installation of electrical conduit for wiring. Transmitter dimensions are given in Figure 8-3.

Mount a Transmitter in any position (orientation).

Be sure to allow sufficient clearance for:
- Installation of wiring
- Removal of the enclosure end caps
- Viewing of the optional Digital Meter

4.4.1 Pipe Mounting

A Transmitter can be mounted to a vertical or horizontal 2-inch pipe using the supplied mounting bracket.

1. Transmitter to Bracket Mounting

1) Refer to Figure 4-5 and align four mounting holes in the base of the enclosure with the four 0.281-inch diameter holes in the Bracket. Note that the transmitter can be mounted to the Bracket in four possible positions (90° apart) to the Bracket.

2) Using supplied 1/4-20 x 1/2 bolts, mount the transmitter to the bracket.

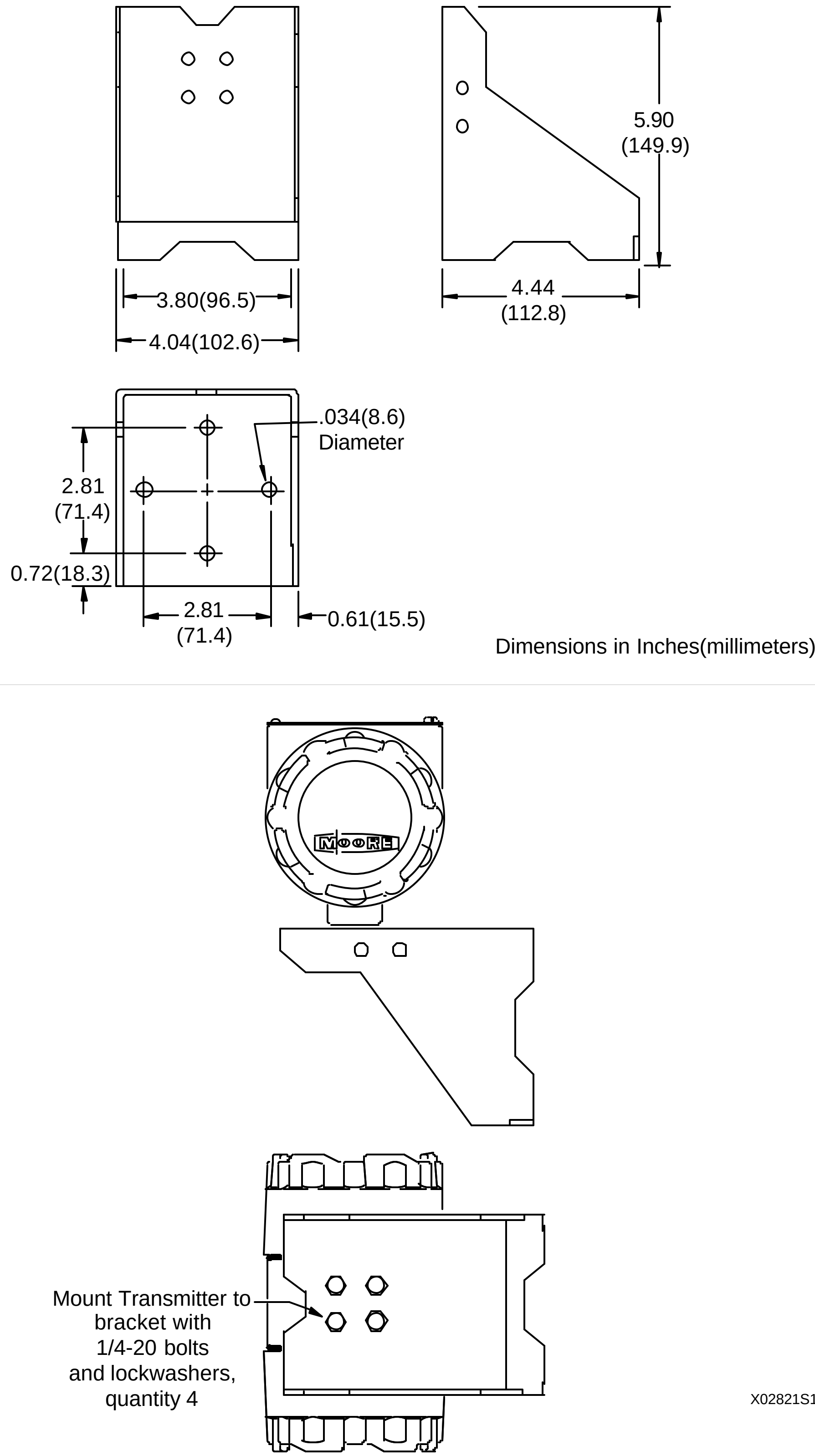


FIGURE 4-5 Dimensions, Mounting Bracket for Model 344

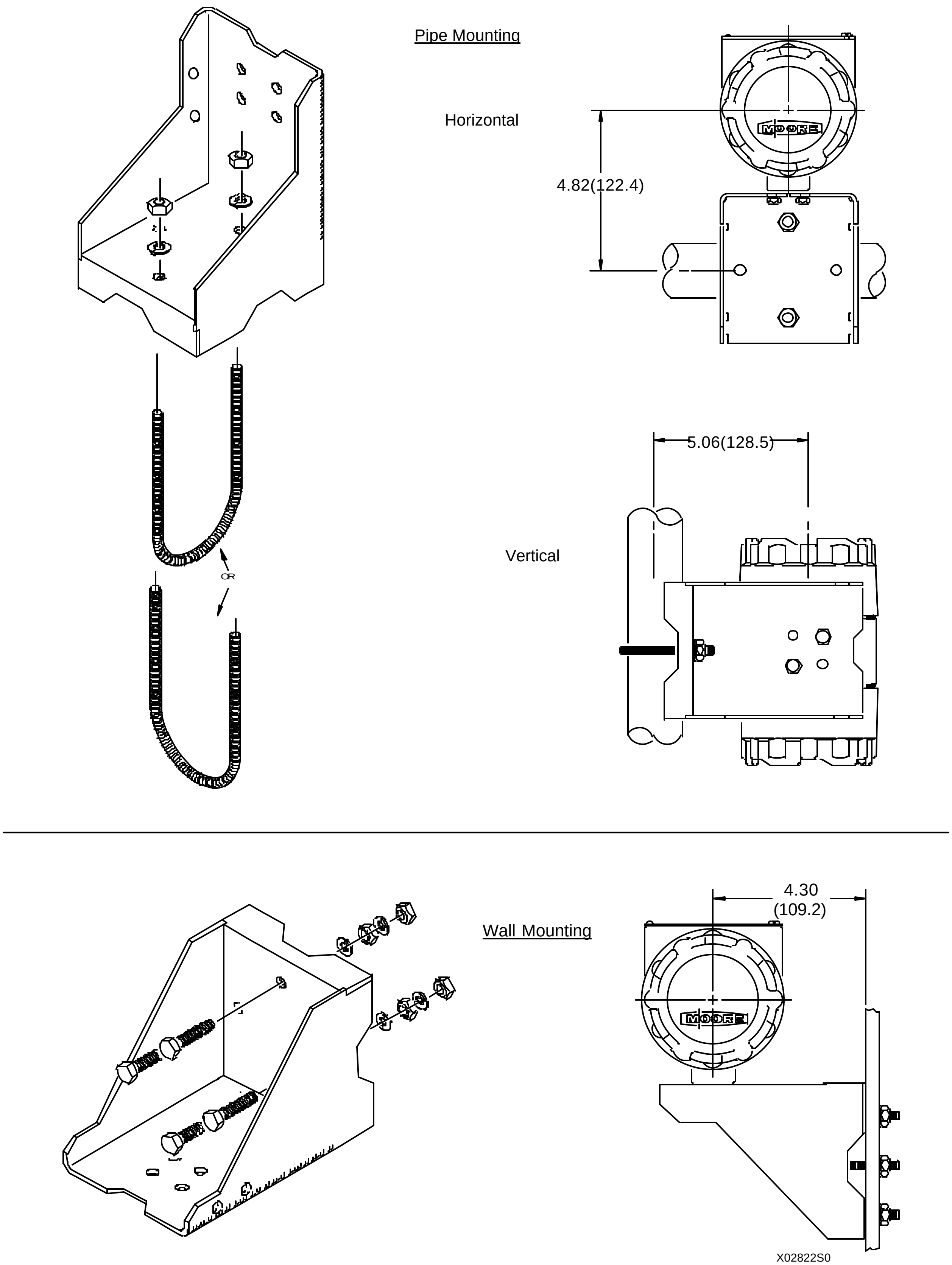

Pipe Mounting
Horizontal
4.82(122.4)
5.06(128.5)
Vertical
OR
Wall Mounting
4.30
(109.2)
X02822S0

FIGURE 4-6 Model 344 Mounting Configurations with Supplied Bracket

2. Bracket to Pipe Mounting

   1) At the selected location on the pipe, place the pipe-groove side of the mounting bracket against the pipe. See Figure 4-6.

   2) Slip the supplied U-bolt around the pipe and through one of the two pairs of mounting holes in the pipe-groove face plate of the bracket.

   3) Place a supplied washer and hex nut on each end of the U-bolt and hand tighten the nuts. Rotate the bracket around the pipe to place the Transmitter in the desired position, then secure the bracket to the pipe.

3. Reposition the Transmitter's local display (if any) to provide the best possible view of the display. Refer to Section 4.4.4.

4.4.2 Flat Surface Mounting

A Transmitter can be mounted to a flat surface using the supplied mounting bracket and user supplied 5/16-inch bolts.

Refer to Figures 4-5 and 4-6 and the following for mounting guidance:

1. Bracket To Flat Surface Mounting

   1) Refer to Figure 4-5 for the bracket mounting hole dimensions.

   2) Layout the mounting hole pattern on the selected area of the surface. Drill 0.344-inch diameter mounting holes to accept 5/16-inch bolts.

      The thickness of the mounting surface and bracket height above the surface are factors in determining the required length of the mounting bolts.

   3) Place the pipe-groove side of the bracket against the mounting surface site and align the bracket and surface mounting holes. Install the bracket with user supplied 5/16-inch bolts, washers, and hex nuts.

2. Transmitter To Bracket Mounting

   1) Mount transmitter to bracket as described in Section 4.4.1, step 1.

   2) Reposition the Transmitter's local display (if any) to provide the best possible view of the display. Refer to Section 4.4.4.

4.4.3 Direct Mounting to Process

The Transmitter can be mounted directly to the point of measurement and supported by the thermowell, extension fittings, and probe assembly.

IMPORTANT

It is recommended that high temperature anti-seize compound be applied to the threads of thermowells, extension nipples, union connectors, and sensor assemblies.

Refer to Figures 4-7 and 4-8 and the following for mounting guidance:

1. Unscrew the thermowell from the Sensor Assembly. Refer to the thermowell manufacturer's installation literature and install the thermowell at the measurement point.

2. Screw onto the thermowell the extension nipple and union (if any).

3. If required, install insulation around the surface area of the measurement point to limit the effects of heat radiating from the chamber, vessel, or pipe containing the process material.

4. Insert the probe assembly through the extension nipple (if present) and seat into the thermowell. Screw the probe nipple into the union (if present) or into the thermowell.

5. If it is desired to have terminal compartment access from the same direction as the Sensor Assembly, then screw an elbow-plus close nipple-plus coupling onto the probe nipple. See Figure 4-7.

6. Select one of the two conduit inlets and route the sensor leads extending from the probe into the terminal compartment of the transmitter. Do not connect the wires.

7. Screw the transmitter onto the threads of the probe's nipple or elbow fitting (if used).

8. Refer to Section 4.5 to connect the sensor wires to the appropriate terminals.

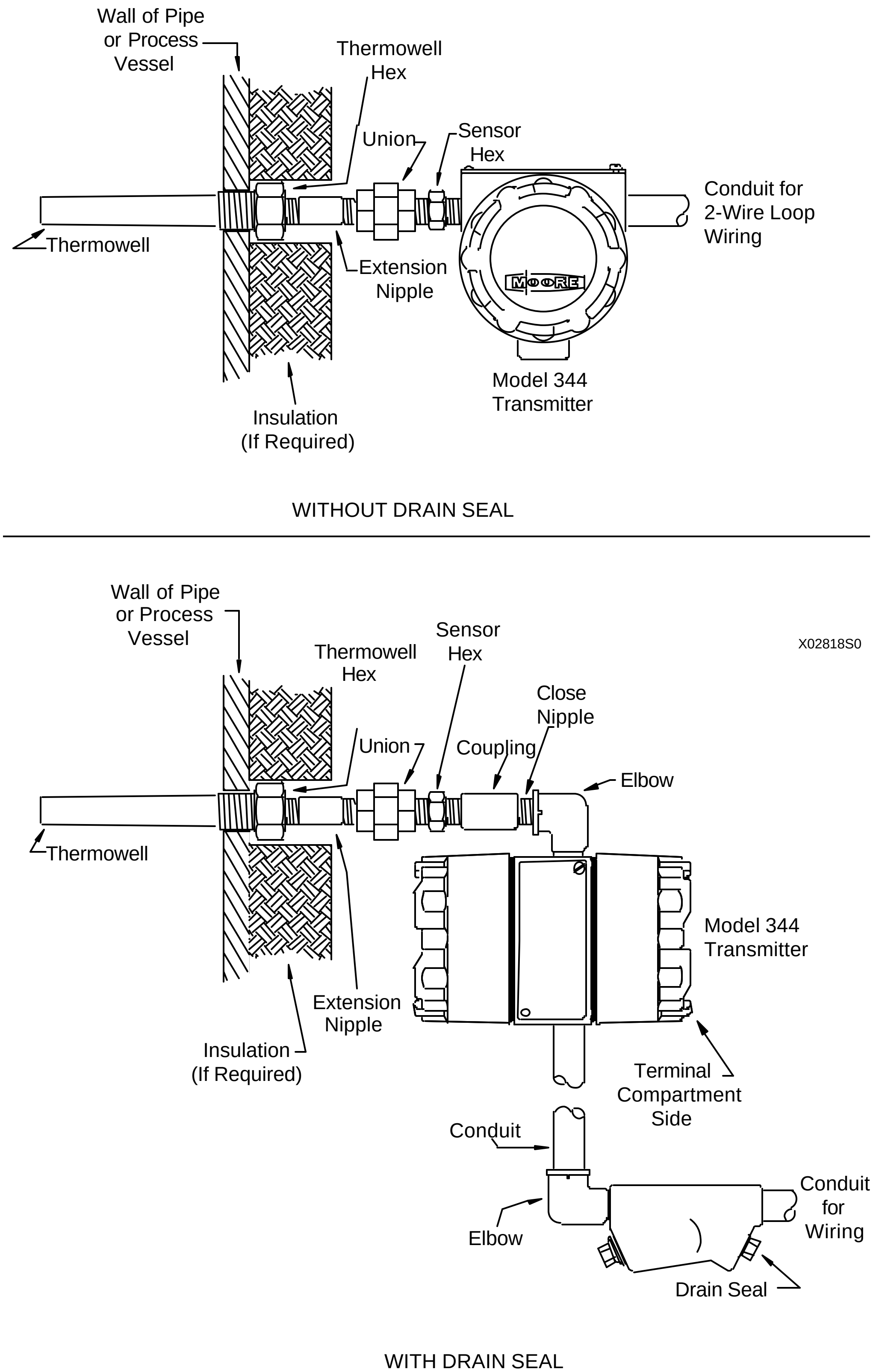
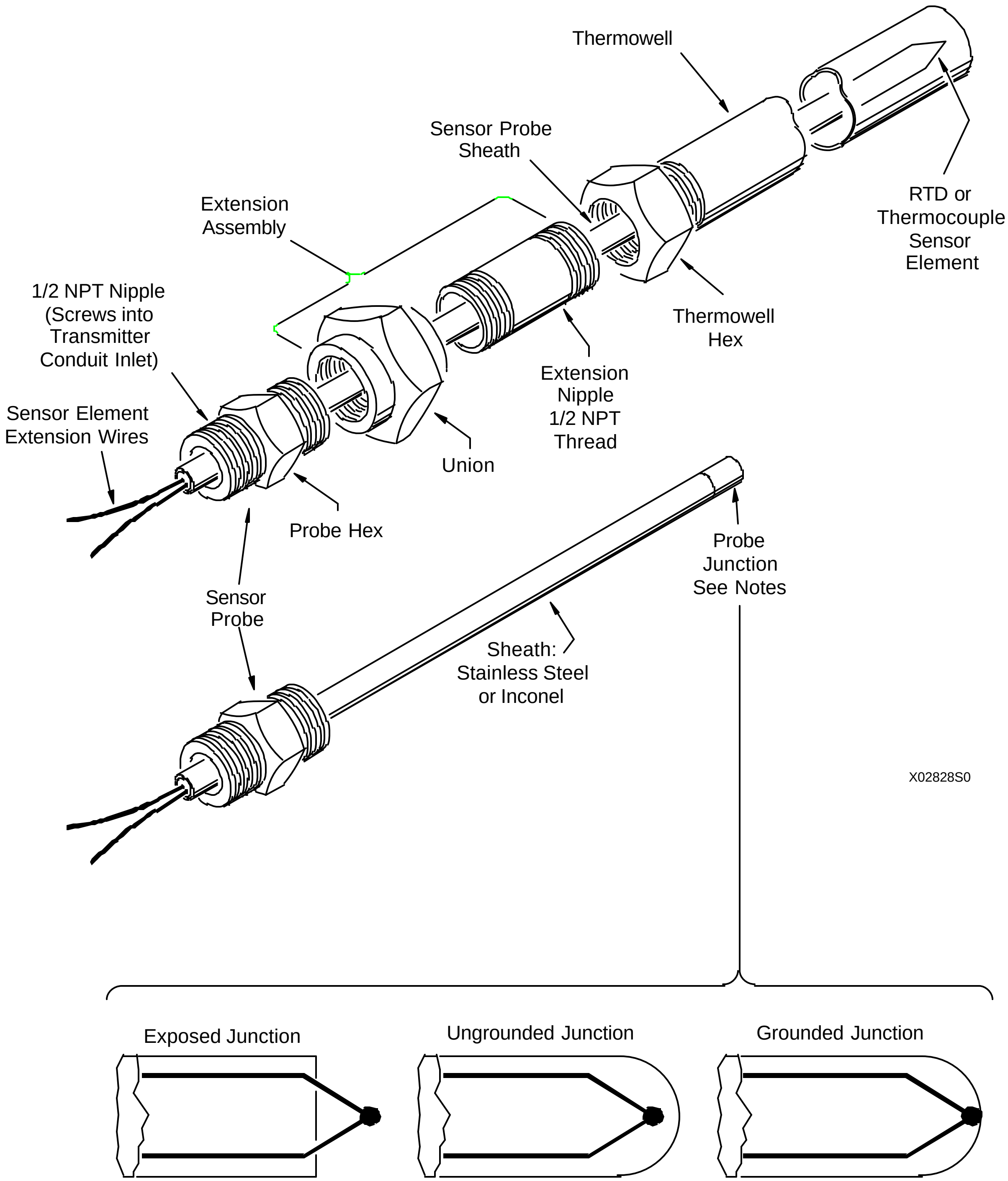


FIGURE 4-7 Transmitter-To-Process Mounting



Notes:

1. Three styles of thermocouple probe junctions are shown.

2. An RTD probe is a closed end tube only. RTD sensors are not grounded.

FIGURE 4-8 Sensor Assembly

4.4.4 Local Digital Meter Installation, Repositioning and Removal

Three procedures are provided in this section. Refer to Figures 4-9 and 4-10 as necessary.

IMPORTANT

Follow proper electronic circuit board handling procedures to avoid damage to the semiconductors by electrostatic discharge.

- Two procedures describe repositioning of an installed meter: A is for rotating the meter 180°, and B is for rotating the meter 90° clockwise or counterclockwise (actually ±78°).
- To remove a meter, perform procedure A, steps 1-5 and 9.
- To install a meter perform procedure C.

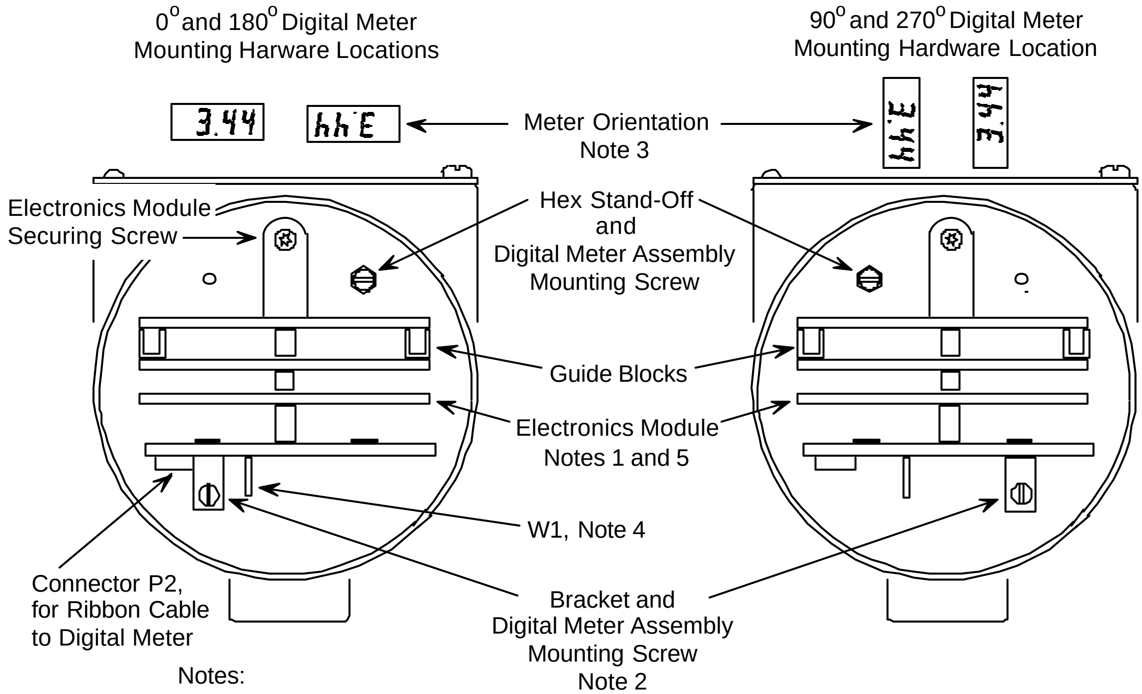
A. Rotate Meter 180°

1. Turn off power to transmitter and remove enclosure cap to access Digital Display.
2. Snap wrist strap on wrist and connect ground clip to an unpainted area on the Transmitter or mounting bracket.
3. Locate a short ribbon cable that connects the Electronics Module to the Digital Meter assembly, at connector J1 typically. Disconnect the connector at the Digital Meter assembly and the slide cable from cable slot.
4. Loosen (do not remove) upper right and lower left assembly retaining screws.
5. Gently rotate assembly counterclockwise to position upper right retaining screw in large hole in keyhole and carefully lift assembly clear of screw, then slide it clear of lower left retaining screw.
6. Rotate the assembly 180°, place under the retaining screws, rotate assembly clockwise, and tighten screws.
7. Position ribbon cable in closest cable slot and connect cable to connector J3.
8. Disconnect wrist strap's ground clip.
9. Replace enclosure cap and restore power to transmitter.

B. Rotate Meter 90° CW or CCW

1. Remove Digital Meter assembly as described in paragraph A, steps 1 to 5, above.
2. Remove the upper right 3.25-inch hex stand-off. Install the stand-off in the upper left mounting hole.

3. At the Electronics Module, remove the meter mounting bracket attached to the left corner of bottom circuit board . Install bracket in right front corner of that circuit board.



Notes:

1. Enclosure Cap and Digital Meter removed to show Meter mounting hardware.
2. Bracket screwed to the Electonics Module.
3. Meter orientations relative to Transmitter body are shown.
4. Jumper W1, Zero and Full Scale Pushbutton Enable/Disable:
   Enable - jumper pins 2 & 3
   Disable - jumper pins 1 & 2.
5. When installing an Electronics Module, guide blocks must engage guide posts in housing. P1 power connector on Module must engage connector on baseboard.

X028AAS0

FIGURE 4-9 Digital Meter Orientation and Mounting Hardware

4. Rotate the Digital Meter assembly either CW or CCW 90° (to the 90° or 270° position), slip the assembly under the retaining screws, and tighten both screws.

5. Position the cable in the cable slot and insert the cable connector into the closest connector (J2 or J4).

6. Replace the enclosure cap and restore power to transmitter.

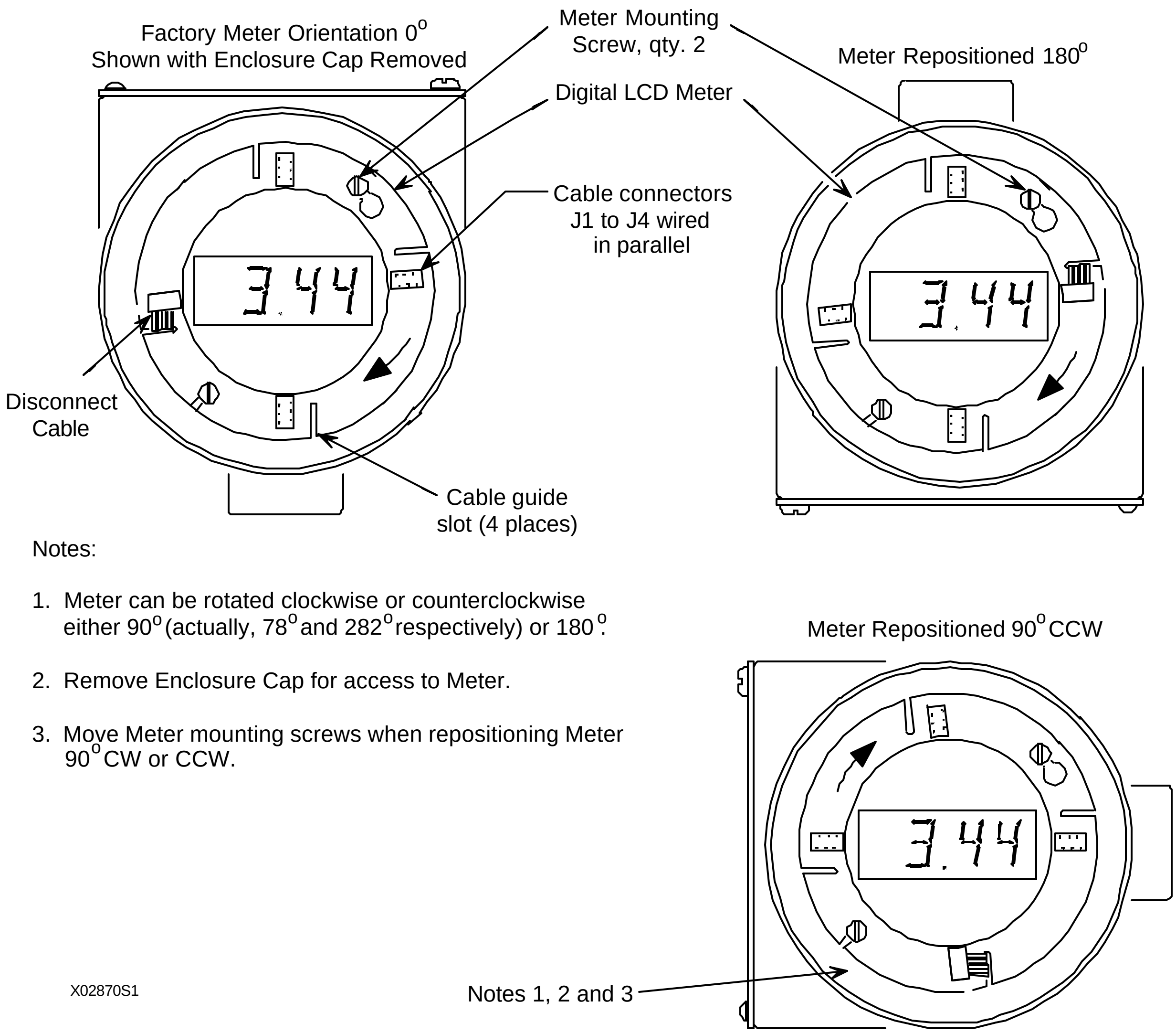


FIGURE 4-10 Digital Meter Repositioning and Removal

C. Installation

1. Turn off power to transmitter and remove the longer enclosure cap.

2. Snap wrist strap on wrist and connect ground clip to an unpainted area on the Transmitter or mounting bracket.

3. Determine desired meter orientation and perform either procedure A or B. Note the following when installing and positioning the short ribbon cable and when applying power to the transmitter.

