# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1</td>
<td>DOCUMENTATION</td>
<td>1-1</td>
</tr>
<tr>
<td>1.2</td>
<td>PRODUCT DESCRIPTION</td>
<td>1-1</td>
</tr>
<tr>
<td>1.3</td>
<td>CONFIGURATION</td>
<td>1-4</td>
</tr>
<tr>
<td>1.4</td>
<td>MODEL DESIGNATION</td>
<td>1-6</td>
</tr>
<tr>
<td>1.4.1</td>
<td>ACCESSORIES</td>
<td>1-6</td>
</tr>
<tr>
<td>1.5</td>
<td>SPECIFICATIONS</td>
<td>1-6</td>
</tr>
<tr>
<td>1.5.1</td>
<td>MECHANICAL</td>
<td>1-8</td>
</tr>
<tr>
<td>1.5.2</td>
<td>ELECTRICAL</td>
<td>1-10</td>
</tr>
<tr>
<td>1.5.3</td>
<td>I/O SPECIFICATIONS</td>
<td>1-10</td>
</tr>
<tr>
<td>1.5.4</td>
<td>ENVIRONMENTAL</td>
<td>1-11</td>
</tr>
<tr>
<td>1.5.5</td>
<td>ELECTRICAL CLASSIFICATION</td>
<td>1-11</td>
</tr>
<tr>
<td>1.6</td>
<td>GLOSSARY</td>
<td>1-12</td>
</tr>
<tr>
<td>2.0</td>
<td>INSTALLATION</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1</td>
<td>EQUIPMENT DELIVERY AND HANDLING</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1.1</td>
<td>FACTORY SHIPMENT</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1.2</td>
<td>RECEIPT OF SHIPMENT</td>
<td>2-2</td>
</tr>
<tr>
<td>2.1.3</td>
<td>RETURN SHIPMENT</td>
<td>2-3</td>
</tr>
<tr>
<td>2.1.4</td>
<td>STORAGE PARAMETERS</td>
<td>2-3</td>
</tr>
<tr>
<td>2.2</td>
<td>ENVIRONMENTAL CONSIDERATIONS</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3</td>
<td>INSTALLATION CONSIDERATIONS</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3.1</td>
<td>MECHANICAL</td>
<td>2-2</td>
</tr>
<tr>
<td>2.3.2</td>
<td>ELECTRICAL</td>
<td>2-3</td>
</tr>
<tr>
<td>2.3.3</td>
<td>IMPULSE PIPING</td>
<td>2-4</td>
</tr>
<tr>
<td>2.3.4.1</td>
<td>DETERMINE TRANSMITTER OPERATING MODE AND NETWORK TYPE</td>
<td>2-7</td>
</tr>
<tr>
<td>2.3.4.2</td>
<td>Analog Mode</td>
<td>2-7</td>
</tr>
<tr>
<td>2.3.5</td>
<td>DETERMINE POWER SUPPLY REQUIREMENTS</td>
<td>2-11</td>
</tr>
<tr>
<td>2.3.5.1</td>
<td>Conventional and Point-To-Point Networks</td>
<td>2-11</td>
</tr>
<tr>
<td>2.3.5.2</td>
<td>Multi-Drop Network</td>
<td>2-12</td>
</tr>
<tr>
<td>2.3.6</td>
<td>CABLE REQUIREMENTS AND MAXIMUM LENGTH</td>
<td>2-12</td>
</tr>
<tr>
<td>2.3.6.1</td>
<td>Cable Requirements</td>
<td>2-12</td>
</tr>
<tr>
<td>2.3.6.2</td>
<td>Maximum Cable Length Calculation</td>
<td>2-13</td>
</tr>
<tr>
<td>2.3.7</td>
<td>NETWORK JUNCTIONS</td>
<td>2-14</td>
</tr>
<tr>
<td>2.3.7.1</td>
<td>Point-To-Point and Conventional Networks</td>
<td>2-14</td>
</tr>
<tr>
<td>2.3.7.2</td>
<td>Multi-Drop Network</td>
<td>2-15</td>
</tr>
<tr>
<td>2.3.8</td>
<td>SAFETY BARRIERS</td>
<td>2-15</td>
</tr>
<tr>
<td>2.3.9</td>
<td>CONNECTION OF MISCELLANEOUS HARDWARE</td>
<td>2-15</td>
</tr>
<tr>
<td>2.3.10</td>
<td>SHIELDING AND GROUNDING</td>
<td>2-16</td>
</tr>
<tr>
<td>2.4</td>
<td>MECHANICAL INSTALLATION</td>
<td>2-17</td>
</tr>
<tr>
<td>2.4.1</td>
<td>PIPE MOUNTING</td>
<td>2-21</td>
</tr>
<tr>
<td>2.4.2</td>
<td>FLAT SURFACE MOUNTING</td>
<td>2-21</td>
</tr>
<tr>
<td>2.4.3</td>
<td>DIRECT MOUNTING TO PROCESS</td>
<td>2-22</td>
</tr>
<tr>
<td>2.4.4</td>
<td>TRANSMITTER ENCLOSURE REPOSITIONING</td>
<td>2-23</td>
</tr>
<tr>
<td>2.4.5</td>
<td>OPTIONAL LOCAL DISPLAY REPOSITIONING</td>
<td>2-23</td>
</tr>
<tr>
<td>2.4.5.1</td>
<td>Analog Meter</td>
<td>2-23</td>
</tr>
<tr>
<td>2.4.5.2</td>
<td>Digital Meter</td>
<td>2-24</td>
</tr>
<tr>
<td>SECTION</td>
<td>TITLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>2.4.6</td>
<td>ELECTRICAL CONDUIT AND CABLE INSTALLATION</td>
<td>2-26</td>
</tr>
<tr>
<td>2.4.6.1</td>
<td>Conduit</td>
<td>2-26</td>
</tr>
<tr>
<td>2.4.6.2</td>
<td>Cables</td>
<td>2-26</td>
</tr>
<tr>
<td>2.4.6.3</td>
<td>Access to Transmitter Terminal Compartment</td>
<td>2-28</td>
</tr>
<tr>
<td>2.4.7</td>
<td>EXPLOSION-PROOF INSTALLATION</td>
<td>2-28</td>
</tr>
<tr>
<td>2.5</td>
<td>ELECTRICAL INSTALLATION</td>
<td>2-28</td>
</tr>
<tr>
<td>2.6</td>
<td>HAZARDOUS AREA INSTALLATIONS</td>
<td>2-31</td>
</tr>
<tr>
<td>3.0</td>
<td>OPERATION AND SYSTEM CHECKOUT</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>TRANSMITTER LOCAL PUSHBUTTON OPERATION</td>
<td></td>
</tr>
<tr>
<td>3.1.1</td>
<td>INPUT RANGING</td>
<td></td>
</tr>
<tr>
<td>3.1.1.1</td>
<td>Pushbutton Ranging Procedure</td>
<td></td>
</tr>
<tr>
<td>3.1.2</td>
<td>DAMPING ADJUSTMENT</td>
<td></td>
</tr>
<tr>
<td>3.1.2.1</td>
<td>Procedure Using Digital Meter</td>
<td></td>
</tr>
<tr>
<td>3.1.2.2</td>
<td>Procedure Without Digital Meter</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>TRANSMITTER-CONTROLLER LOCAL PUSHBUTTON OPERATION</td>
<td></td>
</tr>
<tr>
<td>3.2.1</td>
<td>AUTO/MANUAL, SET POINT, AND VALVE ADJUSTMENTS</td>
<td></td>
</tr>
<tr>
<td>3.2.1.1</td>
<td>General Digital Meter and Pushbutton Information</td>
<td></td>
</tr>
<tr>
<td>3.2.1.2</td>
<td>Local Pushbutton Operational Procedures</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>SYSTEM CHECKOUT</td>
<td></td>
</tr>
<tr>
<td>3.3.1</td>
<td>EQUIPMENT REQUIRED</td>
<td></td>
</tr>
<tr>
<td>3.3.2</td>
<td>EQUIPMENT CONNECTION</td>
<td></td>
</tr>
<tr>
<td>3.3.3</td>
<td>VERIFICATION PROCEDURE</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>CALIBRATION</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>EQUIPMENT REQUIRED</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>TRANSMITTER ANALOG OUTPUT CALIBRATION PROCEDURE</td>
<td></td>
</tr>
<tr>
<td>4.2.1</td>
<td>TRANSMITTER NORMALLY CONFIGURED FOR ANALOG MODE</td>
<td></td>
</tr>
<tr>
<td>4.2.2</td>
<td>TRANSMITTER NORMALLY CONFIGURED FOR DIGITAL MODE</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>MOUNTING POSITION ZERO SHIFT CALIBRATION</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>CIRCUIT DESCRIPTION</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>SENSOR MODULE</td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>ELECTRONICS MODULE</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>THEORY OF OPERATION</td>
<td></td>
</tr>
<tr>
<td>5.3.1</td>
<td>PRESSURE TO FREQUENCY CONVERSION</td>
<td></td>
</tr>
<tr>
<td>5.3.2</td>
<td>FREQUENCY TO DIGITAL CONVERSION</td>
<td></td>
</tr>
<tr>
<td>5.3.3</td>
<td>D/A CONVERSION AND CURRENT SIGNAL TRANSMISSION</td>
<td></td>
</tr>
<tr>
<td>5.3.4</td>
<td>COMMUNICATION FORMAT</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>MAINTENANCE</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>TOOL AND EQUIPMENT REQUIREMENTS</td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>PREVENTIVE MAINTENANCE</td>
<td></td>
</tr>
<tr>
<td>6.2.1</td>
<td>ELECTRONIC ASSEMBLY HANDLING</td>
<td></td>
</tr>
<tr>
<td>6.2.2</td>
<td>TRANSMITTER PREVENTIVE MAINTENANCE</td>
<td></td>
</tr>
<tr>
<td>6.2.2.1</td>
<td>Transmitter Exterior Inspection</td>
<td></td>
</tr>
<tr>
<td>6.2.2.2</td>
<td>Transmitter Exterior Cleaning</td>
<td></td>
</tr>
<tr>
<td>6.2.2.3</td>
<td>Transmitter Enclosure Interior Inspection</td>
<td></td>
</tr>
<tr>
<td>6.2.2.4</td>
<td>Transmitter Calibration</td>
<td></td>
</tr>
<tr>
<td>6.2.3</td>
<td>IMPULSE PIPING PREVENTIVE MAINTENANCE</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF ILLUSTRATIONS

FIGURE | TITLE | PAGE
--- | --- | ---
1-1 | Model 340D Transmitter | 1-2
1-2 | Traditional Process Variable Measurement | 1-3
1-3 | Mycro XTC Communicator | 1-3
1-4 | Supply Voltage Versus Network Resistance Graph | 1-9
2-1 | Flow Measurement Piping Arrangements (Gas/Liquid) | 2-5
2-2 | Level Measurement Piping Arrangements | 2-6
2-3 | Conventional and Point-To-Point Networks | 2-8
2-4 | Conventional and Point-To-Point Network Examples | 2-9
2-5 | Multi-Drop Network | 2-10
2-6 | Dimensions, Model 340D Transmitter | 2-18
2-7 | Dimensions, Mounting Bracket for Model 340D | 2-19
2-8 | Model 340D Mounting Configurations with Optional Bracket | 2-20
2-9 | Analog Meter Removal and Repositioning | 2-25
2-10 | Digital Meter Repositioning | 2-25
2-11 | Conduit Drain and Explosion Proof Installations | 2-27
2-12 | Signal Conductor Termination | 2-30
4-1 | Transmitter Calibration Set-Up | 4-3
5-1 | Model 340 Functional Block Diagram | 5-2
6-1 | Analog Meter Removal and Replacement | 6-18
6-2 | Digital Meter Removal and Replacement | 6-20
6-3 | Electronics Module Removal and Replacement | 6-22
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Configuration Data</td>
<td>1-4</td>
</tr>
<tr>
<td>1.2</td>
<td>Model Designation</td>
<td>1-7</td>
</tr>
<tr>
<td>2.1</td>
<td>Operating Mode vs. Network</td>
<td>2-7</td>
</tr>
<tr>
<td>3.1</td>
<td>Output Display Code Choices</td>
<td>3-6</td>
</tr>
<tr>
<td>6.1</td>
<td>Self-Diagnostics Troubleshooting</td>
<td>6-8</td>
</tr>
</tbody>
</table>

SIGNIFICANT CHANGES FOR ISSUE 3

Significant changes are indicated by change bars located in page margins. Changes include:

SECTION       | CHANGE                                                                 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>Table 1.2 Model Designation revised to list current models and certifying agencies.</td>
</tr>
<tr>
<td>1.5.5</td>
<td>Current certifying agencies and categories listed.</td>
</tr>
<tr>
<td>2.0</td>
<td>Reference to hazardous area installation drawings in Appendix A added.</td>
</tr>
<tr>
<td>2.6</td>
<td>HAZARDOUS AREA INSTALLATIONS section added.</td>
</tr>
<tr>
<td>4</td>
<td>Figure 4-1 now shows bench and field calibration wiring. Section text revised to support Figure. Ammeter readings restated and MXC messages updated.</td>
</tr>
<tr>
<td>6.4.6</td>
<td>ZERO/FULL SCALE PUSHBUTTON SEAL REPLACEMENT section deleted.</td>
</tr>
</tbody>
</table>

Appendix A Hazardous area installation drawing included here.

TRADEMARK ACKNOWLEDGEMENT

Mycro XTC is a trademark of Moore Products Co.
HART is a registered trademark of Rosemount Inc.
Teflon is a registered trademark of E.I. DuPont de Nemours & Co., Inc.
TORX is a registered trademark of the Camcar division of Textron Corp.
1.0 INTRODUCTION

This Installation And Service Instruction is for the Mycro XTC™ Model 340D Intelligent Pressure Transmitter and Transmitter-Controller. The following section briefly discusses the information contained in this Instruction.

1.1 DOCUMENTATION

This Instruction is divided into six sections:

Section 1, INTRODUCTION, provides general information relating to product description, model designation, and specifications. A glossary of pressure measurement and HART® network terms is provided.

Section 2, INSTALLATION, furnishes specific information for mechanical and electrical installation.

Section 3, OPERATION AND SYSTEM CHECKOUT, describes the use of either the Transmitter's pushbuttons or the Mycro XTC Communicator to set range and damping. The section also provides a system checkout procedure.

Section 4, CALIBRATION, provides calibration procedures for analog or digital mode Transmitters and for canceling position induced zero shift.

Section 5, CIRCUIT DESCRIPTION, provides assembly level circuit description to support assembly level servicing.

Section 6, MAINTENANCE, furnishes preventive maintenance, troubleshooting, and assembly replacement procedures.

Some procedures require a Mycro XTC Communicator (MXC). Reference guide cards are supplied with each MXC. They provide guidance for MXC operation and transmitter configuration.

1.2 PRODUCT DESCRIPTION

The Model 340D Pressure Transmitter and Transmitter-Controller is a microprocessor-based, self-contained converter that accurately measures differential pressure. See Figures 1-1 and 1-2.

Developed and patented by Moore Products Co., a capacitive pressure sensor assembly is used to generate a digital output signal that is proportional to input pressure. The sensor assembly is mounted in a capsule assembly located between the process end caps, beneath the cylindrical transmitter enclosure.

Sensor signal output is then linearized and corrected for ambient temperature changes by a microprocessor, and a 4-20 mA analog output signal is provided over a twisted 2-wire cable. The 2-wire cable is also used for HART (Highway...
NOTE: PROCESS CONNECTION BLOCKS CAN BE ROTATED 180° FOR TOP OR BOTTOM VENT/DRAIN. SIDE VENT OPTION ONLY.

FIGURE 1-1 Model 340D Transmitter
FIGURE 1-2 Traditional Process Variable Measurement

FIGURE 1-3 Mycro XTC Communicator
Addressable Remote Transducer) digital communications and for powering the Transmitter from a 24 Vdc source, typically.

The Transmitter can be user-configured using a Mycro XTC Communicator (MXC), a personal computer running XTC Configuration Software, or other HART Primary or Secondary Master, and it can operate in either an analog or digital mode. HART digital signals are superimposed (AC coupled) on the analog current and do not affect the accuracy of the 4-20 mA signal.

A Model 340D_A Transmitter or Model 340D_B Transmitter-Controller operating in the analog mode is used in either a Conventional or a Point-To-Point Network where a single transmitter is wired directly to a recorder, controller, or other device and provides a standard 4-20 mA analog output signal.

A Model 340D_A Transmitter operating in the digital mode can also be used in a Multi-Drop Network consisting of multiple parallel connected transmitters. All Transmitters provide a digital, AC coupled HART output signal when polled by a Primary or Secondary Master. Each Transmitter is "parked" on the network and outputs a constant 4 mA current. Multi-Drop Networks are restricted to digital signalling to prevent interference between Transmitters. (A Model 340D_B Transmitter-Controller may not be installed on a Multi-Drop Network as it must be operated in the analog mode to provide an active 4 to 20 mA output to a field device.)

The companion Mycro XTC Communicator (MXC), a Secondary Master, can access transmitter data using the HART protocol. From either a local or remote location, it is able to interrogate, configure, run diagnostics, calibrate, and perform monitoring functions on a Transmitter. (See Figure 1-3.)

The Transmitter has an explosion proof, field mounted, hardened enclosure. A mounting bracket permits either pipe mounting (2" pipe) or wall mounting. Optional factory or field installed integral analog and digital (LCD) meters are available when local indication of transmitter output is required.

1.3 CONFIGURATION

A Model 340D Pressure Transmitter-Controller may be factory configured to user specifications or to factory default values. Configuration in the field requires either a Mycro XTC Communicator or a personal computer running XTC Configuration Software. Configuration data, listed in Table 1.1, are stored within the Transmitter in an EEPROM (Electrically Erasable Programmable Read Only Memory) to prevent loss of data should an electrical power interruption occur.

