INSTALLATION AND SERVICE INSTRUCTION
SSPH® FLUIDIC FLOWMETER
MODEL 14 SIGNAL CONVERTER
FOR
METER BODY
WITH
DEFLECTION SENSOR

MOORE PRODUCTS CO., Spring House, PA 19477
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1.0 INTRODUCTION

This Instruction provides information pertinent to the installation and maintenance of the Model Series 14CNB Signal Converter. It is divided into five sections.

Introduction — Provides a brief description of the product, model designation, and general specifications.

Installation — Furnishes mechanical and electrical installation guidelines.

Scaling and Polarity Selection — Describes the setting of various jumpers and switches to arrange the Converter's circuits to produce a pulse output of the proper polarity, scaled to the desired engineering units.

Circuit Description — General and detailed descriptions of the Converter's circuits are provided in this section.

Maintenance — This section contains information on suggested maintenance and a procedure for calibrating the Converter's current output.

This Signal Converter is used with a deflection sensor equipped Model 14 or Model 140 Meter Body to produce electrical signals which are proportional, in either frequency or magnitude, to the rate of fluid flow through the Meter Body. The Converter consists of a Deflection Sensor Baseboard and a Range Board which plugs into a connector on the Baseboard.

The Converter is mounted in a NEMA 4 enclosure. As shipped, the Converter has a 4 to 20 mA current output and a pulse output consisting of positive going, 12 Volt, scaled pulses referenced to circuit common.

A jumper on the Range Board provides for changing the pulse output to 12 Volt, negative going, scaled or unscaled pulses referenced to +12 Volts.

As shipped, the Converter's output circuit is connected for use with a high impedance, 10K ohm or more, load. The output circuit can be field modified for use with a low impedance load, less than 10K ohm, or to an open collector NPN transistor switched output requiring an external pull-up resistor and voltage source.

1.1 MODEL DESIGNATION

<table>
<thead>
<tr>
<th>Sample Model Number</th>
<th>14 CN B 21 S 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Flow Meter Designation</td>
<td></td>
</tr>
<tr>
<td>Type of Output; Enclosure Type</td>
<td>CN 4 to 20 mA and Scaled Pulses; NEMA 4</td>
</tr>
<tr>
<td>Input</td>
<td>B — Deflection Sensor</td>
</tr>
<tr>
<td>Range Designation</td>
<td>00 to 99 (selected by Moore Products Co. based on flow rate)</td>
</tr>
<tr>
<td>Output Response (Analog)</td>
<td>S — Standard</td>
</tr>
<tr>
<td>Power Supply</td>
<td>1 — 110 Vac, 50/60 Hz</td>
</tr>
</tbody>
</table>
1.2 GENERAL SPECIFICATIONS

1.2.1 ELECTRICAL

Power Requirements .......................... 120V +10%/-15%, 50/60 Hz, 13W max.

Input
  Deflection Sensor .......................... Terminals 9, 10, 11 and 12
  Open Circuit Voltage ..................... 10 Vdc max.
  Short Circuit Current ..................... 6 mA max.

Outputs
  Current Output, 4 to 20 mA Isolated (Terminals 4 and 5)
    Maximum Load Resistance .............. 600 ohms
    Maximum Current ....................... 35 mA dc
    Maximum Voltage ....................... 18.9 Vdc
  Span Adjustment ........................... 30% of maximum span
  Linearity .................................. Within 0.25% of span

  0-100% Step Response ....................... 4 Sec. to 10 Sec. depends on Range Board
  Ambient Temperature Effect .............. Within ± 0.02% of span per °C
  Output Load Effect ........................ Less than 0.01% of span for 0 to 600 ohms
  Supply Voltage Effect ..................... Less than 0.01% of span for ±10% change of supply

Pulse Output
  Load in parallel with output transistor (Terminals 6 and 7)
    Minimum Load Resistance .............. 60 ohms
    Maximum Current ....................... 200 mA dc
    Maximum Voltage ....................... 35 Vdc (open collector)
    Saturation Voltage ...................... 0.4 Vdc at 100 mA

Open Collector Pulse Output
  Load in series with output transistor (Terminals 7 and 8)
    Minimum Load Resistance .............. 60 ohms
    Maximum Current ....................... 200 mA dc
    Maximum Voltage ....................... 35 Vdc
    Internal Pull-up Voltage ............... 12 Vdc ±5%

  Pulse Characteristics
    Rise and Fall Time ....................... 1 usec. with 0.005 μF maximum
    Unscaled Pulse Width .................... 2 to 10 msec. depends on Range Board
    Scaled Pulse Width ...................... 50 to 70 msec.