NOTE

Pin 1 end of cable connector is identified by dark Red or Blue striped cable conductor. Pin 1 of Board “J” connector is identified by the “1” printed next to one corner of the connector.

At power-up, an automatic display test is performed which turns on all LCD segments for approximately 5 seconds. At the conclusion of the test, if the Transmitter is active, a numerical value will be displayed with an annunciator. If the Transmitter is configured as a Controller, additional annunciators may be displayed.

4.4.5 Electrical Conduit and Cable Installation

Electrical conduit and network, sensor, and power wire are supplied by the user. Access to electrical terminals is described in Section 4.4.5.3.

For conduit and cable routing, refer to the user's installation drawings. Installation of conduit and cabling should follow the guidelines given below.

4.4.5.1 Conduit

- Transmitter conduit inlets accept male conduit fittings. Refer to the Transmitter's nameplate and Section 8.1 to determine whether conduit threads are ½-14 NPT or M20 x 1.5.

  Seal ½ NPT fittings with TFE/PTFE tape; seal M20 fittings with a soft-setting sealing compound rated for at least 105°C (221°F).

- When routing conduit, avoid areas that might subject the conduit to chemical or physical abuse or areas with high EMI/RFI conditions.

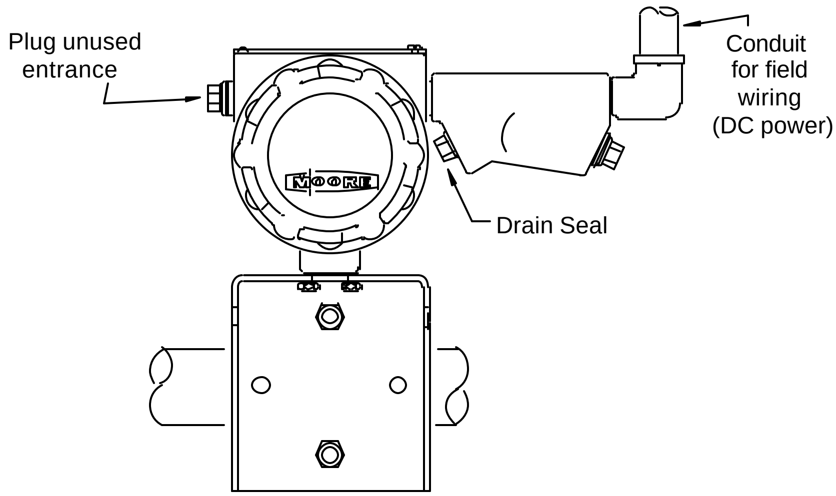
- Long sensor cable runs should be installed in conduit between the transmitter and sensor.

- Install sensor cable in conduit in areas of high electrical interference.

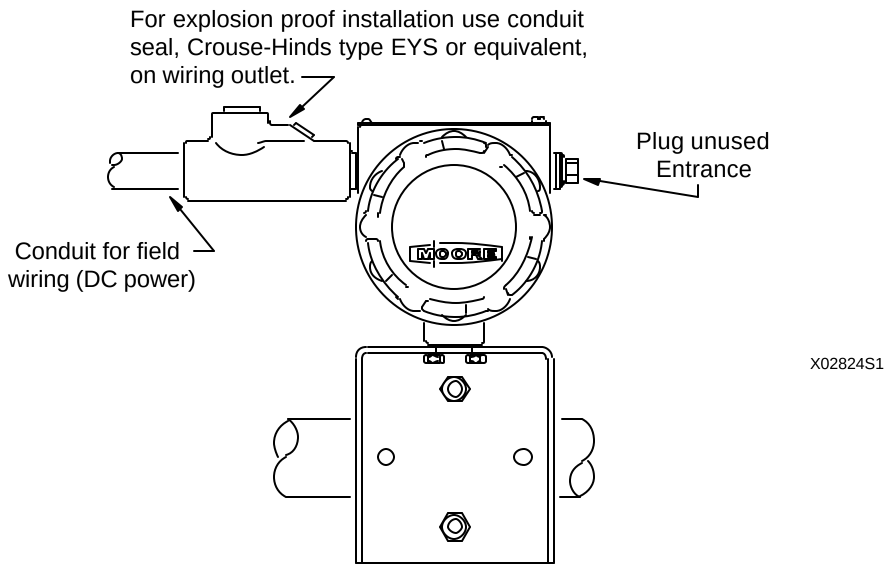
- Install conduit for field wiring.

- If a high humidity environment can exist and the transmitter is located at a low point in the conduit run, install drain seals at the transmitter's conduit inlets to prevent condensation from entering the Transmitter. See Figure 4-11.

- Remove all sharp edges or burrs from conduit that may damage wires.



Conduit Drain Installation



Explosion Proof Installation

FIGURE 4-11 Conduit Drain and Explosion Proof Installations

- Thermocouple wire must be handled with great care when being installed in conduit. Decalibration of the wire can result by cold-working the metal conductor, an effect that can occur when the wire is drawn through a conduit or damaged by rough handling or vibration.

4.4.5.2 Cables

- Mark or tag each signal cable conductor as either SIGNAL (+) or SIGNAL (-) to ensure correct connection at the Transmitter.
- Mark or tag each sensor wire to be connected to a remote mounted transmitter to indicate its specific transmitter terminal number (1, 2, 3) connection

  EXAMPLE: 3-wire RTD tag descriptors: RTD (+) #1, RTDI #2, RTD (-) #3
  Thermocouple tag descriptor: TC (+) #1, TC (-) #3

- Use pulling grips and cable lubricants for easier cable pulling. Pull cable through conduit into Transmitter terminal compartment.
- Do not exceed the maximum permitted pulling tension on the cables. Maximum tension is normally specified as 40% of the cable's breaking strength.
- Do not exceed the maximum conduit fill specified by the National Electric Code.

4.4.5.3 Access to Transmitter Terminal Compartment

Two terminal strips for signal (loop), MXC, test (milliammeter), and sensor connections are located inside the shorter enclosure cap; see Figure 1-1. To access the terminal strips, simply unscrew the enclosure cap protecting the terminal compartment.

This completes the mechanical installation.

4.5 ELECTRICAL INSTALLATION

This section describes loop wiring for Point-To-Point and Multi-Drop Networks. Refer also to Section 4.6 for installations in hazardous locations. Figure 4-12 shows signal and sensor termination terminal strips in the Transmitter's enclosure.

The following should already have been completed:

- Selection of either analog or digital operating mode and corresponding Point-To-Point or Multi-Drop Network; Section 4.3.3.
- Selection of a power supply; Section 4.3.4.
- Mechanical installation of Transmitter(s) installed; Section 4.4.
- Pulling of loop and sensor cables through conduit and into terminal compartment; Section 4.4.5.

Connect the transmitter to the loop as follows.

1. Access transmitter signal terminals by unscrewing the short enclosure cap.

2. As shown in Figure 4-12, there are two terminal strips:

   Upper Terminal Strip

   - SIGNAL (+) and SIGNAL (-): Transmitter Network Connections
   - TEST (+) and TEST (-): Analog test (milliammeter) connections

   Lower Terminal Strip

   - #1: RTD (+) or OHM (+); TC (+) or mV (+) sensor connections
   - #2: RTDI sensor connection
   - #3: RTD (-) or OHM (-); TC (-) or mV (-) sensor connections

3. Determine method of connection to transmitter signal (loop) terminals.

   Strip loop cable and conductors. Install ring tongue or spring spade terminals for #6 screws and the cable conductor gauge. If terminals will not be used, tin conductor ends and form a loop.

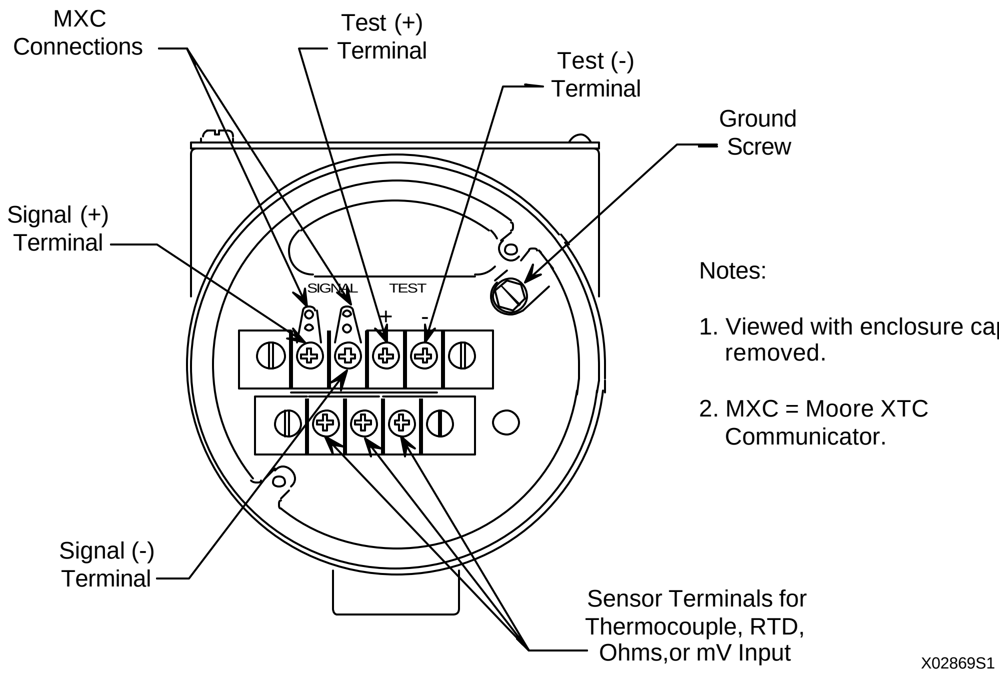


FIGURE 4-12 Signal (Loop) , Sensor, MXC and Test Terminals

4. Connect the loop cable to the SIGNAL (+) and (-) terminals inside the Transmitter's enclosure. Refer to Figure 4-1, 4-2 or 4-3 for the needed connections for the type of Network. Terminals will accommodate wire sizes up to 16 AWG. Attached to both signal terminals are lugs that facilitate the connection of the MXC Communicator. DO NOT connect signal wires to the lugs.

IMPORTANT

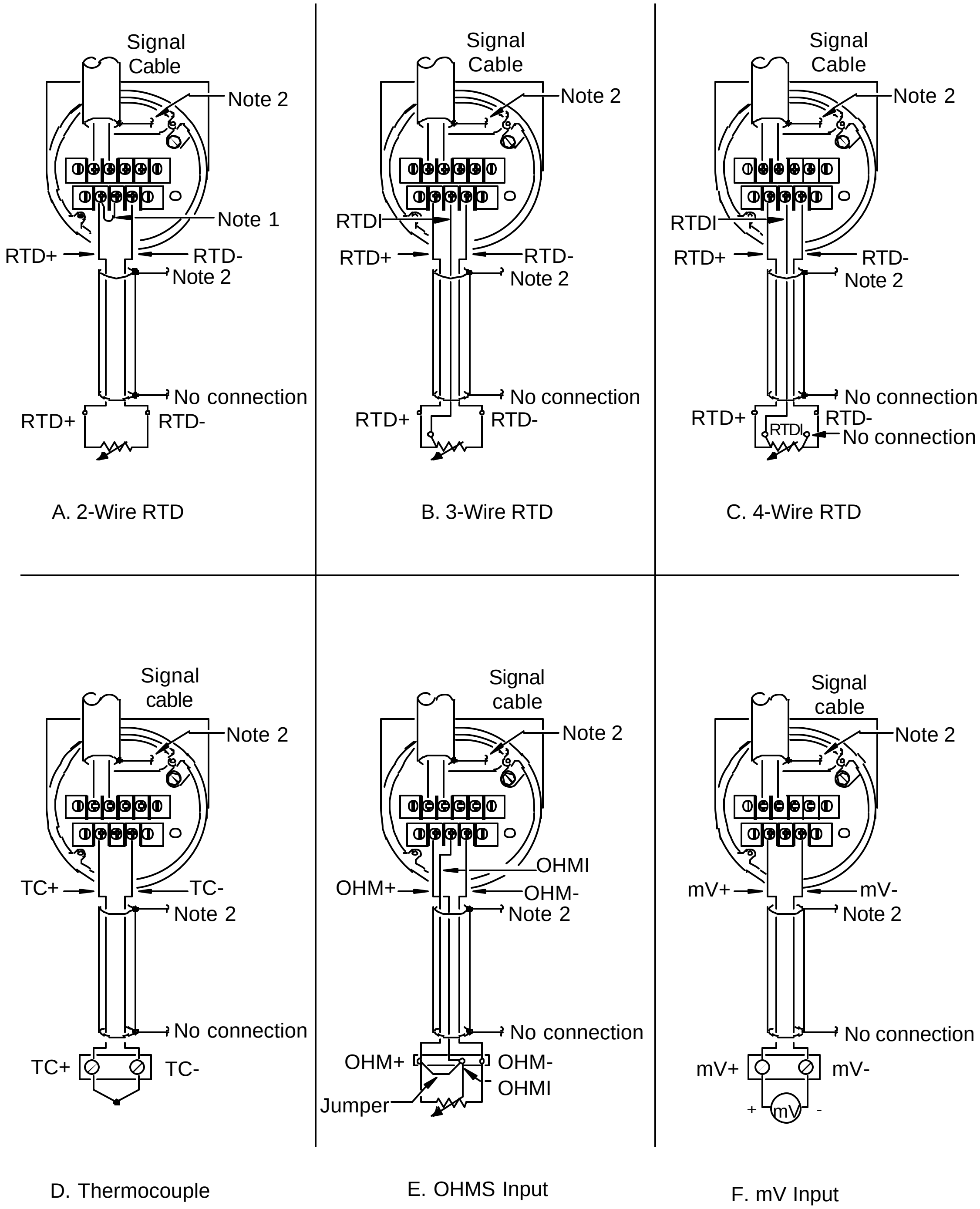
The cable shield must be insulated from all terminals and the transmitter enclosure. Refer to Section 4.3.11 for additional shielding and grounding information.

5. Connect Sensor Wires

Hook each stripped solid wire end or insert each crimp-on terminal under the appropriate terminal screw and tighten the screw for a reliable electrical connection. Refer to figures showing the needed connections as listed below in paragraphs 1) to 4).

1) RTD Sensor - Connect the tagged RTD leads as shown in Figure 4-13 detail A, B, or C, depending upon type of RTD used.

2) Thermocouple Sensor - Connect the tagged thermocouple extension leads as shown in Figure 4-13 detail D. The positive and negative thermocouple leads are usually color coded.



Notes:

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1. Install jumper wire between terminals 1 and 2.

2. Connect the sensor and signal cable shields and insulate from ground.
   Ground shields only at the power source.

FIGURE 4-13 Model 344 Sensor Wiring

Standard ANSI color coding is used on insulated thermocouple or extension grade wire when the insulation permits. Some insulations will use a colored tracer to indicate the lead polarity. Refer to Table 4.2 for color code information and bare wire characteristics for identifying non-color coded wires.

When connecting solid thermocouple extension wire, wire insulation should butt against the head of the screw. The conductor should not be visible.

TABLE 4.2 Thermocouple And Extension Grade Wire Characteristics

ANSI TYPE T/C	POSITIVE LEAD METAL	COLOR	NEGATIVE LEAD METAL	COLOR	BARE WIRE CHARACTERISTICS
T	Copper	Blue	Constantan	Red	Copper - yellow Constantan - silver
J	Iron	White	Constantan	Red	Iron - magnetic Constantan - non-magnetic
E	Chromel	Purple	Constantan	Red	Chromel - shiny metal Constantan - dull metal
K	Chromel	Yellow	Alumel	Red	Chromel - non-magnetic Alumel - magnetic
S	Platinum & 10% Rhodium	Black	Pure Platinum	Red	---
R	Platinum & 13% Rhodium	Black	Pure Platinum	Red	---
B	Platinum & 30% Rhodium	Gray	Platinum with 0.6% Rhodium	Red	---

3) Ohms-to-Milliampere Conversion - connect the OHM (+), OHM (-), and OHM I leads as shown in Figure 4-13 detail E, Ohms Input.

4) Millivolt-to-Milliampere Conversion - Connect the mV (+) and mV (-) leads as shown in Figure 4-13 detail F, mV Input.

Inspect each connection for strands of wire that could short to an adjacent terminal, for connection to correct terminal, and for tightness of terminal screw.

Be certain that the shield braid is insulated from all terminals and the metal terminal enclosure.

6. Reinstall enclosure cap. Tighten cap to compress the internal O-ring.

IMPORTANT

Be certain that enclosure threads are coated with an anti-seize compound and that the cap seal (O-ring) is in place before installing a cap. A typical compound is Never-Seez by Emhart Bostik.

7. If one of the two electrical conduit entrances in the housing is not used, it should be plugged. Refer to the Transmitter's nameplate and Section 8.1 to determine whether entrance holes accept ½-14 NPT or M20 x 1.5 fittings.

   Seal ½ NPT fittings with TFE/PTFE tape; seal M20 fittings with a soft setting sealing compound rated for at least 105°C (221°F).

4.6 HAZARDOUS AREA INSTALLATION

Drawings showing Transmitter installation data for hazardous areas are located in Appendix B. Entity parameters, barrier selection, and important wiring information are specified on these drawings. The Appendix also contains a list of tested barriers.

Before installing a transmitter in a hazardous area, check the nameplate and Sections 8.1 and 8.3 of this Manual for required approvals or certifications.

NOTE

The MXC is approved for use in non-hazardous areas only.

EXPLOSION-PROOF INSTALLATION

If the installation is required to be explosion-proof per the National Electrical Code, refer to a current copy of the Code and the following:

- User supplied explosion-proof conduit seals (glands) are required on transmitter housing conduit outlets and any installed junction boxes. See Figure 4-11.
- Explosion-proof glands must provide a good seal. Apply a sealing compound around the sealing surface if necessary.
- Sensor and power wiring conduit entries at the Transmitter must have a minimum of five threads fully engaged.
- The enclosure cap must be installed and have a minimum of eight threads fully engaged with no damaged threads permitted.
- Go to Section 4.5 for wiring connections to the transmitter's terminals. Refer to Appendix B for hazardous area installation information.

This completes the physical installation.

•

5.0 ON-LINE AND OFF-LINE OPERATION

On-line operation is any configuration or monitoring activity which involves direct communication with a transmitter. When the controller function block is disabled, the local pushbuttons may be used to configure range and damping. When the controller is enabled, the local pushbuttons may be used to display PROCESS VARIABLE (PV), SETPOINT (SP) and VALVE (V); transfer control mode from AUTO (A) to MANUAL (M); and change or store SET POINT and VALVE settings.

The configuration may be edited remotely using an MXC, a personal computer (PC) running XTC Configuration Software, or another HART Primary or Secondary Master. The MXC can also be used to monitor a transmitter's variables and to look at a transmitter's status.

Off-line operation is any configuration activity that occurs without direct communication with a transmitter. This includes using the MXC to create or edit a configuration and then to store that configuration in an MXC archive. It also includes using a personal computer and XTC Configuration Software to create or edit, and then store, a configuration.

5.1 ON-LINE OPERATION

The first part of this section contains the steps to configure and monitor a Model 344 from an MXC. The latter part of this section describes configuring the transmitter using the local pushbuttons.

5.1.1 Using the MXC for Configuration

Each transmitter is shipped with default data stored in its memory. Some of this data controls communication and transmitter operation and cannot be altered by the user. Other data determines how the transmitter responds to changes in temperature with a change in current or digital output and is alterable by the user. Using the MXC in the on-line mode, configurations can be uploaded from the transmitter, edited, and saved to archive memory or downloaded to the Model 344. The following sections describe configuration in more detail.

The following sections are in a two column format. Step-by-step procedures are in the right column. The left column contains relevant MXC screens.

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP   CAL/   CON -
                     END
OVRD   TEST   FIG
```

1. Establish communication with a transmitter; see Section 3.2. The On-Line Menu shown adjacent should be displayed.

```
CONFIGURATION MODE

EDIT   EDIT
ARCH   CONF          END
```

2. Press CONFIG (F3) at the On-Line Menu screen to enter the configuration mode and display the Configuration Mode screen (adjacent). This screen is used to select editing a configuration stored in either the selected transmitter or archived in the MXC.

```
TEMP XMTR
MODEL 344      TYPE 03

               QUIT   CONT
```

3. Press EDIT CONF (F2) to continue with configuration and display the transmitter type. See adjacent screen.

NOTE

The EDIT ARCH (F1) key is pressed to edit an archived configuration and will be discussed later.

```
WRITE PROTECT STATUS
DISABLE
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

4. Press CONT (F4) to show the Status screen. Select the state of the Write Protect mode (enable /disable) by toggling the LAST OPTN (F1) or NEXT OPTN (F2) key.

NOTE

Write Protect prevents changes to transmitter parameters and the transmitter will not accept a downloaded configuration.

5. Press SEL/CONT to continue. The MXC screen will display the Function Block menu.

```
CONFIGURATION
COMPLETE
              RE-    DOWN
QUIT   SAVE   VIEW   LOAD
```

Press SEL/END (F3) to end this session. The MXC screen will display the Configuration Complete menu with options to quit configuration mode, save the configuration, review the configuration, or download the configuration

.

NOTE

Most configuration screens show the option of ending configuration and going to this screen. These choices are discussed in Section 5.1.1.9.

```
SELECT BLOCK TO EDIT
-  SENSOR INPUT  -
                     SEL-
PREV   NEXT   END    ECT
```

6. Choose the function block to be configured. Press either PREV (F1) or NEXT (F2) to scroll through the function blocks.

NOTE

Function blocks are in an easy to use format with configuration parameters grouped by like function. Those supported are Sensor Input, Operator Display, Transmitter ID, Output Block, Alarm Block, SP Track & Hold, A/M Transfer and Controller Block. Each is shown in Appendix A.

7. Press SELECT (F4) to view or edit a function block's parameters. Pressing END (F3) will end configuration (see step 4 above).

Go to the section for the selected function block (Sections 5.1.1.1 - 5.1.1.8).

5.1.1.1 Sensor Input Block

INPUT TYPE: T/C
J THERMOCOUPLE

LAST OPTN	NEXT OPTN	SEL/ END	SEL/ CONT

MEASURED VARIBLE
UNITS: deg F

LAST OPTN	NEXT OPTN	SEL/ END	SEL/ CONT

RANGE LO: 0.0000
deg F HI: 100.00

EDIT	SNSR INPUT	SEL/ END	SEL/ CONT

The following parameters can be changed: INPUT TYPE, MEASURED VARIABLE (MV) UNITS, RANGE, DAMPING, and BURNOUT DIRECTION.

1. Press SEL (F4) at the Sensor Input Block to display the Input Type.

2. Press LAST OPTN (F1) or NEXT OPTN (F2) to scroll through the Input Options: T/C, OHM, mV, RTD.

3. Press SEL/CONT (F4) to select the current parameter, and continue to the next Input Type configuration parameter.

4. Press LAST OPTN (F1) or NEXT OPTN (F2) to scroll through the Input Options.

5. Press SEL/CONT (F4) to select the current parameter, and continue to the MEASURED VARIABLE UNITS Screen.

6. Press LAST OPTN (F1) or NEXT OPTN (F2) to scroll through the units selections. These units are listed in Appendix C under the Sensor Input Block description.

7. Press SEL/CONT (F4) to select the current parameter, display the Range screen, and continue to the next configuration parameter (go to step 8).

Pressing SEL/END (F3) will select the current parameter, end configuration, and return to the On-Line Menu.

8. The Range screen shows the unit of measurement and the lower and upper range values (LRV and URV) currently configured. Set the transmitter's temperature range corresponding to 4 and 20 mA. (See Section 8 for transmitter input ranges.)

   These values can be changed using either of two methods: "Tell" or "Show."

   Values for URV and LRV entered in the following procedures are stored in the MXC. Complete configuration and perform the download steps in Section 5.1.2 to send the configuration to a transmitter.

METHOD 1 - The "Tell" Method

```
MV LO : 0.0000
ENTER MV LO: ▫
                        EN-
 <            QUIT      TER
```

```
MV HI : 100.00
ENTER MV HI: ▫
                        EN-
 <            QUIT      TER
```

1) Press EDIT (F1) to display the screen for entering the Lower Range Value (LRV).

2) Type the desired value at the blinking cursor.

3) Press either ENTER (F4) to select the value or QUIT (F3) to exit this selection without saving.

4) The next screen displays the transmitter's Upper Range Value (URV) which is set as described above.

METHOD 2 - The "Show" Method

```
 mV: 79.120 deg F
-0.0000 TO 100.00
SET    SET
LO     HI      QUIT   ENTER
```

In this method, the transmitter is ranged by applying actual URV and LRV sensor inputs.

1) Press SNSR INPT (F2) in the Range screen.

   The screen displays the On-Line value for the actual temperature or MV units that the transmitter is reading.

2) Apply the LRV sensor input to the transmitter.

3) Press SET LO (F1) to set the LRV for the transmitter's range.

4) Apply the URV sensor input to the transmitter

5) Press SET HI (F2) to set the URV for the transmitter's range. The screen shows new LRV and URV values.

Press ENTER to store the new value in the on-line alterable memory and return to the Range screen. Pressing QUIT displays the Range screen without saving a new value.

NOTE

To conserve battery power, the MXC should not be left in the Sensor Input mode.

```
DAMPING : 1.0000 SEC

              SEL/    SEL/
EDIT          END     CONT
```

9. At the Range screen, press SEL/CONT to display the Damping screen and current damping value.

   Press EDIT (F1) to enter a new damping value.

```
DAMPING : □      SEC
ENTER DAMPING VALUE
                      EN-
 <            QUIT    TER
```

   Type a new damping value and press either ENTER to save and exit or QUIT to exit without saving.

```
BURNOUT DIRECTION:
UPSCALE
LAST   NEXT   SEL/    SEL/
OPTN   OPTN   END     CONT
```

10. At the Burnout Direction screen press either LAST OPTN or NEXT OPTN to choose UPSCALE or DOWNSCALE.

    When the desired function is chosen, press SEL/END to return to the Function Block Menu.

Go to the next section or the next desired function block.

5.1.1.2 Operator Display Block

```
SELECT BLOCK TO EDIT
- OPERATOR DISPLAY -
                      SEL-
PREV   NEXT   END     ECT
```

The Operator Display block has the following parameters: PROCESS VARIABLE UNITS, RANGE, AUTO RERANGE, and LOCAL DISPLAY CODE.