<table>
<thead>
<tr>
<th>TABLE 1.1 Configuration Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSOR INPUT BLOCK</td>
</tr>
<tr>
<td>- MV Units ...................</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>- MV Range ...................</td>
</tr>
</tbody>
</table>

February 1993
TABLE 1.1 Configuration Data, Continued

- Damping ............... 0 to 30 seconds
- Output ................ Linear or Square Root

OPERATOR DISPLAY BLOCK
- Output Display Code ...... Percent, Process Variable, Measured Variable
- PV Range ................. LO and HI range values
- Process Variable Units ... 4 ASCII character tag (e.g., GPH, SCFM)
- Auto Rerange ............ Enable or Disable

TRANSMITTER ID BLOCK
- Tag ...................... Unique 8 character identification
- Descriptor ................ 16 character description of transmitter
- Mess. ..................... 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 Operation, 1 to 15=Digital Operation)

OUTPUT BLOCK
- Failsafe Level ........... HI, LO, Last Value

ALARM BLOCK (MODEL 340D_B)
- 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 (MODEL 340D_B)
- Tracking Set Point ...... Yes or No
- PUSP ..................... Enter power-up set point value

A/M TRANSFER BLOCK (MODEL 340D_B)
- Power UP Mode .......... Automatic or Manual
- Auto Mode Only .......... No or Yes
- Power up Valve .......... -1 to 100%

CONTROLLER BLOCK (MODEL 340D_B)
- Controller ON/OFF ...... Turn Controller ON or OFF
- Controller Type .......... Select PID, ID, or PD
- Controller Action ....... Select Direct or Reverse
- Proportional Gain ....... Range from 0.01 to 100.0
- Integral Time .......... Range from 0.01 to 1000.0 minutes/reset
- 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

Refer to supplemental literature for specific configuration details.

February 1993
1.4 MODEL DESIGNATION

Table 1.2 decodes the model designation of a Transmitter. The model designation is shown on the nameplate on each Transmitter's enclosure.

IMPORTANT

Before installing, applying power, or servicing a Transmitter, check the model designation.

1.4.1 ACCESSORIES

1. Meters and Displays

1) Digital (LCD) Meter - May be used with both analog and digital mode transmitters. Shows local indication of the process variable, nine annunciators for instrument status, and calibration and configuration steps.

2) Analog Meter - Use only with an analog mode transmitter. Shows analog output.

The Transmitter can accommodate both optional meter installations.

Digital Meter Kit ........................................ P/N 15965-797
Analog Meter Kit (0-100% scale) ...................... P/N 15965-798
Analog Meter Kit (0-10 square root) ............... P/N 15965-799

2. Mounting Bracket Kit, pipe or flat surface mounting .. P/N 15965-180

1.5 SPECIFICATIONS

1.5.1 MECHANICAL

TRANSMITTER DIMENSIONS ............................... See Figure 2-6
MOUNTING BRACKET DIMENSIONS ...................... See Figure 2-7
WEIGHT (without mounting bracket) ................... 10 Lbs (4.5 Kg)*

* All weights are approximate
### TABLE 1.2 Model Designation

<table>
<thead>
<tr>
<th>SAMPLE MODEL NUMBER</th>
<th>340D</th>
<th>2</th>
<th>A</th>
<th>H</th>
<th>12</th>
<th>1</th>
<th>N</th>
<th>N</th>
<th>1</th>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0.75-15.0 inches of Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 10-450 inches of Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 350 inches of Water-450 PSIG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 4-20 mA Transmitter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B 4-20 mA Transmitter or Transmitter-Controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Diaphragm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H Hastelloy (input range 2 &amp; 3 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Monel (input range 2 &amp; 3 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T Tantalum (input range 2 &amp; 3 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S 316SS (input range 1 only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Body Parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Caps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gaskets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conn Blocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 316SS</td>
<td>316SS (end conn.)</td>
<td>SS</td>
<td>Teflon</td>
<td>SS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Hastelloy</td>
<td>Hast (end conn.)</td>
<td>SS</td>
<td>Teflon</td>
<td>Hast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Kynar</td>
<td>N/A</td>
<td>SS</td>
<td>Teflon (O-Ring)</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 316SS</td>
<td>316SS (side conn.)</td>
<td>SS</td>
<td>Teflon</td>
<td>SS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Hastelloy</td>
<td>Hast (side conn.)</td>
<td>SS</td>
<td>Teflon</td>
<td>Hast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fill Fluid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B Silicone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Florolube</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D Paratherm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Indicator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N Not required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Analog Meter (0-100 scale)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Analog Meter (0-10 square root scale)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Digital Meter (LCD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N Not Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S High Performance &quot;Sterling&quot; Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Features</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N Not Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Connection (later nameplates only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1/2-14NPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 M20 x 1.5 (Not available with FM/CSA units)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazardous Area Classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refer to the following lists for the certifying agency. Refer to section 1.5.5 Specifications, Electrical Classification for approval categories.
1.5.2 ELECTRICAL

TWO-WIRE TRANSMITTER INPUT POWER
Minimum Voltage (across SIG +/SIG - terminals) . +10 Vdc, Figure 1-4
Maximum Voltage (across SIG +/SIG - terminals) . +42 Vdc
Minimum Power Supply Voltage .................. See Figure 1-4
Ripple ........................................... 0.2 Vp-p, 47-125 Hz
Noise ............................................ 0.6 mV RMS maximum
Impedance ....................................... 10 Ohms maximum

TWO-WIRE CABLE
Type .............................................. Twisted Single-Pair,
                                          Shielded, Copper

Conductor Size
  Network length less than 5000 ft. ............ 24 AWG minimum
  Network length greater than 5000 ft. ........ 20 AWG minimum
                                          16 AWG maximum

Cable Capacitance ................................. Refer to section 2.3.6
Recommendation .................................... Belden 8641, 24 Ga.
                                          Belden 8762, 20 Ga.
Maximum Length .................................... Refer to section 2.3.6

TRANSMITTER INPUT CAPACITANCE ................. 12,500 pF., HART \( C_n = 3 \)
                                          Refer to section 2.3.6

NETWORK TOPOLOGY
Conventional or Point-To-Point Network (Analog 4-20 mA Output)
  Transmitter Quantity ............................ 1
  Network Signal and Connection ................ Analog, single current
                                          loop (Figure 2-3)
  Network Resistance (Loop Load Resistance) .... See Figure 1-4

Multi-Drop Network (Digital Output Only, 4 mA Parked Output)
  Transmitter Quantity ............................ 1 to 15
  Network Signal and Connection ................ Digital, parallel
                                          connected (Figure 2-5)
NOTES:

1. Depending upon the circuit parameter known, use A or B to determine the operating point of an analog mode Transmitter connected to a conventional or point-to-point network. The operating point must fall within the operating region.

   A. If the Network Resistance is known, calculate the minimum power supply voltage:

      Formula: \[ \text{Minimum Power Supply Voltage} = 10V + (0.02 \times \text{Network Resistance in Ohms}) \]

      Example: Desired barrier and sense resistances total 750 ohms. What is the minimum power supply voltage?

      \[ \text{Minimum Power Supply Voltage} = 10 + (0.02 \times 750) = 25 \text{ Vdc} \]

      Note that the power supply voltage can be higher providing that the operating region and the maximum power supply voltage are not exceeded. Refer to section 2.3.5.1.

   B. If a power supply is available, calculate the maximum Network Resistance:

      Formula: \[ \text{Maximum Network Resistance in Ohms} = 50 \times (\text{Minimum Power Supply Voltage} - 10) \]

      Example: The Transmitter will be powered by the +26 Vdc from a MYCRO 352 Single Loop Digital Controller (terminal BS).

      \[ \text{Maximum Network Resistance} = 50 \times (26 - 10) = 800 \text{ Ohms} \]

      The Network Resistance can be lower provided that the operating region is not exceeded and the HART communication resistance specification in note 3 is met.

2. To determine the operating point of a digital mode Transmitter connected to a multi-drop network, refer to section 2.3.5.2.

3. For HART communications, the Network Resistance must be between 250 and 1100 ohms.
1.5.3 I/O SPECIFICATIONS

INPUT RANGEABILITY (independent of mounting position)

<table>
<thead>
<tr>
<th>Range #</th>
<th>Range</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Span (Min.)</th>
<th>Span (Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.75/15&quot; H2O</td>
<td>-15&quot; H2O</td>
<td>+15&quot; H2O</td>
<td>0.75&quot; H2O</td>
<td>+15&quot; H2O</td>
</tr>
<tr>
<td>2</td>
<td>10/450&quot; H2O</td>
<td>-450&quot; H2O</td>
<td>+450&quot; H2O</td>
<td>10&quot; H2O</td>
<td>450&quot; H2O</td>
</tr>
<tr>
<td>3</td>
<td>350&quot; H2O to 450&quot; PSIG</td>
<td>-450 PSIG</td>
<td>+450 PSIG</td>
<td>350&quot; H2O</td>
<td>450 PSIG</td>
</tr>
</tbody>
</table>

MAXIMUM OVER RANGE
- Range 1 ........................................... +/-100 PSI
- Range 2 .......................................... +/-2000 PSI
- Range 3 .......................................... +/-2000 PSI

POWER-UP OUTPUT TIME ......................... 10 sec. max. to stated spec.

ANALOG OUTPUT SIGNAL
- Calibration ........................................ 4 to 20 mA
- Zero ............................................. 4 mA +/− trim
- Full Scale ........................................ 20 mA +/− trim
- Maximum .......................................... Less than 25 mA
- Minimum .......................................... Not less than 3.84 mA
- Signal Reference, Common .................. Negative (-) Signal Terminal

DIGITAL OUTPUT SIGNAL (HART)
- Coupling ........................................ AC
- Bit Rate Transmission ......................... 1200 Baud +/-1%
- FSK (frequency-shift-keyed) .................. Logic 1 = 1200 Hz +/-1%
  Logic 0 = 2200 Hz +/-1%

DIGITAL FILTER TIME CONSTANTS
- Using HART Communications ................... Continuously adjustable, 0 to 30 seconds
- Using ZERO/FULLSCALE Pushbuttons ........... 0.0, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 30

TRANSMITTER ANALOG UPDATE RATE
- Model 3400_A, Transmitter .................. 100 milliseconds
- Model 3400_B, Transmitter/Controller ..... 150 milliseconds

MOUNTING POSITION EFFECT ..................... 1.4" H2O maximum shift for 90° rotation; can be calibrated out

1.5.4 ENVIRONMENTAL

Electronics Operating Temperature ............ -40°F* to 185°F (-40°C to 85°C)
Capsule Assembly Operating Temperature .... -40°F* to 257°F (-40°C to 125°C)
* CIMEL/E: -4°F (-20°C)

February 1993
Storage Temperature ...................... -139°F to 185°F (-95°C to 85°C)
Operating Humidity ..................... 0 to 100% RH
Operating Maximum Moisture .......... Less than 0.050 lb. H₂O per lb. of dry air
Storage Humidity ...................... 0 to 100% RH Non-Condensing
Storage Maximum Moisture .......... Less than 0.028 lb. H₂O per lb. of dry air
EMI Susceptibility ..................... Less than 0.25% of min. span at 30 V/meter from 30 MHz to 1 GHz with scale for any range
ESD Susceptibility ..................... IEC 801-2 Severity Level 4 (15 Kv)
Surge Protection ....................... +/-60 Vdc from 5uF capacitor through 600 ohms; +2500V at 150 ohm source resistance
Corrosive Atmosphere ................. Operates in Class G3 (Harsh) environment per ISA-S71.04
Enclosure ............................... Rated for NEMA 4
Vibration ............................... Less than +/-0.05% of max. span shift per g, 0 to 60 Hz in any axis, up to 2g max.

1.5.5 ELECTRICAL CLASSIFICATION

IMPORTANT

Before installing, applying power to, or servicing a Transmitter, see the Transmitter’s nameplate and Table 1.2 for electrical classification. Contact Moore Products Co. for latest certifications.

Designed to meet the following requirements:

FM/CSA
  Intrinsically Safe
    Class I, Div 1, Groups A, B, C, & D
    Class II, Div 1, Groups E, F, & G
    Class III, Div 1
    When installed in accordance with Moore drawing 15032-3401
    Temperature Code T4A
Explosion Proof
   Class I, Div 1, Groups B, C, & D
   Class II, Div 1, Groups E, F, & G
   Class III, Div 1
   Conduit seal required within 18" of conduit entry
Non-Incendive
   Class I, Div 2, Groups A, B, C, & D

CENELEC EP
   Explosion Proof
     EEx d IIC T4, T5, T6 IP67

SAA
   Intrinsically Safe
     Ex ia IIC T6 IP65
   Explosion Proof
     Ex d IIB T6 IP65
   Non-Incendive
     Ex n DIP IIC T6 IP65

CENELEC IS
   Intrinsically Safe
     EEx ia IIC T4, T5, T6 IP67

1.6 GLOSSARY

Listed here are terms used in the field of pressure measurement and terms relevant to HART networks.

ABSOLUTE (abs) PRESSURE - A pressure measured against zero pressure or a total vacuum as a reference. The units of measurement are called absolute pressure units. For example: psia = pounds per square inch absolute.

ANALOG SIGNALLING - A low current signal of 4 to 20 mA dc from a Field Instrument to a Primary Master Communicator or non-signalling hardware.

ANSI - American National Standards Institute

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.
CURRENT SENSE RESISTANCE - The resistance in a Network Element or non-signalling hardware across which the field instrument (Transmitter) signal voltages are developed.

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 - Any network element that uses current variation for digital signalling or digital plus analog signalling. These devices respond to commands from Primary or Secondary Master Communicators and function as a slave in a master-to-slave relationship with the master. Field Instruments are assigned a HART Cn integer (1, 2, 3, etc.) that corresponds to its terminal capacitance. This integer is used in calculating Network cable length.

GAUGE PRESSURE - A pressure measured against atmospheric or barometric pressure as a reference. The units of measurement are called gauge pressure units. For example: psig = pounds per square inch gauge.

HART - Highway Addressable Remote Transducer - A communication protocol developed by Rosemount Inc.

HART NETWORK - A single pair of cabled wires and the attached communicating HART elements.

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 static and differential pressures that can safely be applied to a transmitter.

MULTI-DROP NETWORK - A Network having from one to fifteen field instruments that are parallel connected. This Network uses digital signalling only. Analog signalling is not employed.

NETWORK - A Network includes the following items:
• Transmitter(s)
• Network Element (controller, recorder, or passive non-signalling element)
• 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 and Barrier Resistance, if any, in the Network.

NPT - National Pipe Thread

February 1993
INTRODUCTION

POINT-TO-POINT NETWORK - A Network having a single field instrument and Primary Master. Analog signalling or analog plus digital signalling is possible.

PRIMARY MASTER - The single controlling Network Element that communicates with one or more field instruments.

SECONDARY MASTER - An occasional user of the Network such as the Mycro XTC Communicator (MXC).

SEDIMENT - A solid material deposit that settles in a liquid or gas that can cause a blockage that may affect the pressure measurement.

TRANSUDER - A device that accepts an input, such as pressure, and converts that input into an output of some other form, such as a voltage.
2.0 INSTALLATION

This section covers handling and storage, installation considerations, mechanical and electrical installation, and related topics necessary for the installation of a Model 340D Pressure Transmitter-Controller.

NOTE

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

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

In this section, "Transmitter" will refer to both Transmitter and Transmitter-Controller versions of the model 340D, except where specifically noted otherwise or the full product name is used.

2.1 EQUIPMENT DELIVERY AND HANDLING

2.1.1 FACTORY SHIPMENT

Prior to shipment, the Pressure Transmitter is fully tested and inspected to ensure proper operation. The Transmitter is then packaged for shipment. Accessories are cartoned separately.

2.1.2 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 possible previously 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.
2.1.3 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.

2.1.4 STORAGE PARAMETERS

The environmental guidelines of section 1.5.4 must be met for storage of a Transmitter.

2.2 ENVIRONMENTAL CONSIDERATIONS

Many industrial processes create severe environmental conditions. The conditions at each transmitter location must be within the specifications stated in section 1.5.4.

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

CAUTION

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

2.3 INSTALLATION CONSIDERATIONS

Sections 2.3.1 and 2.3.2 outline basic considerations needed to achieve a successful mechanical/electrical installation. The remaining sections then provide detailed pre-installation information.

2.3.1 MECHANICAL

A. Select needed Transmitter model(s) by determining process measuring needs. Refer to section 1.4 Model Designation.
   • Flow measurement: Liquid, Gas, Steam
   • Level Measurement: Open Tank, Closed Tank

B. Determine if optional analog meter or digital meter for monitoring transmitter output is required. Refer to section 1.4.1.

C. Determine physical mounting of Transmitter, need for optional brackets for pipe mounting or surface mounting, need to rotate transmitter enclosure for clearance or access, and need to rotate optional analog meter or digital meter. Refer to sections 1.4.1 and 2.4.5

February 1993
D. Determine if an explosion proof or intrinsically safe installation is required. Refer to Transmitter nameplate for electrical classifications and sections 1.4 and 2.4.7.

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

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

E. Determine conduit routing. Refer to section 2.4.6.

F. Consider pressure piping recommendations. Refer to section 2.3.3.

G. Consider installation of a three valve manifold.

It is recommended in applications requiring a differential pressure transmitter that a three valve manifold be used as this device provides both an equalizing valve and high and low pressure block valves.

The equalizing valve permits both inputs to be equalized before a transmitter is serviced. The block valves permit the transmitter to be isolated from the process for servicing.

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

2.3.2 ELECTRICAL

A. Determine Transmitter operating mode (analog or digital) and type of Network needed; refer to section 2.3.4.

B. Determine minimum power supply requirements. Refer to section 2.3.5.

C. Select twinxial cable type and determine maximum cable length. Refer to section 2.3.6.

D. Determine the need for network junctions. Refer to section 2.3.7.

E. Installations requiring intrinsic safety will need barriers. Refer to section 2.3.8.

F. Consider the effect of connecting miscellaneous equipment to the network. Refer to section 2.3.9.

G. Review section 2.3.10 for grounding and shielding recommendations.

February 1993
2.3.3 IMPULSE PIPING

Impulse piping is the piping to be connected to the Transmitter’s process connection(s). Refer to Figures 2-1 and 2-2 for suggested flow and level measurement piping arrangements. Note the following when planning and installing the piping.

A. Install impulse piping in accordance with ANSI Code B31.1.0.

B. Make length of impulse piping as short as possible to reduce friction loss and temperature-induced density variations.

C. On lines between the process and Transmitter, use impulse piping of 3/8” OD or larger to avoid friction effects (causes lagging) and blockage.

D. Use the least number of fittings and valves possible to minimize leakage problems. Teflon® tape is the recommended thread sealant for process connections at the Transmitter.

E. Valves used in pressure service should be either globe or gate type. Valves used in gas service should be of a type that does not permit condensate to build up behind the valve.

F. Install sediment chambers with drain valves to collect solids suspended in process liquids or moisture carried with non-condensing gases.

G. Install air chambers with vent valves at high point in pipes to vent gas entrained in liquid pressure lines.

H. Use sealing fluid to keep corrosive liquid or gas from the transducer pressure inlets. The sealing fluid must be of greater density than the process fluid and non-miscible. Fill both pressure lines to the same level.

I. For Transmitters located above the process, slope piping from the Transmitter at least 1 inch/foot (83 mm/M) down toward process.

J. For Transmitters located below the process, slope piping at least 1 inch/foot (83 mm/M) up toward process.

K. Protect pressure lines (by shielding if necessary) from objects or equipment that may bend or kink the line causing fluid flow restriction.

L. Protect the pressure lines from extreme temperature ranges. Lines should be protected from freezing by installing a heat trace.

M. A three-valve manifold should be used with a Model 340D Transmitter to permit servicing and zero checks.
FIGURE 2-1 Flow Measurement Piping Arrangements (Gas/Liquid)
A. PRESSURIZED (CLOSED) VESSEL INSTALLATION: NON-CONDENSABLE FLUID

SUPPRESSED-ZERO TO CALCULATE MAXIMUM DISTANCE
SUBTRACT ACTUAL SPAN SETTING FROM RANGE LIMIT GIVEN IN SPECIFICATIONS

NOTE 3
NOTE 1

DIPLEG AND DRAIN VALVE

B. PRESSURIZED (CLOSED) VESSEL INSTALLATION: CONDENSABLE FLUID

SUPPRESSED-ZERO TO CALCULATE MAXIMUM DISTANCE
SUBTRACT ACTUAL SPAN SETTING FROM RANGE LIMIT GIVEN IN SPECIFICATIONS

NOTE 2

C. OPEN VESSEL INSTALLATION

NOTES:
1. TRANSMITTER MAY BE MOUNTED AT THE MINIMUM LEVEL TO BE MEASURED OR BELOW THE MINIMUM LEVEL (SUPPRESSED ZERO RANGE REQUIRED).
2. OPEN OR VENTED VESSELS REQUIRE ONLY A (HP) HIGH PRESSURE CONNECTION.
3. HIGH PRESSURE LINE SENSES STATIC PRESSURE PLUS LEVEL, LOW PRESSURE LINE SENSES STATIC PRESSURE ONLY. THE TWO PRESSURES OPPOSE EACH OTHER CANCELLING THE EFFECT OF STATIC PRESSURE.
4. DISTANCE 'X' CAN BE ANY DISTANCE SINCE BOTH THE HIGH AND LOW PRESSURE LINES HAVE EQUAL AND OPPOSITE FORCES WHICH CANCEL THE FORCES CREATED BY THIS DISTANCE.
5. ENTIRE LENGTH OF LOW PRESSURE PIPE IS KEPT FULL OF CONDENSATE TO ACT AS A REFERENCE. THEREFORE, AN ELEVATED-ZERO RANGE IS REQUIRED AND THE DISTANCE 'Y' IS THE LIMITING FACTOR.

FIGURE 2-2 Level Measurement Piping Arrangements
2.3.4 DETERMINE TRANSMITTER OPERATING MODE AND NETWORK TYPE

A Transmitter can output either an analog current or an equivalent digital signal. The operating mode must be selected since it determines the type of Network (Conventional, Point-To-Point, or Multi-Drop) to be installed, as shown in Table 2.1 and the following subsections. The operating mode selection is entered during Transmitter configuration.

<table>
<thead>
<tr>
<th>OPERATING MODE</th>
<th>NETWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog</td>
<td>Conventional or Point-To-Point</td>
</tr>
<tr>
<td>Digital</td>
<td>Multi-Drop</td>
</tr>
</tbody>
</table>

2.3.4.1 Analog Mode

A. Analog signals are required for inputs to devices such as controllers and valves, and as a control signal to a final control element; the Transmitter outputs a 4-20 mA analog signal.

B. Analog operation requires either a Point-To-Point Network comprising a Transmitter and Primary Master Controller or a Conventional Network with an allowable non-signalling device. Figures 2-3 and 2-4 illustrate these Networks.

C. An Analog Meter option can be used if local indication of transmitter output is required.

D. The Transmitter is shipped as an analog mode Transmitter to output a 4 to 20 mA signal.

E. A Mycro XTC Communicator (MXC) can be used for configuration, diagnostics, and reporting current process variable.

2.3.4.2 Digital Mode

A. Number of Allowable Network Elements

- Primary Master - 1
- Secondary Master - 0 or 1
- Transmitters - 1 to 15; reduce the number of transmitters if the Network power supply cannot safely provide 60 mA.

The process variable signal of each transmitter is a digitally polled variable. The output of each transmitter is "parked" at 4 mA. Figure 2-5 illustrates a Multi-Drop Network.

February 1993
FIGURE 2-3 Conventional and Point-To-Point Networks
NOTES:
1. A TRANSDUCER OR VALVE POSITIONER (E.G., MOORE PRODUCTS MODEL 77, 771, OR 750E) WITH HIGH RESISTIVE OR INDUCTIVE INPUT IMPEDANCE REQUIRES A COMMUNICATION FILTER (KIT 20137-3) TO PERMIT HART DIGITAL SIGNALS TO COMMUNICATE WITH THE TRANSMITTER.

2. MINIMUM 2500 NETWORK RESISTANCE (SUM OF BARRIERS AND CURRENT SENSE RESISTANCES) REQUIRED TO SUPPORT COMMUNICATIONS. OPTIONAL BARRIERS MAY INCLUDE SUPPLY AND RETURN OR SUPPLY ONLY. MAXIMUM NETWORK RESISTANCE IS 1100Ω.

3. CONNECT THE XTC BETWEEN THE CURRENT SENSE RESISTOR AND EITHER THE BARRIER OR THE TRANSMITTER IN A NON-HAZARDOUS AREA ONLY. THE XTC IS A NON-POLAR DEVICE.

4. ALL CABLE SHIELDS AT A NETWORK JUNCTION AND BARRIER MUST BE CONNECTED AND NOT GROUNDED.

5. CABLE SHIELD AT THE TRANSMITTER IS NOT GROUNDED.

6. = TWISTED PAIR CONDUCTOR

FIGURE 2-4 Conventional and Point-To-Point Network Examples
NOTES:
1. THE POWER SUPPLY IS SHOWN AS SEPARATE FROM THE PRIMARY MASTER. IN PRACTICE, THE POWER SUPPLY MAY BE PART OF AND CONTAINED IN THE PRIMARY MASTER.

2. MINIMUM 250Ω NETWORK RESISTANCE (SUM OF BARRIERS AND CURRENT SENSE RESISTANCES) REQUIRED TO SUPPORT COMMUNICATIONS. OPTIONAL BARRIERS MAY INCLUDE SUPPLY AND RETURN (SHOWN ABOVE) OR SUPPLY ONLY. MAXIMUM NETWORK RESISTANCE IS 1100Ω.

3. A MAXIMUM OF 15 TRANSMITTERS MAY BE CONNECTED TO THE NETWORK. TRANSMITTERS MUST BE CONFIGURED AS DIGITAL TRANSMITTERS ONLY.

4. CONNECT THE WNC BETWEEN THE CURRENT SENSE RESISTOR AND EITHER THE BARRIER OR THE TRANSMITTER IN A NON-HAZARDOUS AREA ONLY. THE WNC IS A NON-POLAR DEVICE.

5. ALL CABLE SHIELDS AT A NETWORK JUNCTION AND BARRIERS MUST BE CONNECTED AND NOT GROUNDED.

6. CABLE SHIELDS OF BOTH CABLES MUST BE CONNECTED TOGETHER.

7. CABLE SHIELD AT LAST TRANSMITTER IS NOT GROUNDED.

8. — = TWISTED PAIR CONDUCTOR
B. The HART communication source is a Primary Master Controller. A Secondary Master, the Mycro XTC Communicator, may be used for configuration, diagnostics, and reporting current process variable.

C. If local indication is needed, the digital meter option must be selected for display of transmitter output, calibration, and configuration messages. There is no 4-20 mA output signal in the Multi-Drop Network; therefore, the analog meter option cannot be used.

D. Place the transmitter in the digital mode, to park its output at 4 mA, by assigning it a SHORT ADDRESS number (1 to 15) when configuring the TRANSMITTER ID BLOCK with the Mycro XTC Communicator.

**IMPORTANT**

Under no circumstances should a transmitter configured for the analog mode be connected to a Multi-Drop Network.

### 2.3.5 DETERMINE POWER SUPPLY REQUIREMENTS

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

- A separate stand-alone unit capable of powering several Transmitters
- Located in a controller (such as a Primary Master) or other station if it is able to safely provide additional operating current and it meets the power supply specifications of section 1.5.2

To determine power supply electrical characteristics, the Network Resistance must be calculated and the graph in Figure 1-4 consulted. Figure 1-4 shows the minimum power supply voltage needed for the calculated Network Resistance.

The total Network Resistance is the sum of the Current Sense Resistance and end-to-end Barrier Resistance (if used). The minimum Network Resistance (see Glossary) required to support HART communications is 250 ohms. The maximum resistance is 1100 ohms.

#### 2.3.5.1 Conventional and Point-To-Point Networks

A. Figure 1-4 defines an analog mode Transmitter’s operating region for the allowable ranges of supply voltage and network resistance.

B. The minimum compliance voltage across the input terminals of a Transmitter is 10 volts. The minimum network power supply voltage requirement is a function of Network Resistance and full scale current (20 mA), and is calculated by the following formula:

\[
\text{Minimum Supply Voltage} = 10 \text{ volts} + (0.02 \times \text{Network Resistance in ohms})
\]
C. The maximum compliance voltage permitted across the input terminals of a Transmitter is 42 volts. The maximum network power supply voltage is a function of Network Resistance and zero scale current (4 mA), and is calculated by the following formula:

Maximum Supply Voltage = 42 volts + (0.004 x Network Resistance in ohms)

D. If a Conventional Network contains an allowable non-signalling element (e.g., Model 362 Electronic Recorder) with available two-wire transmitter output voltage terminals, it may supply operating power if it meets the power supply specifications of section 1.5.2.

E. When a Point-To-Point or Conventional Network contains no element with a usable power source, then a stand-alone power supply meeting the power supply specifications of section 1.5.2 must be used to power the Transmitter.

2.3.5.2 Multi-Drop Network

A. The minimum compliance voltage across the input terminals of a Transmitter is 10 volts. The minimum network power supply voltage requirement is a function of Network Resistance and the total current draw of all the transmitters in the Network, and is calculated by the following formula:

Minimum Supply Voltage = 10 volts + [(0.004 x number of transmitters on Network) x (Network Resistance)]

B. The maximum compliance voltage permitted across the input terminals of a Transmitter is 42 volts. The 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 Voltage = 42 volts + [(0.004 x number of transmitters on Network) x (Network Resistance)]

C. 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.

2.3.6 CABLE REQUIREMENTS AND MAXIMUM LENGTH

A cable length calculation is necessary when HART communications are to be employed.

2.3.6.1 Cable Requirements

Cable type, conductor size, and recommended cable model numbers are stated in section 1.5.2 Electrical.
Cable capacitance is a parameter used in the calculation of the maximum length of cable that can be used to construct the Network. The distance between Network Elements will be maximized when a cable with the lowest capacitance value is used. 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.

2.3.6.2 Maximum Cable Length Calculation

The maximum permissible single-pair cable length is 10,000 feet 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.

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 determined as follows:
### FIELD INSTRUMENT CAPACITANCE

<table>
<thead>
<tr>
<th>Cn VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5000 pF</td>
</tr>
<tr>
<td>5000 pF to less than 10000 pF</td>
</tr>
<tr>
<td>10000 pF to less than 15000 pF</td>
</tr>
<tr>
<td>15000 pF to less than 20000 pF</td>
</tr>
<tr>
<td>20000 pF to less than 25000 pF</td>
</tr>
</tbody>
</table>

For Field Instruments without Cn values, use Cn = 1

**Example Calculation:**

Assume a Network consists of two Field Instruments (Cn = 1 and Cn = 1).

Let \( R = 250 \) ohms, \( C = 40 \) pF/ft., \( C_r = 10,000 \)

\[
65,000,000 \quad \frac{10,000}{40} + \frac{10,000}{40} = 6000 \text{ feet (1800 meters)}
\]

(250)(40) 40

### 2.3.7 NETWORK JUNCTIONS

#### 2.3.7.1 Point-To-Point And Conventional Networks

A Network Junction, shown in Figure 2-3, can be installed at a Wiring Panel or Junction Box. Multiple Junctions are permitted to provide field access terminals for the connection of a Mycro XTC Communicator.

A Network Junction must comply with the following:

A. For a Network using barriers, a Junction may be located anywhere along the Network in the non-hazardous area between a barrier and the Current Sense Resistor.

B. For a Network without barriers, a Junction may be located anywhere along the Network between the Current Sense Resistor and Transmitter.

C. A Junction should be a simple electrical series connection containing NO repeaters or other devices (active or passive) that can influence HART communications.
2.3.7.2 Multi-Drop Network

Network Junctions, shown in Figure 2-5, should be made at Junction Boxes or Wiring Panels. A Mycro XTC Communicator can be connected to these Junctions. Multi-Drop Network Junctions must comply with the guidelines listed in section 2.3.7.1.

2.3.8 SAFETY BARRIERS

Installed safety barriers must comply with the following:

A. Intrinsic safety barriers may be located between the Primary Master residing in the non-hazardous area and the transmitter(s) in the hazardous area.

B. Supply and return barriers may be used as illustrated in Figure 2-3.

C. 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.

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

E. The barrier impedance to the HART range of frequencies (500 Hz to 2500 Hz) shall not be less than 5000 ohms.

F. The end-to-end resistance of the barrier as listed by the manufacturer is used in calculating the maximum Network cable length.

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

2.3.9 CONNECTION OF MISCELLANEOUS HARDWARE

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

IMPORTANT

No non-signalling hardware (meters or measuring devices) may be connected to a Multi-Drop Network as the transmitters are not providing an analog process variable.

February 1993
A. Miscellaneous hardware may be series or parallel connected to the Network according to its function.

B. Miscellaneous hardware must be passive two-terminal devices.

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

D. Individual miscellaneous hardware must meet the following requirements:
   - Capacitance to Ground ..................... 50 pF maximum
   - Resistance to Ground ...................... 1 Megohm minimum
   - Impedance if Series Connected .............. Less than 10 ohms
   - Impedance if Parallel Connected .......... Greater than 50k ohms.

E. 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 .......... 62.5k ohms
   - Maximum series impedance ............... 160 ohms
   - Minimum parallel impedance .............. 3125 ohms

2.3.10 SHIELDING AND GROUNDING

Preferred methods of grounding are illustrated in Figures 2-3, 2-4, and 2-5.

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

A. The single point grounding concept should be used.

B. Preferably, ground the cable shield at the Network power supply.

C. When the cable shield is grounded at the power supply, the cable shield should remain open (not connected) at the Field Instrument (Transmitter).

D. When the cable shield is grounded at the power supply, the shields of both cables at any and all Network Junctions may be spliced. Alternatively, they both may be connected to a terminal in the Box or Panel, provided that the terminal is isolated from ground.

E. Point-To-Point and Conventional 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 in the above step D.

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.

F. 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.

2.4 MECHANICAL INSTALLATION

This section describes the mechanical installation of a Transmitter and the installation of electrical conduit for power cables. Transmitter dimensions and related mounting information are provided in Figures 2-6, 2-7, and 2-8.

The Transmitter can be mounted in any position, however, the mounting position can cause a zero shift. There is no affect on zero when the plane of a capsule diaphragm is perpendicular to ground. A zero shift occurs for any other plane with the maximum shift occurring for a 90 degree rotation. Figure 2-8 shows the diaphragm plane.

Any zero shift is simply calibrated out with the Transmitter installed in its final mounting position, or it may be bench calibrated. Refer to section 3, CALIBRATION for details.

Be sure to allow sufficient room at each end of the Transmitter for removal of enclosure end caps.
NOTES:

1. DIMENSIONS IN INCHES (MILLIMETERS)

2. PROCESS CONNECTION BLOCKS CAN BE ROTATED 180° FOR TOP OR BOTTOM VENT/DRAIN. SIDE VENT OPTION ONLY.

FIGURE 2-6 Dimensions, Model 340D Transmitter
FIGURE 2-7 Dimensions, Mounting Bracket for Model 340D
FIGURE 2-8  Model 340D Mounting Configurations with Optional Bracket
2.4.1 PIPE MOUNTING

A Model 340D Transmitter can be mounted to a vertical or horizontal 2-inch pipe using an optional mounting bracket kit; kit part numbers are given in section 1.4.1.

1. Transmitter To Bracket Mounting

1) Refer to Figure 2-7 and align each pair of end cap (vent/drain end) mounting holes with the desired pair of elongated mounting holes found on the bracket face.

There are four opposing elongated mounting holes on the bracket face allowing mounting positions that differ by 90 degree increments.

2) Using the supplied 7/16-20 X 3/4 bolts, secure the Transmitter to the 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 2-8.

2) Slip the supplied large U-bolt around the pipe and through one of the two pair of mounting holes provided 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 enclosure and/or optional local display (if any) as necessary. Refer to sections 2.4.4 and 2.4.5.

2.4.2 FLAT SURFACE MOUNTING

The Model 340D can be mounted to a flat surface using a mounting bracket kit and user supplied 5/16-inch bolts.

Refer to Figure 2-8 and the following for mounting guidance:

1. Bracket To Flat Surface Mounting

1) Refer to Figure 2-7 for the bracket mounting hole dimensions.
2) Layout the mounting hole pattern on the selected 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

Mount the Transmitter to the bracket; refer to section 2.4.1, step 1.

3. Reposition the Transmitter’s enclosure and/or optional local display (if any) as necessary. Refer to sections 2.4.4 and 2.4.5.

2.4.3 DIRECT MOUNTING TO PROCESS

The Transmitter can be interfaced to the process through a commercially available three-valve manifold and supported by the piping connections (3-inch nipples) if mounted directly at the point of measurement.

The transmitter process connection flanges (end caps) are on 2.13-inch (54mm) centers to allow direct mounting (bolting) to manifold flanges of the same spacing. Each transmitter process connection flange has two tapped 7/16-20 mounting holes and a 1/4 NPT tapped pressure inlets.

Process orifice flanges with standard 2.13-inch spacing permit a transmitter/three-valve manifold combination to be mounted to the orifice flanges.

The procedure for mounting a Transmitter to a three-valve manifold, and the manifold to orifice flanges, is covered by the installation instructions supplied by the manifold manufacturer.

The following is a guide and may need to be modified for some installations. Teflon® tape is the recommended thread sealant for process connections at the Transmitter.

1. Remove process connection blocks from the Transmitter’s process flanges.

2. Place supplied seals over the Transmitter’s process flange input ports and bolt the Transmitter to the transmitter side of the three-valve manifold.