1. Press SELECT to edit process variable units.

```
PROCESS VARIABLE
UNITS□ EGF
              SEL/    SEL/
 <       >    END     CONT
```

2. Type the process variable's units. It can be a combination of up to four alphanumeric characters. To edit, use the < or > keys to move to the character to be changed.

   Press SEL/CONT to continue. Press SEL/END to end configuration of this block and return to the Function Block Menu.

```
RANGE LO: 0.0000
HI: 100.00
              SEL/    SEL/
EDIT          END     CONT
```

3. To set the range in the Operator Display Block, use the "tell" method described in Section 5.1.1.1 Sensor Input Block. Edit PV LO and HI in their respective screens by typing the upper and lower range values desired.

   Press SEL/CONT to continue. Pressing SEL/END will end configuration and return to the Function Block Menu.

```
AUTO RERANGE:
DISABLE
LAST   NEXT    SEL/    SEL/
OPTN   OPTN    END     CONT
```

4. Set Auto Rerange to enable or disable using the LAST OPTN and NEXT OPTN keys.

   Press SEL/CONT to continue. Pressing SEL/END will end configuration of this block.

```
LOCAL DISPLAY CODE:
PROCESS VARIABLE
LAST    NEXT   SEL/    SEL/
OPTN    OPTN   END     CONT
```

5. Scroll through the Local Display Code using the LAST OPTN and NEXT OPTN keys to view the following three choices: MEASURED VARIABLE, PERCENT, or PROCESS VARIABLE. Display the desired selection.

   Press either SEL/END or SEL/CONT to enter the selection and return to the Function Block Menu.

Go to the next section or the desired function block.

5.1.1.3 Transmitter ID Block

```
SELECT BLOCK TO EDIT
-  TRANSMITTER ID  -
                       SEL-
PREV   NEXT    END     ECT
```

1. Press the NEXT key to display the Transmitter ID Block and then press SELECT to display the Tag screen.

```
TAG:□  TC-101

                SEL/    SEL/
 <       >      END     CONT
```

2. If desired, enter or edit the transmitter tagname by typing an alphanumeric sequence. The blinking cursor shows where a character will be placed. Use the arrow keys < and > to move the cursor to any position in the tagname.

   Press SEL/CONT to continue. Pressing SEL/END will end configuration of the transmitter ID Block.

3. As described in steps 1 and 2, enter or edit the DESCRIPTOR and the MESSAGE, respectively.

```
DATE (DD/MM/YY):
□ 28/02/95
                SEL/    SEL/
 <       >      END     CONT
```

4. At the Date screen, enter or edit the date using the < and > keys to move the cursor to any position in the date field.

NOTE

> The format shown on the screen, DD/MM/YY, must be followed or the MXC will not download the selection.

```
DEVICE SERIAL NUMBER
□  12345678
                SEL/    SEL/
 <       >      END     CONT
```

   Press SEL/CONT to display the Device Serial Number screen. Pressing SEL/END will end configuration of the transmitter ID Block.

5. Enter or edit the device serial number on the nameplate using the < and > keys to place the cursor to any position within the serial number field.

```
SHORT ADDRESS 00

                   SEL/    SEL/
EDIT               END     CONT
```

NOTE

Only numbers may be used in the serial number field.

Press SEL/CONT to display the Short Address screen. Pressing SEL/END will end configuration of the transmitter ID Block.

```
SHORT ADDRESS 00
ENTER ADDRESS       ▫
                    EN-
 <           QUIT   TER
```

6. Enter or edit the transmitter short address using the EDIT, QUIT, and ENTER keys as described below.

   EDIT - display the Short Address edit screen. Use the < key to edit by erasing one character in the address at a time, starting with the last character. Type the new short address on the keypad.

   QUIT - return to the previous screen without saving the address.

   ENTER - store the new short address in the current MXC On-Line Memory. The MXC will now show the Function Block Menu.

5.1.1.4 Output Block

```
FAILSAFE LEVEL :
LOW
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

1. At the Function Block Menu, press NEXT to configure the Output block and display the Failsafe Level screen.

2. Edit or change this value by scrolling through the selections using the LAST OPTN and NEXT OPTN keys.

3. Press either SEL/END or SEL/CONT to return to the Function Block Menu.

5.1.1.5 Alarm Block

```
ALARM1 : ENABLE

LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

```
ALARM1 SETPOINT:
25.000 DEG F
              SEL/   SEL/
EDIT          END    CONT
```

There are two absolute alarms which may be configured as HI or LO. The setpoint for the alarms is in the same units selected in the operator display block.

1. Press SEL (F4) at the Alarm Block to display the Alarm 1 screen.

2. Press NEXT OPTN (F2) to enable or disable Alarm 1.

3. Press SEL/CONT (F4) to continue to the setpoint screen.

4. Press EDIT (F1) to edit the setpoint value. Press ENTER (F4) to change the setpoint value. Press QUIT (F3) to exit without changing the setpoint.

```
SELF CLEARING NAKS:
ON
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

```
ALARMS OUT OF
SERVICE: OFF
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

5. Press SEL/CONT (F4) to configure the alarm type.

6. Press NEXT OPTN (F2) to choose either HIGH or LOW.

7. Press SEL/CONT (F4) to configure Alarm 2 or SEL/END (F3) to return to the Function Block Menu.

8. At the SELF CLEARING NAKS screen press NEXT OPTN (F2) to choose ON or OFF.

9. At the ALARMS OUT OF SERVICE screen press NEXT OPTN (F2) to choose OFF or ON and SEL/CONT (F4) to return to the Function Block Menu.

5.1.1.6 Setpoint Track and Hold Block

This function block can be configured as tracking or non-tracking. When configured as tracking, the SP will track the PV when the controller is in manual. If it is configured as non-tracking the SP will remain at its hold value. On power -up, the operating value in the function block is initialized to the Power-Up (PUSP) value.

```
TRACKING SETPOINT:
NO
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

```
PUSP: 55.000 DEG F
0.0000 TO 100.00
              SEL/   SEL/
EDIT          END    CONT
```

1. At the SP TRACK & HOLD menu press SELECT (F4) to configure the TRACKING SETPOINT block. Press NEXT OPTN (F2) to choose either YES or NO. Press SEL/CONT (F4) to continue to the PUSP screen.

2. At the PUSP screen Press EDIT (F1) to edit the setpoint. Press ENTER (F4) to change the setpoint or QUIT (F3) to exit without changing the setpoint. Press SEL/CONT (F4) to return to the Function Block Menu.

5.1.1.7 A/M Transfer Block

The A/M Transfer may be configured to power-up in Automatic or Manual. From the A/M Transfer Menu choose SELECT (F4) for the POWER-UP MODE screen.

```
POWER-UP MODE:
AUTOMATIC
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

```
AUTOMATIC MODE ONLY:
NO
LAST   NEXT   SEL/   SEL/
OPTN   OPTN   END    CONT
```

1. Press NEXT OPTN (F2) to choose between AUTOMATIC AND MANUAL. Press SEL/CONT (F4) for the AUTOMATIC MODE ONLY screen.

2. Press NEXT OPTN (F2) to choose YES or NO. When YES is selected the function block will always remain in the AUTO position. Press SEL/CONT (F4) for the POWER-UP VALVE screen.

```
POWER-UP VALVE:
0.000%
EDIT        SEL/  SEL/
            END   CONT
```

3. Press EDIT (F1) to edit the Power-Up Valve setting. Press ENTER (F4) to change the setting, press QUIT (F3) to exit without changing the setting. Press SEL/CONT (F4) to return to the Function Block menu.

5.1.1.8 Controller Block

The controller function block provides an extensive range of Proportional-Integral-Derivative functions including PID, PD and ID. For more detailed descriptions of these controller functions refer to the appendix.

```
CONTROLLER: ON
LAST  NEXT  SEL/  SEL/
OPTN  OPTN  END   CONT
```

1. At the CONTROLLER BLOCK Screen press SELECT (F4) .

2. Press NEXT OPTN (F2) to turn the controller function ON or OFF.

3. Press SEL/CONT (F4) to configure the Controller Parameters or SEL/END (F3) to return to the Function Block menu.

```
CONTROLLER TYPE: PID
LAST  NEXT  SEL/  SEL/
OPTN  OPTN  END   CONT
```

4. At the CONTROLLER TYPE screen use LAST OPTN (F1) and NEXT OPTN (F2) to scroll through the PID, PD, ID options. Press SEL/CONT (F4) for the controller ACTION screen.

```
ACTION: REVERSE
LAST  NEXT  SEL/  SEL/
OPTN  OPTN  END   CONT
```

5. Press NEXT OPTN (F2) to select either a DIRECT or REVERSE acting controller. Press SEL/CONT (F4) to continue to the Proportional Gain, Time-Integral, Time Derivative, Derivative Gain, and Manual Reset blocks.

```
PROPORTIONAL GAIN:
1.0000
EDIT        SEL/  SEL/
            END   CONT
```

6. Press EDIT (F1) to edit a parameter. Press ENTER (F4) to change a parameter or QUIT (F3) to exit without changing the parameter.

```
MANUAL RESET TRACK:
NO
LAST  NEXT  SEL/  SEL/
OPTN  OPTN  END   CONT
```

7. Press SEL/CONT (F4) for the MANUAL RESET TRACK screen. Press NEXT OPTN (F2) to select YES or NO.

8. Press SEL/CONT (F4) to return to the Function Block Menu. This completes configuration.

5.1.1.9 End or Review Configuration

As described in the previous sections, there is a Function Block Menu in configuration mode from which basic function blocks can be accessed. Also in the previous sections, it was explained how to get back to this screen when making changes to a function block.

```
SELECT BLOCK TO EDIT
-  SENSOR INPUT  -
                    SEL-
PREV  NEXT   END   ECT
```

```
CONFIGURATION
COMPLETE
                RE-     DOWN
QUIT    SAVE    VIEW    LOAD
```

1. Choose END at the Function Block Menu in configuration mode to display the Configuration Complete Menu. It shows these selections: QUIT, SAVE, REVIEW, or DOWNLOAD. Choose one after all configuration changes are entered.

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP    CAL/    CON -
OVRD    TEST    FIG     END
```

QUIT - return to the MXC's On-Line Menu (adjacent) that appeared after initial communication had been established.

```
SAVE TO ARCHIVE  92
TTC-101
        NEW
YES     ARCH            END
```

SAVE - go to the Save To Archive screen to save the transmitter configuration in an archive. The MXC will show the tagname, the archive location last used in the MXC, and three selections: YES, NEW ARCH, and END.

```
CAUTION - PRESSING
ENTER WILL REPLACE
ARCH 00         A-      EN-
PTC - 101       BORT    TER
```

YES - save the configuration in the archive location shown on the screen. If the archive shown contains a configuration (other than a default configuration), a Caution screen will be displayed. Press Enter to overwrite the stored configuration.

NEW ARCH - save the configuration to a new archive location.

END - return to the previous screen without saving.

REVIEW - return to the Function Block Menu. The configuration can be reentered and edited from this Menu by pressing CONT.

```
TEMP XMTR
MODEL 344       TYPE 03
                QUIT    CONT
```

DOWNLOAD - downloads the configuration to the transmitter. Go to the next section.

5.1.2 Downloading A Configuration

After all configuration information has been edited at the MXC, download the configuration to the transmitter. A download can be performed in configuration mode at any time by pressing a series of END and SEL/END keys until a DOWNLOAD key is visible on the screen.

```
NO CONFIGURATION
CHANGES MADE.
DOWNLOAD ABORTED.
                        CONT
```

1. Press DOWNLOAD to send the configuration to the transmitter.

   - If no changes have been made to a configuration and DOWNLOAD is pressed, the MXC will display the adjacent screen and *will not perform a download* to prevent unnecessary communication.

```
WARNING! DOWNLOADING
WILL CHANGE XMTR
CONFIG-         A-      DOWN
URATION         BORT    LOAD
```

- If the configuration has been edited, the MXC will display the adjacent warning that the transmitter's configuration will be changed.

DOWNLOADING
CONFIGURATION
∞
- PLEASE WAIT -

DOWNLOAD
COMPLETE ∞

2. From the above Warning screen, press one of the following two keys:

   DOWNLOAD - start a download. The MXC will show the Download Wait screen and then the Download Complete screen. The new configuration is now stored in the transmitter.

   ABORT - return to the previous screen.

5.1.3 Local Transmitter Operation

The Model 344 has two local pushbuttons labeled FS (Fullscale) and Z (Zero) located on the housing. These are used to set range and damping when the controller block is configured "OFF". This is detailed in the following sections.

When the controller block is configured "ON" the ranging/ damping capabilities are not available. In this mode the pushbuttons may be used to transfer between AUTO and MANUAL control, change VALVE output, and change the SETPOINT. This is detailed in the following sections.

Local Pushbutton Operation:

The "Pushbutton Mode" must be activated as described below to use the Zero and Full Scale pushbuttons.

- The Pushbutton Mode is activated whenever either pushbutton is pressed and held for a *minimum* of 5 seconds and then released. The "PB" annunciator on the Digital Meter will be lit while the Pushbutton Mode is active.
- The Pushbutton mode will automatically time-out after 1 minute.
- Failure to hold a pushbutton ON for a minimum of 5 seconds will prevent entry into the Pushbutton mode.
- The pushbuttons are disabled when the transmitter is placed in "CONFIGURATION HOLD," as when downloading a configuration.

Pushbuttons are enabled or disabled by jumper W1 on the Electronics Module and are enabled by the factory. Jumpering pins 2 and 3 equals ENABLE. When the jumper is in the DISABLE position, the pushbuttons perform no function.

5.1.3.1 Display Functions

The numerals displayed on the Digital Meter represent the value of the PROCESS VARIABLE (PV) when the "PV" annunciator is lit; see Figure 5-1. The units associated with PV are chosen during transmitter configuration of the OPERATOR DISPLAY BLOCK. Refer to section 5.1.1.2. There are three OUTPUT DISPLAY CODE choices listed in Table 5.1 that describe what information is displayed and how it will be annunciated.

The VALVE (V) is always displayed as a percentage of controller output and the "V" and "%" annunciators will be lit. The SETPOINT (SP) is displayed in the same units as the PROCESS VARIABLE (PV). When the controller is ON depressing the FULL SCALE pushbutton will toggle the display between "PV" and "V". The ZERO pushbutton will toggle the display between "PV" and "SP".

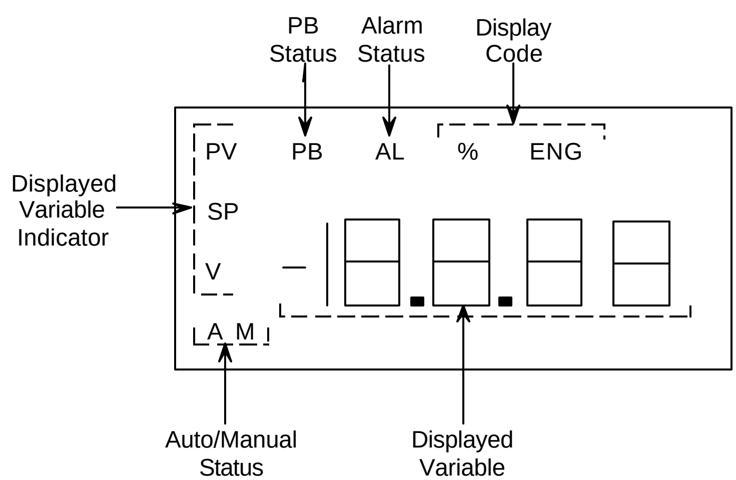


FIGURE 5-1 Model 344 Digital Meter

TABLE 5.1 Output Display Code Choices

OUTPUT DISPLAY CODE	LIT ANNUN.	PV UNITS
0 (Percent)	%	Percent of full span (0 to 100)
1 (Process Variable)	ENG	Engineering Units (e.g., CEL, FAHR)
2 (Measured Variable)	None	CEL, OHMS, MV, KELV, RANK, FAHR

5.1.3.2 Local Pushbutton Input Ranging (Controller OFF)

The low and high process temperatures selected as the 0% and 100% span points may be applied to the transmitter and stored in the EEPROM using the ZERO/FULLSCALE pushbuttons. This procedure assumes the transmitter is field mounted to an operating process. If the transmitter does not contain an optional Digital Meter to report the process variable, other instrumentation on the Network must be available to provide this information.

1. Open the sliding cover on top of the Transmitter's housing to access the ZERO/FS pushbuttons. See Figure 1-1.

2. Change ZERO range value:

    1) Supply new ZERO value.

       If the process variable currently being reported by the Transmitter is not the desired ZERO value, then the process must be manipulated by an operator to arrive at the desired value.

    2) Activate the Pushbutton Mode

       Press and hold for 5 seconds or more the ZERO pushbutton, then release the pushbutton

    3) Enter ZERO Value

       Press and release the Zero pushbutton. The new 0% range value is stored in memory. If an optional Digital Meter is installed, observe that the "PB" annunciator in the display extinguishes (Normal Mode).

       When a new 0% value is set, the Transmitters 100% value is automatically shifted to maintain the original span except as follows:

       - If the process is out of range, no new ZERO value is stored.

       - If the new ZERO value would shift the FULLSCALE value past the sensor limit, the new FULLSCALE value is automatically set to the appropriate sensor limit (except in the case where this would produce a span that is too small, in which case no new ZERO or FULLSCALE value is stored).

3. Change FULLSCALE range value:

   1) Supply FULLSCALE value.

      If the process variable currently being reported by the Transmitter is not the desired FULLSCALE value, then the process must be manipulated by an operator to arrive at the desired value.

   2) Activate the Pushbutton Mode

      Press and hold for 5 seconds or more the FULLSCALE pushbutton, then release the pushbutton.

   3) Enter FULLSCALE value

Press and release the FULLSCALE pushbutton. The new 100% range value is stored in memory. If an optional Digital Meter is installed, observe that the "PB" annunciator in the display extinguishes (Normal Mode).

NOTE

Changing the FULLSCALE range value does not affect the ZERO range value. If the input value is beyond the sensor limit, or the span is too small, no new FULLSCALE range value will be stored

4. If a damping value change is not required, return the protective cover over the pushbuttons.

5.1.3.3 Local Pushbutton Damping Adjustment (Controller OFF)

Adjusting the damping changes the value of the digital filter's time constant. An installed Digital Meter is recommended for this procedure so that the damping values may be monitored.

1. Activate the Pushbutton Damping Mode.

   Simultaneously press and hold, for 5 seconds or more, the FULLSCALE and ZERO pushbuttons, then release both pushbuttons. Note the following.

   - The Damping Mode is automatically de-activated when a 1 minute "mode active" period times-out. If a change is not made, the present value is retained.

   - When both pushbuttons are pressed a "PB" annunciator will appear on the Digital Meter. If the pushbuttons have been held on for the required minimum 5 seconds, when they are released, the "PB" annunciator will remain on and the Digital Meter will alternately display the letters "SEC" (for seconds) and the present damping value in seconds.

2. Select a new damping value. The damping value choices are: 0, 0.5, 1, 2, 5, 10, 20, 30, 60, 90, and 120 seconds.

   Repeatedly press the ZERO pushbutton to step down or the FULLSCALE pushbutton to step up through the list.

   Select a time constant from the list that is closest to the desired value.

3. Simultaneously press, then release, both pushbuttons. The new value is stored in memory and normal operation is restored.

4. Restore protective cover over pushbuttons.

5. To set damping without a digital meter activate the pushbutton mode as described in step 1 above.

6. Repeatedly press the ZERO pushbutton at least ten times to set the damping value to zero seconds.

7. Refer to step 2 above and select the new damping value. Count the number of steps (damping values) from “0” seconds to the selected value. This number “N” will be used in the following step 8.

8. Press and release the FULLSCALE pushbutton “N” times to step to the selected damping value.

9. Perform steps 3 and 4 above.

5.1.3.4 Local Pushbutton AUTO/MANUAL, SETPOINT and VALVE Adjustments (Controller ON)

These procedures assume the Transmitter-Controller is field mounted to an operating process and contains an optional Digital Meter to display the AUTO or MANUAL control mode and PROCESS VARIABLE, SET POINT, and VALVE values.

Open the sliding cover on top of the Transmitter's housing to access the ZERO/FULLSCALE pushbuttons (Figure 1-1), then refer to the following procedures to make any required changes to the Controller's operation.

A. Change AUTO/MANUAL Control Mode

The active control mode is shown by a lit "A" (AUTO) or "M" (MANUAL).

IMPORTANT

If the present control mode is AUTO, and the Controller's A/M TRANSFER BLOCK has been configured for "AUTOMATIC MODE ONLY", a change from AUTO to MANUAL cannot be made using the pushbuttons.

1. Note the present control mode as indicated in the Digital Meter. Simultaneously press and hold, for a minimum of 5 seconds, the ZERO/FULLSCALE pushbuttons, then release both buttons.

2. Confirm the transfer of mode control from "A" to "M" or "M" to "A".

B. Change SET POINT

1. The Controller must be in the AUTO control mode to change the SET POINT; if not, place the Controller in the AUTO control mode.

2. Press and hold, for a minimum of 5 seconds, the ZERO pushbutton, then release the button.

   The "SP" and "PB" annunciators shall be lit and the "PV" annunciator shall be extinguished.

   The displayed number is the active SET POINT value.

3. Select new SET POINT. Note the following.

   - Cycling (pressing and releasing in less than 1 second) the ZERO or FULLSCALE pushbutton respectively decrements or increments the SET POINT in 0.01% increments of span.

   - Pressing and holding either pushbutton, for more than 1 second, initiates a special acceleration algorithm whereby the SET POINT changes in greater and greater increments until limiting occurs.

   - The new SET POINT value is changed in RAM only and not yet stored permanently in memory. If the Pushbutton Mode times-out before storage is accomplished, the Controller will operate with the new SET POINT; however, the new value will be lost after a power-down or Master Reset.

C. Store New SET POINT to Memory (new Power-Up Setpoint Valve in Setpoint Track & Hold Block)

1. Simultaneously press and release both pushbuttons to store new SET POINT.

   After SET POINT storage, the Controller exits the Pushbutton Mode and returns to normal operation.

D. Change VALVE

1. The Controller <u>must</u> be in the MANUAL control mode to change the VALVE; if it is not, place the Controller in the MANUAL control mode.

2. Press and hold, for a minimum of 5 seconds, the FULLSCALE pushbutton, then release the button. Note the following.

   - The "V", "%", and "PB" annunciators shall be lit and the "PV" annunciator shall be extinguished.

   - The displayed number is the VALVE position in percent (-1 to 110).

   - Interpreting a VALVE Open/Close position depends upon knowing if the FINAL CONTROL ELEMENT is configured as REVERSE or DIRECT acting. For DIRECT acting, 0% indicates a fully closed valve and 100% indicates a fully opened valve. The opposite is true for a REVERSE acting controller.

3. Select new VALVE between -1.0% and 110%. Note the following.

   - Cycling (pressing and releasing in less than 1 second) the ZERO or FULLSCALE pushbutton respectively decrements or increments the VALVE in 0.01 % increments.

   - Pressing and holding either pushbutton, for more than 1 second, initiates a special acceleration mode whereby the VALVE changes in greater and greater increments until limiting occurs.

   - The new value is changed in RAM only and not yet stored permanently in memory. If the Pushbutton Mode times-out before storage is accomplished, the Controller will operate with the new VALVE; however, the new value will be lost after a power-down or Master Reset.

E. Store New VALVE to Memory (new Power-Up Valve in Auto Manual Transfer Block)

1. Simultaneously press and release both pushbuttons to store new VALVE.

   After VALVE storage, the Controller exits the Pushbutton Mode and returns to normal operation.

5.1.4 Quick Access Key Operation

MXC Quick Access keys are used to view transmitter parameters while the MXC is on-line and communicating with a transmitter (refer to Section 2). Eight Quick Access keys are used with the Model 344: TRANS. VAR'S., TREND, ZOOM, and STATUS, are available with the controller ON or OFF. CHANGE SP, CHANGE VALVE, A/M and TUNE are only available when the controller is ON. Press a key to access live transmitter data.

NOTE

> Conserve battery power. Do not leave the MXC in the on-line mode.

```
Dev ID: 210300003C
Tag: TTC-101   ADD: 00
LOOP   CAL/   CON -
                        END
OVRD   TEST   FIG
```

1. Establish communication with a transmitter, see Section 3.2, and go to the On-Line Menu (adjacent).

2. Press a Quick Access key to view the desired transmitter parameter(s) at the On-Line Menu. The following paragraphs will describe how to view these parameters.

   TRANS. VAR'S. - displays updated on-line transmitter parameters. These parameters include the measured variable (MV), the current output (I), the process variable (PV) and their respective units or the Process (P), Set Point (S) and Valve (V) controller variables.. Exit this screen by again pressing the TRANS. VAR'S. key or pressing END.

```
M: 76.534 deg F
I: 3.8377 mA
P: 63.272 deg F
                        END
```

   TREND - displays the adjacent screen to select the variable to be trended.

```
TREND WHICH VAR?
MEASURED VARIABLE
                      SEL-
PREV  NEXT   END      ECT
```

   1) Press PREV or NEXT to toggle between Process Variable, Measured Variable, and Valve with the Controller “ON.”

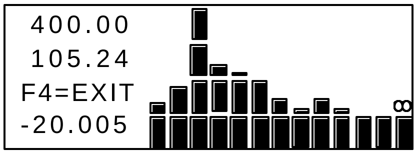
   2) Press SELECT to enter a value. Pressing END will exit this procedure and display the On-Line Menu.

```
ENTER SAMPLING TIME
   SECONDS
                      EN-
 <           END      TER
```

   3) Type the desired sample time: range 1-300 seconds; default is 1 second. Thirteen samples (maximum) of the variable can be shown while sampling at the sample time chosen.

      If the sample time entered is greater than 300 seconds, a Warning message will appear that shows the range of values.

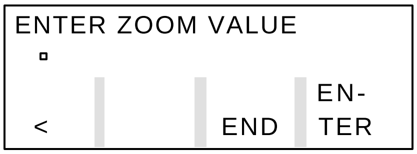
```
WARNING: TREND TIME
MUST FALL BETWEEN
1 AND 300 SECONDS.
                       EXIT
```



4) Press ENTER. The following are shown in the adjacent screen: Upper and Lower Range Values stored in the transmitter, the current transmitter reading and the thirteen sample trend.

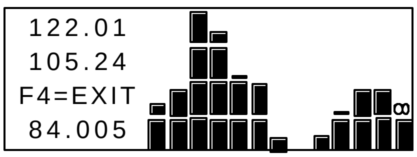
5) Press either TREND or F4 to exit this screen.

ZOOM - expands a portion of a selected variable's trend. Zoom is selected from the Trend screen.

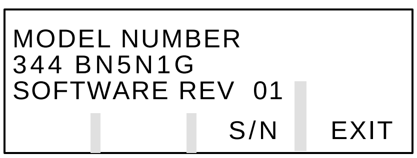


1) Press ZOOM to display the adjacent screen. Type a zoom value.

   If the value is outside the transmitter's range, a Caution screen will appear with a selection to show the range of possible values.

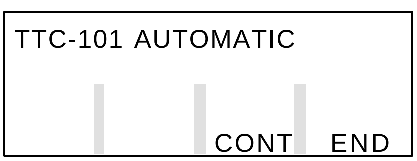


   The MXC will display the trended variable within the zoom range chosen (i.e. zoom range = 10% of the transmitter range, centered on the zoom value entered) on the screen. The screen will show:
   - Upper and Lower Range Values of zoomed range
   - current transmitter reading
   - trend of thirteen samples



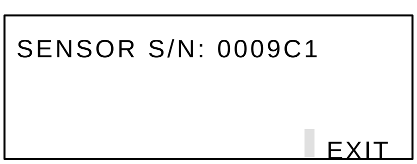
2) Press either F4 to exit to the Trend screen or ZOOM to return to the Enter Zoom Value screen.

3) Press EXIT in the Trend screen to go to the On-Line Menu.



STATUS - displays the transmitter's tagname and existing status's. See adjacent screen.

1) Press CONT to display the transmitter's model number, and software revision number. Pressing EXIT will end this display.



2) Press S/N to show the sensor serial number. Pressing EXIT will return to the Status screen.

3) Press EXIT twice to go to the On-Line Menu.