3. Thread 1/2” nipples of 3 inch (or less) length into the high and low pressure ports of the orifice flanges. Thread sealant must be used.
4. Thread the process connection blocks directly onto the nipples. Thread sealant must be used. The 1/2" NPT tapped hole in a process connection block is off center to accommodate 2" or 2.25" centers (Figure 2-6). For 2.13" pipe centers, the tapped holes should be offset to the right side.

5. Place supplied seals on connection blocks and bolt them to manifold.

6. Reposition the Transmitter’s enclosure and/or optional local display (if any) as necessary. Refer to sections 2.4.4 and 2.4.5.

2.4.4 TRANSMITTER ENCLOSURE REPOSITIONING

The transmitter enclosure can be repositioned by rotating the enclosure up to 120 degrees, left or right, for a total of 240 degrees as shown in Figure 2-6. A 10-32 set screw that locks the enclosure to the stem of the Capsule Assembly is provided for this purpose.

Enclosure repositioning may be required to optimize viewing of an optional Analog or Digital Meter or to provide clearance for enclosure cap removal.

2.4.5 OPTIONAL LOCAL DISPLAY REPOSITIONING

In some cases, the final mounting position of the Transmitter may require repositioning of an Analog or Digital Meter to preserve optimum viewing.

A Digital Meter can be repositioned 78° to the right, 282° to the left, and to the 180° position. An Analog Meter can be rotated only 180°. A T15 TORX® screwdriver is needed. Refer to the following for repositioning procedures:

2.4.5.1 Analog Meter

1. Turn off Transmitter power. Remove enclosure cap to access Analog Meter.

2. As shown in Figure 2-9, loosen (do not remove) the Meter’s two mounting plate retaining screws.

3. Rotate the mounting plate counterclockwise to position screws in large circular slots and gently lift the Meter clear of the screws. Removal of Meter’s leads is not required to reposition Meter.

   If complete removal is desired, tag and disconnect the Meter’s leads from the TEST (+) and (-) terminals.

4. Carefully rotate the mounting plate 180° and fit over retaining screws. Rotate mounting plate clockwise and tighten screws.

5. Replace enclosure cap and restore power to transmitter.
2.4.5.2 Digital Meter

**IMPORTANT**

Refer to SD3900-4 for circuit card handling procedures to prevent damage to Digital Meter Board from electrostatic discharge.

A. Rotate 180° Positioning

1. **Turn off power to transmitter** and remove enclosure cap to access Digital Meter.

2. Snap wrist strap on wrist and connect ground clip to transmitter or mounting bracket.

3. As shown in Figure 2-10, disconnect cable from connector J1 and slide cable from cable slot.

4. Loosen (do not remove) upper right and lower left Meter Board retaining screws.

5. Gently rotate Meter Board counterclockwise to position upper right retaining screw in large circular hole and carefully lift Board clear of screw, then slide Board clear of lower left retaining screw.

6. Rotate the Board 180°, place under the retaining screws, rotate Board clockwise, and tighten screws.

7. Position cable in 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. Left/Right Positioning

1. Remove Digital Meter Board as described in the above paragraph A, steps 1 to 5.

2. Refer to Figure 2-10 and remove the upper right 2-inch spacer. Install the spacer in alternate upper left mounting hole provided for this purpose.

3. Remove and retain lower right baseboard retaining screw.

4. Remove lower left 3-inch spacer from Baseboard and install in place of just removed lower right baseboard retaining screw.

5. Install baseboard retaining screw in place of just removed 3-inch spacer.

February 1993
FIGURE 2-9 Analog Meter Removal and Repositioning

NOTES:
1. METER ASSEMBLY CAN ONLY BE REPOSITIONED 180 DEGREES.
2. TO REPOSITION METER ASSEMBLY, PARTIALLY REMOVE ASSEMBLY AND ROTATE 180 DEGREES.
   FIT PLATE OVER SCREWS, ROTATE PLATE TO MOUNTING POSITION AND TIGHTEN SCREWS.
3. TERMINAL BLOCK LOCATED BEHIND METER ASSEMBLY.

FIGURE 2-10 Digital Meter Repositioning

NOTES:
1. DIGITAL METER MAY BE ROTATED IN 7.5' OR 28.7' INCREMENTS.
2. REFER TO SECTION 2.4.6 FOR REPOSITIONING INSTRUCTIONS.
6. Rotate Digital Meter Board to the desired 282° or 78° position (left or right) and position Board under retaining screws and tighten screws.

7. Position cable in cable slot and connect cable to appropriate connector (J2 or J4).

8. Replace enclosure end cap and restore power to transmitter.

2.4.6 ELECTRICAL CONDUIT AND CABLE INSTALLATION

All electrical conduit and all signal wires must be supplied by the user. Access to electrical terminals is described in section 2.4.6.3.

For conduit and cable routing, refer to user’s installation drawings.

Installation of conduit and cabling should follow the guidelines given below:

2.4.6.1 Conduit

A. Transmitter conduit inlets will accept male conduit fittings with 1/2-14 NPT.

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

C. Install conduit for field wiring.

D. 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 2-11.

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

2.4.6.2 Cables

A. Ensure each signal wire connected to the Transmitter is marked by a tag to indicate that it is a SIGNAL (+) or SIGNAL (-) wire.

B. Use pulling grips and cable lubricants for easier cable pulling. Pull cable through conduit into Transmitter terminal compartment.

C. Do not exceed the maximum permitted pulling tension on the cables. Maximum tension is normally specified as 40% of the cable’s breaking strength.

D. Do not exceed the maximum conduit fill specified by the National Electric Code.

2-26

February 1993
FIGURE 2-11 Conduit Drain and Explosion Proof Installations
2.4.6.3 Access to Transmitter Terminal Compartment

1. Unscrew the enclosure cap protecting the terminal compartment.

As shown in Figure 2-6, the two 1/2 NPT signal wire entrance holes in the transmitter’s electronic housing are off-center. The terminal compartment is located to the off-center side.

2. If the optional Analog Meter is installed in the terminal compartment, refer to section 2.4.5 and remove the Meter to access the signal terminals.

2.4.7 EXPLOSION-PROOF INSTALLATION

If the installation is required to be explosion-proof per the National Electrical Code:

A. User supplied explosion-proof conduit seals are required on transmitter housing conduit outlets and any installed junction boxes. See Figure 2-11.

B. Power wiring conduit entries at the Transmitter must have a minimum of five threads fully engaged.

C. Both transmitter enclosure caps must be installed and have eight threads fully engaged with no damaged threads permitted.

D. Refer to section 2.6 for hazardous area installation information.

This completes the mechanical installation.

2.5 ELECTRICAL INSTALLATION

This section describes wiring for Conventional, Point-To-Point, and Multi-Drop Networks. Refer also to section 2.6 for installations in hazardous locations.

The following should already have been completed:

- The selection of either analog or digital operating mode, and corresponding network, as described in section 2.3.4.
- The selection of a power supply, as described in section 2.3.5.
- The Transmitter(s) mechanically installed, as described in section 2.4.
- The Network cable pulled through conduit (if installed) and into the terminal compartment, as described in section 2.4.6.
Connect the Network to the SIGNAL(+) and SIGNAL(-) terminals inside the Transmitter’s enclosure. Terminals will accommodate wire sizes up to 16 AWG. Refer to section 2.4.6.3 for access to the terminal compartment.

**Do not** connect the Network to the "TEST" terminals; they are for connection of the optional local Analog Meter.

1. To access the signal terminals, unscrew the enclosure cap protecting the terminal compartment.

As shown in Figure 2-6, the two 1/2 NPT signal wire entrance holes in the Transmitter’s electronic housing are off-center. The terminal compartment is located to the off-center side.

2. If the optional Analog Meter is installed in the terminal compartment, refer to section 2.4.5, paragraph A, and remove the Meter to access the signal terminals.

3. Strip cable and conductors and connect (observing the correct polarity) to the terminals. Refer to Figure 2-3, 2-4 or 2-5 for the needed connections for the type of Network. Figure 2-12 shows the preferred method of connecting conductors to the terminals.

Be certain that the shield braid is completely insulated from all terminals and the metal terminal enclosure. Refer to section 2.3.10 for additional information concerning shielding and grounding.

4. If an Analog Meter was removed, reinstall by reversing the procedure in section 2.4.5.

5. Reinstall enclosure cap.

**IMPORTANT**

Enclosure threads on early models were coated with a wet paste type anti-seize compound. Be certain that enclosure threads having this compound are coated with adequate 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.

Later models use a dry type anti-seize compound with superior retention to the threads.

6. If one of the two electrical entrance holes in the housing is not used, it should be plugged. The entrance holes accept 1/2 NPT fittings.
2.6 HAZARDOUS AREA INSTALLATIONS

Refer to the drawings in Appendix A when locating a Transmitter in a hazardous area. Entity parameters, barrier selection, and important wiring information are specified on these drawings.

Before installing a transmitter in a hazardous area, check the nameplate and section 1 of this Instruction for required approvals or certifications.

NOTE

The Mycro XTC Communicator (MXC) is approved for use in non-hazardous areas only.

This completes the electrical installation.
3.0 OPERATION AND SYSTEM CHECKOUT

This section first describes setting a Transmitter’s range and damping by means of either a Transmitter’s pushbuttons or a Mycro XTC Communicator. Setting of the Model 340D_A Transmitter is discussed in section 3.1. Section 3.2 discusses the setting of a Model 340D_B Transmitter-Controller.

Finally, system checkout procedures to test communications, diagnostics, configuration, and analog signal output are described in section 3.3.

NOTE

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

3.1 TRANSMITTER LOCAL PUSHBUTTON OPERATION (Model 340D_A only)

Local pushbutton operation of the Transmitter involves the use of the ZERO/FULLSCALE pushbuttons to range the input or adjust damping (digital filter time constant). This section describes the ranging and damping value adjustment procedures.

The Transmitter is shipped from the factory completely calibrated and configured to a particular range (span) and damping value as specified by the user, or to factory default values. A pushbutton ENABLE/DISABLE jumper is factory set to ENABLE (Figure 6-3). Pushbuttons perform no functions when DISABLED.

3.1.1 INPUT RANGING

The input may be ranges in either of two ways.

1. Using the Mycro XTC Communicator:

   Range values are chosen while configuring the Transmitter. This procedure is covered in the reference guide cards supplied with the Mycro XTC (MXC) Communicator, and the MXC Users Guide AD340-510.

2. Using the Transmitter’s ZERO/FULLSCALE Pushbuttons:

   Low and high process pressures applied to the Transmitter are selected as the 0% and 100% span points and entered into EEPROM using the Transmitter’s ZERO/FULLSCALE pushbuttons. Refer to section 3.1.1.1 for procedure.

February 1993
3.1.1.1 Pushbutton Ranging Procedure

This procedure assumes the Transmitter is field mounted to an operating
process. If the Transmitter does not contain either an optional Analog Meter
or Digital Meter to report the process variable, it is assumed that other
instrumentation on the Network is 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 2-6.

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. The Pushbutton Mode will automatically time-out after 1
      minute.

      IMPORTANT

      Failure to hold a pushbutton ON for a minimum of 5
      seconds will prevent entry into the Pushbutton Mode.

      The Pushbutton Mode may be de-activated in two ways: by
      simultaneously pressing and then releasing both the ZERO and
      FULLSCALE pushbuttons, or by allowing the 1 minute "mode active"
      period to time-out.

      On the optional Digital Meter, when a pushbutton is pressed a "PB"
      annunciator will appear in the display. If the pushbutton has
      been held for the required minimum 5 seconds, when it is released,
      the "PB" annunciator will remain on (Pushbutton Mode).

3) Enter ZERO Value.

   Press and release the ZERO pushbutton. The new 0% range value is stored
   in EEPROM. 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 Transmitter's 100% value is
   automatically shifted to maintain the original span, except as
   follows:

   • If the process is out of range, then 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

Push the FULLSCALE button in the same manner as described above for the ZERO button in 2). Activate the Pushbutton Mode.

3) Enter FULLSCALE value

Press and release the FULLSCALE pushbutton. The new 100% range value is stored in EEPROM. 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.

3.1.2 DAMPING ADJUSTMENT

Adjusting the damping changes the value of the digital filter's time constant.

The adjustment may be accomplished in either of two ways:

1. Using the Mycro XTC Communicator:

Damping values are entered while configuring the Transmitter. This procedure is covered in the Mycro XTC Communicator's reference guide cards and the MXC Users Guide AD340-510.

February 1993
2. Using the Transmitter's ZERO/FULLSCALE Pushbuttons:

Use both pushbuttons to access the ten damping values. Use either pushbutton to step up/down through the values, then use both pushbuttons to enter the selected value in EEPROM. Refer to section 3.1.2.1 for procedure.

IMPORTANT

An installed Digital Meter is recommended for this procedure.

3.1.2.1 Procedure Using Digital Meter

1. Activate the Pushbutton Damping Mode.

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

IMPORTANT

Failure to hold both pushbuttons ON for a minimum of 5 seconds will prevent entry into the pushbutton Damping Mode.

The Damping Mode is automatically de-activated when the 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 optional 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 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, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 30 seconds.

Repeatedly press the ZERO pushbutton to step down the list; press 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 EEPROM and normal operation is restored.

4. Restore protective cover over pushbuttons.
3.1.2.2 Procedure Without Digital Meter

1. Activate the pushbutton mode as described in step 1 of section 3.1.2.1.

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

3. Refer to step 2 of section 3.1.2.1 and select the new damping value. Count the number of steps (damping values) from "0" sec. to the selected value. This number "N" will be used in the following step 4.

4. Press and release the FULLSCALE pushbutton "N" times to step to the selected damping value.

5. Perform steps 3 and 4 of section 3.1.2.1.

3.2 TRANSMITTER-CONTROLLER LOCAL PUSHBUTTON OPERATION (Model 340D_B only)

When the Controller is ENABLED (configuration), local pushbutton operation of the Transmitter-Controller involves the use of the ZERO/FULLSCALE pushbuttons and optional Digital Meter (LCD) to perform the following functions:

- Display PROCESS VARIABLE (PV)
- Display SET POINT (SP)
- Display VALVE (V) position
- Transfer control mode from AUTO (A) to MANUAL (M)
- Transfer control mode from MANUAL to AUTO
- Change SET POINT in RAM
- Store SET POINT in EEPROM
- Change VALVE in RAM
- Store VALVE in EEPROM

<table>
<thead>
<tr>
<th>PV</th>
<th>AL</th>
<th>PB</th>
<th>%</th>
<th>ENG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DIGITAL METER

PV - Process Variable
SP - Set Point
V - Valve
A - Auto Control
M - Manual Control
AL - Alarm
PB - Pushbutton
ENG - Engineering Units
% - Percent (Valve or Process)

This section describes pushbutton operation to perform the above listed functions.

The Transmitter is shipped from the factory completely calibrated and configured to particular Controller parameters as specified by the user, or to factory default values.
3.2.1 AUTO/MANUAL, SET POINT, AND VALVE ADJUSTMENTS

AUTO/MANUAL (A/M), SET POINT (SP), and VALVE (V) Controller parameters may be viewed and/or adjusted in either of two ways:

1. Using the Mycro XTC Communicator (MXC):

   A/M, SP, and V Controller parameters may be viewed and changed through the use of the following dedicated MXC keys: A/M, CHANGE SP, CHANGE VALVE, and TRANS. VAR’S. These procedures are covered in the reference guide cards supplied with the Mycro XTC Communicator and the MXC Users Guide AD340-510.

2. Using the Transmitter’s ZERO/FULLSCALE Pushbuttons:

   The Transmitter’s ZERO/FULLSCALE pushbuttons, when used both individually and/or simultaneously, provide local operation of the field mounted Controller. Refer to section 3.2.1.2 for procedures.

3.2.1.1 General Digital Meter and Pushbutton Information

A. Digital Meter (LCD)

   The numerals displayed in the LCD represent the value of the PROCESS VARIABLE (PV) when the "PV" annunciator is lit. The "Units" associated with "PV" are chosen during Transmitter configuration of the OPERATOR DISPLAY BLOCK. There are three OUTPUT DISPLAY CODE configuration choices listed in Table 3.1 that describe what information is displayed and how it is annunciated.

<table>
<thead>
<tr>
<th>OUTPUT DISPLAY CODE</th>
<th>LIT ANNUN.</th>
<th>PV UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (PERCENT)</td>
<td>%</td>
<td>Percent of full span (0 to 100)</td>
</tr>
<tr>
<td>1 (PROCESS VARIABLE)</td>
<td>ENG</td>
<td>Engineering Units (e.g., GPM, SCFM)</td>
</tr>
<tr>
<td>2 (MEASURED VARIABLE)</td>
<td>None</td>
<td>Pressure Units (e.g., mm Hg, PSI, PA)</td>
</tr>
</tbody>
</table>

NOTE

The actual "Units" and Upper and Lower Range Levels (span) chosen during configuration are available from the hand-held MXC (archives) or user documentation.

The VALVE is always displayed as a percentage of controller output and the "V" and "%" annunciators will be lit. The SET POINT is displayed in the same units as the PROCESS VARIABLE. The "SP" and "ENG", or "%", (or none) annunciators will be lit.
B. PUSHBUTTONS

Changes to Controller parameters can only be made by activating the "Pushbutton Mode". The Pushbutton Mode is activated whenever either pushbutton is pressed and held, for a minimum of 5 seconds, and then released. The "PB" annunciator will remain lit when the Pushbutton Mode is active. The Pushbutton Mode will automatically time-out after 1 minute.

IMPORTANT

Failure to hold a pushbutton ON for a minimum of 5 seconds will prevent entry into the Pushbutton Mode.

Whenever a pushbutton is pressed, the "PB" annunciator will light and extinguish when released if the Pushbutton Mode is not active.

The Pushbutton ENABLE/DISABLE jumper (W1), located on the Electronic Module's Digital Board (Figure 6-3), is factory set to ENABLED. When in DISABLE, the pushbuttons perform no function.

The pushbuttons are disabled whenever the Transmitter is placed in "CONFIGURATION HOLD" as when downloading a new configuration with HART, and when the controller is turned OFF.

3.2.1.2 Local Pushbutton Operational Procedures

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 2-6), 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 by 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 from "A" to "M" or "M" to "A".

February 1993
B. Change SET POINT

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

   **NOTE**

   Cycling the ZERO pushbutton toggles the displayed information between PROCESS VARIABLE and SET POINT.

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 value between the Lower and Upper Range Levels.

   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 EEPROM. 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 EEPROM

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 must be in the MANUAL control mode to change the VALVE; if it is not, place the Controller in the MANUAL control mode.

NOTE

Cycling the FULLSCALE pushbutton toggles the displayed information between PROCESS VARIABLE and VALVE.

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

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

The displayed number is the active VALVE position in percent (0 to 100).

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 a new VALVE between -1.0% and 110%.

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 SET POINT changes in greater and greater increments until limiting occurs.

The new value is changed in RAM only and not yet stored permanently in EEPROM. 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 EEPROM

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.
3.3 SYSTEM CHECKOUT

This section provides guidelines to verify that the proper Transmitter is installed and operational prior to placing the Transmitter in service.

3.3.1 EQUIPMENT REQUIRED

1. User configuration data for configuring Transmitter under test.
2. Mycro XTC Communicator (MXC)
3. Digital Multimeter (DMM) with 0.05% accuracy or better; used to verify analog output signal
4. 6.25 ohm, 1%, 1/4 watt resistor; used to verify analog output signal

3.3.2 EQUIPMENT CONNECTION

1. Connect the MXC to a Network Junction or the Transmitter under test as shown in Figure 2-3, 2-4 or 2-5. There is no connection polarity as the MXC is a non-polar device.

2. DMM Connection (loop current verification)
   1) Set the DMM to read Volts DC. The DMM will measure the following level voltage:

   Volts DC = (4 to 20 mA loop current) x (current sense resistor)

   2) At the Network receiving element, connect the DMM across the current sense resistor, if it is accessible.

   If the current sense resistor is not accessible, connect a 6.25 ohm resistor in series with either signal lead of the receiver element. Connect the DMM across the resistor.

   The DMM will read a 4 mA signal as 25 mV and a 20 mA signal as 125 mV. This translates into 1 mV per 1% output.
3.3.3 VERIFICATION PROCEDURE

A. COMMUNICATION TEST

This test will verify that the MXC and Transmitter(s) can communicate properly.

Analog Mode:

1. From user configuration documentation, obtain Transmitter's ID and Tag. Transmitters operating in an analog mode are automatically assigned an address of "0" (zero).

2. Refer to the MXC reference guide cards and execute the FIND XMTR (Analog Type) program.

   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.

   If a problem exists in the Transmitter or Network wiring, the MXC will display a warning message "NO TRANSMITTER FOUND".

Digital Mode Polling:

1. On a Multi-Drop Network, polling all Transmitters will quickly verify Network communications.

2. Refer to the MXC reference guide cards and execute the FIND XMTR and POLL program.

   The MXC will contact all accessible Transmitters and collect their ID's. The MXC will display the ID, TAG, and ADD (address) of one of the Transmitters.

3. Press either the LAST XMTR or NEXT XMTR keys to scroll through the Transmitter ID's collected; check against user documentation to confirm that all Transmitters are configured correctly and all Multi-Drop Network connections are correct.

   If a problem exists in a Transmitter or its junction wiring, that Transmitter will be excluded from the POLL. If a major fault exists in the Network wiring, the MXC will display a warning message "NO TRANSMITTER FOUND".
B. OPERATIONAL DIAGNOSTIC TEST

When the MXC is turned on it automatically executes a self-test routine. If there is a problem with the MXC, it will display that it has failed the self test.

The following test will check the status of a Transmitter.

1. Refer to MXC reference guide cards and execute the FIND XMTR (analog or digital mode) program for the Transmitter to be checked.

2. When the MXC displays the Transmitter’s ID, press the dedicated STATUS key and check Transmitter status.
   1) Press ALARM (F1) and check the ALARM OUT OF SERVICE status.
   2) Press ERRORS (F2) and check for ROM, RAM, EPROM, TIMER, and SENSOR errors.
   3) Press EXIT key to return to main menu.

C. VERIFY CONFIGURATION DATA

1. From user documentation, obtain configuration data assigned to the Transmitter(s).

2. Refer to the MXC reference guide cards and execute the FIND XMTR program. When the transmitter is found, configuration data is uploaded into the working registers of the MXC. Consult user documentation to verify correctness of displayed data.

3. Change any incorrect settings at this time. Refer to MXC reference guide cards. Press END key to return to normal operation.

D. VERIFY ANALOG OUTPUT SIGNAL

This test verifies that the Transmitter is operating properly and is capable of transmitting a 0% or 100% analog output signal that can be received at its destination. This test is applicable only to Transmitters operating in the analog mode.

1. From the MXC, execute the FIND XMIT program and display transmitter ID.

2. Press LOOP OVRD (key F1) to enter the Loop Override program.

3. Select the 4 mA option (key F1) and read the DMM. The DMM shall read:
   
   250 Ohm Sense Resistor reading = 1.000 +/- 0.0005 Vdc
   6.25 Ohm Resistor reading = 25 +/- 0.0125 mVdc

3-12  

February 1993
4. Select the 20 mA option (key F2) and read the DMM. The DMM shall read:

250 Ohm Sense Resistor reading = 5.000 +/- 0.0025 Vdc
6.25 Ohm Resistor reading = 125 +/- 0.0625 mVdc

5. Press the END key to exit the test program.

This completes the system checkout. Disconnect test equipment, connect any disconnected wires, and restore any removed protective covers on transmitter or receiver element.
4.0 CALIBRATION

Described below are procedures to calibrate the analog output signal from a Transmitter configured for either analog or digital mode of operation. Also provided is a procedure to cancel mounting position induced zero shift.

A Transmitter is shipped factory calibrated. If the initial installation orients the Transmitter such that its diaphragms are not perpendicular with ground (Figure 2-8), the procedure in section 4.3 must be performed.

It is recommended that an annual calibration check be performed to ensure that analog accuracy is within specifications. Perform the steps in either section 4.2.1 for analog operation or 4.2.2 for digital operation. Calibrating an installed Transmitter, or positioning the Transmitter during a bench calibration to exactly match the installed orientation, eliminates the need to perform the procedure in section 4.3.

A Mycro XTC Communicator (MXC) is needed for calibration and provides two calibration programs. The two calibration programs are identified as:

- SELECT CALIBRATION DAC OUTPUT - Calibrates the Digital-To-Analog Converter which sets the transmitter's analog output signal.
- SELECT CALIBRATION MOUNTING POSITION - Calibrates out a shift in zero when the plane of the diaphragms are other than perpendicular to ground.

**NOTE**

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

4.1 EQUIPMENT REQUIRED

- Mycro XTC Communicator (MXC)
- Mycro XTC Communicator Users Manual
- Laboratory grade precision digital ammeter; for calibration of the 4 to 20 mA output signal
  - Display: 4-1/2 digits
  - Resolution: +/- 1.0 uA
  - Impedance: 15 Ohms or less
- 24 Vdc power supply; for bench calibration
- Resistor 250 Ohm +/- 10%, carbon, 1/4 watt; for bench calibration

4.2 TRANSMITTER ANALOG OUTPUT CALIBRATION PROCEDURE

Perform the steps in the appropriate section according to the Transmitter's normal operating mode: analog operation, section 4.2.1; digital operation, section 4.2.2.

Regardless of the normal operating mode, a Transmitter must be configured for the analog mode during calibration.

February 1993
4.2.1 TRANSMITTER NORMALLY CONFIGURED FOR ANALOG MODE

1. If the Transmitter is field mounted and conditions permit, the calibration check may be accomplished at the site; otherwise, the Transmitter is removed for bench testing.

2. Refer to Figure 2-5 or 2-6 and remove the enclosure cap for access to the terminal compartment.

3. If an Analog Meter is installed in the Transmitter, refer to section 2.4.5.1 to remove the meter. Mark Meter leads to indicate connections and disconnect from TEST terminals.

4. Refer to Figure 4-1 for bench or field connection of the MXC and digital ammeter to the Transmitter and connect the equipment.

**NOTE**
Connection of the MXC across the 250 ohm sense resistor improves calibration accuracy.

5. If the Transmitter is being bench checked, orient the Transmitter to match its installed position.

6. Refer to the MXC User’s Manual and select the CAL/TEST program.

7. Step through the program and select the SELECT CALIBRATION DAC OUTPUT program. Press SELECT (key F4).

   The MXC’s screen will display: PRESSING ENTER WILL SET TRANSmitter OUTPUT TO 4.00 mA

8. Press ENTER (key F4). Screen will display: ENTER OUTPUT CURRENT

9. Read the ammeter. It should indicate: 4.000 +/-0.0024 mA.

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

    If calibration is required, perform steps 11 and 12.

11. In response to the displayed prompt, key in the current indicated by the ammeter and press ENTER (key F4).

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

    If calibration is still required, repeat step 11 as many times as necessary until the output is within limits, then press QUIT and proceed to step 13.
FIGURE 4-1 Transmitter Calibration Set-Up
13. The MXC’s screen displays: PRESSING ENTER WILL SET TRANSMITTER OUTPUT TO 20.00 mA

14. Press ENTER (key F4)

15. Read the ammeter. It should indicate: 20.000 +/- 0.0024 mA.

16. If the output is within limits, press QUIT (key F3) and exit the calibration mode. Calibration is now completed. If calibration is required, perform steps 17 and 18.

17. In response to the displayed prompt, key in the current indicated by the ammeter and press ENTER (key F4).

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

If calibration is still required, repeat step 17 as many times as necessary until the output is within limits, then press QUIT (F3) to exit the calibration mode.

19. When calibration is completed, disconnect test equipment and reconnect Transmitter as necessary.

4.2.2 TRANSMITTER NORMALLY CONFIGURED FOR DIGITAL MODE

When a Transmitter is configured to operate in the digital mode, its 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 is recommended that the output be checked periodically for an abnormal output (high or fluctuating parking current) that may cause communications interference on the Multi-Drop Network.

If the Transmitter is field mounted and conditions permit, the calibration check may be accomplished at the site; otherwise, the Transmitter is removed for bench testing.

Perform the steps in the appropriate paragraph A or B.

A. Field Calibration Procedure

1. Refer to Figure 2-5 or 2-6 and remove the enclosure cap for access to the terminal compartment.

2. Refer to Figure 4-1 and connect the digital ammeter to the Transmitter

3. Read the ammeter. It should indicate: 4.000 +/- 0.0024 mA.
4. If the output is within stated limits, remove the digital ammeter and install the enclosure cap. The calibration check is completed.

   If the output is not within stated limits and calibration is desired, proceed to step 5.

5. Connect the MXC across the SIGNAL (+) and (-) terminals of the Transmitter as shown in the field connections drawing in Figure 4-1.

6. Refer to the MXC’s User’s Manual and configure the Transmitter to operate in the analog mode.

7. Refer to the MXC User’s Manual and select the CAL/TEST program.

8. Step through the program and select the SELECT CALIBRATION DAC OUTPUT program. Press SELECT (key F4).

   The MXC’s screen will display: PRESSING ENTER WILL SET TRANSMITTER OUTPUT TO 4.00 mA

9. Press ENTER (key F4). Screen will display: ENTER OUTPUT CURRENT

10. Read the ammeter. It should indicate: 4.000 +/- 0.0024 mA.

11. If output is within limits, press QUIT (key F3) and proceed to step 14.

   If calibration is required, perform steps 12 and 13.

12. In response to the displayed prompt, key in the current indicated by the ammeter and press ENTER (key F4).

13. Read the ammeter. If the output is within limits, press QUIT (key F3) and proceed to step 14.

   If calibration is still required, repeat step 12 as many times as necessary until the output is within limits, then press QUIT and proceed to step 14.

14. The MXC’s screen will display: PRESSING ENTER WILL SET TRANSMITTER OUTPUT TO 20.00 mA

15. Press ENTER (key F4)

16. Read the ammeter. It should indicate: 20.000 +/- 0.0024 mA.

17. If the output is within limits, press QUIT (key F3) and exit the calibration mode. Calibration is now completed.

   If calibration is required, perform steps 18 and 19.

18. In response to the displayed prompt, key in the current indicated by the ammeter and press ENTER (key F4).
19. Read the ammeter. If the output is within limits, press QUIT (key F3) to exit the calibration mode.

If calibration is still required, repeat step 19 as many times as necessary until the output is within limits, then press QUIT (F4) to exit the calibration mode.

20. When calibration is completed, configure the Transmitter to operate in the digital mode and disconnect test equipment.

B. Bench Calibration Procedure

1. Remove the Transmitter for bench calibration by performing REMOVAL steps 1 to 10 of section 6.4.4 and noting the following:

- Removing a Transmitter can interrupt power to transmitters located beyond the removed Transmitter toward the end of the Network. Note the effect this may 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 shorts. SIGNAL lead current is limited to 4 mA for a digital Transmitter. To restore power to all remaining Transmitters, connect together and insulate the two disconnected SIGNAL (+) leads and the two SIGNAL (-) leads.

2. Orient the Transmitter on the bench to match its installed field position.

3. Connect the digital ammeter and MXC to the Transmitter as shown in the bench connection drawing of Figure 4-1.

4. Perform steps 6 through 19 of paragraph A. Site Calibration Procedure.

5. When calibration is completed, configure the Transmitter to operate in the digital mode. Disconnect the test equipment and install the Transmitter at its site by performing in reverse REMOVAL steps 1 to 10 of section 6.4.4.

4.3 MOUNTING POSITION ZERO SHIFT CALIBRATION

There is no zero shift when a Transmitter is positioned such that the plane of its process diaphragms are perpendicular to ground. When the plane of the diaphragm is other than perpendicular to ground, a zero shift can occur. The maximum shift occurs when the plane of the diaphragm is parallel to ground (see Figure 2-8).

The zero shift value with the diaphragm parallel to ground is 1.5 inches H₂O, nominal.

A MycroXTC Communicator is needed for this procedure.

February 1993
It is recommended that this procedure be performed with the Transmitter installed in its final mounting position. The electrical installation of the Transmitter must be completed to provide operating power.

A bench calibration may be performed provided the Transmitter is exactly positioned as it is in the final field mounted position.

**Calibration Procedure**

**IMPORTANT**

NO pressures, other than atmospheric, may be applied to the Transmitter’s process HIGH and LOW input pressure ports.

For field mounted Transmitters with connected piping to the LOW pressure port, the manipulation of piping valves and/or drains may be required to ensure this requirement is met.

1. Connect the MXC to the Network at the most suitable location.
2. Refer to the MXC User’s Manual and select the CAL/TEST program.
3. Step through the program and select the SELECT CALIBRATION MOUNTING POSITION program. Press SELECT (key F4).

   MXC will display: CALIBRATING SENSOR WILL CHANGE PROCESS CALIBRATION

4. Press CONT (key F4). Screen will display: PUT TRANSMITTER IN DESIRED MOUNTING POSITION

5. Press CAL (key F4). Calibration is now completed.

This completes calibration of the Transmitter.
5.0 CIRCUIT DESCRIPTION

This section provides a basic circuit description of the Mycro XTC Model 340 Series Pressure Transmitter-Controllers. Figure 5-1 shows a functional block diagram of the transmitter consisting of two modules: the Sensor Module and Electronics Module.

The Model 340 Transmitter Family consists of four model types: Differential Pressure (340D), Gauge Pressure (340G), Absolute Pressure (340A), and Flange Mounted Liquid Level (340F). All the models use the same interchangeable Electronics Module.

All Model 340 Transmitters can communicate with a Mycro XTC Communicator (MXC) or a Primary Master Controller using the HART protocol.

5.1 SENSOR MODULE

The Sensor Module is part of the Capsule Assembly that includes the process diaphragms and process connection blocks. The Module consists of a nonvolatile EEPROM memory chip, a custom Application Specific Integrated Circuit (ASIC), and a capacitive pressure sensor element.

During the characterization process at the factory, all capsule assemblies are subjected to temperature and pressure cycles. Data recorded from those cycles are used to generate characterization factors that are stored in the Sensor Module’s EEPROM. The appropriate sensor range limits (Range 1, 2, 3, or 4) are also stored in the EEPROM. Because the characterization data is stored in EEPROM, no calibration is required if the Capsule Assembly is replaced.

The sensor element contains two silicon based capacitors: a sense capacitor \( C_s \) whose value changes in response to an applied process pressure, and a reference capacitor \( C_r \) whose value is independent of pressure. Layers of glass and silicon are combined to form the capacitive element. These layers are anodically bonded to form a seal that is stronger than the glass itself and provides a monolithic structure which is extremely stable and has no measurable hysteresis.

The custom ASIC, which is mounted on the header of the capacitive sensor element, contains oscillator, amplifier, and buffer circuitry. The capacitive sensor element is part of the ASIC’s oscillator and forms a multimode oscillator (MMO) that generates three frequencies based on the capacitive measurements of \( C_s, C_r, \) and \( C_s + C_r \). These frequencies are amplified and buffered by the ASIC and presented as CMOS compatible square wave outputs for processing by the Electronics Module.
5.2 ELECTRONICS MODULE

The Electronics Module, located in the transmitter's housing, consists of a Digital Board and an Analog Board. Digital and Analog Boards are stacked. A separate Base Board contains surge and noise filter circuitry.

The Digital Board contains the following:

- A standard Bell 202 Modem that employs the Frequency Shift Keying technique (FSK) for remote communications via the HART protocol.

- A Microcontroller that:
  - Controls communications
  - Corrects and linearizes the input pressure signal
  - Stores configuration data; configuration data is stored in a 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 selections through the use of the local Zero/Fullscale pushbuttons (Transmitter Mode only)
  - Performs Proportional-Integral-Derivative control functions (Transmitter-Controller only)

- A custom ASIC (Application Specific Integrated Circuit) that provides:
  - A clock to the Microcontroller
  - Multiplexing of display information to the LCD
  - Frequency-to-digital conversion of pressure signal from sensor module
  - Serial D/A conversion of the Sensor Module's signal to drive the V/I Converter on the Analog Board

The Analog Board contains the following:

- A 3.5 Vdc Power Supply with current limiting that provides operating power to the Sensor and Electronic Modules.

- 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.
5.3 THEORY OF OPERATION

The theory of operation presented in this section is for the Model 340 Transmitter version (Model 340_ _A).

5.3.1 PRESSURE TO FREQUENCY CONVERSION

The process variable applied to the capacitive pressure sensor changes the value of the sensor’s $C_s$ capacitor, thereby generating a sense frequency ($F_s$) by the Multimode Oscillator (MMO) that is directly proportional to the applied pressure. The MMO uses the reference capacitor ($C_r$) and the sum of both capacitors ($C_{s+r}$) to generate additional frequencies $F_r$ and $F_{s+r}$. One at a time, each of the three frequencies are gated to the MMO ASIC by digital commands from the Electronic Module.