```
S: 50.000%
NEW SETPOINT:□
0.0000 TO 100.00
  <            END  ENTER
```

CHANGE SP - allows you to view and change the on-line-setpoint of the controller.

1) Enter new setpoint and press ENTER (F4) to store the value.

2) Press the “CHANGE SP” key again or END (F3) to exit.

```
VALVE: 10.000%
NEW VALVE:□
-1.000 TO 110.00
  <            END  ENTER
```

CHANGE VALVE - allows you to view and change the position of the valve in MANUAL. If the controller is in AUTO, the valve cannot be changed.

1) Enter the new valve setting and press ENTER (F4) to store the new value.

2) Press the “CHANGE VALVE” key again or END (F3) to exit.

```
STATUS: AUTOMATIC

MAN-
UAL   AUTO              END
```

A/M - toggles the controller between automatic and manual control

1) Press MANUAL (F1) or AUTO (F2) to change state.

2) Press “A/M” key again, or END (F4) to exit.

```
PV                   47.625
SP                   47.625
 V                   56.000
ACTION REVERSE        CONT
```

```
PV                   99.930
SP                   99.930
 V                   50.210
 PG      TI      TD   CONT
```

```
PV                   23.000
SP                   47.000
 V                   10.000
 DG      MR     END   CONT
```

TUNE - displays controller tuning parameters for viewing or editing.

1) The first screen displays the Process, Setpoint, and Valve settings and the controller action. Press CONT (F4) to continue.

2) The Proportional Gain (PG), Time Integral (TI) and Time Derivative (TD) can be changed from this screen. Press F1, F2, or F3 to display the current value and edit the parameter.

3) Press CONT (F4) to continue.

4) The Derivative Gain (DG) and Manual Reset (MR) can be changed from this screen. Press F1 or F2 to display the current value and edit the parameter.

5) Press CONT (F4) to go to the previous screen. Press the “TUNE” key again, or END (F3) to exit.

5.2 OFF-LINE OPERATION

Off-line operations include editing parameters in a transmitter configuration stored in an MXC archive for downloading at a later time to a transmitter. The first part of this section describes off-line configuration editing. The second part explains downloading a configuration to a transmitter.

An archive is a transmitter configuration stored in the MXC. It resides in a specific location in the MXC's On-Line Memory. This Memory can store up to 100 configurations, numbered 0-99. To save time and reduce errors, simply recall and edit an archived configuration rather than creating a completely new configuration.

Configurations created using the MXTC Configuration Software (PN 15939-41Vn.nn*) running on a personal computer can be downloaded to and archived in the MXC.

* Vn.nn is the software version number.

5.2.1 Using Off-Line Operations to Access an Archive

```
SELECT FUNCTION

FIND   ARCH   TEST
XMIT   FUNC    MXC    END
```

```
ENTER ARCHIVE # (0-99)
OR TAG: ▫
                       EN-
 <      >      END     TER
```

```
WARNING : ARCHIVE
CONTAINS NO DATA
               A-
               BORT   CONT
```

```
ARCHIVE 97  FTC1300
SELECT A FUNCTION
EDIT   CLR
ARCH   ARCH              END
```

1. At the Main Menu, press ARCH FUNC to go to the Enter Archive # screen (Off-Line Archive menu).

2. To call an archived configuration, type the archive number or the tagname of a transmitter and press ENTER.

   To create a new configuration to be archived, type an unused archive number (0-99) and press ENTER.

3. Select one of the following:

   - If there is no data stored in this archive, a Warning screen appears. Press ABORT to exit the archive function or press CONT to continue. Go to step 4.

   - If the configuration at this archive number is no longer needed, press CLR ARCH to erase it. Press END to exit this screen.

   - To review or edit the configuration, press EDIT ARCH. Press CONT and select a function block to view or edit, then return to this section and go to "After configuration is complete." step 1.

```
SELECT X-MITTER TYPE
TEMP CONTROLLER
                      SEL-
PREV  NEXT  END       ECT
```

4. Use PREV and NEXT to select the transmitter type - Temperature - then press SELECT. The default configuration for a temperature transmitter will be loaded into the Off-Line Memory of the MXC.

```
ARCHIVE 97  DEFAULT
SELECT A FUNCTION
EDIT
ARCH                END
```

5. The next screen shows the archive number to be edited. Press either EDIT ARCH to begin editing or END to select another archive number.

6. Press CONT to continue and select a configuration block for editing. Refer to Section 5.1.1 to edit configuration parameters.

   Press QUIT to return to the previous screen.

```
CONFIGURATION
COMPLETE
             RE-
QUIT  SAVE   VIEW
```

After configuration is complete:

1. Press END in the Function Block menu to access the following three choices from the adjacent screen.

   QUIT - go to the Main Menu and end configuration.

   REVIEW - return to the Function Block menu to make any changes or additions. Refer to Section 5.1.1 as necessary.

   SAVE - show the archive number and tagname of the current configuration and provide the option to save the configuration either under the current archive number or under a new number. Go to step 2.

```
SAVE TO ARCHIVE  97
DEFAULT
      NEW
YES   ARCH          END
```

2. Press YES in the Save Archive screen to save the archive under the current number. Perform one of the two steps below:

```
ERROR!  ARCHIVE TYPE
DOESN'T MATCH THE
TRANSMITTER TYPE
                   CONT
```

```
WARNING: TAG NAME
USED ENTER NEW TAG
NAME.
                   CONT
```

   - If the new configuration will overwrite an existing archive, the MXC will provide a warning message before the store operation is performed. Press ENTER to continue.

   - If the tagname of a new configuration has already been assigned to an archived configuration, a WARNING screen appears. Press CONT to move to the TRANSMITTER ID block and display the tag selection.

     - If the tagname is not to be changed, press either SEL/END to return to the Save Archive screen or SEL/CONT to return to the previous screen.

- If the tagname is changed, press SEL/END or SEL/CONT to return to the original Save screen. Follow the prompts to save the configuration in the MXC.

5.2.2 Using an Archive in On-Line Memory

An archived configuration can be accessed using the MXC during On-Line operations through the configuration mode.

```
CONFIGURATION MODE

EDIT   EDIT
ARCH   CONF          END
```

1. Press CONFIG at the On-Line menu screen to display: EDIT ARCH, EDIT CONF, and END.

2. Select EDIT ARCH to call an archived configuration from MXC memory.

```
ENTER ARCHIVE # (0-99)
OR TAG:  ¤
                   EN-
 <     >    END    TER
```

3. At the adjacent screen, type the archive number or the tagname of the configuration to be edited and press ENTER.

```
ARCHIVE 97  DEFAULT
SELECT A FUNCTION
EDIT
ARCH                END
```

- If the archive contains data, the next screen will provide the option of editing the archive or downloading the archive directly to the transmitter.

```
WARNING : ARCHIVE
CONTAINS NO DATA
               A-
               BORT  CONT
```

- If the archive contains no data, a Warning message will appear and default configuration data will be loaded into the On-Line memory. Press CONT to edit or download the configuration.

```
ERROR!  ARCHIVE TYPE
DOESN'T MATCH THE
TRANSMITTER TYPE
                     CONT
```

- If the archive contains data that does not match the current transmitter type, an Error message will appear. Press CONT to choose a new archive number.

4. Press either EDIT ARCH to edit the configuration as described in section 5.1.1 or DOWNLOAD to download the configuration to the transmitter and bring up a series of screens.

   When download is chosen, the MXC will display:

   - A prompt if there are any differences between the downloaded configuration data and the configuration resident in the transmitter - simply respond to the prompt, continue or abort.

- A warning that the transmitter's configuration will change - respond to the prompt.
- A warning if the archive has a different tagname than the transmitter - respond to the prompt.

Press END to return to the previous screen.

6.0 CALIBRATION AND MAINTENANCE

This section describes calibration, preventive maintenance, and troubleshooting

The Maintenance section has preventive maintenance procedures that are employed to prevent conditions from occurring that would be detrimental to the reliability of the transmitter. Should a malfunction occur, troubleshooting procedures will assist in minimizing down-time. This section also includes transmitter removal and replacement procedures, recommended spare and replacement parts, and an exploded view drawing with a parts list.

WARNING

In Division 1 areas, where an explosion-proof rating is required, *remove power from the transmitter* before removing the transmitter's end cap for access to the electrical terminal compartment.

The MXC is approved for use in non-hazardous areas only.

6.1 CALIBRATION

A transmitter is calibrated at the factory and should not require field calibration. Sections 6.1.2 and 6.1.3 describe field and bench calibration of a transmitter.

Transmitter calibration should be checked at least annually and the procedures in this section performed if out of tolerance.

An MXC is needed for calibration. It provides four calibration programs:

- DAC OUTPUT - Calibrates the Digital-to-Analog Converter that sets the transmitter's analog output signal.
- WIDE mV - Calibrates the millivoltmeter for TC/mV inputs between -18.00 mV and 103 mV.
- NARROW mV - Calibrates the millivoltmeter for TC/mV inputs between -11.00 mV and 26.00 mV
- CURRENT SOURCE - Calibrates the transmitter’s current source that supplies a forcing current to RTD/Ohm sensors.

6.1.1 Equipment Required

- Moore XTC Communicator (MXC) - refer to Section 2 of this User's Manual
- Laboratory grade digital multimeter (DMM); for calibrating the 4 to 20 mA output signal
  Voltmeter Section .... Accuracy +/-0.01% of reading
  Resolution 1.0 mV
  Input impedance 10 MΩ
  Ammeter Section .... Accuracy +/-0.1% of reading
  Resolution +/-1 µA
  Shunt resistance 10Ω or less
- 24 Vdc power supply; for bench calibration
- Resistor 250Ω +/-1%, carbon, 1/4 watt; for bench calibration
- Laboratory grade precision microammeter with a resolution of +/-0.001 µA; used to calibrate Current Source.
- Precision adjustable millivolt source, range to 110 mV. Used to check and calibrate mV/thermocouple inputs.
- Digital voltmeter to monitor the millivolt source with a resolution of +/- 0.001 mV for ranges up to 110 mV.
- Precision resistance decade box; 5-dial type with largest dial providing 100 ohm steps. Accuracy to be +/-0.02 ohms. Used to simulate RTD/Ohm type input resistance.
- Thermocouple reference tables providing millivolts vs. temperature data. Use to check accuracy of indicated temperature.
- RTD reference tables providing ohms vs. temperature data. Used to check accuracy of indicated temperature.

6.1.2 Transmitter Analog Output (DAC) Calibration

Perform the steps in the appropriate Section according to the transmitter's normal operating mode: analog operation, Section 6.1.2.1; digital operation, Section 6.1.2.2.

IMPORTANT

Calibration of the Digital-to-Analog Converter (DAC) is not normally required and should be performed only after all other options have been exhausted.

6.1.2.1 Transmitter Normally Configured for Analog Mode

If the transmitter is field mounted and conditions permit, calibration can be performed at the site as described in steps 2 through 18. If a bench calibration is desired, perform steps 1 through 18.

1. Bench Calibration only: Disconnect the transmitter from the process by performing the steps in Section 6.5.

NOTE

Removing a transmitter can interrupt power to other transmitters powered from a common power source. Note the effect this can have on process control and operation and, if necessary, follow the proper procedures to shut down the process.

When disconnecting the SIGNAL leads, carefully insulate each lead as it is removed to prevent accidental electrical shorts.

2. Remove the enclosure cap for access to the terminal compartment

3. Connect MXC and DMM (milliammeter) to the loop as shown in either Figure 6-1 or 6-2. Set DMM to measure 4-20 mA.

   Field Calibration Wiring - Open jumper at Circuit Junction.

4. Place loop in Manual mode.

5. Apply power to the Loop.

6. Establish communication between MXC and transmitter. Refer to Section 3.2 as necessary.

   If the transmitter is configured for digital mode, reconfigure for analog mode by setting the short address to zero (0). Refer to Section 5.1.1.3 as necessary.

7. At the Main Menu, select the CAL/TEST program.

   Step through the MXC screens and use the PREV and NEXT buttons to select the DAC OUTPUT calibration. Press SELECT (F4).

   The MXC will display the adjacent screen:

```
PRESSING ENTER WILL
SET TRANSMITTER
OUTPUT TO    A-     EN-
4.00 MA      BORT   TER
```

8. Press ENTER (F4).

   The MXC will display:

```
ENTER OUTPUT CURRENT
         MA
                    EN-
 <           QUIT   TER
```

9. Read the ammeter. It should indicate: 4.000 ±0.0048 mA.

10. If output is within limits, press QUIT (F3) and proceed to step 13.

    If calibration is required, perform steps 11 and 12.

11. Respond to the prompt. Key in the current indicated by the ammeter and press ENTER (F4).

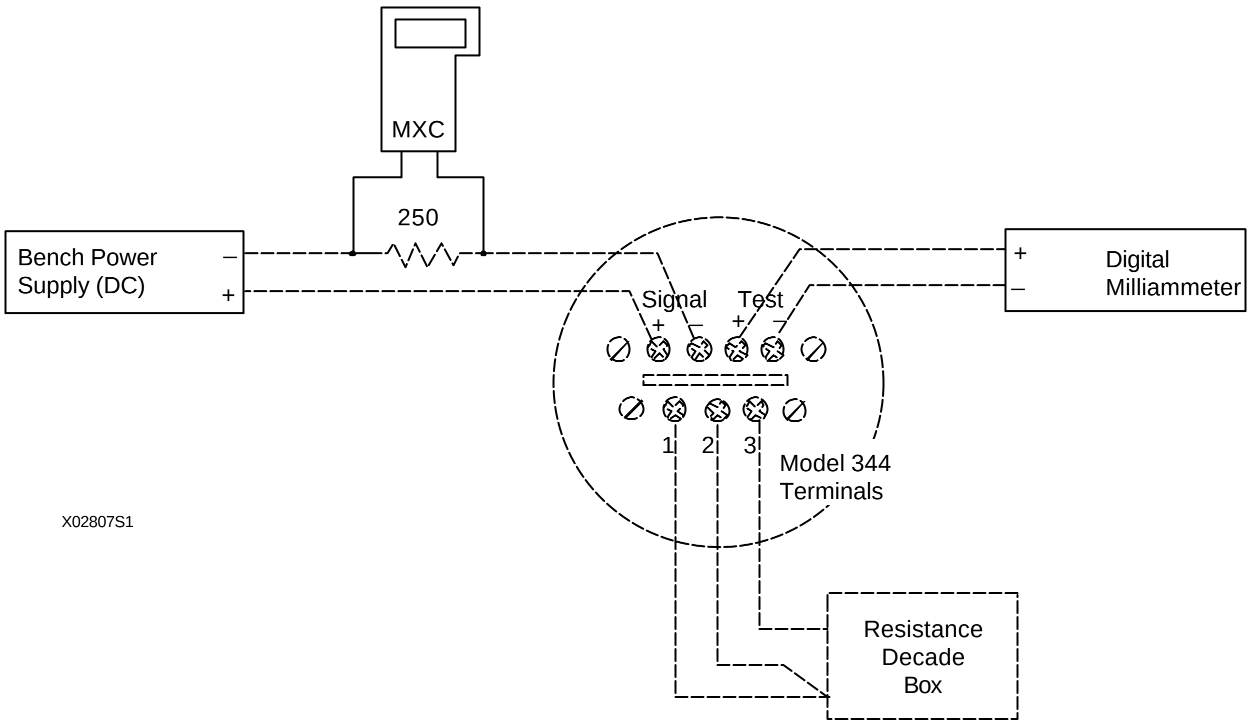


FIGURE 6-1 Bench Test Connections

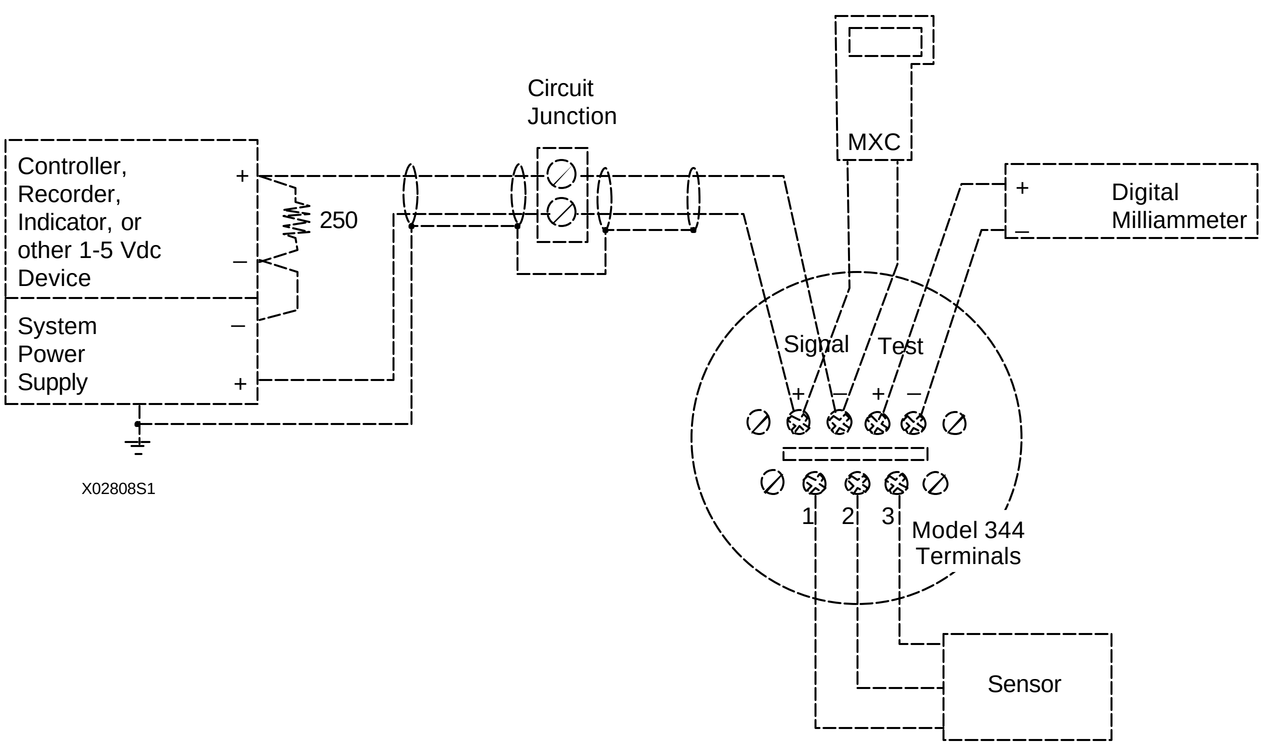


FIGURE 6-2 Field Calibration Connections

12. Read the ammeter. If the output is within limits, press QUIT (F3) and proceed to step 13.

    If calibration is still required, repeat step 10 as many times as necessary until the output is within limits, then press QUIT and proceed to step 13.

    The MXC will display the adjacent screen:

```
PRESSING ENTER WILL
SET TRANSMITTER
OUTPUT TO    A-      EN-
20.00 MA     BORT    TER
```

13. Press ENTER (F4).

    The MXC will display the adjacent screen:

```
ENTER OUTPUT CURRENT
           MA
                     EN-
 <            QUIT   TER
```

14. Read the ammeter. It should show: 20.000 ±0.0048 mA.

15. If the output is within limits, press QUIT (F3) and exit the calibration mode. Calibration is now complete; go to step 18.

    If calibration is required, perform steps 16 and 17.

16. Respond to the prompt. Key in the current indicated by the ammeter and press ENTER (F4).

17. Read the ammeter. If output is within limits, press QUIT (F3) to exit the calibration mode.

    If calibration is still required, repeat step 16 as many times as necessary until the output is within limits, then press QUIT (F3) to exit the calibration mode.

18. When calibration is completed, disconnect test equipment, reconnect transmitter as necessary. If transmitter is to operate in the digital mode, configure the short address to a number from 1 to 15 before disconnecting test equipment.

6.1.2.2 Transmitter Normally Configured for Digital Mode

When a transmitter is configured to operate in the digital mode, its analog output is parked at 4 mA. Although the analog output current function is not used when a transmitter is operating in the digital mode, it can cause communications interference on the Multi-Drop Network or an excessive current load. To check the analog output of a transmitter normally configured for digital mode, perform the steps in the preceding section.

6.1.3 RTD/OHM Type Input Calibration

The conversion accuracy of the temperature signal from RTD/Ohm type inputs, as indicated by transmitter output ZERO and FULL SCALE values, depends upon both CURRENT SOURCE and NARROW/WIDE MILLIVOLT calibration (section 6.1.4.2).

The calibration check consists of substituting a resistance decade box for an RTD or Ohm (slidewire potentiometer) type sensor. RTD/Ohm resistances corresponding to ZERO and FULL SCALE values are applied to the transmitter and the 4 mA and 20 mA outputs are checked for accuracy.
The CURRENT SOURCE calibration procedure consists of precisely measuring and storing in the transmitter the value of the RTD/Ohm sensor forcing current.

6.1.3.1 RTD/OHM Calibration Check

1. Connect test equipment to transmitter as shown in Figure 6-1 or 6-2. The decade box is connected in a 3-wire RTD configuration which eliminates the lead wire resistance effect; however, all three test leads should be approximately the same length.

2. Determine zero and full scale resistances for RTD or Ohm type input.

   For an RTD type input: consult user supplied RTD resistance/temperature table and record the resistance of the Zero and Full Scale temperatures.

   For an Ohm type input: consult user supplied data and record the resistance of the Zero and Full Scale points.

3. Set decade box to resistance corresponding to Zero Scale value.

4. Apply power and read indicated Zero Scale value. Perform either A) or B) and compare the reading to the specifications in step C).

   A) Digital Meter installed - read the indicated Zero Scale value on the Meter.

   B) Digital Meter not installed - perform the following:

      1) From the MXC, execute the FIND XMTR program. (Refer to Section 2 as necessary.)

      2) When the MXC finds the transmitter, press the dedicated TRANS VAR'S key on the MXC and read the indicated value.

   C) Accuracy specifications:

      RTD input .... Equal to or less than +/-0.1°C of Zero and Full Scale temperatures. Equal to or less than +/-0.02% of selected span in Deg. C; the higher value will be the accuracy tolerance.

Ohm input (wide range) ...... Equal to or less than +/-1.3 ohm of Zero and Full Scale ohmic values.

Ohm input (narrow range) . Equal to or less than +/-0.45 ohm of Zero and Full Scale ohmic values.
Equal to or less than +/-0.02% of selected span in ohms; the higher value will be the accuracy tolerance.

5. Set decade box to resistance corresponding to Full Scale value and check accuracy of indication against specifications listed in step 4.

   If calibration is required, retain the test set-up and proceed to Section 6.1.3.2 to perform the Current Source Calibration.

   If accuracy is within specifications, calibration is not required. Disconnect test equipment, reconnect all wires, and install enclosure cap.

6.1.3.2 Current Source Calibration (Transmitters with Software Rev 1 only)

1. Turn OFF the power supply.

   Disconnect the test resistance decade box from the transmitter.

   Connect the test microammeter to the transmitter as shown in Figure 6-3 and turn ON the power supply.

2. From the MXC, execute the FIND XMTR program. (Refer to Section 2.)

   Select CAL/TEST (F2) from the display menu.

   1) Step through the MXC screens using the PREV and NEXT buttons to select CURRENT SOURCE calibration. Press SELECT (F4). The MXC will display the adjacent screen:

```
SHORT mV+ (1) TO RTD (2)
WITH COPPER WIRE

                    CONT
```

   2) Press CONT (F4). MXC will display:

```
PRECISELY MEASURE THE
CURRENT BETWEEN RTDI
(2) AND mV- (3)
                    CONT
```

   3) Press CONT (F4). MXC will display:

```
ENTER THE CURRENT
▫            UA

  <          QUIT  ENTER
```

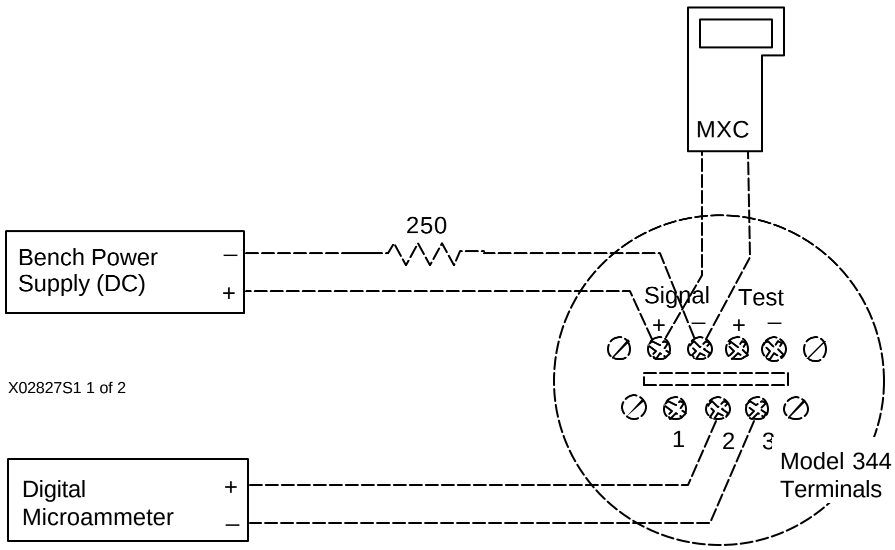


FIGURE 6-3 RTD/Ohm Current Source Calibration Set Up

3. Read and note, to three decimal places, the value of the forcing current as displayed by the digital microammeter.

4. In response to the screen prompt, enter the noted current (in microamps) into the MXC. For example: 51.125 µA.

5. Press ENTER (F4). The screen will display:

```
WARNING: BURNING
EPROM WILL CHANGE
CALIBRATION CHARAC-
TERISTICS
               ABRT  CONT
```

   Press CONT (F4) to calibrate.

   Press ABRT (F3) to QUIT without changing calibration.

   Calibration is now complete.

6. Turn OFF the power supply.

   Disconnect the test microammeter and reconnect the test resistance decade box to the transmitter (Figure 6-2).

7. Turn ON the power supply and return to Section 6.1.3.1 and again perform a calibration check.

   If accuracy is within specifications, disconnect test equipment. Connect all wires and install enclosure cap.

   If accuracy is still NOT within specifications, additional calibration is required.

   1) Turn OFF the power supply.

2) Disconnect the test resistance decade box and connect the test millivolt source to the transmitter. See Figure 6-4.

3) Turn ON the power supply and proceed to section 6.1.4.2 and perform the Narrow/Wide Millivolt calibration procedures.

6.1.4 Thermocouple/Millivolt Type Input Calibration

The calibration check consists of substituting a millivolt source for a thermocouple (TC) or mV (slidewire potentiometer) type sensor. Millivolt values corresponding to Zero and Full Scale temperatures are applied to the transmitter and the indicated output checked for accuracy.

Narrow/Wide Millivolt calibration consists of applying one low and one high millivolt signal to the transmitter and entering them into EPROM.

Narrow Millivolt: Applicable to mV inputs between -11.00 to +26.00 millivolts including inputs from an R, S, T, or B type thermocouple.

Wide Millivolt: Applicable to mV inputs between -18.00 to +103.00 millivolts including inputs from a J, K, E, or N type thermocouple.

6.1.4.1 Thermocouple/Millivolt Calibration Check

1. Connect test equipment to transmitter as shown in Figure 6-4.

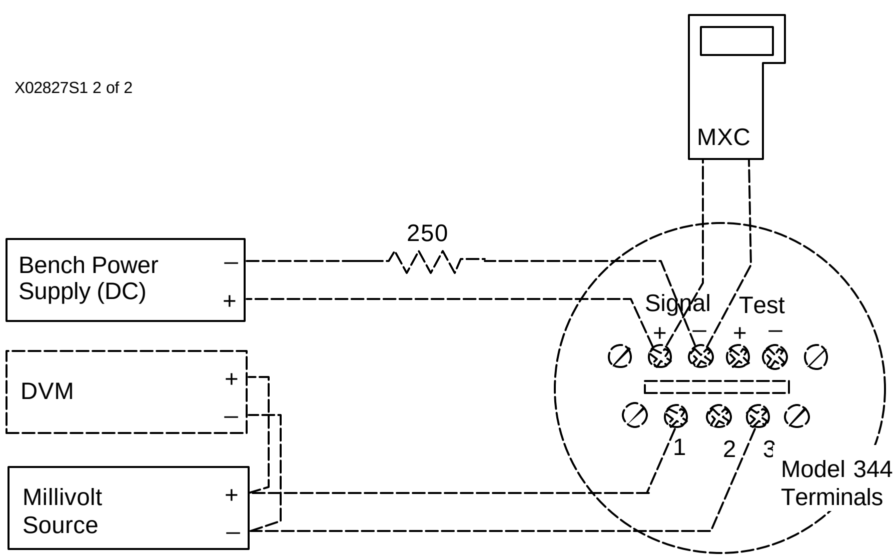


FIGURE 6-4 TC/mV Input Accuracy Check and Calibration Set Up

2. Determine millivolt values for thermocouple or mV input.

   - Thermocouple Type Input: Consult user supplied TC millivolt vs temperature table and record the millivolt values corresponding to the Zero and Full Scale temperatures.
   - mV Type Input: Consult user supplied data and record the millivolts equivalent to the Zero and Full Scale points.

3. Set millivolt source to voltage corresponding to Zero Scale value. Adjust source to three decimal places as read from the digital voltmeter (DVM) connected across millivolt source.

4. Apply power.

5. Read indicated Zero Scale value. Perform either A) or B) and compare the reading to the specifications in step C).

   A) If an optional Digital Meter is installed, read the indicated Zero Scale value.

   B) If a Digital Meter is not installed, perform the following:

      1) From the MXC, execute the FIND XMTR program.

      2) When the MXC finds the transmitter, press the dedicated TRANS VAR'S key on the MXC and read the displayed value.

   C) Accuracy specifications:

   TC input .... Equal to or less than:
   +/-0.2° F type T
   +/-0.3° F type E, J
   +/-0.4° F type K,R,S,B,N

   Equal to or less than +/-0.02% of span. The higher value will be the accuracy tolerance.

   mV input (narrow range) ... Equal to or less than +/-15 microvolts

   mV input (wide range) .... Equal to or less than +/-30 microvolts

   Equal to or less than +/-0.02% of span. The higher value will be the accuracy tolerance.

6. Set millivolt source to voltage corresponding to Full Scale value and check accuracy of indication against specifications listed in step 5.

   If calibration is required, retain test set-up and go to Section 6.1.4.2.

If accuracy is within specifications, calibration is not required. Disconnect test equipment, re-connect all wires and install enclosure cap.

6.1.4.2 Narrow/Wide Millivolt Calibration

Calibration equipment connections are as shown in Figure 6-4.

A. NARROW MILLIVOLT CALIBRATION

1. From the MXC, execute the FIND XMTR program then select CAL/TEST (F2) from the display menu.

2. Step through the MXC screens using the PREV and NEXT buttons to select NARROW MILLIVOLT calibration. Press SELECT (F4).

   The MXC will display:

```
APPLY 26.000 mV TO
mV+ (1) AND mV- (3)
WITH COPPER WIRE
                 CONT
```

3. Adjust the output of the millivolt source to 26.000 mV.

4. Press CONT (F4). Screen will display:

```
APPLY -11.000 mV TO
mV+ (1) AND mV- (3)
WITH COPPER WIRE
                 CONT
```

5. Adjust the output of the millivolt source to -11.000 mV.

6. Press CONT (F4). Screen will return to SELECT CALIBRATION menu shown here.

```
WARNING: BURNING
EPROM WILL CHANGE
CALIBRATION CHARAC-
TERISTICS
            ABRT CONT
```

7. Press CONT (F4) to calibrate.

   Press ABRT (F3) to quit without changing calibration.

8. Narrow Millivolt calibration is completed.

   If no other calibrations are required, disconnect test equipment, reconnect all wires, and install enclosure cap.

   If Wide Calibration is required, retain test set-up and proceed to paragraph B.

B. WIDE MILLIVOLT CALIBRATION

1. From the MXC, execute the FIND XMTR program then select CAL/TEST (F2) from the display menu.

2. Step through the MXC screens to select WIDE MILLIVOLT calibration.. Press SELECT (F4).

The MXC's screen will display:

```
APPLY  103.00 mV TO
mV+ (1) AND mV-(3)
WITH COPPER WIRE
                CONT
```

3. Adjust the output of the millivolt source to 103.000 mV.

4. Press CONT (F4). Screen will display:

```
APPLY -18.000 mV TO
mV+ (1) TO AND mV- (3)
WITH COPPER WIRE
                  CONT
```

5. Adjust the output of the millivolt source to -18.000 mV.

6. Press CONT (F4). Screen will display:

```
WARNING: BURNING
EPROM WILL CHANGE
CALIBRATION CHARAC-
TERISTICS      ABRT  CONT
```

7. Press CONT (F4) to calibrate.

   Press ABRT (F3) to quit without changing calibration.

8. Wide Millivolt calibration is completed.

   Disconnect test equipment, reconnect wires, and install enclosure cap.

This completes the calibration checks and procedures

6.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of periodic inspection of the transmitter, cleaning the external surface of the transmitter's enclosure, and draining condensate from conduit. Preventive maintenance should be performed at regularly scheduled intervals.

NOTE

> The electronics module contains integrated circuits that can be damaged by improper handling. The high quality devices used contain built-in protective circuitry, however, they can be damaged by low energy, high voltage electrostatic discharge. Follow procedures to prevent the buildup and discharge of electrostatic energy (see Service Kit below).

6.2.1 Tool and Equipment Requirements

The following tools and equipment are required for servicing:

- Set of Phillips, flat-blade, and Torx-Head screwdrivers.
- Service Kit containing wrist strap and conductive mat (P/N 15545-110 or equivalent) for handling semiconductor components and circuit board assemblies.
- Digital Multimeter (DMM); see Section 6.1.1 for specifications

6.2.2 Transmitter Exterior Inspection

The frequency of inspection will depend on the severity of the transmitter's environment.

1. Inspect the exterior of the transmitter enclosure for accumulated oil, dust, dirt, and especially any corrosive process overspray.

2. Check that each enclosure cap is fully threaded onto the enclosure, compressing the O-ring between the cap and the enclosure. The O-ring must not be cracked, broken, or otherwise damaged.

3. If a digital meter is installed, inspect the protective viewing glass in the enclosure cap for cleanliness and damage. A cracked or punctured glass must be replaced; see Section 6.4 and the Parts List at the back of this Manual.

4. Inspect both enclosure conduit entrances for possible moisture leaks. An unused conduit entrance must be plugged and sealed. Inspect the cable clamps of all watertight cable conduits for loose clamps and deteriorated sealing material. Tighten clamps and reseal as necessary.

5. If a conduit drain is installed, inspect the drain seals for obstructions.

6. If subjected to vibration, inspect all transmitter mounting hardware for tightness. Tighten as necessary.

7. Inspect pushbutton seals for cracks or punctures. Defective seals must be replaced.

6.2.3 Transmitter Exterior Cleaning

After an exterior inspection of the transmitter, the enclosure can be cleaned with the transmitter operating.

1. Clean the enclosure (except enclosure cap glass) with a mild, nonabrasive liquid detergent, and a soft bristle brush, sponge, or cloth. Rinse the weatherproof enclosure with a gentle spraying of water.

   If the transmitter is subjected to heavy process overspray, keep the enclosure free of excessive accumulation of process residue. Hot water or air may be used to flush away process residue if the temperature of the cleaning medium does not exceed the operating temperature of the transmitter as listed in Section 8.3.5 Environmental.

2. Clean enclosure cap glass with a mild nonabrasive liquid cleaner and a soft, lint-free cloth.

6.2.4 Transmitter Enclosure Interior Inspection

Remove the enclosure cap periodically to inspect the interior of the enclosure's terminal compartment. Because the enclosure is sealed, there should be no accumulation of dust, dirt, or water (condensate) in the interior. If condensate is present, a conduit drain must be installed. See Figure 4-11.

Check that all wire connections are tight.
Enclosure threads *must be coated* with a wet, paste-type, anti-seize compound such as Never-Seez by Emhart Bostik. Inspect the enclosure O-ring for damage.

It is not recommended that the enclosure's electronics module compartment be opened for inspection.

6.2.5 Transmitter Calibration

An annual calibration check should be performed to ensure that the transmitter is within specifications. Refer to Section 6.1 for details.

6.3 TROUBLESHOOTING

This Section provides guidance and procedures to assist in identifying and correcting a malfunctioning Model 344 Temperature Transmitter. Section 6.2.1 lists needed tools and equipment.

All documentation associated with the transmitter including piping and loop wiring diagrams and configuration documentation should be available to maintenance personnel to facilitate troubleshooting.

NOTE

The Moore XTC Communicator (MXC) is approved for use in non-hazardous areas only.

6.3.1 Preliminary Troubleshooting

Symptoms and messages resulting from a transmitter malfunction can expedite the troubleshooting process. Messages are displayed on an MXC screen and the optional digital meter

The following paragraphs explain the displayed messages and other visual indications that show the status of the loop or the status of the transmitter.

A. Moore XTC Communicator

Use the MXC's STATUS key to interrogate a transmitter and display a **FAILSAFE** message caused by a transmitter failing a self-diagnostic test. This will identify the source of error through an error message described in Table 6.1 and Section 6.3.2.1, paragraph A.

CALIBRATE / TEST

CAL TEST END

Transmitter self-diagnostics are executed by selecting TEST from the MXC's CALIBRATE/TEST screen. If the test is failed, a message is displayed. Refer to Section 6.3.2.1, paragraph A for details.

MXC STATUS and Diagnostic Displays require fault-free HART communications between the MXC and the transmitter. In the event of communication problems, the MXC can display communication error messages. Refer to Section 6.3.2.1, paragraph B for details.

B. Optional Digital Meter

The Model 344 routinely performs self-diagnostic tests and will display the message “FAIL” if a fault is detected. If the controller function is “OFF” the LCD will flash whenever the process temperature is over or under the range limits by 3%.

C. Console Station, Work Station or Controller

Troubleshooting information can be displayed on a video monitor associated with a console station or work station that is configured to monitor the loop. Refer to the literature supplied with the station.

A panel mounted controller or other station accepting a loop signal generated by a transmitter, or using HART signals to communicate with a transmitter, can display information about the status of the loop and transmitter. Again, refer to the literature supplied with the station.

6.3.2 Troubleshooting

The following procedures can assist maintenance personnel in identifying and isolating a transmitter or loop problem and its source. Diagnostic messages and symptoms related to transmitter malfunction help in diagnosing a problem. Begin troubleshooting by noting the diagnostic message or symptom that accompanies a transmitter malfunction.

6.3.2.1 Diagnostic Messages

Transmitter diagnostic messages consist of displays initiated by transmitter self-diagnostics (paragraph A) or communication warnings (paragraph B) shown on an MXC.

A. Transmitter Self-Diagnostics

Microprocessor initiated transmitter self-diagnostics perform tests on the Electronics Assembly but not the temperature measuring sensor.

NOTE

Faults such as a failed digital meter or erratic sensor are not detectable by the self-diagnostics.

A transmitter failing its self-diagnostics can result in one of the following displays. Perform the procedure given below to access the diagnostic displays and remedy the problem.

FAIL

Transmitter LCD MXC

1. If not already in communication with the suspect transmitter, establish communications by executing the "FIND XMTR" routine on the MXC as described in Section 3.2.

2. Press the MXC's STATUS key. If the message "FAILSAFE" appears in the display, the transmitter has failed a self-diagnostic test.

3. Press ERRORS (F2) to display all active transmitter errors. Note which of the error messages in Table 6.1 is displayed (multiple errors can be displayed).

TABLE 6.1 Self-Diagnostics Troubleshooting

MXC MESSAGE	PROBABLE CAUSE	CORRECTIVE ACTION
E2 ROM	ROM CHECKSUM match failed.	Replace Electronics Module
E3 RAM	Microprocessor failed, RAM inoperative.	Replace Electronics Module
E4 EPROM	Microprocessor cannot retain configuration or calibration data.	Reconfigure/recalibrate transmitter. Perform transmitter TEST (step 4). If TEST fails, replace Electronics Module.
E5 TIMER	A major cycle interrupted itself.	Replace Electronics Module
E6 SENSOR	Three successive A/D sensor conversions were bad	Replace Electronics Module

TRANSMITTER FAILED
TRANSMITTER SELFTEST
CONT

4. Confirm that the fault still exists by selecting the CALIBRATE/TEST screen from the On-Line Menu of the MXC and press TEST (F3). This instructs the transmitter to perform a self-diagnostic test.

PT101 FAILSAFE
ER-RORS EXIT

TRANSMITTER FAILED
TRANSMITTER SELFTEST
CONT

Fault Remains:

If the fault remains, the adjacent message will be displayed:

Repeat the "TEST" program to ensure the validity of the reported fault.

Press END (F4) to exit the CALIBRATE/TEST program. Go to step 5.

<u>Fault Does Not Reappear:</u>

If the fault was temporary - possibly caused by excessive electrical noise or a power line spike - the adjacent message will be displayed:

If the transmitter passes the selftest, it will automatically exit the failsafe mode and resume operation.

5. If a fault exists, on the MXC, press STATUS then ERRORS (F2). Compare the displayed errors with those noted in step 3. Refer to Table 6.1 for a list of errors and corrective action. The MXC screen is shown here.

```
E2 ROM        E3 RAM
E4 EPROM      E5 TIMER
E6 SENSOR
                   EXIT
```

B. Communication Warning Messages

The following three communication warning messages can interrupt the MXC screen at any time during a communication if an error is detected. A troubleshooting procedure with a "possible cause" and "corrective action" recommendation is provided for each error message in Tables 6.2, 6.3 and 6.4.

```
    !  WARNING  !
NO TRANSMITTER FOUND
              RE-
              TRY     END
```

```
      !  WARNING  !
 COMMUNICATION ERROR
RETRY                QUIT
```

```
!  WARNING  !
FIELD DEVICE
MALFUNCTION
```

TABLE 6.2 Message - No Transmitter Found

This message is the result of a failed attempt to communicate with a specific transmitter when executing the FIND XMTR program on the MXC.

```
TRANSMITTER PASSED
TRANSMITTER SELFTEST

                    CONT
```

POSSIBLE CAUSE	CORRECTIVE ACTION
Wrong Transmitter Address (Digital transmitter only) or Tag	Consult configuration documentation to obtain correct address or Tag.
Electrical Noise on Signal Wires	Press RETRY (F3) at least 3 times, waiting at least 1 minute between retries. If not successful, continue troubleshooting. Check for multiple loop cable shield grounds.

POSSIBLE CAUSE	CORRECTIVE ACTION
Loop Wiring Failure	Check for 12 Vdc minimum across SIGNAL +/- terminals in transmitter terminal compartment. Check polarity of loop wiring at both power supply and transmitter. Check that loop resistance is between 250Ω and 1100Ω. Check for loose or broken loop wiring at power supply terminals, Supply Barriers (if used), junction boxes, and transmitter terminal compartment. Check for disconnected or broken Current Sense Resistor. Check for short between shield and SIGNAL + loop wire. Check for accumulation of moisture in transmitter terminal compartment. Check for the proper type and length of loop cable and for electrical interference between the loop cable and any adjacent cables in a cable tray or conduit..

TABLE 6.2 Message - No Transmitter Found, Continued

Possible Cause: Loop Power Supply Failure	Check power supply output voltage for installed network resistance: 17 Vdc minimum at 250Ω 42 Vdc maximum at 1100Ω Check power supply for blown fuse or tripped circuit breaker
Possible Cause: Transmitter Electronics Module Failure	Replace Electronics Module. Refer to Section 6.5.2.

TABLE 6.3 Message - Communication Error

This message results when, after having successfully established communications with a transmitter, an error flag is detected in a received message and the message is not accepted. Error types are: Vertical Parity Error, Overrun Error, Framing Error, Longitudinal Parity Error, and Buffer Overflow.

POSSIBLE CAUSE	CORRECTIVE ACTION
Possible Cause: Noise on Loop Wires	Press RETRY (F3) at least 3 times, waiting at least 1 minute between retries. If not successful, continue troubleshooting
Loop Wiring Failure	Check for 12 Vdc minimum across SIGNAL +/- terminals in transmitter terminal compartment. Check polarity of loop wiring. Check that loop resistance is between 250Ω and 1100Ω to support HART communications. Check for loose or broken loop wiring at power supply terminals, Supply Barriers (if used), junction boxes, and transmitter terminal compartment. Check for disconnected or broken Current Sense Resistor. Check for short between cable shield and SIGNAL + loop wire. Check for accumulation of moisture in transmitter terminal compartment. Check for the proper type and length of loop cable and for electrical interference between the loop cable and any adjacent cables in a cable tray or conduit.
Loop Power Supply Failure	Check power supply output voltage: 17 Vdc minimum, 42 Vdc maximum. Check power supply for blown fuse or tripped circuit breaker.
Transmitter Electronics Failure	Replace Electronics Module. Refer to Section 6.5.2.

TABLE 6.4 Message - Field Device Malfunction

This message results when, after having successfully established communications with a transmitter, a transmitter self-diagnostics failsafe flag is detected in a received message. Use the MXC STATUS program to identify the error source.

POSSIBLE CAUSE	CORRECTIVE ACTION
Transmitter Failed Self-Diagnostic Test	Press the STATUS key on the MXC. Confirm that the message "FAILSAFE" appears in the upper right corner of the display. With transmitter in FAILSAFE mode, see paragraph A of this section and perform steps 3 to 5.

6.3.2.2 Possible Transmitter Output Problems

In this section, Tables 6.5 through 6.9 provide information on diagnosing several types of analog output malfunction symptoms. Under each symptom, possible causes are identified and corrective action suggested.

TABLE 6.5 Symptom - Zero or Low Output

POSSIBLE CAUSE	CORRECTIVE ACTION
Transmitter accidentally configured for Digital Mode. Output current reads a constant 4.000 mA.	Configure transmitter for Analog Mode by changing its short address to zero; See Section 3.
Transmitter Electronics Failure	Determine if transmitter communicates with MXC by executing FIND XMTR program on MXC; see Section 3. Refer to Section 6.3.2.1, paragraph B, to troubleshoot a communications failure. Check transmitter STATUS. If a FAILSAFE message is posted, refer to Section 6.3.2.1, paragraph A, for troubleshooting procedures. If transmitter STATUS checks OK, at the Main Menu, select LOOP OVRD (loop override). Verify the loop by setting the output current to 4, 12 and 20 mA. If an Digital Meter is not installed, verify current by connecting an ammeter to the transmitter's TEST +/- terminals. If the measured selected loop currents are significantly low in value, or loop current cannot be set, replace the Electronics Module. See Section 6.5.2. If transmitter passes loop override test, transmitter electronics are OK. Continue troubleshooting.

TABLE 6.5 Symptom - Zero or Low Output, Continued

Loop Wiring/Power Supply	Check for 12 Vdc minimum across SIGNAL +/- terminals in transmitter terminal compartment. Check power supply output voltage for specified level: 17 Vdc minimum, 42 Vdc maximum. Check power supply for blown fuse or tripped circuit breaker. Check polarity of loop wiring. Check that loop resistance is between 250Ω and 1100Ω. Check for loose or broken loop wiring at power supply terminals, Supply Barriers (if used), junction boxes, and transmitter terminal compartment. Check for disconnected or broken Current Sense Resistor. Check for short between cable shield and SIGNAL + loop wire. Check for accumulation of moisture in transmitter terminal compartment. Check for the proper type of loop cable and for electrical interference between the loop cable and any adjacent cables in a cable tray or conduit.
Transmitter stuck in Loop Override Mode.	Re-enter Loop Override from MXC Main Menu and properly exit Loop Override Mode.

TABLE 6.6 Symptom - High Output

POSSIBLE CAUSE	CORRECTIVE ACTION
Transmitter Electronics Failure	Establish communications between the MXC and transmitter, then check the STATUS of the transmitter. If a FAILSAFE message is posted, refer to Section 6.3.2.1, paragraph A, for troubleshooting procedures. If transmitter STATUS checks OK, EXIT the Status screen to the On-Line Menu and select LOOP OVRD (loop override). Verify the loop by setting the output current to 4, 12 and 20 mA (read at Digital Meter or ammeter connected to TEST +/- terminals. If selected loop currents are significantly out of tolerance as measured by the Ammeter, or loop current cannot be set, replace the Electronics Module. See Section 6.5.2. If transmitter passes loop override test, continue troubleshooting.

TABLE 6.7 Symptom - Output Current Fixed Below Scale at Approximately 3.84 mA

POSSIBLE CAUSE	CORRECTIVE ACTION
Loop supply voltage less than 12 Vdc at transmitter SIGNAL +/- terminals.	Replace power supply.
Thermocouple Burnout (if Downscale protection) or thermocouple extension wire(s) open.	Refer to Figure 4-13 and perform a standard open circuit (thermocouple) check between transmitter terminals #1 and #3.
Thermocouple wires have polarity reversed.	Consult thermocouple wire tables (or Table 6.1) and determine color code for positive and negative wires. Check wire connections at transmitter terminal compartment and at thermocouple head if thermocouple is remote mounted.
Shorted thermocouple extension wires (due to insulation failure) between remote mounted thermocouple and transmitter. The transmitter will read the temperature at the short (junction) which, if 3% less than the configured Zero range value, will force the output current to a maximum low value of 3.84 mA.	Special Time-Domain Reflectometer (TDR) measurements can be used to locate the short; otherwise, a visual inspection of the length of wire must be made to locate the short.
Incorrect lead connections on 3-wire RTD.	Refer to Figure 4-13 and check for correct sensor wiring.
Open RTD lead on double-lead side of 3-wire RTD.	Refer to Figure 4-13 and perform continuity check between RTD wires connected to transmitter terminals #1 and #2 to confirm open circuit.
The single side RTD lead is shorted to one of the double-side RTD leads (RTD shorted out).	Refer to Figure 4-13 and perform continuity check between RTD wires #1 and #3 to confirm shorted RTD
Temperature is less than Lower Range Limit (LRL).	Re-range transmitter. Refer to Section 5.

TABLE 6.8 Symptom - Output Current Fixed Above Scale at Approximately 21.8 mA

POSSIBLE CAUSE	CORRECTIVE ACTION
Thermocouple Burnout (if Upscale protection) or thermocouple extension wire(s) open.	Refer to Figure 4-13 and perform burnout check on thermocouple and continuity check on wires between transmitter terminals #1 and #3 to isolate the fault.
RTD element open or, if RTD is remote mounted, return wire to transmitter terminal #3 is open	Refer to Figure 4-13 and perform continuity checks on RTD and RTD return wire to transmitter terminal #3 to isolate the fault
Temperature is greater than Upper Range Limit (URL).	Re-range transmitter. Refer to Section 5.

TABLE 6.9 Symptom - Erratic Output

POSSIBLE CAUSE	CORRECTIVE ACTION
Loop Wiring	Check for 12 Vdc minimum across SIGNAL +/- terminals in transmitter terminal compartment. Check power supply output voltage: 17 Vdc minimum; 42 Vdc maximum. Check for loose loop wiring at power supply terminals, Supply Barriers (if used), junction boxes, and transmitter terminal compartment. Check for loose leads at Current Sense Resistor. Check for accumulation of moisture in transmitter terminal compartment. Check for multiple grounds on loop cable shield. Check for the proper type of loop cable and for electrical interference between the loop cable and any adjacent cables in a cable tray or conduit. Check signal loop is grounded, not floating. Ground signal loop at one point only, preferably at the power supply negative terminals.
Loop power supply excessively noisy	Confirm defective power supply by substituting spare supply for suspect supply. Select a higher damping value (software filter time constant).
High level noise pick-up in sensor leads	Low level leads between sensor and transmitter should be shielded.
Transmitter Electronics Failure	Check transmitter STATUS. If a FAILSAFE message is posted, refer to Section 6.3.2.1, paragraph A, for troubleshooting procedures. If STATUS is OK, select LOOP OVRD (loop override). Verify loop by setting output current to 4, 12 and 20 mA (read on Digital Meter or ammeter connected to TEST +/- terminals). Carefully observe that the selected currents remain steady. If current cannot be set or is unstable, replace the Electronics Module. See Section 6.5.

6.3.3 Diagnosing a Defective Digital (LCD) Meter

The optional LCD is functionally tested during a transmitter power up or master reset. It is also tested when the MXC TEST program (transmitter self-diagnostics) is executed. The 4 second test activates all the legends and numerical segments of the LCD. However, if the LCD fails the test, the failure is not reported by the self-diagnostics. The LCD must be observed when performing the MXC TEST program to confirm its test.

If the LCD is not functioning correctly, use an on-hand spare LCD to prove the suspect LCD is defective as follows:

1. Turn off power to the transmitter and remove protective enclosure cap to access the LCD.

2. Snap a grounding wrist strap on wrist and connect ground clip to transmitter or mounting bracket.

3. As shown in Figure 4-10, disconnect cable from Digital Meter Board and slide cable from cable slot in Board.

4. Connect the cable to the spare LCD. Restore power to the transmitter and check that the spare LCD is functioning correctly. To repeat the test, use the MXC to TEST the transmitter.

5. If the spare LCD functions correctly, replace the defective LCD. Refer to Section 4.4.4.

   If the spare LCD exhibits the original problem, replace the Electronics Module. Refer to Section 6.5.

6.3.4 Enclosure Thread Lubrication

Enclosure caps should turn smoothly and easily on the enclosure threads. These threads are factory coated with a wet, paste-type, anti-seize compound such as Never-Seez by Emhart Bostik.

- Do not use force to thread a cap onto the enclosure.
- Be careful not to wipe off the lubricant while handling the transmitter.
- Recoat the enclosure threads if the cap is at all difficult to turn on the enclosure threads.
- Always inspect the enclosure O-ring for damage before installing a cap.

6.4 NON-FIELD-REPLACEABLE ITEMS

- Enclosure Cap Display Viewing Glass: Agency regulations do not permit field replacement of a broken or damaged glass as this would invalidate the enclosure's explosion proof rating. Replace the entire damaged enclosure end cap assembly.
- Power/Sensor Input Terminal Strip: A damaged (unusable) terminal strip requires the replacement of the enclosure body
- Electronics Baseboard: ---

6.5 ASSEMBLY REMOVAL AND REPLACEMENT

This section provides general information concerning the replacing of assemblies. Removal and replacement of assemblies is easily accomplished with standard hand tools. Section 4.4.4 describes repositioning and removal of the digital meter. This procedure is also used for meter replacement.

NOTE

If the transmitter (Controller version) is controlling a process, use the proper procedures and shut down the process.

6.5.1 Electronics Module Removal and Replacement

The Electronics Module should be returned to the factory for repair if found to be defective.

REMOVAL

1. The electronics module can usually be replaced at the installation site; otherwise, remove the transmitter for bench servicing.

   If a Transmitter-Controller is controlling the process, use the proper procedures and shut down the process. Turn off power to transmitter and remove the enclosure cap to access the electronics module.

2. Retrieve the wrist strap from the maintenance kit and snap it on. Connect ground clip to unpainted area on the transmitter or mounting bracket. Use proper handling procedures to prevent damage to the Electronics Module from electrostatic discharge. Store an electronic assembly in a static shielding bag.

3. If a Digital Meter is installed, remove the meter assembly as described in Section 4.4.4. Disconnect digital meter board cable from Module connector P2. Retain removed cable.

   Place digital meter assembly in static protective bag.

4. As shown in Figure 4-9, unscrew captive screw from Module's retaining bracket. Slide Module forward until Module's guide blocks are free of the metal guide posts. Place removed Module in static protective bag.

REPLACEMENT

1. Remove replacement Electronics Assembly from static protective bag. Refer to Figure 4-9 and check that Push Button Enable/Disable jumper W1 is in the Enable position.

2. If a Digital Meter is to be installed, refer to section 4.4.4 and connect the removed digital meter board cable to the Electronic Module's P2 connector.

3. Carefully insert the Electronic Module into the housing.

- The Electronics Module's guide blocks engage the guide posts
- The P1 power connector (at rear of Module) engages the mating connector on the Baseboard.

4. Secure the Electronic Modules's retaining bracket to the stand-off.

5. If applicable, refer to section 4.4.4 and install removed digital meter.

6. Restore power to the transmitter and perform the following:
   - Transmitter Configuration: Refer to Section 5 On-Line and Off-Line Configuration
   - System Checkout: Refer to Section 3.0.

6.6 MAINTENANCE RECORDS

An accurate record keeping system for tracking maintenance operations should be established and kept up to date. Data extracted from the record may serve as a base for ordering maintenance supplies, including spare parts. The record may also be useful as a troubleshooting tool. In addition, maintenance records may be required to provide documentary information in association with a service contract. It is suggested that, as appropriate, the following information be recorded:

1. Date of service incident
2. Name or initials of service person
3. Brief description of incident symptoms and repairs performed
4. Replacement part or assembly number
5. Software compatibility code of original part
6. Software code of replacement part
7. Serial number of original part
8. Serial number of replacement part
9. Issue number of original electronics module
10. Issue number of replacement electronics module
11. Date of completion

6.7 RECOMMENDED SPARE AND REPLACEMENT PARTS

The quantity and variety of spare parts is determined by the time a transmitter can be permitted to remain out of service or off-line. An electronics module should be stocked by the user for immediate repairs.

Replaceable parts are listed in the Parts List at the back of this Manual.

To replace a part, refer to Section 4, Installation and the Parts List drawing at the back of this Manual.

When ordering a part, provide the following information for the item, module or assembly to be replaced or spared. This information will help insure that a repair addresses the observed problem, and that a compatible part is supplied.

1. Part number from Parts List or from a label on assembly

2. The single number software compatibility code

3. Serial number from the label on the transmitter's nameplate

4. User purchase order number of original order, available from user records

5. New user purchase order number for the assembly to be replaced or spared

6. Reason for return for repair; include system failure symptoms, station failure symptoms, and error codes displayed.

Returns should be packaged in original shipping materials if possible. Otherwise, package item for safe shipment or contact factory for shipping recommendations. Refer to Section 6.9 to obtain a Return Material Authorization number.

IMPORTANT

The electronics module must be placed in a static shielding bag to protect it from electrostatic discharge.

6.8 SOFTWARE COMPATIBILITY

A single number software compatibility code identifies transmitter software revision level. This software controls the transmitter's operating routines and its HART communications with loop connected stations and gateways.

To read the software level of a transmitter (see Section 5 for a detailed procedure):

1. Connect the MXC to the loop. Establish communication with the transmitter and display the On-Line Menu.

2. Press STATUS, then press CONT. Read the model number and software revision level.

6.9 PRODUCT SUPPORT

Product support can be obtained from the Moore Products Co. Technical Information Center (TIC). TIC is a customer service center that provides direct phone support on technical issues related to the functionality, application, and integration of all products supplied by Moore Products Co.

To contact TIC for support, either call 215-646-7400, extension 4TIC (4842) or leave a message in the bulletinboard service (BBS) by calling 215-283-4958. The following information should be at hand when contacting TIC for support:

- Caller ID number, or name and company name

When someone calls for support for the first time, a personal caller number is assigned. This number is mailed in the form of a caller card. Having the number available when calling for support will allow the TIC representative taking the call to use the central customer database to quickly identify the caller's location and past support needs.

- Product part number or model number and version (see section 7.0 for guidelines on identification)

- If there is a problem with product's operation:
  - Is problem intermittent
  - The steps performed before the problem occurred
  - Any error messages displayed
  - Installation environment

6.10 RETURN SHIPMENT

The return of equipment or parts for any reason must always be coordinated with the factory. When it becomes necessary to make a return shipment, be sure to contact Moore Products Co. first and obtain packaging information and carrier recommendations.

TO RETURN EQUIPMENT

- Call Moore Products Co. at (215) 646-7400, ext. 4RMA (4762) weekdays between 8:00 a.m. and 4:45 p.m. Eastern Time to obtain an RMA (Return Material Authorization) number. Mark the RMA number prominently on the outside of the return shipment.

- When calling for an RMA number, provide the reason for the return. If returning equipment for repair, failure information (e.g., error code, failure symptom, installation environment) will be requested. A purchase order number will be requested.

MATERIAL SAFETY DATA SHEET

- A Material Safety Data Sheet (MSDS) must be included with each item being returned that was stored or used anywhere hazardous materials were present.

- Decontaminate a transmitter before packaging it for shipment.

PACKAGING

- Package assembly in original shipping materials. Otherwise, package it for safe shipment or contact the factory for shipping recommendations.

7.0 CIRCUIT DESCRIPTION

This section provides a basic circuit description of the XTC Model 344 Temperature Transmitter-Controller. Figure 7-1 shows a functional block diagram of the transmitter.

The main Electronics Assembly is comprised a four circuit boards: Digital Board with microprocessor and HART modem chips, Analog Board with the Digital/Analog converter and power supply, an Input Board, and an Output Board. The baseboard contains filtering components for the transmitter I/O and an optional digital LCD display board provides local indication of the transmitter output.

7.1 ELECTRONICS ASSEMBLY

The main Electronics Module has four boards which contain the following:

- A standard Bell 202 Modem that employs Frequency Shift Keying (FSK) for remote communications via the HART protocol.

- A Microcontroller that:
  - Controls communications
  - Corrects and linearizes the sensor input signal
  - Stores configuration data; configuration data is stored in nonvolatile EEPROM memory in the Microcontroller and is retained when power is interrupted permitting the Transmitter to become functional upon power-up
  - Performs re-ranging and damping value selection upon input from user actuated local Zero, and Fullscale pushbuttons

- A custom ASIC (Application Specific Integrated Circuit) that provides:
  - A clock to the Microcontroller
  - Serial D/A conversion of the Microcontroller’s signal to drive the V/I Converter

- A Low Voltage Power Supply with current limiting that provides DC operating power

- A power supply Voltage Monitor that generates a Microcontroller Reset signal when the Network (Loop) supply voltage is interrupted.

- A Bandpass Filter that passes HART signals and rejects low frequency analog signaling.

- A Voltage-to-Current Converter (V/I) that converts the output of the ASIC's D/A to a 4 to 20 mA loop output signal.

- Reference junction temperature sensor that measures and regulates the temperature of the TC(+) screw terminal.

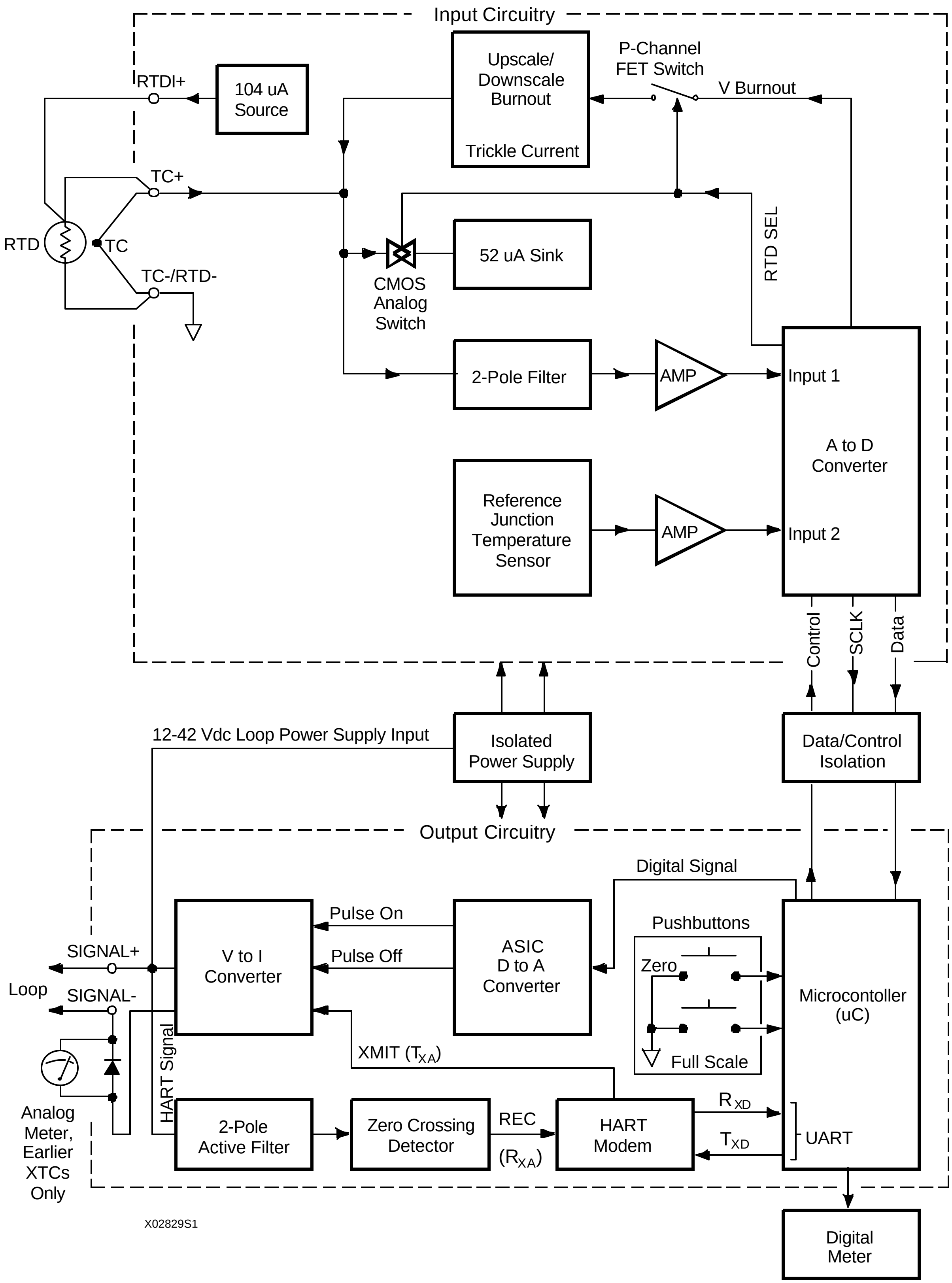


FIGURE 7-1 Model 344 Electronics Module Block Diagram

7.2 THEORY OF OPERATION

The transmitter input signal, obtained from a Thermocouple (TC), Millivolt (mV), Resistance Temperature Detector (RTD) , or Resistive (Ohm) source is wired to the transmitter's signal input terminal block. The standard calibration curves for J, K, E, T, R, S, B and N type Thermocouples and US/DIN curves for 100, 200, and 500 Platinum RTDs are stored in memory. The input is corrected for ambient temperature effects, linearized, and converted to a 4 to 20 mA or HART digital output signal. The specific type of input signal is selected during configuration.