5.3.2 FREQUENCY TO DIGITAL CONVERSION

The first of the three frequencies ($F_r$, $F_{s+r}$, and $F_s$) generated by the MMO is applied to the ASIC. Two counters in the ASIC count the time and number of cycles for each frequency. This data is stored and a Mode Toggle (MT) command is sent to the MMO to switch to the next frequency. When all three frequencies are stored, the Microcontroller shifts the data into its serial port.

The Microcontroller uses a specially developed algorithm that cancels the effects of parasitic capacitance and calculates the true ratio $C_r/C_s$. When the ratio is equal to one (1), the pressure is known to be zero. A ratio less than one corresponds to a positive pressure and a ratio greater than one to a negative pressure. The ratio is now linearized and temperature corrected to produce an accurate pressure signal that is sent back to the ASIC for digital display processing and D/A conversion.

5.3.3 D/A CONVERSION AND CURRENT SIGNAL TRANSMISSION

The pressure signal received by the ASIC is applied to a D/A Converter and Multiplexer. The Multiplexer sends serial clock and display information to the LCD Board where it is decoded and displayed on an optional LCD as pressure in engineering units.

The D/A Converter translates the digitized pressure signal into a Pulse Width Modulated signal whose pulse width is in direct proportion to the magnitude of the process pressure. The pulses are filtered and applied to an Operational Amplifier which drives a V/I Converter, whose output is a Darlington transistor pair acting as a pass transistor, that outputs a standard 4-20 mA current signal to the Network (output loop).
5.3.4 COMMUNICATION FORMAT

The Model 340 communicates, via the HART protocol, with the portable MXC and any Primary Master Controller connected to the Network.

HART communications uses phase-continuous frequency-shift-keying (FSK) at 1200 bits/sec and shift 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 signalling is high frequency AC, its DC average is zero and does not interfere with analog signalling.

A 2-Pole Active Filter connected to the loop input receives HART transmissions. The filter effectively rejects low frequency analog signalling, 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 phase continuous 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.
6.0 MAINTENANCE

Transmitter maintenance consists of preventive maintenance and troubleshooting. Preventive maintenance is designed to prevent conditions from occurring that are detrimental to the reliability of the Transmitter. When a malfunction does occur, troubleshooting procedures will assist the user in repairing the Transmitter, assuring minimum down-time.

This section also includes removal and replacement procedures, recommended spare and replacement parts, and an exploded view drawing with parts list.

6.1 TOOL AND EQUIPMENT REQUIREMENTS

The following tools and equipment are required for servicing:

A. Set of Phillips, flat-blade, and TORX screw drivers.

B. Set of open-end or box-end wrenches.

C. Torque wrench (30 ft-lbs), 11/16" socket; used for connection block nuts.

D. Maintenance Kit, P/N 15545-110, containing wrist strap and conductive mat. This kit, or its equivalent, is required when the Electronics Module or Digital Meter assembly is handled for any reason.

E. Digital Multimeter (DMM)
   Voltmeter section ........ Accuracy +/-0.01% of reading
   Resolution 1.0 mV
   Input impedance 10 Megohms

   Ammeter section ........ Accuracy +/-0.1% of reading
   Resolution +/-1 uA
   Shunt resistance 15 ohms or less

6.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of proper Electronics Module handling procedures, periodic inspection of the Transmitter, cleaning the external surface of the Transmitter’s enclosure and Capsule Assembly, draining condensate from conduit, and blowing-down or purging impulse piping to keep piping free of sediment. Preventive maintenance should be performed at regularly scheduled intervals.

6.2.1 ELECTRONIC ASSEMBLY HANDLING

The Electronics Module and Digital Meter assembly contain integrated circuits that can be damaged by improper handling. The high quality ICs used contain built-in protective circuitry; however, they can be damaged by a low energy,
high voltage electrostatic discharge. Refer to SD3900-4 MYCRO Circuit Card Handling and Cleaning Procedures for proper handling techniques.

All necessary procedures to prevent the build-up and discharge of electrostatic energy must be followed. For example, a grounded wrist strap must be worn when handling an electronic assembly (a Maintenance Kit is listed in section 6.1). An electronic assembly must be stored in a static shielding bag and immediately be placed in a static shielding bag upon removal from a Transmitter. A damaged bag should be discarded.

6.2.2 TRANSMITTER PREVENTIVE MAINTENANCE

The following procedures should be performed on each Transmitter.

6.2.2.1 Transmitter Exterior Inspection

The frequency of the 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 over spray.

   The enclosure is rated NEMA 4X which provides excellent protection of internal electronics from harsh environmental conditions.

2. Loosen nameplate securing screw and rotate nameplate to expose ZERO/FULL-SCALE pushbuttons. Inspect the surface of each pushbutton’s protective membrane seal for cracks or punctures. A damaged seal must be replaced; see section 6.4.6.

3. Check that each enclosure cap is fully screwed onto the enclosure, compressing an O-ring between the cap and the enclosure. The O-ring must not be cracked, broken, or otherwise damaged.

4. If an optional analog or 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 6.4.6.

5. 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.

6. If a conduit drain is installed, inspect the drain seals for obstructions.

7. On Transmitters subjected to constant vibration, inspect all Transmitter-to-bracket and bracket-to-pipe mounting bolts for tightness. Tighten loose bolts as necessary.

February 1993
8. Inspect Capsule Assembly's process connection blocks for evidence of leakage, both at the impulse pipe connections and at the block interface to the Capsule. If necessary, add sealant to pipe threads, tighten block bolts, and replace block teflon seals.

6.2.2.2 Transmitter Exterior Cleaning

After an exterior inspection of the Transmitter, the enclosure and capsule assembly can be cleaned with the Transmitter operating.

1. Clean the enclosure (except enclosure cap glass) and capsule assembly 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, it is necessary to keep the enclosure and capsule assembly 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 temperatures of the Transmitter as listed in section 1.5.4.

2. If applicable, clean enclosure cap glass with a mild nonabrasive liquid cleaner and a soft, lint-free cloth.

6.2.2.3 Transmitter Enclosure Interior Inspection

1. 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 2-11.

Inspect all wires for tight connections.

IMPORTANT

Enclosure threads on early models were coated with a wet paste type anti-seize compound. Be certain that enclosure threads having this type compound are coated with adequate 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.

Later models use a dry type anti-seize compound with a superior retention (to threads) quality.

2. It is not recommended that the enclosure's electronics module compartment be opened for inspection.

February 1993
6.2.2.4 Transmitter Calibration

An annual calibration check should be performed to ensure that analog accuracy is within specifications. Refer to section 4.0 CALIBRATION for details.

6.2.3 IMPULSE PIPING PREVENTIVE MAINTENANCE

To ensure accuracy and continued satisfactory performance, impulse piping must be kept clean and inspected for damage.

Sediment or other foreign particles must not be allowed to clog or collect in piping or the pressure chamber of the capsule assembly’s process connection blocks as a build up of residue can cause faulty measurement.

1. Inspect high and low pressure impulse piping to the Transmitter for loose, bent, or cracked piping. Damaged piping must be replaced.

2. At regular intervals, blow down the piping without passing line fluids containing suspended solids through the capsule assembly’s process connection blocks.

   The time interval between blow downs is determined by the user's previous experience with such systems or determined by evaluating system performance only after the Transmitter has been in operation for a period of time.

6.3 TROUBLESHOOTING

This section provides guidance and procedures to assist in identifying and correcting a malfunctioning Model 340 Pressure Transmitter-Controller.

It is recommended that all documentation associated with the Transmitter including piping and loop wiring diagrams, AD340-510, and the Mycro XTC Communicator User’s Manual, be obtained and made available to maintenance personnel to facilitate troubleshooting.

NOTE

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

6.3.1 PRELIMINARY TROUBLESHOOTING INFORMATION

Symptoms and messages resulting from a Transmitter malfunction can expedite the troubleshooting process. Messages are displayed by a Transmitter’s Digital Meter and a Mycro XTC Communicator’s (MXC) screen. An Analog Meter can not display a message but will indicate the configured FAILSAFE LEVEL.

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. Digital Meter

The Transmitter-Controller routinely performs self-diagnostic tests and will display the message "FAIL" if a fault is detected.

The Model 340D_A Transmitter will flash the display if the process pressure is greater than 3% above upper range or 3% below lower range values.

B. Mycro XTC Communicator

The Mycro XTC Communicator (MXC) can interrogate the Transmitter using the STATUS key and display a FAILSAFE message resulting from a Transmitter failing a self-diagnostic test. It will then identify the source of error through error messages as described in Table 6.1 and section 6.3.2.1, paragraph A.

Transmitter self-diagnostics can be executed by selecting TEST from the CALIBRATE/TEST program of the MXC. If the test is failed, a failure message is displayed. Refer to section 6.3.2.1, paragraph A for details.

The STATUS and Diagnostic Displays at the MXC require fault free HART communications between the MXC and the Transmitter. In the event of communication problems the MXC can display the three communication error messages. Refer to section 6.3.2.1, paragraph B for details.

C. Analog Meter

An optional Analog Meter indicates the 4-20 mA output of the Transmitter which represents 0-100% of the Transmitter range. When the OUTPUT BLOCK of the Transmitter is configured, a FAILSAFE LEVEL of HI, LO, or LAST VALUE is chosen. Should the Transmitter fail its self-diagnostics test, the analog current will be locked to the chosen FAILSAFE LEVEL where HI=100%, LO=0%, and LAST VALUE can be anything between 0 and 100%. The Analog Meter will indicate the failsafe level.

D. Console Station, Work Station or Controller

Troubleshooting information may be displayed on a video monitor associated with a console station or a 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, may provide information about the status of the loop and the Transmitter. Again, refer to the literature supplied with the station.
6.3.2 TROUBLESHOOTING PROCEDURES

The following procedures are provided to assist maintenance personnel in identifying and isolating a Transmitter problem and its source.

Procedures using diagnostic messages and symptoms related to Transmitter malfunctions will help in diagnosing the 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 Capsule Assembly and Electronics Module but not the optional Analog and Digital Meters.

NOTE

Faults such as a failed Digital Meter (LCD), damaged diaphragm or drifting 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.

<table>
<thead>
<tr>
<th>FAIL</th>
<th>TRANSMITTER FAILED TRANSMITTER SELFTEST</th>
<th>FAILSAFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter LCD</td>
<td>MXC TEST Screen</td>
<td>AUTO/MAN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AL- ER-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARM RORS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN ALARM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT</td>
</tr>
</tbody>
</table>

MXC STATUS Screen*

* The STATUS screen shown is for the Transmitter-Controller version. AUTO/MAN, ALARM, and IN ALARM legends are not present in the screen for the Transmitter only version.

1. If not already in communication with the suspect Transmitter, establish communications by executing the "FIND XMTR" program on the MXC.

2. Press the "STATUS" key of the MXC. If the message "FAILSAFE" appears in the upper right corner of the display, the Transmitter has failed a self-diagnostic test.
3. Press function key F2 to display "ERRORS". Note which of the error messages in Table 6.1 is displayed (multiple errors can be displayed).

4. Confirm that the fault still exists.

Select the CALIBRATE/TEST program from the menu of the MXC and execute the "TEST" program (key F3). This instructs the Transmitter to perform a self-diagnostic test.

If the fault still exists, the following message will be displayed:

"TRANSMITTER FAILED TRANSMITTER SELFTEST"

If the fault was temporary - caused by excessive electrical noise or a power line spike - the following message will be displayed:

"TRANSMITTER PASSED TRANSMITTER SELFTEST"

If the Transmitter passes the selftest, it will automatically exit the failsafe mode and resume operation. The word "FAIL" will extinguish in the Transmitter LCD.

If the Transmitter fails the selftest, repeat the "TEST" program again to ensure the validity of the fault.

Press "END" (key F4) to exit the CALIBRATE/TEST program.

5. On the MXC, press the STATUS key then select "ERRORS" (key 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 below.

<table>
<thead>
<tr>
<th>E2 ROM</th>
<th>E3 RAM</th>
<th>E4 EPROM</th>
<th>E5 TIMER</th>
<th>E6 SENSOR</th>
<th>STATUS PROGRAM</th>
<th>MXC ERROR SCREEN</th>
<th>EXIT</th>
</tr>
</thead>
</table>

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 on the following pages for each error message.

- ! WARNING !
  NO TRANSMITTER FOUND
  #1 MXC "FIND XMTR" Screen

- ! WARNING !
  COMMUNICATION ERROR
  #2 MXC Screen

- ! WARNING !
  FIELD DEVICE MALFUNCTION
  #3 MXC Screen

February 1993
TABLE 6.1 Self-Diagnostics Troubleshooting

<table>
<thead>
<tr>
<th>MXC MESSAGE</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2 ROM</td>
<td>ROM CHECKSUM match failed.</td>
<td>Replace Electronics Module.</td>
</tr>
<tr>
<td>E3 RAM</td>
<td>Microprocessor failed, RAM inoperative.</td>
<td>Replace Electronics Module.</td>
</tr>
<tr>
<td>E5 TIMER</td>
<td>A major cycle interrupted itself.</td>
<td>Replace Electronics Module.</td>
</tr>
<tr>
<td>E6 SENSOR</td>
<td>1. Capsule’s CHECKSUM match failed.</td>
<td>Check that Sensor cable is mated to Electronics Module.</td>
</tr>
</tbody>
</table>

1. MESSAGE #1: 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.

1) Possible Cause: Wrong Transmitter Address (Digital Transmitter only) or Search Tag.

Corrective Action: Consult configuration documentation to obtain correct address or Tag.

2) Possible Cause: Noise on Loop Wires

Corrective Action:
- Press RETRY key (F3) at least 3 times, waiting at least 1 minute between retries. If not successful, continue troubleshooting.
- Check for multiple loop cable shield grounds.

3) Possible Cause: Loop Wiring Failure

Corrective Action:
- Check for 10 Vdc minimum across SIG +/SIG - terminals in Transmitter terminal compartment.
- Check polarity of loop wiring at both power supply and Transmitter.

- Check that loop impedance is between a minimum 250 and a maximum 1100 ohms.

- 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 SIG + loop wire.

- Check for accumulation of moisture in Transmitter terminal compartment.

4) Possible Cause: Loop Power Supply Failure

Corrective Action:

- Check power supply output voltage for specified level: minimum 15 Vdc at 250 ohms Network Resistance, maximum 47.4 Vdc at 1100 ohms.

- Check power supply for blown fuse or tripped circuit breaker.

5) Possible Cause: Transmitter Electronics Module Failure

Corrective Action:

- Replace Module. Refer to section 6.4.3

2. MESSAGE #2: COMMUNICATION ERROR

This message results when, after having successfully established communications with a Transmitter, an error flag is detected in a subsequent received message and it is not accepted. Error types are: Vertical Parity Error, Overrun Error, Framing Error, Longitudinal Parity Error, and Buffer Overflow.

1) Possible Cause: Noise on Loop Wires

Corrective Action:

- Press RETRY key (F3) at least 3 times, waiting at least 1 minute between retries. If not successful, continue troubleshooting.
2) Possible Cause: Loop Wiring Failure

Corrective Action:

- Check for 10 Vdc minimum across SIG +/SIG - terminals in Transmitter terminal compartment.
- Check polarity of loop wiring.
- Check that loop impedance is a minimum 250 ohms required 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 SIG + loop wire.
- Check for accumulation of moisture in Transmitter terminal compartment.

3) Possible Cause: Loop Power Supply Failure

Corrective Action:

- Check power supply output voltage for specified level: minimum 15 Vdc, maximum 42 Vdc.
- Check power supply for blown fuse or tripped circuit breaker.

4) Possible Cause: Transmitter Electronics Module Failure

Corrective Action:

- Replace Module. Refer to section 6.4.3

3. MESSAGE #3: FIELD DEVICE MALFUNCTION

This display message results when, after having successfully established communications with a Transmitter, a Transmitter self-diagnostics failsafe flag is detected in a subsequent received message. The Transmitter LCD will display FAIL. The MXC STATUS program must be used to identify the error source.

Possible Cause: Transmitter Failed Self-Diagnostic Test
Corrective Action:
- Press the "STATUS" key of the MXC. Confirm that the message "FAILSAFE" appears in the upper right corner of the display.
- With Transmitter in FAILSAFE mode, under paragraph A of this section perform steps 3 to 5.

6.3.2.2 Possible Transmitter Output Problems

This section provides information on diagnosing three types of analog output malfunction symptoms. Under each symptom, potential trouble sources are identified and corrective action suggested.

1. SYMPTOM: ZERO OR LOW OUTPUT

1) Possible Cause: Transmitter accidentally configured for Digital Mode. Output current reads a constant 4.000 mA.
   Corrective Action: Configure Transmitter for Analog Mode.

2) Possible Cause: Transmitter Electronics Module Failure
   Corrective Action:
   - Determine if Transmitter communicates with MXC by executing FIND XMTR program on MXC. 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, select the LOOP OVRD (loop override) program. Verify the loop by setting the output current to 4, 10 and 20 mA. If an Analog Meter is not installed, verify current by connecting an Ammeter to the Transmitter 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 6.4.3. If Transmitter passes loop override test, Electronics Module is OK. Continue troubleshooting.

3) Possible Cause: Loop Wiring/Power Supply
   Corrective Action:
   - Check for 10 Vdc minimum across SIG +/- terminals in transmitter terminal compartment.
- Check power supply output voltage for specified level. Minimum 15 Vdc. Maximum 42 Vdc.

- Check power supply for blown fuse or tripped circuit breaker.

- Check polarity of loop wiring.

- Check that loop impedance is a minimum 250 or maximum 1100 ohms.

- 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 SIG + loop wire.

- Check for accumulation of moisture in transmitter terminal compartment.

4) Possible Cause: Primary Element

Corrective Action:

- Check that primary element is correctly installed.

- Check element for damage and leaks.

- Note any changes in process fluid properties that may affect output.

5) Possible Cause: Impulse Piping

Corrective Action:

- Check that high and low pressure pipe connections are not reversed.

- Check for leaks or blockage.

- Check for entrapped gas in liquid lines.

- Check for sediment in Transmitter’s process connection blocks.

- Check that blocking valves are fully open and that bypass valves are tightly closed.

- Check that density of fluid in piping is unchanged.

6) Possible Cause: Transmitter Capsule Assembly Failure (output current reads a constant 3.84 mA and Transmitter LCD is flashing)

Corrective Action: Refer to section 6.3.3.
2. SYMPTOM: HIGH OUTPUT

1) Possible Cause: Transmitter Electronics Module Failure

   Corrective Action:
   - 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 menu to the Transmitter's main menu and select the LOOP OV RD (loop override) program. Verify the loop by setting the output current to 4, 10 and 20 mA. If an Analog Meter is not installed, verify current by connecting an Ammeter to the Transmitter 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 6.4.3. If Transmitter passes loop override test, continue troubleshooting.