7.2.1 Thermocouple/Millivolt (TC/mV) Input

The range limit for a millivolt input signal from a TC or mV source is -10 mV to +100 mV. Since input circuits for mV and TC inputs operate identically, a TC input will be described.

The input from the thermocouple is applied to a 2-pole filter which reduces RFI and 60 Hz noise. The filter's output is fed to a high gain amplifier and applied to INPUT 1 of the A/D Converter. An amplified reference junction input from an Integrated Circuit Temperature Sensor is fed to INPUT 2 of the A/D Converter. The Sensor measures the temperature of the TC (+) screw terminal and regulates the current at a rate of 1 microamp per degree Kelvin. The Microcontroller (µC) periodically reads the Sensor signal and compensates the TC input for changes in ambient temperature.

UPSCALE/DOWNSCALE indicates thermocouple burnout (open circuit) by driving the output to a high or low limit depending on the selected configuration parameter. When the transmitter input is configured for a TC, the RTD SEL output from the A/D Converter goes logic low. This turns on the P-channel FET and turns off the CMOS Analog Switch, disabling the 52 µA Current Sink used for RTD/OHMS input.

The V BURNOUT output from the A/D Converter, either a plus or minus voltage depending on the upscale/downscale choice, passes through the FET and is converted to a trickle current. If the TC opens, the trickle current will charge the input filter in the appropriate direction and drive the perceived temperature to the high or low limit.

The input circuitry communicates with the microcontroller (µC) through three pulse transformers (DATA/CONTROL ISOLATION) which provide isolation with minimum current consumption.

7.2.2 RTD/OHMS Input

The range input for an OHM type input is 0 to 1875 ohms (from an RTD or potentiometer source). Input circuits for a potentiometer or RTD input operate identically; here, an RTD input will be described.

The operation of the input circuitry with an RTD/OHM input is essentially the same as with a TC/mV input with the following exception; an RTD/OHM input is read by forcing a 52 microamp current through the sensing device and measuring the resulting voltage drop that is applied to the input filter (52 microamps was chosen to generate standard TC voltages when used with a TC input) .

When the transmitter is configured for an RTD input, the RTD SEL output from the A/D Converter goes logic high turning off the P-channel FET and disabling the burnout trickle current network. The CMOS

Analog Switch is turned on enabling the 52 µA sink circuit.

The current from the 104 microamp source is applied to the RTDI(+) pin which is jumpered to the TC(+) pin. Since the 52 µA sink network draws 52 microamps, the remaining current flows through the RTD input to ground creating a voltage at the input to the 2-pole filter. 52 microamps is drawn through the TC (+) pin into the 52 µA sink network, ensuring that when a 3-wire RTD is used , both measurement leads will have identical current flowing in the same direction into the transmitter.

7.2.3 Signal Conversion

The digitized sensor and reference junction signals are passed from the input circuit's A/D Converter through isolated pulse transformers into the microcontroller (µC) for signal linearization and temperature compensation.

The output signal from the µC is applied to a D/A Converter which outputs two variable width pulses (PULSE ON/PULSE OFF). The widths of the pulses are modulated in direct proportion to the voltage level of the sensor input signal. The pulses are simultaneously applied to the V/I Converter and to two P-channel FETs within the Converter. The output from the FETs is filtered and fed into an operational amplifier whose output drives the voltage-to-current conversion circuit, a Darlington transistor pair acting as a pass transistor for the 4 to 20 mA loop current output.

7.2.4 Communication Format

The Model 344 communicates, via the HART protocol, with the portable MXC and any Primary or Secondary Master connected to the Network.

HART communication uses phase-continuous frequency-shift-keying (FSK) at 1200 bits/sec and frequencies of 1200 Hz for logic 1 and 2200 Hz for logic 0. HART communications are superimposed (AC coupled) on the analog 4-20 mA signal. Because the digital signaling is high frequency AC, its DC average is zero and does not interfere with analog signaling.

A 2-Pole Active Filter connected to the loop input receives HART transmissions. The filter rejects low frequency analog signaling, and other out-of-band interference, preventing a compromise of the digital reception. The filtered signal is applied to a Zero Crossing Detector which converts the filtered information into clean pulses of uniform amplitude before introduction to the Bell 202 Modem.

The Modem receives and processes (e.g., demodulation) the serial FSK signal (R_{xa}) and outputs the signal (R_{xd}) to the Microcontroller where serial to parallel conversion is performed.

In response to the received signal, the Microcontroller outputs a signal (T_{xd}) to the Modem where it is modulated and fed into the feedback circuit of the V/I Converter for transmission (T_{xa}) over the loop.

8.0 MODEL DESIGNATION AND SPECIFICATIONS

This section contains the model designation table, accessory tables, and specifications for all Model 344 Temperature Transmitters.

8.1 MODEL DESIGNATION

Table 8.1 identifies each model designation entry on a transmitter's nameplate. The nameplate also carries other important transmitter information in addition to the model designation: bill of material number (B/M), serial number, span limits, factory calibration (FCTY CAL), and certifications.

IMPORTANT

Confirm transmitter model by referring to the transmitter's model designation on its nameplate and Table 8.1 before installing, applying or removing power, configuring or servicing.

TABLE 8.1 Model 344 Model Designation

EIGHT PLACE MODEL NUMBER

Basic Model Number
344 Temperature Transmitter-Controller

- **Output**
  - B Transmitter-Controller
- **Integral Thermal Element** (1)
  - N No (element supplied with connection head)
  - Y Yes (element attached to a conduit entrance)
- **Output Indicator**
  - N Not Required
  - 5 4 1/2 Digit Digital Smart Display
- **Standard Options**
  - N Not Required
  - Y Special Features (describe)
- **Mounting Bracket**
  - 1 2" Pipe Mount, SS Hardware
  - 2 Universal
  - 3 2" Pipe Mount, 316 SS Bracket
  - N Not Required
- **Housing**
  - 1 Aluminum 1/2-14 NPT
  - 2 Aluminum M20 x 1.5 (2)
- **Hazardous Area Classification**
  - 2 CSA All
  - G FM (EP, DI, NI)
  - N Not Required
  - W FM & ABS Type Approved

344 B N N N N 1 G Sample Model Number

SEVEN PLACE MODEL NUMBER

Basic Model Number
344 Temperature

- **Service**
  - B Transmitter-Controller
- **Reserved for Factory Use**
  - N Not Required
- **Output Indication**
  - N Not Required
  - 1 Analog Linear 0-100% (earlier units only (4))
  - 5 Digital
  - 6 Digital/Analog 0-100% (earlier units only (4))
- **Special Features**
  - N Not Required
  - Y Yes
- **Electrical Connection**
  - 1 1/2-14 NPT
  - 2 M20 x 1.5 (2)
- **Hazardous Area Classification**
  - 2 CSA All
  - G FM (EP, DI, NI)
  - N Non-Approval

344 B N N N 1 N Sample Model Number

(1) A Model 344T Thermal Element should be specified separately. Shipping oversized integral thermal elements attached to a Model 344 is at Moore Products Co.'s discretion.

(2) Not available with FM/CSA Units.
(3) Tags - The permanent transmitter nameplate can be stamped with a tagname of up to 8 characters. Optional, wired-on SS tags are also available.
(4) Refer to SD344 for details.

8.2 ACCESSORIES

Table 8.2 lists the general accessories available for the transmitter. Accessories are ordered separately since they are not included in a transmitter's model number.

Table 8.3 lists the thermal sensors commonly available for the transmitter. Each sensor can be provided as an integral or remote assembly. The integral version, shown in Figure 8-1, provides a direct connection that becomes part of the transmitter assembly. The remote version, shown in Figure 8-2, includes a connection head that provides a termination point for the sensor wires, allowing the sensor to be installed separately.

TABLE 8.2 General Accessories

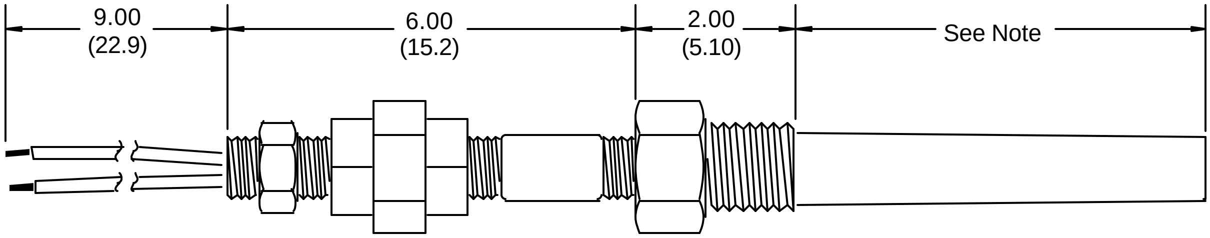
DESCRIPTION	PART NUMBER
Transient Protection*	14999-287
General Purpose Power Supply, 24 Vdc, 2A*	15124-1
Field Mounted Power Supply, 28 Vdc, 125 mA* (NEMA 4x, EP)	16055-299
Communication Filter Kit*	16202-3
Digital Meter Kit*	15965-808
Moore XTC Communicator (MXC)	15965-665

TABLE 8.3 Thermal Sensors

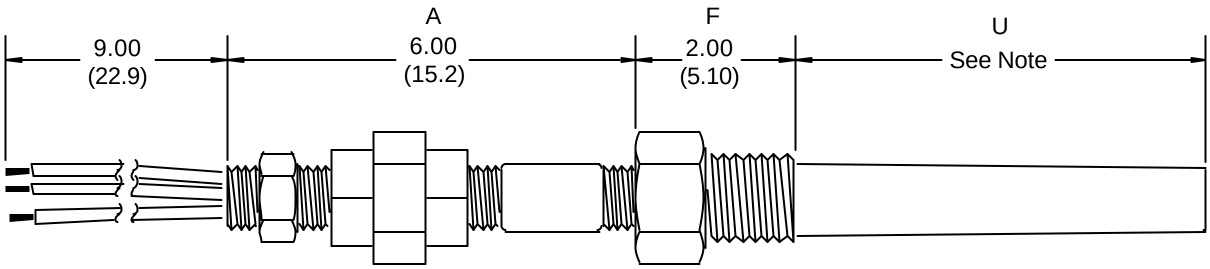
DESCRIPTION	BASIC REFERENCE NUMBER
Threaded Bar Stock Well Assembly	344T1**
Flanged Bar Stock Assembly	344T2**
Socket or Weld-In Assembly	344T3**
Flanged Pipe Well Assembly	344T5**
Industrial CERAMOCOUPLE® Assembly	344T6**
Sanitary Probe	344T7** and 344T8**

** Refer to PI34-3, XTC Transmitter Accessory Guide for additional details.*

*** Refer to corresponding GC344T_ or PI34-3 for ordering information.*



Thermocouple Thermowell Assembly



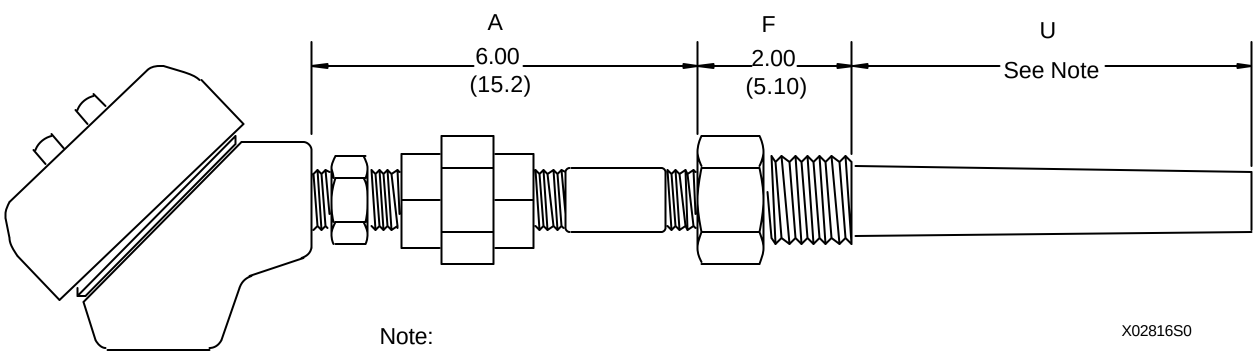
3-Wire RTD Thermowell Assembly

X02815S0

Note:
Typical Well Lengths in Inches (Centimeters).

3.50(8.9)	6.00(15.2)	8.00(20.3)	10.00(25.4)	12.00(30.5)

FIGURE 8-1 Typical TC and RTD Thermowell Assemblies without Heads



X02816S0

Note:
Typical Well Lengths in Inches (Centimeters).

3.50(8.9)	6.00(15.2)	8.00(20.3)	10.00(25.4)	12.00(30.5)

FIGURE 8-2 Typical TC or RTD Assembly with Head

Notes for Figures 8-1 and 8-2:

1. *'A' Dimension, Extension Assembly - Joins connection head or transmitter to thermowell.*
2. *'F' Dimension, Process Connection - Provides connection to process vessel.*
3. *'U' Dimension, Probe - The length of the thermowell assembly inserted into the process (immersion).*

Table 8.4 provides a list of replacement thermocouples and RTDs for Model 344T series thermal sensors. In critcal applications, it may be desirable to have on-hand spare elements. All thermal elements are 1/4" in diameter with a 316SS sheath and grounded measuring junction. All thermal elements are spring loaded. *The length of the assembly, computed as A + F + U, must be supplied*. For cast aluminum or cast iron connection heads add 2" to the computed length for T/Cs and RTDs.

Table 8.5 lists thermocouple wire for common thermocouple types. Thermocouple wire is twisted-shielded pair, 20 gauge, PVC insulated. RTD wire is 16 or 20 gauge 3-wire twisted-shielded.

TABLE 8.4 Replacement Thermocouples and RTDs for 344T Temperature Elements

SINGLE ELEMENT	TYPE	DUAL ELEMENT	TYPE
ASL14J	J	ADSL14J	J
ASL14T	T	ADSL14T	T
ASL14K	K	ADSL14K	K
ASL14E	E	ADSL14E	E
ASL14S	S	ADSL14S	S
ASL14R	R	ADSL14R	R
ASL14B	B	ADSL14B	B
ASL14N	N	ADSL14N	N
RTD 14	100 ohm platinum RTD (Alpha = 0.00385)	DRTD14	100 ohm platinum RTD (Alpha = 0.00385)

TABLE 8.5 Thermocouple Wire

16 GAUGE	20 GAUGE	TYPE
UP/ALPTW-16-JX	UP/ALPTW-20-JX	J
UP/ALPTW-16-TX	UP/ALPTW-20-TX	T
UP/ALPTW-16-KX	UP/ALPTW-20-KX	K
UP/ALPTW-16-EX	UP/ALPTW-20-EX	E
UP/ALPTW-16-SX	UP/ALPTW-20-SX	S
UP/ALPTW-16-RX	UP/ALPTW-20-RX	R
UP/ALPTW-16-BX	UP/ALPTW-20-BX	B
UP/ALPTW-16-NX	UP/ALPTW-20-NX	N
UP/ALPTW-16-TRIAD	UP/ALPTW-20-TRIAD	RTD 100 Ω

8.3 SPECIFICATIONS

The following specifications are for all transmitter models except as noted.

8.3.1 Mechanical

Transmitter Dimensions...Figure 8-3

Mounting Bracket Dimensions, Supplied Bracket............Figure 4-5

Weight (approximate)
  Transmitter with Display...8.5 lbs (3.9 kg)
  Supplied Bracket...1.5 lbs (0.7 kg)

8.3.2 Functional and Performance

Range/Sensor Input Types..See Table 8.6

TABLE 8.6 Sensors: Type, Range, Span, and Accuracy

SENSOR INPUT	INPUT RANGE °C	INPUT RANGE °F	MIN/MAX SPAN °C	MIN/MAX SPAN °F	ACCU-RACY[1]
RTD - 2,3,4-Wire					
100Ω Pt DIN α = 0.00385	-200 to 850	-328 to 1562	10/1050	18/1890	±1.6°C
200Ω Pt DIN α = 0.00385	-200 to 850	-328 to 1562	20/1050	36/1890	±1.5°C
500Ω Pt DIN α = 0.00385	-200 to 850	-328 to 1562	20/1050	36/1890	±0.9°C
100Ω Pt U.S. α = 0.003902	-200 to 650	-328 to 1202	10/850	18/1530	±1.5°C
200Ω Pt U.S. α = 0.003902	-200 to 650	-328 to 1202	20/850	36/1530	±1.4°C
500Ω Pt U.S. α = 0.003902	-200 to 650	-328 to 1202	20/850	36/1530	±0.8°C
Thermocouples					
Type B NBS	100 to 1815	212 to 3299	20/1773	126/3191	±2°C[2]
Type E NBS	-185 to 1000	-301 to 1832	40/1185	72/2133	±0.55°C
Type J NBS	-185 to 1095	-301 to 2003	30/1280	54/2304	±0.6°C
Type K NBS	-185 to 1370	-301 to 2498	60/1555	108/2799	±0.9°C
Type N NBS	-185 to 1300	-301 to 2372	55/1485	99/2673	±1.4°C
Type R NBS	-18 to 1760	0 to 3200	60/1775	108/3200	±1.7°C
Type S NBS	-18 to 1650	0 to 3002	70/1668	126/3002	±1.65°C
Type T NBS	-200 to 400	-328 to 752	20/600	36/1080	±0.55°C
Millivolt					
Wide Range	-15 to 100		5/115 mV		±30µV
Narrow Range	-10 to 25		1/35 mV		±15µV
Ohm Input					
Wide Ohm	0 to 1875Ω		25/1875Ω		±1.3Ω
Narrow Ohm	0 to 470Ω		10/470Ω		±0.45Ω

Notes:
1. Includes transmitter's absolute digital accuracy and ambient temperature effect over the entire operating range.

2. For 400° C and above. For 100° C to 400° C, accuracy is 9° C. Common applications are above 800° C.

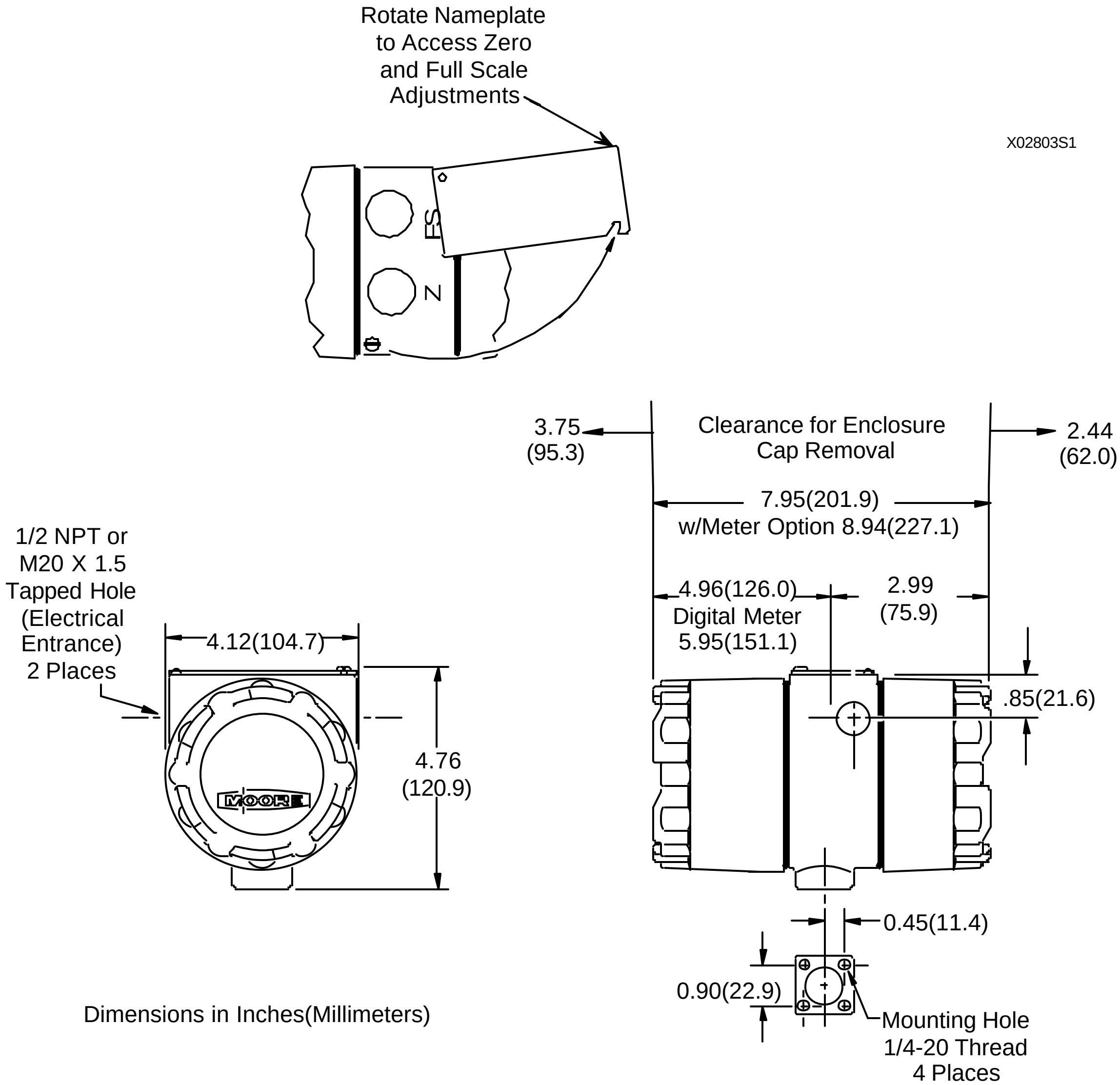


FIGURE 8-3 Model 344 Dimensions

Accuracy, Analog Output
- D/A Converter Accuracy..0.075% of span over entire temperature range
- Total Accuracy...Digital Accuracy + D/A Converter Accuracy

Analog Update Rate ....500 milliseconds

Damping ....0 to 120 seconds

Outputs
- Analog ....Two-wire with digital communication superimposed on the 4-20 mA signal, Max, less than 25 mAdc, Min., greater than 3.84 mAdc
- Digital...HART protocol for field communication bus

Power Supply
- Minimum Compliance Voltage ....+12 Vdc with no loop resistance, see Figure 4-4
- Network (Current Sense or Loop)
  - Resistance (R_L)..250Ω minimum, 1100Ω maximum
    *$R_L = 43.4V_S - 520.8$; where V_S = power supply voltage
- Maximum Loop Voltage ....+42 Vdc; for Ex N use, see Section 8.3.6
- Ripple ....0.2 Vp-p, 47-125 Hz
- Noise ....0.6 mV RMS maximum
- Impedance ....10 Ohms maximum

Power Supply Effect...Less than 0.005% of output span per volt

Indication, optional ....4-1/2 digit LCD with status indicators

Transmitter Input Capacitance ....27,000 pF, HART $C_n = 6$; refer to section 4.3.5

Network Topology
- Point-To-Point
  - Transmitter Quantity 1
  - Network Signal and Connection ....Analog 4-20 mA, single current loop; see Figures 4-1 and 4-2
  - Network Resistance ....See Figure 4-4
- Multi-Drop
  - Transmitter Quantity ....1 to 15
  - Network Signal and Connection ....Digital, parallel connected; see Figure 4-3
  - Network Resistance ....See Figure 4-4

Transmitter I/O Isolation
- Between Input/Output Terminal...............................250 Vac
- Between Case and Networking Wiring.....................250 Vac

8.3.3 Two-Wire Cable

Type ....Twisted Single-Pair, Shielded, Copper

Conductor Size for Network Length
- Less than 5000 ft. (1500 m) ....24 AWG minimum
- More than 5000 ft. (1500 m) ....20 AWG minimum, 16 AWG maximum

Cable Capacitance ....Refer to Section 4.3.5

Recommendation ....Belden 8641, 24 AWG
Belden 8762, 20 AWG

Length, Maximum ....Refer to Section 4.3.5

8.3.4 Sensor Inputs

Common Mode Rejection ....120 dB at 50/60 Hz and 1000 ohm unbalanced input
Normal Mode Rejection ....6 dB at 2 Hz and 60 dB at 50/60 Hz
Input Overvoltage Protection ....+/-30 Vdc
Digital Filter Range ....0.001 to 10Hz (breakpoint frequency) selectable

Thermocouple (TC)
Reference Junction Compensation ....Automatic
Input Impedance ....Greater than 200,000 Ohms
Thermocouple Burnout Scale Direction ....HART selectable (UP/DOWN)
Conformity ....Greater than or equal to 0.1°F; NIST curve based on IPTS - 1968

Millivolt (mV)
Input Impedance ....Greater than 1 Megohm

Resistance Temperature Detector (RTD)
Input Impedance ....Greater than 1 Megohm

Resistance (Potentiometer)
Input Impedance ....Greater than 1 Megohm

8.3.5 Environmental

Ambient Temperature Range, Storage & Operating
Operating ....-40° to 85°C (-40° to 185°F)
Storage ....-40° to 85°C (-40° to 185°F)

Humidity
Operating ....5-100% RH
Storage ....0-100% RH, non-condensing

Maximum Moisture
Operating ....Less than 0.050 lb. H_2O per lb. of dry air
Storage . ...Less than 0.028 lb. H_2O per lb. of dry air

Corrosive Atmosphere ....Operates in Class G3 (Harsh) environment per ISA-S71.04

Vibration Effect ....Less than ±0.05% URL per G from 0 to 2000 Hz in any axis (per SAMA PNC 31.1) up to 7Gs max

EMI Susceptibility ....Tested for RFI from 30 MHz to 1 GHz for a field of 30V/m

ESD Susceptibility ....IEC severity level 4, 15 kV

8.3.6 Hazardous Area Classification

Before installing, applying power to, or servicing a transmitter, see the transmitter's nameplate and the Table in section 8.1 for the electrical classification. Contact Moore Products Co. for latest approvals and certifications.

The transmitter has been designed to meet the following:

FM/CSA - (CSA approval has been granted. FM approval was pending at the time this User's Manual was prepared.)

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

Explosion Proof: Class I, Division 1, Groups B, C and D
Class II, Division 1, Groups E, F, and G
Class III, Division 1

Non-Incendive: Class I, Division 2, Groups A, B, C and D
Class II, Division 2, Groups E, F, and G
Class III, Division 2

Electronics Housing: NEMA 4X, IP 66/IP 68

CENELEC

Flame Proof: EEx d IIC T4 Tamb 85°C
T6 Tamb 60°C
T8 Tamb 50°C

BASEEFA

Ex N IIC T4 (Tamb = -40°C to 85°C)
Ex N IIC T5 (Tamb = -40°C to 60°C)

Ex N Use - Install a voltage limiting device that will prevent loop terminal voltage from exceeding 42 Vdc.

Electronics Housing: IP66/IP68

EMC Compatibility: A Declaration of Conformity showing accordance with EN45014 is located on the following page.

SAA Certification: The transmitter has been assessed to the entity concept. Consider the following electrical parameters during installation.

Maximum Input Voltage (Ui)	42V
Maximum Input Current (Ii)	180 mA
Maximum Internal Capacitance (Ci)	0 µF
Maximum Internal Inductance (Li)	0 mH

It is a condition of safe use for Ex n and Ex d installations that any unused entry be blocked such that the IP rating is maintained and requires use of a tool to effect its removal.

DECLARATION OF CONFORMITY

according to EN 45014

We

Moore Products Co.
Sumneytown Pike, Spring House, PA 19477

declare under our sole responsibility that the product,

Model 344, Temperature Transmitter with any factory installed options and in any configuration available from the factory

to which this declaration relates is in conformity with the following standards or other normative documents

EMC: EN50081-1 and EN50081-2 Emissions
EN50082-1 and EN50082-2 Immunity

following the provisions of the EMC directive

Spring House, PA U. S. A.

James O. Moore
General Manager
Measurement and Control Division

8.3.6.1 CSA Hazardous Locations Precautions

This section provides CSA hazardous location precautions that should be observed by the user when installing or servicing the equipment described in this Instruction. These statements supplement those given in the preceding section.

WARNING

Failure to observe the following precautions could result in an explosion hazard.

Precautions - English

For Class I, Division 1 and Class I, Division 2 hazardous locations,

- Use only factory-authorized replacement parts. Substitution of components can impair the suitability of this equipment for hazardous locations.

For Division 2 hazardous locations:

When the equipment described in this Instruction in installed without safety barriers, the following precautions should be observed. Switch off electrical power at its source (in non-hazardous location) before connecting or disconnecting power, signal, or other wiring.

Précautions - Français

Emplacements dangereux de classe I, division 1 et classe I, division 2:

- Les pièces de rechange doivent être autorisées par l'usine. Les substitutions peuvent rendre cet appareil impropre à l'utilisation dans les emplacements dangereux.

Emplacement dangereux de division 2:

Lorsque l'appareil décrit dans la notice ci-jointe est installé sans barrières de sécurité, on doit couper l'alimentation électrique a la source (hors de l'emplacement dangereux) avant d'effectuer les opérations suivantes branchment ou débranchement d'un circuit de puissance, de signalisation ou autre.

9.0 GLOSSARY

Listed here are terms used in the field of temperature measurement; terms and abbreviations that appear on a Moore XTC Communicator (MXC) screen; and terms relevant to HART networks.

ALPHA - The average percent change in resistance per degree of a pure metal resistance device between 0 and 100 degrees Centigrade. Designated by the Greek letter alpha.

ANALOG SIGNALING - A low current signal of 4 to 20 mAdc from a Field Instrument to a Primary Master or non-signaling hardware.

ANSI - American National Standards Institute

ARCH = ARCHIVE **-** MXC screen abbreviation

ARCHIVE - A database of user-set parameter values that is stored in an MXC. An archive is usually a complete configuration. Each archive is assigned a unique number (1-99).

AWG - American Wire Gauge

BARRIER - A device whose function is to limit the voltage and current in the hazardous area even if certain types of faults occur on the non-hazardous side of the Barrier.

BARRIER RESISTANCE - The maximum end-to-end resistance of a barrier, as specified by the barrier manufacturer. If both supply and return barriers are used in a network, the barrier resistance is the sum of the end-to-end resistance of both barriers. For active barriers that use resistance to limit current, the barrier resistance is the internal resistance between the hazardous area terminal and the barrier internal node where voltage is regulated.

COMMISSIONING - Testing of a transmitter and loop to verify transmitter configuration and loop operation and wiring.

CONF/CONFIG = CONFIGURE **-** MXC screen abbreviation

CONFIGURATION - A database (or archive) created using an MXC and downloaded to a transmitter to define transmitter operation.

CONFIGURE/CONFIGURING - The entering of specific parameter data into an MXC to be downloaded to a transmitter to define that transmitter's operating characteristics.

CONNECTION HEAD - An enclosure attached to the head of a thermocouple within which the electrical connections are made.

CONT = CONTINUE **-** MXC screen abbreviation

CURRENT SENSE RESISTANCE - The resistance in a Network across which the field instrument (Transmitter) signal voltages are developed.

DAMPING - A user selectable output characteristic that increases the response time of a transmitter to smooth the output when the input signal contains rapid variations.
DIN - Deutsche Industrial Norms - A German agency that sets engineering and dimensional standards and has world-wide recognition.

DIN 43760 - The standard that defines the characteristics of a 100 ohm platinum RTD having an R versus T curve with an Alpha of 0.00385 ohms per ohm per degree C.

DIGITAL SIGNALING - The high frequency HART signal.

EXPLOSION-PROOF ENCLOSURE - An enclosure that can withstand an explosion of gases within it and prevent the explosion of gases surrounding it due to sparks, flashes, or the explosion of the container itself, and maintain an external temperature which will not ignite the surrounding gases.

FIELD INSTRUMENT - A network element that uses current variation for digital signaling or digital plus analog signaling.

HART - Highway Addressable Remote Transducer - A communication protocol that provides simultaneous analog and digital signaling between master and slave devices. It is supported by the HART Communication Foundation.

HART NETWORK - A single pair of cabled wires and the attached communicating HART elements.

LOWER RANGE LIMIT (LRL) - Determined by the transmitter's range, this is the lowest value of the measured variable that the transmitter can be configured to measure.

LOWER RANGE VALUE (LRV) - Representing the 4 mA point in the transmitter's output, this is the lowest value of the measured variable that the transmitter is currently configured to measure.

INTRINSICALLY SAFE INSTRUMENT - An instrument which will not produce any spark or thermal effects under normal or abnormal conditions that will ignite a specified gas mixture.

MAXIMUM OVERRANGE - The maximum pressure (static plus differential) that can safely be applied to a transmitter.

MULTI-DROP NETWORK - A HART Network having from one to fifteen field instruments that are parallel connected on a single 2-wire cable. This Network uses digital signaling only. Analog signaling is not employed.

NETWORK - A Network includes the following items:
- Transmitter(s)
- Network Element (controller, recorder, passive non-signaling element, or other device)
- Cabling interconnecting these devices
- Barriers for intrinsic safety, if installed
- Current sense resistor

NETWORK ELEMENT - Any field instrument or Primary or Secondary Master.

NETWORK RESISTANCE - Defined as the sum of the Current Sense Resistance, Barrier Resistance, if any, and any other resistance in the Network.

NPT - National Pipe Thread
OPTN = OPTION - MXC screen abbreviation

OTHR = OTHER - MXC screen abbreviation

OVRD = OVERRIDE - MXC screen abbreviation

POINT-TO-POINT NETWORK - A Network having a single field instrument and Primary Master. Analog signaling or analog plus digital signaling is possible.

PREV = PREVIOUS - MXC screen abbreviation.

PRIMARY MASTER - The single controlling Network Element that communicates with one or more field instruments.

RERANGING - Changing the transmitter's 4 and 20 mA settings (i.e., setting LRV and URV); this is a configuration function.

RTD - Resistance temperature detector - A temperature transducer based on the principle that the resistivity of a metal shows a marked temperature dependence.

SECONDARY MASTER - An occasional user of the Network such as the XTC Communicator (MXC).

SEL = SELECT **-** MXC screen abbreviation.

SNSR INPT = SENSOR INPUT **-** MXC screen abbreviation

SPAN - Algebraic difference between the upper and lower range values (URV and LRV).

TEMPERATURE TRANSMITTER (TWO-WIRE) - A device which is used to transmit temperature data from either a thermocouple or RTD via a two-wire current loop. The loop provides power to the transmitter which acts as a variable resistor with respect to its input signal.

THERMOWELL - A closed-end tube designed to protect temperature sensors from severe environments , high pressure, and flows. Usually made of corrosion-resistant metal or ceramic material.

TRANSDUCER - A device that accepts an input, such as pressure, and converts that input into an output of some other form, such as a voltage.

TRANSMITTER SHORT ADDRESS - A unique number assigned during configuration that identifies a transmitter connected to a network. An address between 1 and 15 is assigned to a transmitter connected to a Multi-Drop network. A transmitter connected to a point-to-point network has 0 as an address.

UPPER RANGE LIMIT (URL) - Determined by the transmitter's range, this is the highest value of the measured variable that the transmitter can be configured to measure.

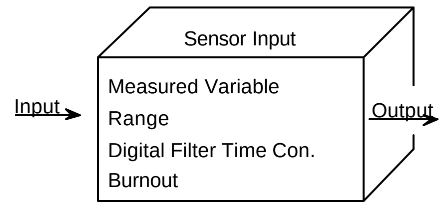
UPPER RANGE VALUE (URV) - Representing the 20 mA point in the transmitter's output, this is the highest value of the measured variable that the transmitter is currently configured to measure.

XMIT/X-MITTR/X-MTR = TRANSMITTER - MXC screen abbreviations.

A.0 APPENDIX A - FUNCTION BLOCK DESCRIPTIONS

A.1 SENSOR INPUT BLOCK

Input Type............... MV (Wide/Narrow), OHM (Wide/Narrow)
RTD (PT 100 OHM DIN, PT 100 OHM US,
PT 200 OHM DIN, PT 200 OHM US,
PT 500 OHM DIN, PT 500 OHM US),
T/C (J/K/E/T/R/S/B/N)
T/C and RTD Measured Variable Units .... Celcius
Fahrenheit
Rankin
Kelvin
Millivolts (mV input only)
Ohms (Ohm input only)
Measured Variable Range Lo .... -999999 to 999999
Measured Variable Range Hi .... -999999 to 999999
Damping Time Constant .... 0 to 120 seconds
Burnout Direction .... Upscale/Downscale

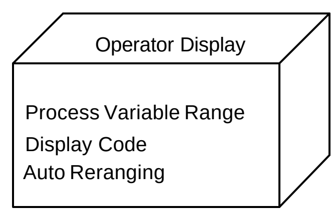


This function block allows the user to determine the range and the units in which the sensor will measure the sensor input. Range and span limits are dictated by a transmitter's sensor.

Also included is a digital filter for removing process and sensor noise.

A.2 OPERATOR DISPLAY BLOCK

Process Variable Units .... 4 Character ASCII
Process Variable Range Lo .... -19999 to 19999
Process Variable Range Hi .... -19999 to 19999
Auto Rerange .... Enable or Disable
Local Display Code .... Measured Variable,
Percent, or Process Variable



Use this function block to set up Process Variable Ranges and Units to improve the understanding of the Measured Variable. The Process Variable differs from the Measured Variable. As stated in the previous function block description, the Measured Variable in actual physical units such as ohms, and the Process Variable can be shown in units that represent the actual process parameter being measured such as Temperature (deg C). The output display code determines which variable will be displayed on the digital meter. There are three options for the output display code:

1. Measured Variable - When measured variable is selected, the input will be displayed in measured variable units.

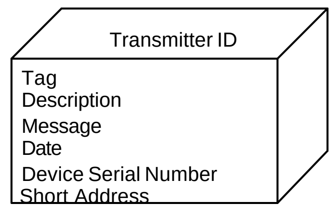
2. Percent - When percent is selected, the input will be displayed as 0-100% of the process variable range.

3. Process Variable - When process variable is selected, the input will be displayed in process variable units.

Auto Rerange automatically rescales the Process Variable in proportion to the Measured Variable in the Sensor Input Block. It will also rescale the Measured Variable range if the Process Variable range is changed. For example, if the Measured Variable is set at 0-100 Ohms, and the Process Variable is set at 0-500 deg C, then a change in Measured Variable range to 0-200 Ohms will result in the Process Variable being automatically rescaled to 0-1000 deg C.

A.3 TRANSMITTER ID BLOCK

Tag .... 8 Character ASCII
Descriptor .... 16 Character ASCII
Message .... 32 Character ASCII
Date Format .... DD/MM/YY
Device Serial Number (8 Digit) .... 0 to 16777215
Short Address
Analog Mode 0
Digital Mode 1-15



The Transmitter ID block contains ASCII strings that can be entered to aid in record keeping and identification of the transmitter. These ASCII strings include an 8-character Tag, a 16-character Descriptor, and a 32-character Message. In addition, a date code and an 8-digit Device Serial Number that can be used to identify the transmitter can be entered.

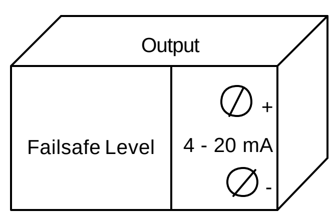
Set the Short Address to 0 to place the transmitter in Analog or Point-to-Point mode. Set the Address to 1-15 for Digital or Multidrop mode.

NOTE

Each transmitter in a Multidrop network must have a unique address. An analog mode transmitter should never be used in a Multidrop network.

A.4 OUTPUT BLOCK

Failsafe Level .... Lo, Hi, or Last Value

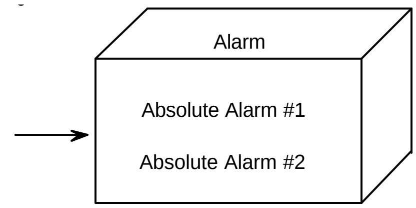


The Output Block converts the internal 0 to 100% it receives to an output signal. The input to the block represents either the actual Process Variable when the transmitter is configured as a transmitter only, or the valve signal when configured as a controller. A 4 mA signal wll be output if in Digital mode.

The failsafe level is the value to which the transmitter output will go if an error is detected while the transmitter is performing its self-diagnostic program. This value may be set at Lo (≤ 4 mA), Hi (≥ 20 mA), or at the last value the transmitter recorded before entering failsafe mode.

A.5 ALARM BLOCK

Alarm 1 .... Enable/Disable
Alarm 1 Setpoint .... -999999 to 999999
Alarm 1 Type .... High/Low
Alarm 2 .... Enable/Disable
Alarm 2 Setpoint .... -999999 to 999999
Alarm 2 Type .... High/Low
Self Clearing NAKS... On/Off
Alarms Out Of Service .... On/Off



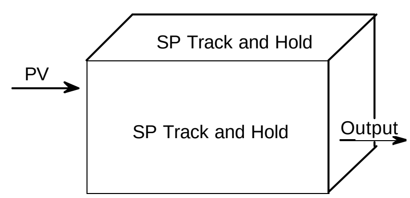
This function block includes 2 absolute alarms. The action of these alarms can be selected as HI or LO. The setpoint for the alarms is entered in the units selected in the operator display block.

The Not Acknowledge bit (NAK) in the alarm status word is set whenever the alarm goes from a no-alarm to an ALARM condition. When the ALARM condition clears, the NAK bit will reset if the Self Clearing NAKS paramter is set to ON. If the Self Clearing NAKS parameter is set to OFF, then the NAK but must be reset via a HART command.

The Alarms Out of Service parameter determines if the out of service bit in the alarm status word is set.

A.6 SETPOINT TRACK AND HOLD BLOCK

Tracking Setpoint .... Yes/No
Power-Up Setpoint .... -999999 to 999999

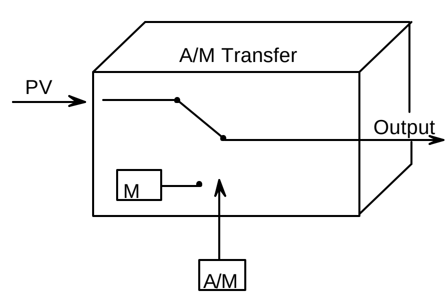


This function block is a setpoint track and hold block and its operating value can be changed from the pushbuttons of the XTC or from the CHANGE SP key of the MXC. This function block can be configured as tracking or non-tracking. If it is configured as tracking, the SP will track the PV when the controller is in manual. If it is configured as non-tracking the SP will remain at its hold value.

On power-up, the operating value in the function block is initialized to the Power-Up value. The Power-Up value can only be changed by editing the parameter in this function block with the MXC or by storing a new value via the pushbuttons of the XTC.

A.7 A/M TRANSFER BLOCK

Power-Up Mode .... Automatic/Manual
Automatic Mode Only .... Yes/No
Power-Up Valve .... -1.0 to 110%



The A/M transfer function block consists of 1 Single Pole/Double Throw switch. The switch is controlled with the pushbuttons of the XTC or from the A/M key of the MXC. When the block is in AUTO, the output is equal to the controller output. When the block is in MANUAL, the output is the manual (M) value (-1.0 to 110%). The manual value can be adjusted with the pushbuttons of the XTC or from the CHANGE VALVE key of the MXC. When the manual (M) value is not the function block output, it will track the output value of the controller function block.

The A/M transfer can be configured as AUTO only. When the Automatic Mode Only parameter is selected as YES, the function block will remain in the AUTO position.

Configuration allows for selecting the A/M block power-up position (automatic, manual). When the function block powers-up in manual, the value of M can be set in configuration from -1.0 to 110%.

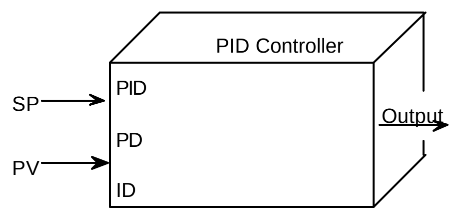
The Power-Up Valve can only be changed by editing the parameter in this function block with the MXC or by storing a new value via the pushbuttons of the XTC.

A.8 CONTROLLER BLOCK

The controller function block provides an extensive range of Proportional-Integral-Derivative functions including: PID, PD and ID.

PID Controller

Controller ....On/Off
Controller Type... PID/PD/ID
Action..Reverse/Direct
Proportional Gain (PID & PD) ....0.01 to 100.0
Time-Integral... 0.01 to 1000 min/repeat
Time-Derivative.. 0.01 to 100.0 min
Derivative Gain..1.00 to 30.00
Manual Reset (PD only)....................................... 0.0 to 100.0%
Manual Reset Tracking (PD only)..................................No/Yes



The PID controller is a reset type controller which uses external feedback to establish the integral action. The function block will force the output to track the feedback when the controller is in manual.
If the derivative time TD is set to 0.00, the derivative section is eliminated.

Equations

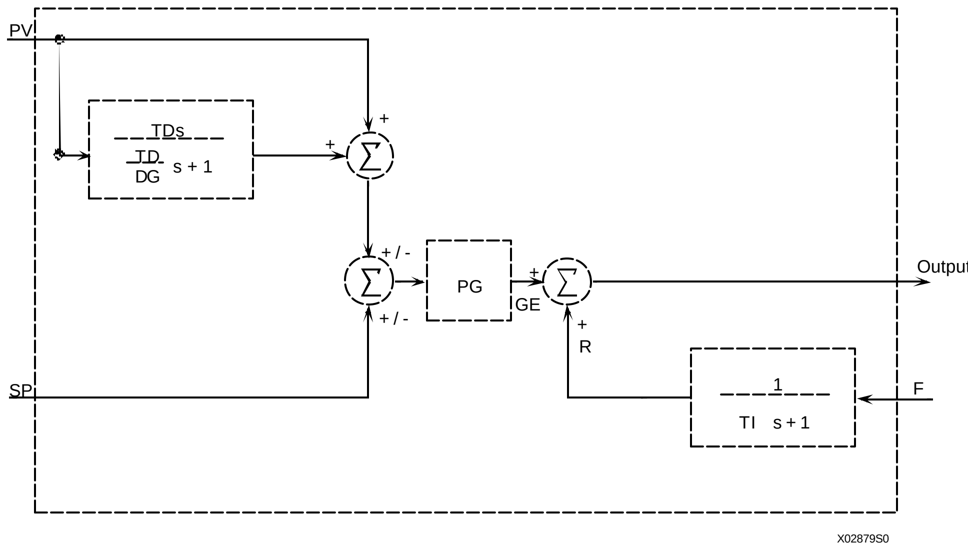
$$O = GE + R$$

AUTO $$R = \frac{F}{TIs + 1}$$

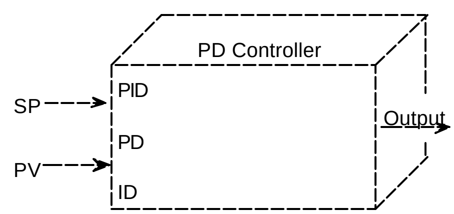
$$O = \pm PG\,[P(1+ \frac{TDs}{(TD/DG)s + 1}) - S] + [1+ \frac{1}{TIs}]$$

MANUAL $$R = F - GE \therefore O = F$$

Block Diagram, PID Controller



PD Controller



Controller .... On/Off
Controller Type.. PID/PD/ID
Action..Reverse/Direct
Proportional Gain (PID & PD) ....0.01 to 100.0
Time-Integral.. 0.01 to 1000 min/repeat
Time-Derivative... 0.01 to 100.0 min
Derivative Gain..1.00 to 30.00
Manual Reset (PD only)....................................... 0.0 to 100.0%
Manual Reset Tracking (PD only).................................No/Yes

The PD controller is a proportional only controller with manual reset which can be selected as tracking or non-tracking.

The track function block will force the controller output to track the feedback, and if manual reset tracking is selected, the manual reset (MR) will also track the feedback when the controller is in manual. In either case, the controller will always go back to AUTO with the output equal to the feedback. The reset value will then return to the value of MR with the time constant established by the integral time (TI). Since the default value of TI is 100 min., it should be reduced (e.g. 0.01 min) when using this controller type. The TI Time Constant is selected for the rate at which the controller should return to normal operation after switching from manual to auto. Bear in mind that the TI time in the PD Controller is not an integral time and does not affect control stability.

If the derivative time TD is set equal to 0.0, the derivative section is eliminated.

Equations

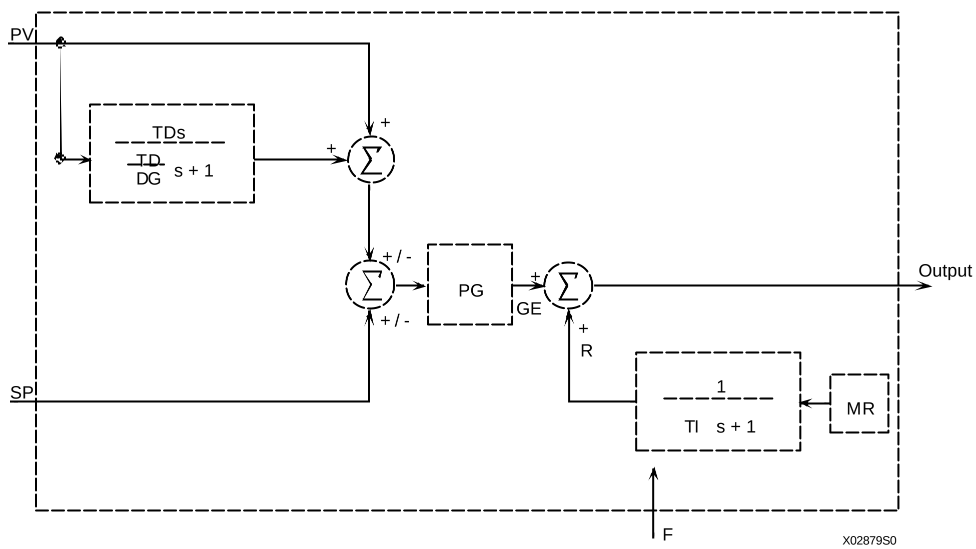
$$O = GE + R$$

AUTO $$R = \frac{MR}{TIs + 1}$$

MANUAL $R = F - GE \therefore O = F$

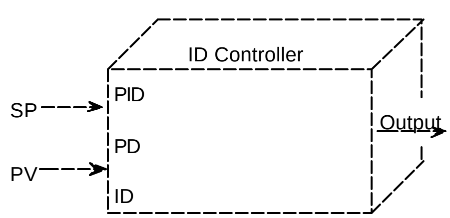
IF MRT = YES $MR = F$

Block Diagram, PD Controller



ID Controller

Controller Status .... On/Off
Controller Type.. PID/PD/ID
Action...Reverse/Direct
Proportional Gain (PID & PD) ....0.01 to 100.0
Time-Integral.. 0.01 to 1000 min/repeat
Time-Derivative.. 0.01 to 100.0 min
Derivative Gain...1.00 to 30.00
Manual Reset (PD only)...................................... 0.0 to 100.0%
Manual Reset Tracking PD only).................................. No/Yes



The ID controller is an integral only controller which uses external feedback to establish integral action.

If the derivative time TD is set to 0.00, the derivative section is eliminated.

The gain for this controller is fixed at a value of 1.00. While the displayed gain can be changed, it will not affect the controller.

Equations

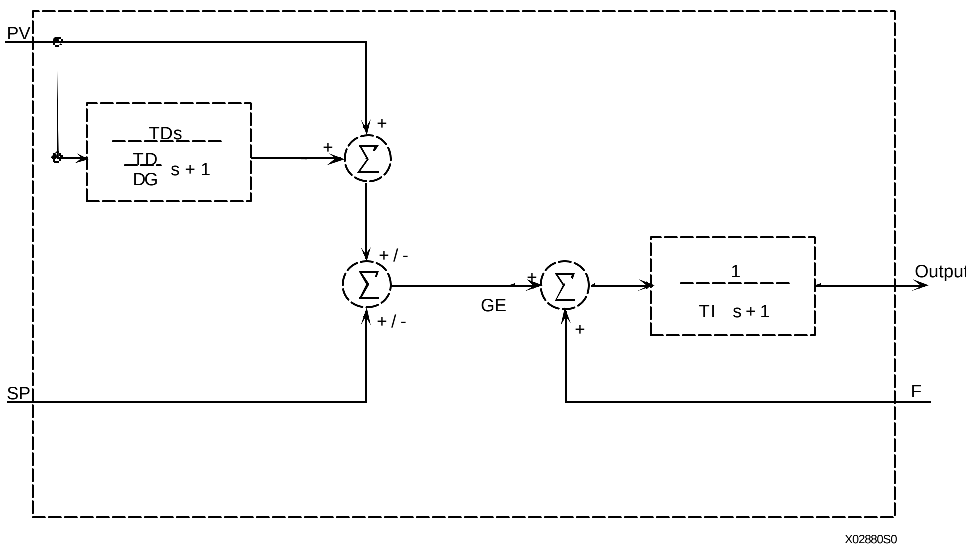
$$O = \frac{GE + F}{TIs + 1}$$

AUTO when output O is connected to feedback F

$$O = +/-PG[P(1+ \frac{TDs}{(TD/DG)s + 1})-S] + [\frac{1}{TIs}]$$

MANUAL O = F

Block Diagram, ID Controller



A.9 FUNCTION BLOCK SUMMARY

SENSOR INPUT BLOCK

- Input Type
  - MV (Millivolts)..Wide or Narrow
  - RTD..PT100 ohm DIN & US, PT200 ohm DIN & US, PT500 ohm DIN & US
  - T/C..J, K, E, T, R, S, B, N
  - Ohm..Wide or Narrow
- MV Units..Celsius, Fahrenheit, Rankine, Kelvin, MV, Ohms
- MV Range...LO and HI range values
- Damping...0 to 120 seconds
- Burnout Direction...Upscale or Downscale

OPERATOR DISPLAY BLOCK

- Local Display Code..Percent, Process Variable, Measured Variable

- PV Range ....LO and HI range values
- Process Variable Units ....4 ASCII character tag (e.g., CEL, FAHR)
- Auto Rerange..Enable or Disable

TRANSMITTER ID BLOCK
- Tag..Unique 8 character identification
- Descriptor...16 character description of transmitter
- Message ....32 character transmitter message
- DD/MM/YY...Enter day, month, and year in register
- User ID Number...24 bit Unsigned Integer (0 to 16777215)
- Short Address ....0 to 15 (0 = Analog Mode, 1 to 15 = Digital Mode)

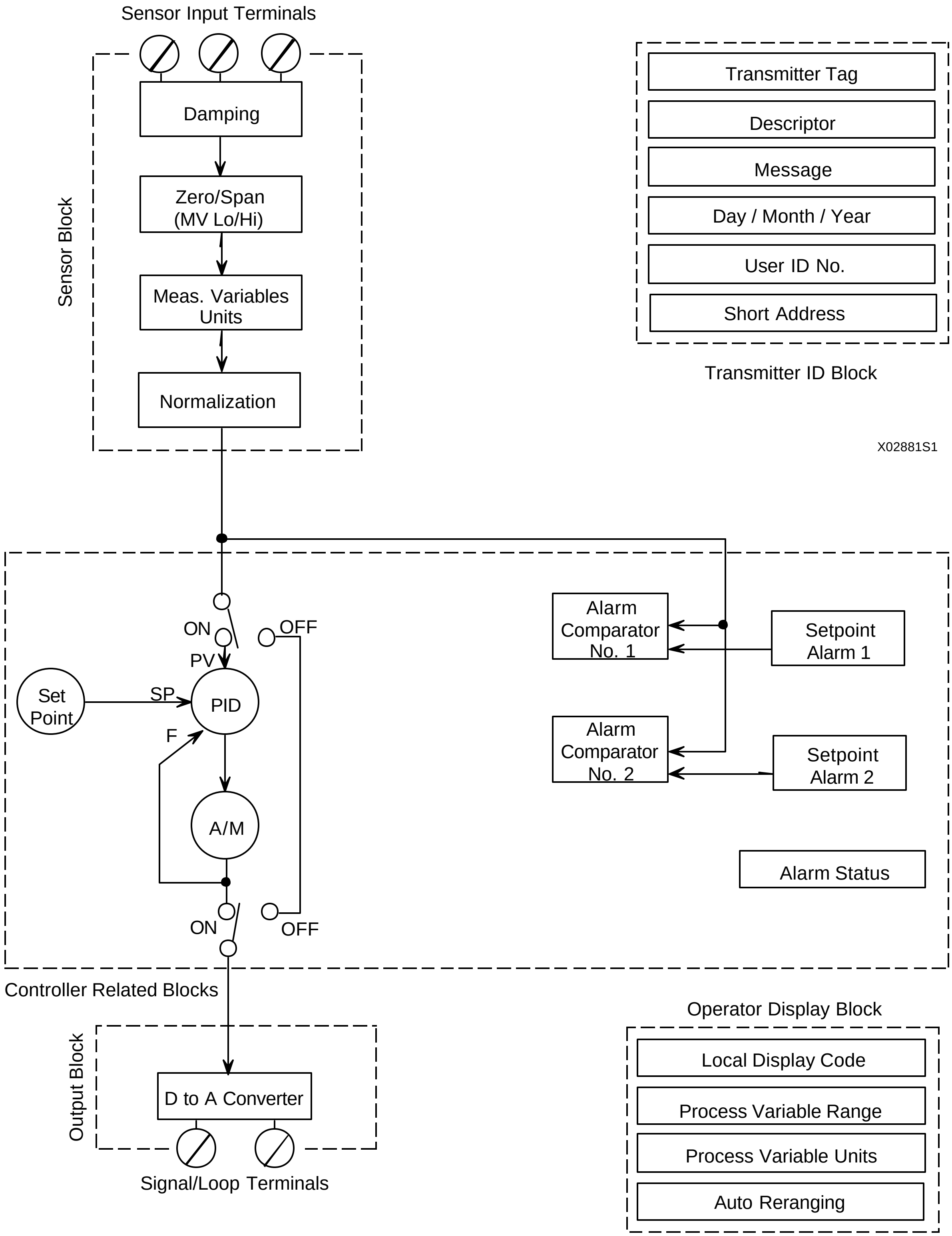
OUTPUT BLOCK
- Failsafe Level...HI, LO, Last Value

ALARM BLOCK
- Alarms 1 and 2...Enable or Disable
- Alarms 1 and 2...Setpoint
- Alarms 1 and 2...Low or High
- Self Clearing Naks..On or Off
- Alarms Out Of Service...................................On or Off

SP TRACK & HOLD BLOCK
- Tracking Set Point..Yes or No
- PUSP ....Enter power-up set point value

A/M TRANSFER BLOCK
- Power UP Mode ....Automatic or Manual
- Auto Mode Only...No or Yes
- Power Up Valve ....-1 to 110%

CONTROLLER BLOCK
- Controller ON/OFF...Turn Controller ON or OFF
- Controller Type ....Select PID, ID, or PD
- Controller Action..Select Direct or Reverse
- Proporational Gain ....Range from 0.01 to 100.0
- Integral Time..Range from 0.01 to 1000.0 minutes/repeat
- Derivative Time..Range from 0.00 to 100.0 minutes
- Derivative Gain ....Range from 1.00 to 30.0
- Manual Reset...Range from 0.0 to 100.0%
- Manual Reset Track.......................................Yes or No



Temperature Controller Function Blocks

B.0 APPENDIX B - HAZARDOUS AREA INSTALLATION DRAWINGS

This Appendix contains four Figures that present wiring and barrier selection information for installation of a Model Series 344 Transmitter in a hazardous location. Refer to the barrier manufacturer's installation instructions and the following Figures when installing or servicing a Transmitter in a hazardous location.

The installer should carefully select barriers based on the required protection, loop wiring, manufacturer's barrier performance data, and the data in the following Figures. Entity parameters are stated in Figure B-1.

FIGURE B-1 Model 344 Hazardous Location Installation (Dwg. 15032-3441, Sheet 1 of 4)

FIGURE B-2 Model 344, Barrier Selection (Dwg. 15032-3441, Sheet 2 of 4)

FIGURE B-3 Model 344, Hazardous Location Installation (Dwg. 15032-3441, Sheet 3 of 4)

FIGURE B-4 Model 344, Intrinsically Safe Installation of Model 344 with Modell 772R (Dwg. 15032-3441, Sheet 4 of 4)

WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate, and all repairs made by it, to be free from defects in material and workmanship under normal use and service. If any part of the equipment herein described, and sold by the Company, proves to be defective in material or workmanship and if such part is within twelve months from date of shipment from the Company's factory, returned to such factory, transportation charges prepaid, and if the same is found by the Company to be defective in material or workmanship, it will be replaced or repaired, free of charge, f.o.b. Company's factory. The Company assumes no liability for the consequence of its use or misuse by Purchaser, his employees or others. A defect in the meaning of this warranty in any part of said equipment shall not, when such part is capable of being renewed, repaired or replaced, operate to condemn such equipment. This warranty is expressly in lieu of all other warranties, guaranties, obligations, or liabilities, expressed or implied by the Company or its representatives. All statutory or implied warranties other than title are hereby expressly negated and excluded.

Warranty repair or replacement requires the equipment to be returned to one of the following addresses.

Equipment manufactured or sold by MOORE PRODUCTS CO.:

MOORE PRODUCTS CO.

Sumneytown Pike

Spring House, PA 19477

Equipment manufactured or sold by MOORE PRODUCTS CO. (CANADA) INC.:

MOORE PRODUCTS CO. (CANADA) INC.

2 km West of Mississauga Rd. Hwy. 7

Brampton, Ontario, Canada

Equipment manufactured or sold by MOORE PRODUCTS CO. (UK) LTD.:

MOORE PRODUCTS CO. (UK) LTD

Copse Road

Lufton, Yeovil

Somerset, BA22 8RN, ENGLAND

The warranty will be null and void if repair is attempted without authorization by MOORE PRODUCTS CO.

■

PARTS LIST

XTC™ MODEL 344
TEMPERATURE TRANSMITTER-CONTROLLER

Drawing No. 15965-639PL

MODELS	PART NUMBERS
344BNNN1G	15965-1114
344BN5N1G	15965-1115

ITEM	PART NUMBER	DESCRIPTION	QUANTITY
1*	2938-44	O-Ring	2
3	---	Enclosure Assembly	1
-	15965-761	NPT	-
-	15965-1029	EExd M20	-
-	15965-1067	EExd NPT	-
4	15965-638	Mounting Bracket Kit, not shown; Kit Contents:	1
-	1-3237	1/4-20 x 1/2 Hex Bolt	4
-	1-7303	1/4 Med. Lockwasher	4
-	1-7312	5/16 Med. Lockwasher	2
-	1-7785	5/16-18 Hex Nut	2
-	15965-1105	5/16 U-Bolt	1
-	15965-1104	Mounting Bracket	1
8*	16048-51	Electronics Assembly (4 circuits boards)	1
15	15965-746	Enclosure Cap	1
16	---	Enclosure Cap	1
-	15965-749	No Digital Meter Installed	-
-	15965-769	For Use With Digital Meter	-
22	15965-632	Digital Meter Male-Female Spacer 3.25″	1
23	15965-674	Digital Meter Mounting Bracket	1
24	16069-96	Digital Meter Cable Assembly, 6-pin	1
25*	16069-81	Digital Meter Board Assembly	1
40	---	Serial Number Label	1
41	1604-42	Pipe Plug	2
-	15965-860	Enclosure Cap Retention Device, not shown; For EExd Xmitr	1
42	---	Connection Diagram Label	1
		HARDWARE	
5	1-1820	8-32 x 0.25 Binding Hd	1
6	1-6838	2 x 0.188 Type U Drive Screw	1
20	3175-195	Tri-Round Pan Screw 6-32 x 0.312	2
21	1-0667	4-40 x 0.313 Binding Hd	1
26	1-7238	#4 Medium Lockwasher	1

Notes:

- Refer to Model 344 User's Manual UM344-2 before servicing the transmitter.
- See drawings on following page for transmitter disassembly and Item number reference.
- An * identifies a recommended on-hand spare part. When ordering a spare or replacement part, provide the transmitter's complete model number, serial number and other nameplate information.

PARTS LIST

XTC MODEL 344 TEMPERATURE TRANSMITTER-CONTROLLER

Drawing No. 15965-639PL

USER’S MANUAL ADDENDUM

UMA344-2-1
Issue: 1
March 1996

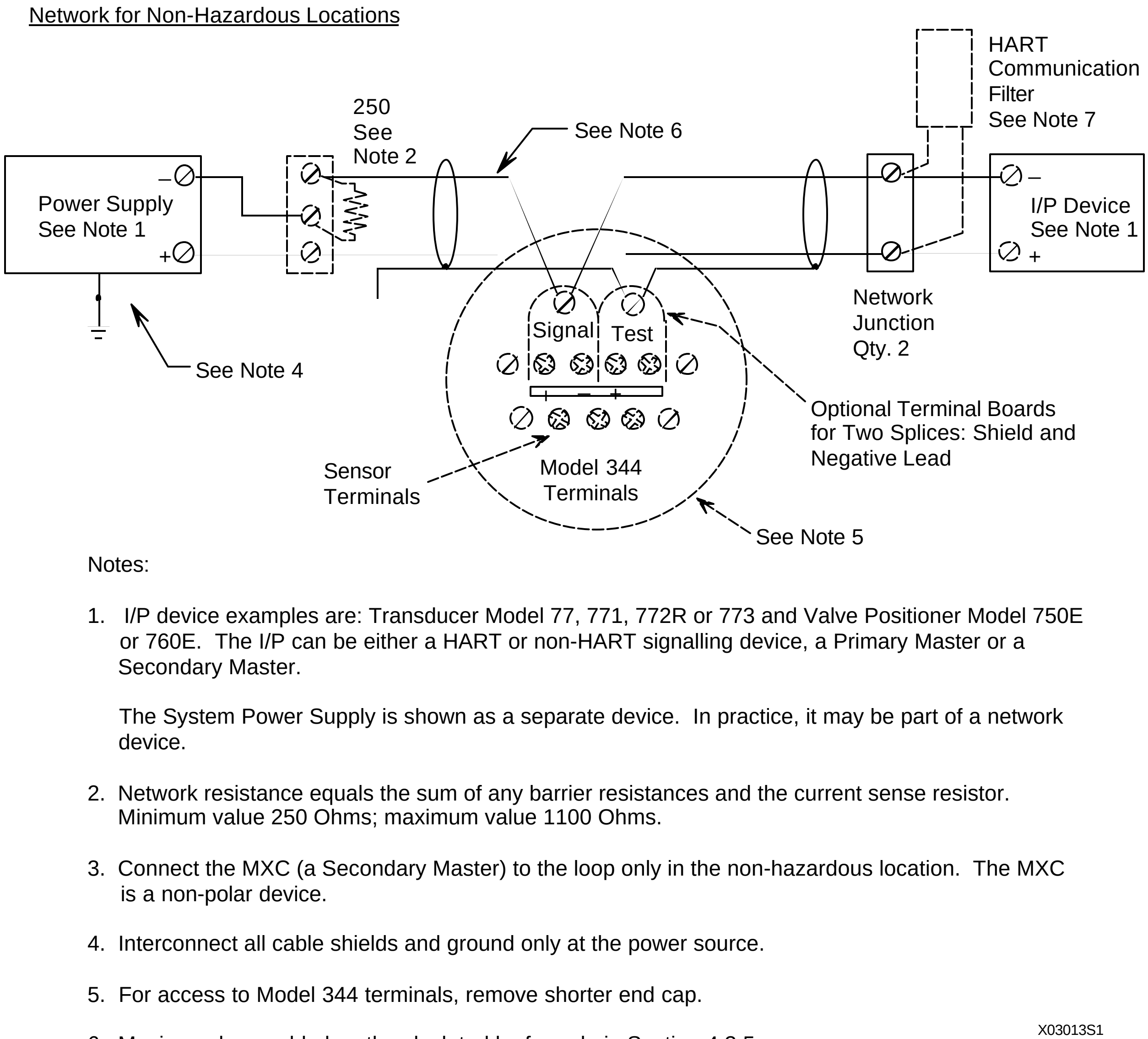
CONTROLLER MODE INSTALLATION WIRING

INVOLVED USER’S MANUAL

UM344-2, Issue 1, September 1995, XTC™ Transmitters, Series 344 Temperature Transmitters, User’s Manual

ADDITIONAL MATERIAL

The wiring diagram on the next page is for a Model 344 Transmitter-Controller configured for controller operation (controller function block ON and short address set to 0 for analog mode operation). This drawing, Figure 4-2a, amends the information in Section 4, Installation.



Notes:

1. I/P device examples are: Transducer Model 77, 771, 772R or 773 and Valve Positioner Model 750E or 760E. The I/P can be either a HART or non-HART signalling device, a Primary Master or a Secondary Master.

   The System Power Supply is shown as a separate device. In practice, it may be part of a network device.

2. Network resistance equals the sum of any barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.

3. Connect the MXC (a Secondary Master) to the loop only in the non-hazardous location. The MXC is a non-polar device.

4. Interconnect all cable shields and ground only at the power source.

5. For access to Model 344 terminals, remove shorter end cap.

6. Maximum loop cable length calculated by formula in Section 4.3.5.

7. Install a HART communication filter when using a Model 77, 771, 750E or other high impedance coil-type device. The filter bypasses HART signals around the high Z device.

FIGURE 4-2a Model 344 Connections, Controller Function Block ON (Analog Mode)

USER’S MANUAL ADDENDUM

UMA344-2-2
Issue: 1
March 1997

Ex N INSTALLATION CONDITION

INVOLVED USER’S MANUAL

UM344-2, Issue 1, XTC™ Transmitters, Series 344 Temperature Transmitters, User’s Manual

ADDITIONAL MATERIAL

The voltage at the loop terminals of a Model 344 installed in an area requiring an Ex N rating must be prevented from exceeding 42 Vdc. This can be accomplished by:

- A double wound mains transformer to BS3535 or equivalent
- An adequately rated zener diode
- An adequately rated semiconductor voltage regulator
- Powering the loop from a battery