2) Possible Cause: Primary Element

   Corrective Action: Check for restrictions at primary element.

3) Possible Cause: Impulse Piping

   Corrective Action:
   - Check for leaks or blockage.
   - Check for entrapped gas in liquid lines and liquid in dry lines.
   - Check for sediment in Transmitter's process connection blocks.
   - Check that blocking valves are fully open.
   - Check that density of fluid in piping is unchanged.

4) Possible Cause: Transmitter Capsule Assembly

   Corrective Action: Refer to section 6.3.3.
3. SYMPTOM: ERRATIC OUTPUT

1) Possible Cause: Loop Wiring

Corrective Action:

- Check for 10 Vdc minimum across SIG +/SIG - terminals in Transmitter terminal compartment.

- Check power supply output voltage for specified level. Minimum 15 Vdc. Maximum 42 Vdc.

- Check for loose loop wiring at power supply terminals, Supply Barriers (if used), junction boxes, and transmitter terminal compartment.

- Check for loose leads on Current Sense Resistor.

- Check for accumulation of moisture in transmitter terminal compartment.

- Check for multiple grounds on loop cable shield.

2) Possible Cause: Variable Process Fluid Flow

Corrective Action:

- Install mechanical dampers in process pressure piping.

- Select a higher damping value (software filter time constant).

3) Possible Cause: Impulse Piping

Corrective Action: Check for entrapped gas in liquid lines and for liquid in dry lines.

4) Possible Cause: Defective Electronics Module

Corrective Action:

- 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, select the LOOP OVRD (loop override) program. Verify the loop by setting the output current to 4, 10 and 20 mA. If an Analog Meter is not installed, verify current by connecting an Ammeter to the Transmitter TEST +/- terminals. Carefully observe that the selected currents remain steady.

If current cannot be set or is unstable, replace the Electronics Module. See section 6.4.3.

February 1993
5) Possible Cause: Transmitter Capsule Assembly

Corrective Action: Refer to section 6.3.3.

6.3.2.3 Transmitter Digital Meter (LCD) Troubleshooting

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 installed 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 2-10, 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 6.4.2.

If the spare LCD exhibits the original problem, replace the Electronics Module. Refer to section 6.4.3.

6.3.3 DIAGNOSING A DEFECTIVE CAPSULE ASSEMBLY

The Capsule Assembly cannot be independently field tested as special pressure generating/measuring equipment, instrumentation, and software are required to confirm operational integrity.

The following procedures, consisting of a combination of Transmitter self-diagnostics, a known particular symptom, and Electronics Module substitution, can be used to prove that a Capsule Assembly is defective:

1. Check for obvious physical damage to the Capsule Assembly or evidence of a loss of fill fluid.
2. Check Transmitter STATUS and perform a Transmitter TEST; refer to section 6.3.2.1, paragraph A. The Transmitter TEST will check for a failed Capsule Assembly EPROM, displayed as message E6 SENSOR on the STATUS screen.

Transmitter self-diagnostics will not report a failure of the Capsule's Sensor or Multi-Mode Oscillator (MMO). To identify this type failure, proceed to step 3.

3. Check for failed MMO/Sensor by pressing the MXC's TRANS. VAR'S. key to display the MV (measured variable), I (analog current), and PV (process variable) parameters. Interest is centered only on the MV and I parameters. If the MMO or Sensor has failed, the value of the MV and I are as follows:

\[
\text{MV} = -156.7\% \text{ of the Capsule Assembly's Upper Range Limit (listed in section 1.5.3 I/O SPECIFICATIONS).}
\]

\[
I = \begin{cases} 
3.84 \text{ mA (if URV is } > \text{ LRV)} \text{ or } 21.6 \text{ mA (if URV is } < \text{ LRV)} 
\end{cases}
\]

An example illustrating a few possible MV values for a Range #2 Capsule Assembly follows:

- Range #2 - Upper Range Limit: +450 in. H₂O (from section 1.5.3)
- 450 in. H₂O is equivalent to: 16.25 PSI, 33.7 in. Hg, 842.4 mm Hg

For a Transmitter SENSOR RANGE BLOCK configured for any one of the following MV UNITS, the corresponding -156.7% value of the MV is listed:

<table>
<thead>
<tr>
<th>MV UNITS</th>
<th>VALUE = 450 in. H₂O</th>
<th>MV @ -156.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSI</td>
<td>16.25 PSI</td>
<td>-25.4 PSI</td>
</tr>
<tr>
<td>in. Hg</td>
<td>33.7 in. Hg</td>
<td>-52.8 in. Hg</td>
</tr>
<tr>
<td>mm Hg</td>
<td>842.4 mm Hg</td>
<td>-1320.0 mm Hg</td>
</tr>
<tr>
<td>in. H₂O</td>
<td>450 in. H₂O</td>
<td>-705 in. H₂O</td>
</tr>
</tbody>
</table>

If an optional Digital Meter is installed in the Transmitter, a failed MMO or Sensor will cause the Meter to flash. The Controller version of the Transmitter will not flash the display.

4. If compliance with steps 1, 2, and 3 does not reveal the Capsule defect, the Capsule may be proved defective by replacing the Electronics Module with an on-hand spare Module (see section 6.4.3). If the original problem still exists, then the Capsule is defective.

The Capsule Assembly is not field repairable and must be replaced if found to be defective. Refer to section 6.4.4.
6.4 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 (refer to section 6.1 for a list of tools).

6.4.1 ANALOG METER REMOVAL AND REPLACEMENT

REMOVAL

1. If the Transmitter is configured as a Controller, use the proper procedures and shut down the process. Turn off power to Transmitter.

2. Unscrew the enclosure cap protecting the terminal strip compartment.

There are two off-center conduit entrance holes in the side of the enclosure. The terminal strip compartment is located at the off-center side.

3. As shown in Figure 6-1, loosen (do not remove) the Meter’s two mounting plate retaining screws.

4. Rotate the mounting plate counterclockwise to position screws in large circular slots and gently lift the Meter clear of the screws.

5. Disconnect the Meter’s leads from the TEST (+) and (-) terminals.

REPLACEMENT

1. Connect the replacement Meter’s red lead to TEST (+) terminal and black lead to TEST (-) terminal.

2. Carefully rotate the replacement Meter to the original Meter’s position and fit the mounting plate over the retaining screws. Rotate mounting plate clockwise and tighten screws.

3. Replace enclosure end cap and restore power to Transmitter.
4-40 MOUNTING PLATE SCREWS, (2 PLACES).
ROTATE PLATE CCW TO POSITION BOTH SCREWS IN LARGE CIRCULAR SLOTS

TERMINAL STRIP

WIRE (RED)
WIRE (BLACK)

SIGNAL TEST

SHOWN WITH ENCLOSURE CAP REMOVED

FIGURE 6-1 Analog Meter Removal and Replacement
6.4.2 DIGITAL METER REMOVAL AND REPLACEMENT

REMOVAL

1. The Transmitter must be removed from service when replacing a digital meter.

   If the Transmitter (Controller version) is controlling a process, use the proper procedures and shut down the process. Turn off power to Transmitter and remove enclosure cap to access Digital Meter.

   There are two off-center conduit entrance holes in the side of the enclosure. The digital meter compartment is located opposite the off-center side.

2. Retrieve wrist strap from Maintenance Kit and snap wrist strap on wrist and connect ground clip to Transmitter or mounting bracket. Refer to section 6.2.1 for handling procedures to prevent damage to the digital meter assembly from electrostatic discharge.

3. As shown in Figure 6-2, disconnect cable from connector J1, J2, J3, or J4 and slide cable from cable slot.

4. Loosen (do not remove) both Meter Board retaining screws.

5. Gently rotate Meter Board counterclockwise to position the one retaining screw in its large circular hole and carefully lift Board clear of screw, then slide Board clear of remaining retaining screw.

REPLACEMENT

1. Retrieve replacement Digital Meter Assembly from static shield bag. Rotate replacement Meter Board to original Meter's position and place under retaining screws, rotate Board clockwise, and tighten screws.

2. Position cable in cable slot and connect cable to nearest connector (J1, J2, J3 or J4). Connectors J1 to J4 are wired in parallel.

   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.

3. Disconnect wrist strap's ground clip.

4. Replace enclosure cap and restore power to Transmitter.
FIGURE 6-2 Digital Meter Removal and Replacement
5. Confirm operation of Digital Meter.

At power-up, an automatic display test will be performed which turns on all possible segments of the LCD for approximately 4 seconds. At the conclusion of the test, if active process pressures are being applied to the Transmitter, a numerical value will be displayed with either an "ENG" or "%" annunciator. If the Transmitter is configured as a Controller, additional annunciators may be displayed.

A Mycro XTC Communicator is required to check or change Transmitter configuration.

6.4.3 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 the Transmitter (Controller version) is controlling the process, use the proper procedures and shut down the process. Turn off power to Transmitter and remove enclosure cap to access electronics module.

   There are two off-center conduit entrance holes in the side of the enclosure. The electronics module compartment is located opposite the off-center side.

2. Retrieve wrist strap from maintenance kit and snap on wrist and connect ground clip to Transmitter or mounting bracket. Refer to section 6.2.1 for handling procedures to prevent damage to the Electronics Module from electrostatic discharge.

3. If a digital meter is installed, remove the meter assembly as described in section 6.4.2. Disconnect digital meter board cable from connector P2 (Figure 6-3) of Module’s digital board. Retain removed cable.

   Place meter assembly in static protective bag.

4. Refer to Figure 6-3 and disconnect sensor cable from connector P1 of Module’s digital board.

5. As shown in Figure 6-3, unscrew retaining screw to free Module’s mounting bracket. The screw and spacer remain attached to the bracket. Slide Module forward until free of card guide rails. Place removed Module in static protective bag.
FIGURE 6.3 Electronics Module Removal and Replacement
REPLACEMENT

1. Retrieve replacement Module from static protective bag. Refer to Figure 6-3 and check that Push Button Enable/Disable jumper W1 is in the Enable position.

2. If applicable, retrieve removed digital meter board cable and connect it to P2 connector of Module’s digital board.

3. Carefully slide the Module in the card guide rails making sure that the P1 power connector (at rear of top analog board) engages its mating connector on the Baseboard.

4. Tighten the Module’s mounting screw and spacer securely to the stand-off.

5. Reconnect sensor cable to digital board’s P1 connector.

6. If applicable, refer to section 6.4.2 and install removed digital meter.

7. Restore power to the Transmitter and perform the following:
   - Transmitter Configuration: A Mycro XTC Communicator is required for configuration.
   - Mounting Position Zero Shift Calibration: Refer to section 4.3. A Mycro XTC Communicator is required to perform calibration.
   - System Checkout: Refer to section 3.3. A Mycro XTC Communicator is required to perform the checkout.

6.4.4 CAPSULE ASSEMBLY REMOVAL AND REPLACEMENT

The Capsule Assembly is a welded assembly and is not repairable. It must be replaced if found defective. The Transmitter must be removed to a work bench to accomplish removal/replacement.

REMOVAL

1. If a Transmitter-Controller is controlling the process, use the proper procedures and shut down the process. Turn off power to Transmitter.

2. Close all appropriate impulse piping valves to isolate the process from the Capsule Assembly.

3. Disconnect the impulse piping from the Capsule Assembly’s high and low pressure process connection blocks (Figure 2-6) and separate the pipes from the blocks. Drain process fluid from process connection blocks of Capsule Assembly.
4. Unscrew the enclosure cap protecting the terminal strip compartment.

There are two off-center conduit entrance holes in the side of the enclosure. The terminal strip compartment is located at the off-center side.

5. If an analog meter is installed, partially remove the Meter to access the terminal strip.

As shown in Figure 6-1, loosen (do not remove) the Meter’s two mounting plate retaining screws.

Rotate the mounting plate counter clockwise to position screws in large circular slots and gently lift the Meter clear of the screws. Position Meter to provide access to terminal strip.

6. Tag and disconnect from the terminal strip SIGNAL (+) and SIGNAL (-) wires.

7. Disconnect conduit from Transmitter’s enclosure and pull SIGNAL wires free of enclosure.

To protect against damage, reinstall analog meter and enclosure cap.

8. Disconnect Transmitter from its bracket and remove to work bench.

9. Clamp the end cap part of the Capsule Assembly (see Figure 2-6) in a bench vise with the Transmitter in an upright position. Use wood blocks to protect the end caps from being damaged by the vise.

10. Unscrew and set aside remaining enclosure cap to access electronics module.

If an optional digital meter is installed, refer to section 6.4.2 and remove the Meter. Store Meter in static protective bag.

11. Disconnect Capsule Assembly’s sensor cable from the PI connector of the Module (Figure 6-3). The Electronics Module may be removed for easier reassembly; refer to section 6.4.3.

12. From inside the enclosure compartment, remove Allen Head 10-32 screw and lockwasher from Capsule Assembly’s tube. This is the enclosure positioning limit screw. Retain screw and lockwasher.

13. Remove enclosure set screw from stem of enclosure and gently pull enclosure from tube of Capsule Assembly. An O-ring on the Capsule Assembly’s tube will offer some resistance to pulling; therefore, gently rotate the enclosure left and right while pulling. Set aside the enclosure and set screw.

February 1993
14. Reposition the Capsule Assembly in the vise so that the Capsule is in a horizontal plane with the end cap bolt heads facing up. The vise jaws should clamp on the non-machined surface of the bottom end cap.

An embossed "arrow" on the Capsule's body (see Figure 2-6), identifying the high pressure side, will be pointing toward the bottom end cap. For assembly reference purposes, the bottom end cap is at the threaded end of the end cap bolts. During reassembly, the "arrow" on the replacement Capsule Assembly must also point to the bottom end cap.

1) Remove and set aside all four end cap bolts and nuts.

2) Carefully, lifting straight up, remove the top end cap from the Capsule. If the Teflon O-ring seal is adhering to the inside grooves of the top end cap, remove and discard the seal. New seals will be used.

3) Holding the Capsule Assembly by its tube, lift it straight up and away from the bottom end cap. Discard non-repairable Capsule Assembly.

4) If the Teflon "O" ring seal is adhering to the inside grooves of the bottom end cap, remove and discard the seal.

REPLACEMENT

1. Prepare end caps for assembly to Capsule by ensuring that all process residue (if any) is cleaned from the interior surfaces of the end caps. Clean all sealant from threads of process connection blocks.

Add anti-seize compound to the threads of the end cap mounting bolts.

2. Lubricate, one side only, new Teflon O-ring seals (P/N 15965-54) with Dow Corning No.4 compound and place the lubricated side of each seal against the inside grooved surface of the end caps. Lightly press around the perimeter of the seal to force the compound into the grooves.

The purpose of the compound is to reduce the movement of the seal during assembly. If the seal "cocks" during assembly, the end cap will leak. Test the seal adhesion to the top end cap by turning it upside down (which is done during assembly) and noting if the seal falls off. If necessary, add additional compound to make seal stick to end cap.

3. Retrieve and unpack replacement Capsule Assembly.

CAUTION

Carefully handle the Capsule Assembly. Do not scratch or puncture the isolating diaphragms.
4. Refer to the Parts List exploded view drawing and carefully assemble the Capsule Assembly as follows:

1) Carefully, grasping the Capsule’s tube, place the Capsule on the bottom end cap with the embossed "arrow" pointing toward the Cap. MAKE CERTAIN NOTHING TOUCHES THE SURFACE OF THE DIAPHRAGM.

2) Align the Capsule’s tube exactly between the four end cap bolt holes.

3) Making sure that the O-ring seal is in position, carefully position the top end cap on the Capsule.

4) Insert bolts, heads up, through end cap holes. Thread nuts on bolts. Initially, only finger tighten all four bolts.

5) Tighten upper left bolt until the end caps seat.

6) With a Torque Wrench, torque the bolts to 38 ft. lbs. using the following torquing sequence:

   lower right - upper right - lower left - upper left

7) Inspect the end cap-to-capsule seating for a cocked end cap.

5. Reposition the Capsule Assembly in the bench vise with the Capsule’s tube pointing up. Use wood blocks to protect the end caps from being damaged by the vise.

   Fold the Capsule’s sensor cable and tuck it a short depth into the tube. This protects the cable from damage when the enclosure is mated to the Capsule Assembly.

6. Grasp the enclosure with both hands and carefully fit its stem over the end of the Capsule’s tube. Note the metal rings on the tube above where the tube enters the Capsule Housing. These stop rings limit the penetration depth of the tube into the enclosure.

   Simultaneously push down on the enclosure while rotating it left and right to overcome the resistance of the tube’s 0-ring. Slowly slide the enclosure down the tube until it just touches the stop rings.

7. Observe the top of the Capsule’s tube inside the enclosure beneath the electronics module. Slowly rotate the enclosure until a hole near the top of the tube appears in full view and is facing directly outward.

8. Retrieve and install in the tube’s screw hole the previously removed 10-32 Allen Head screw and lockwasher.

9. Unfold sensor cable from the Capsule’s tube and lay it out of the way.
10. Install Electronics Module and connect sensor cable to connector P1 on the Module (see Figure 6-1).

11. Install in the enclosure's stem the previously removed set screw.

12. If applicable, install previously removed digital meter (section 6.4.2)

13. Install enclosure cap over electronics module compartment.

14. If desired, refer to section 4.3 and perform a Mounting Position Zero Shift Calibration before the field installation of the Transmitter.

15. Reinstall Transmitter at field site by performing, in reverse, REMOVAL steps 1 to 8. If not already done, perform a Zero Shift Calibration (see section 4.3). Refer to section 2 for installation connections.

16. Turn on system power and open valves to restore Transmitter to service. Check all connections for leakage.

**CAUTION**

Do not exceed the Maximum Overrange ratings when placing Transmitter into service. Properly operate all shut-off and equalizing valves. Ratings are listed in section 1.5.3.

### 6.4.5 BASEBOARD REMOVAL AND REPLACEMENT

The Baseboard contains input power passive filter components, an electronics module power connector, and terminal strip-to-baseboard power receptacles.

The Baseboard is mounted (4 screws) to the wall separating the terminal and electronics module compartments. The Baseboard contains four in-line receptacles which mate with bayonet conductors that are part of (the backside) the power input terminal strip. The receptacle/bayonet mating friction creates a resistance to removal. A tool such as a hooked scribe is required to pry the Baseboard loose.

**REMOVAL**

1. The Baseboard can usually be replaced at the installation site; otherwise, remove the Transmitter for bench servicing.

   If the Transmitter (Controller version) is controlling the process, use the proper procedures to shut down the process.

   Turn off power to Transmitter and remove enclosure cap to access Baseboard.
There are two off-center conduit entrance holes in the side of the enclosure. The Baseboard is located in the compartment opposite the off-center side.

2. Retrieve wrist strap from maintenance kit and snap on wrist and connect ground clip to Transmitter or mounting bracket.

3. If an optional digital meter is installed, remove the Meter as described in section 6.4.2.

   Place Meter in static protective bag.

4. Refer to Figure 6-3 and disconnect sensor cable from connector P1 of electronic module’s digital board.

5. Loosen retaining screw on Module’s mounting bracket. Slide Module forward until free of card guide rails. Mounting screw and spacer remain attached to bracket. Place removed Module in static protective bag.

6. Remove and set aside the Module’s plastic card retainer by removing its two mounting screws from the Baseboard.

7. Remove the two remaining Baseboard mounting screws.

8. Using a hooked scribe or equivalent tool, carefully pry around perimeter of Baseboard to free board from terminal strip’s bayonet conductors. Discard defective board.

REPLACEMENT

1. Align bayonet receptacles on replacement Baseboard with protruding bayonets and press down firmly to seat the Baseboard.

2. Finish the installation by performing in reverse, REMOVAL steps 1 to 7.

3. Restore power to the Transmitter. Calibration is not required.

6.4.6 NON-FIELD-REPLACEABLE ITEMS

- Power Input Terminal Strip: A damaged (unusable) terminal strip requires the replacement of the enclosure body.

- Enclosure Cap Display Viewing Glass: Agency regulations do not permit the field replacement as this would invalidate the enclosure’s explosion proof rating. Replace damaged enclosure cap.
Zero/Full Scale Pushbutton Seals: Agency regulations do not permit the field replacement as this would invalidate the enclosure's explosion proof rating. Return transmitter to factory for repair.

6.5 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 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 circuit module
10. Issue number of replacement circuit module
11. Date of completion

6.6 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. A selection consisting of an Electronics Module, Digital Meter Board, Capsule Assembly, and capsule seals should be stocked by the user to permit repair within this user determined period.

An exploded view drawing with a parts list accompanies this Instruction. It should be consulted to select on-hand spare parts and to obtain spare and replacement part numbers. Contact the factory if assistance is needed in determining quantity and variety of spare parts.

IMPORTANT

When ordering, 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, or that a compatible spare is supplied.

1. Part number from Parts List or from a label on most assemblies

February 1993
2. The single number software compatibility code

3. Serial number from the label on the Transmitter’s nameplate and, if being spared or replaced, from the Sensor Assembly or Module Assembly

4. User PO number of original order, available from user records

5. New user PO number for the card or 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.

**IMPORTANT**

The Electronics Module and Digital Meter Assembly must be placed in static shielding bags to protect them from electrostatic discharge.

### 6.7 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 learn the software level of a Transmitter:

1. Connect the MXC to the loop
2. Establish communication with the Transmitter
3. Press the STATUS key
4. Press the MODL key
5. Read the model number and software revision level

**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.

6-30

February 1993
Warranty repair or replacement requires the equipment to be returned to one of the following addressed.

Equipment manufactured or sold by MOORE PRODUCTS CO.:

MOORE PRODUCTS CO.
Sumneytown Pike
Spring House, PA 19477

Equipment manufactured or sold by MOORE INSTRUMENT CO.:

MOORE INSTRUMENT LTD/LTEE
2KM 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 a member of the MOORE PRODUCTS CO. Service Department.
APPENDIX A - HAZARDOUS LOCATION INSTALLATION DRAWINGS

This Appendix contains four Figures that present wiring and barrier selection information for a Model Series 340 Transmitter in a hazardous location. Refer to these Figures when installing or servicing a Transmitter mounted in a hazardous location.
MODEL 340 BARRIER SELECTION

GENERAL NOTES:
1. BARRIER MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. RESISTANCE BETWEEN BARRIER GROUNDING POINT & EARTH GROUND MUST NOT EXCEED 1 OHM.
3. VOLTAGE REQUIREMENTS:
   - MODEL 340: 10VDC
   - MODEL 756: 30VDC
   - MODEL 772: 30VDC
   - MODEL 773: 30VDC
4. TRANSFORMER (MODEL 756, 772R, 77 OR 771) MAY BE CONNECTED TO TRANSMITTER - CONTROLLER AS SHOWN ON SHEET 1.

COIL NOTES:
1. CONNECTION BETWEEN BARRIER GROUNDING BUS AND EARTH GROUND MUST BE RELESS ANTICIPATING.
2. USE ONLY CSA CERTIFIED BARRIERS OR ISOLATORS HAVING THE FOLLOWING PARAMETERS:
   - GROUPS A, B, C & D
     - Vmax: 250V
     - Imax: 100mA
   - GROUPS E & D ONLY
     - Vmax: 200V
     - Imax: 100mA
   - OR ELECTRONIC BARRIERS: 68 mA, 305 V max, 0.041 V max when used with models 77 & 771.
3. EACH CHANNEL OF A DUAL CHANNEL BARRIER OR DUAL BARRIER SETUP MUST MEET THE PARAMETERS SPECIFIED IN CSA NOTE E2 AND E1 OF THE CHANNELS MUST BE DEDICATED RETURN.

FM NOTES:
1. MODEL 340 ENTITY PARAMETER:
   - Vmax: 420V
   - Imax: 180mA
   - Lmax: 0.7mH (W/OU S/H WITHOUT ANALOG METER)
   - 0.7mH (W/OU S/H WITH ANALOG METER)
2. CHOOSE BARRIERS OR ISOLATORS WITH THE FOLLOWING PARAMETERS:
   - Vmax: LESS THAN OR EQUAL TO Vmax OF MODEL 340
   - Imax: LESS THAN OR EQUAL TO Imax OF MODEL 340
   - Cmax: GREATER THAN OR EQUAL TO Cmax OF ALL INSTRUMENTS IN THE LOOP PLUS THE CAPACITANCE OF THE WIRING
   - Lmax: GREATER THAN OR EQUAL TO Lmax OF ALL INSTRUMENTS IN THE LOOP PLUS THE INDUCTANCE OF THE WIRING
3. IF THE INDUCTANCE AND CAPACITANCE OF THE WIRING ARE NOT KNOWN, THE FOLLOWING PARAMETERS MAY BE USED:
   - CAPACITANCE: 60 pf/ft
   - INDUCTANCE: 0.20 mH/ft.
FIGURE A.1  Model 340 Series, Intrinsically Safe Installation

NOTES:

1. ASSOCIATED APPARATUS AND CONTROL ROOM EQUIPMENT CONNECTED TO IT SHALL NOT USE OR GENERATE MORE THAN 250V (RMS OR DC).
2. ASSOCIATED APPARATUS AND CONTROL ROOM EQUIPMENT MAY BE LOCATED IN DIVISION 2 LOCATIONS IF SO APPROVED.
3. WIRING MUST BE TWISTED, SHIELDED PAIRS, 20 AWG OR LARGER.
4. SOLID CORE STRANDED.
5. 10 LOOPS ARE ALLOWABLE ONLY IN MULTI-DROP MODE, THE OUTPUT OF EACH TRANSMITTER WILL THEN BE "PULLED" AT 4mA. FOR ANALOG MODE THE NUMBER OF LOOPS IS LIMITED BY THE CURRENT AVAILABLE FROM THE ASSOCIATED APPARATUS SEE INSTRUCTIONS 55#549 FOR DETAILS.
6. SEE SHEET 2 FOR BARRIER OR ISOLATOR SELECTION, SHEET 3 FOR FIELDBOX MODULES.
7. TRANSDUCER IS OPTIONAL P/N 20136-6. FILTER IS REQUIRED FOR USE WITH MODELS 750E, 77 OR 771.

MOORE PRODUCTS CO.
SPRING HOUSE, PA 19477 USA

FM/CSA CONTROL Dwg.
AGENCY APPROVAL REQUIRED
BEFORE ANY REVISION

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED
REV.
1 ORIGINAL
DRAWN
9-89
JS

REVISION
APPRO
9-89

DATE
FILE
A
1

10032-3401

SHEET 1 OF 4
FIGURE A3

Intrinsically Safe Installation, Foxboro Spec 200 and Interspec Nest Output Modules

NON HAZARDOUS LOCATION

Hazardous Location
CLASS I, DIVISION 1, GROUPS A, B, C & D

OUTPUT B 0-10 VOLTS DC

INPUT B
4-20 mA DC

OUTPUT A 0-10 VOLTS DC

INPUT A
4-20 mA DC

MODELS 340

FOXBORO SPEC 200
MODEL 245-12V-TGB (FM APPROVAL)
245-13V-TGB (FM APPROVAL)
245-13J-CGB (CSA CERTIFICATION)
245-13V-CGB (CSA CERTIFICATION)

FOXBORO INTERSPEC NEST
MODEL 342-12B CS-E/FGB-A (FM APPROVAL)
342-12B CS-E/CGB-A (CSA CERTIFICATION)

NOTES:
1. ALL WIRING AND INSTRUCTIONS PERTAINING TO INTRINSICALLY SAFE
   VERSIONS OF OUTPUT MODULES MUST BE FOLLOWED
   FOXBORO SPEC 200, SEE INSTRUCTIONS IS-60/61-61/C
   FOXBORO INTERSPEC NEST SEE INSTRUCTIONS IS-88 AND
   APPLICABLE INDIVIDUAL INSTRUCTIONS FOR EACH MODULE.
2. MAXIMUM SAFE AREA VOLTAGE NOT TO EXCEED 250VDC.
3. USE FOXBORO MODULE APPROPRIATE TO THE TYPE OF APPROVAL
   (FM OR CSA) REQUIRED.
   a) TRANSMITTER (MODEL 750E, 772R, 77 OR 771) MAY BE CONNECTED TO
   TRANSMITTER - CONTROLLER AS SHOWN ON SHEET 1.
   b) MAY BE CLASS II OR CLASS III IF HAZARDOUS AREA
   EQUIPMENT IS SUITABLE FOR USE IN SUCH AREAS.
INTRINSICALLY SAFE INSTALLATION OF MODEL 340 WITH MODEL 772R

NON HAZARDOUS LOCATION | HAZARDOUS LOCATION

CLASS I, DIVISION 1, GROUPS A, B, C & D

POWER SUPPLY

ASSOCIATED APPARATUS
(SEE SHEET 2 & 3)

BARRIER CIRCUIT NO. XX

POWER SUPPLY

ASSOCIATED APPARATUS
(SEE SHEET 2 & 3)

BARRIER CIRCUIT NO. 2

POWER SUPPLY

ASSOCIATED APPARATUS
(SEE SHEET 2 & 3)

BARRIER CIRCUIT NO. 1

MODEL 772R ENCLOSURE
(SEE M.P.CO. DWG 15032-7720 (CSA)
OR 15032-7721 (FM) FOR DETAILS)

NOTES:

1. DO NOT INTERCONNECT BARRIER CIRCUITS, EACH MODEL 340-772R
   PAIR MAY BE CONNECTED TO ONE BARRIER CIRCUIT ONLY. EACH BARRIER MAY
   SUPPLY MORE THAN ONE MODEL 340-772R PAIR AS LIMITED BY THE
   CURRENT AVAILABLE FROM THE BARRIER.

2. SEE SHEET 2 FOR BARRIER OR ISOLATOR SELECTION, SHEET 3 FOR
   INTEGRATED MODULES.

3. MAY BE CLASS II OR CLASS III IF HAZARDOUS AREA
   EQUIPMENT IS SUITABLE FOR USE IN SUCH AREAS.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot; 1</td>
<td>2928-44</td>
<td>O-Ring</td>
<td>2</td>
<td>&quot; 13</td>
<td>9</td>
<td>1-1820</td>
<td>2</td>
</tr>
<tr>
<td>&quot; 3a</td>
<td>15965-154</td>
<td>Enclosure Cap</td>
<td>2</td>
<td></td>
<td>10</td>
<td>1-5820</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>w/o meter option</td>
<td></td>
<td></td>
<td>11</td>
<td>2 x 1.88 Type U Drive Screw</td>
<td></td>
</tr>
<tr>
<td>&quot; 3b</td>
<td>15965-560</td>
<td>Enclosure Cap CSA</td>
<td>1</td>
<td></td>
<td>12</td>
<td>1-7274</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>w/o meter option</td>
<td></td>
<td></td>
<td>19</td>
<td>3175-195</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>15965-180</td>
<td>Mounting Bracket Kit</td>
<td>1</td>
<td></td>
<td>21</td>
<td>1-7690</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>15965-265</td>
<td>Enclosure Assy</td>
<td>1</td>
<td></td>
<td>26</td>
<td>20520-42</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>15965-296</td>
<td>Enclosure Cap Assy</td>
<td>1</td>
<td></td>
<td>34</td>
<td>3175-197</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>15965-682</td>
<td>Step Retaining Screw</td>
<td>1</td>
<td></td>
<td>35</td>
<td>3175-163</td>
<td>1</td>
</tr>
<tr>
<td>&quot; 13</td>
<td>2928-99</td>
<td>O-Ring</td>
<td>1</td>
<td></td>
<td></td>
<td>8-32 x .25 Binding Hd.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>15965-634</td>
<td>Male - Female Spacer 2&quot;</td>
<td>1</td>
<td></td>
<td></td>
<td>10-32 x .38 Cup. Pt. Skt Screw</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15965-635</td>
<td>Male - Female Spacer 3&quot;</td>
<td>1</td>
<td></td>
<td></td>
<td>2 x 1.88 Type U Drive Screw</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>16069-81</td>
<td>Digital Meter Board Assy</td>
<td>1</td>
<td></td>
<td>12</td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>20a</td>
<td>15965-659</td>
<td>Conn. Block Stainless Steel Kit</td>
<td>1</td>
<td></td>
<td>19</td>
<td>3175-195</td>
<td></td>
</tr>
<tr>
<td>20b</td>
<td>15965-660</td>
<td>Conn. Block Hastelloy Kit</td>
<td>1</td>
<td></td>
<td>21</td>
<td>1-7690</td>
<td></td>
</tr>
<tr>
<td>&quot; 22</td>
<td>15965-54</td>
<td>Seal</td>
<td>2</td>
<td></td>
<td>26</td>
<td>Hex Nut 7/16 - 14</td>
<td></td>
</tr>
<tr>
<td>23a</td>
<td>15965-59</td>
<td>End Cap (Stainless Steel)</td>
<td>2</td>
<td></td>
<td>29</td>
<td>Cap Screw</td>
<td></td>
</tr>
<tr>
<td>23b</td>
<td>15965-69</td>
<td>End Cap (Hastelloy)</td>
<td>2</td>
<td></td>
<td>34</td>
<td>3175-197</td>
<td></td>
</tr>
<tr>
<td>23c</td>
<td>15965-556</td>
<td>End Cap Side Vent (Stainless Steel)</td>
<td>2</td>
<td></td>
<td>35</td>
<td>3175-163</td>
<td></td>
</tr>
<tr>
<td>23d</td>
<td>15965-557</td>
<td>End Cap Side Vent (Hastelloy)</td>
<td>2</td>
<td></td>
<td></td>
<td>8-32 x .38 Cup. Pt. Skt Screw</td>
<td></td>
</tr>
<tr>
<td>&quot; 25a</td>
<td>20520-157</td>
<td>Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>2 x 1.88 Type U Drive Screw</td>
<td></td>
</tr>
<tr>
<td>&quot; 25b</td>
<td>20520-153</td>
<td>Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>27a</td>
<td>20520-66</td>
<td>Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>2 x 1.88 Type U Drive Screw</td>
<td></td>
</tr>
<tr>
<td>27b</td>
<td>20520-63</td>
<td>Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>1604-41</td>
<td>Plastic Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>8-32 x .38 Cup. Pt. Skt Screw</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>1609-96</td>
<td>Cable Assy.</td>
<td>1</td>
<td></td>
<td></td>
<td>2 x 1.88 Type U Drive Screw</td>
<td></td>
</tr>
<tr>
<td>31a</td>
<td>14745-13</td>
<td>Analog Meter</td>
<td>1</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>31b</td>
<td>14745-14</td>
<td>Analog Meter 0-10 Sq. Rl. Scale</td>
<td>1</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>15965-500</td>
<td>Mounting Plate</td>
<td>1</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>15965-501</td>
<td>Mounting Strap</td>
<td>1</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>33a</td>
<td>2870-1</td>
<td>1/4 In. Socket Head</td>
<td>2</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>38b</td>
<td>20520-68</td>
<td>Pipe Plug</td>
<td>2</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>1604-34</td>
<td>Sensor No. Label</td>
<td>1</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>1604-42</td>
<td>Pipe Plug</td>
<td>3</td>
<td></td>
<td></td>
<td>8 Int. Tooth Lockwasher</td>
<td></td>
</tr>
</tbody>
</table>

**Filled Meter (Diaphragm) Bodies 340D**

- 15965-579 Sst. Diaphragm Range 1 SL
- 15965-580 Sst. Diaphragm Range 2 SL
- 15965-418 Hast. Diaphragm Range 2 SL

**Diaphragm Bodies 340A/G**

- 15965-520 Abs. Xmr. Assy Range 2 HA/SS SI
- 15965-522 Abs. Xmr. Assy Range 3 HA/SS SI
- 15965-524 Gage Xmr. Assy Range 2 HA/SS SI
- 15965-526 Gage Xmr. Assy Range 3 HA/SS SI
- 15965-528 Gage Xmr. Assy. Range 4 HA/SS SI

**Output Board Assembly**

- 16059-93 Transmitter-Controller Board
- 16069-83 Transmitter Board

---

**NOTE:**

- APPLY SIL/CON OIL DC#200 60.000 CS OR EQUIV.
- APPLY ANTI-SEIZE COMPOUND AS NEEDED.
- PLUG CABLE ASSY. INTO P1.
- ITEMS 4 & 20 NOT ASSEMBLED. INCLUDE IN SHIPPING CARTON.
- TORQUE TO 30 FT. LBS.
- ROUTE CABLE ASSEMBLY AS SHOWN.
- APPLY DAG DISPERSION #154 OR EQUIV.
- CONNECT + LEAD TO TEST + CONNECT - LEAD TO TEST +
- APPLY DAG DISPERSION #154 OR EQUIV. AND TORQUE TO 375 INCH/POUNDS.

---

**Replaced by 16069-99**

16069-99 (12/31/91) See Entry 529

---

**Replaced by 16069-98**

16069-63 (2/13/91) See Entry 522