1.2.2 MECHANICAL

Dimensions ................................. See Figure 1

Weight ....................................... 15 lbs.

1.2.3 ENVIRONMENTAL

IEC Location Classification .................. DX (per IEC654-1)

Operating Temperature Range ............... -22° to +122° F (-30° to +50° C)

Humidity Range ............................. 5.0 to 100%

Maximum Moisture .......................... 0.05 lbs. of water per lb. of dry air
2.0 INSTALLATION

This section provides information concerning mechanical and electrical installation procedures for Model Series 14CNB Converters. The installation must be in accordance with the National Electrical Code and any applicable local codes.

Converters should be installed in an environment where the ambient temperature never exceeds the limits specified in section 1.2.3.

CAUTION

Exceeding the specified ambient temperature limits may adversely affect performance and may cause the Converter to fail.

Before installing the Converter:

1. Modify the pulse output circuit on the Deflection Sensor Board to accommodate the output load. See section 2.2.4.

2. Set the scaling switches and jumper and the pulse selection (polarity) jumper. See section 3.0.

2.1 MECHANICAL INSTALLATION

NEMA 4 enclosure dimensions are shown in Figure 1. The enclosure is normally mounted with its longest dimension vertical but can be mounted in any convenient position. It can be fastened to any flat surface with four standard 1/4 inch diameter screws or bolts. Mounting hardware must be supplied by the installer.

2.2 ELECTRICAL INSTALLATION

This section will describe the electrical connections which must be made to a terminal strip within the enclosure. To gain access to this terminal strip, refer to the parts lists at the rear of this Instruction for an exploded view of the enclosure.

Modification of the Deflection Sensor Board may be necessary. Depending upon the required pulse output circuit configuration, it may be necessary to remove or install a resistor. Refer to section 2.2.4 for details.

---

**Figure 1** Mechanical Dimensions
2.2.1 GENERAL

Wiring connections to the Converter are shown in Figure 2. These connections are described in Table 1. When stranded wire is used, crimp-on ring or spring spade tongue terminals for number 6 screws must be used. Use a

---

**TABLE 1 Identification of Wiring Terminals**

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>IDENTIFICATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Hot</td>
<td>120 Vac Power</td>
</tr>
<tr>
<td>N</td>
<td>Neutral</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>G</td>
<td>Ground</td>
<td>Isolated Converter 4 to 20 mA current output proportional to rate of flow.</td>
</tr>
<tr>
<td>4</td>
<td>+ Current Output</td>
<td>Isolated Converter pulse output, see Installation Section</td>
</tr>
<tr>
<td>5</td>
<td>- Current Output</td>
<td>Shield of flowmeter cable.</td>
</tr>
<tr>
<td>6</td>
<td>Common</td>
<td>Connect to corresponding terminals on meter body terminal board</td>
</tr>
<tr>
<td>7</td>
<td>+ Pulse Output</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>+ Pulse Output</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Shield</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Signal (White)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Signal (Red)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Common (Black)</td>
<td></td>
</tr>
</tbody>
</table>

---

**FIGURE 2 Wiring Connections**
high quality crimping tool to insure reliable connections.

**WARNING**
Remove power from all terminals and wires to be connected before proceeding.

**IMPORTANT**
The protective terminal cover must be reinstalled after wires are connected.

### 2.2.2 ACCESS TO TERMINALS

To gain access to the Converter’s terminals perform the following steps.

1. Open the cover of the NEMA 4 enclosure.
2. Loosen two screws which secure the Terminal Enclosure Cover and remove the Cover. Refer to the Parts Lists in rear of this Instruction for a diagram of the enclosure.

### 2.2.3 WIRE ENTRANCES

The Converter’s enclosure has three 0.88 inch diameter holes for 1/2 inch conduit connectors in the side closest to the terminals. Figure 1 locates these holes. Use the left hole for the sensor cable, the center hole for the output wiring, and the right hole for power wiring.

As shipped, the wire entrance holes are plugged with rubber plugs. No grommets, connectors or couplings are supplied. The installer should mount in these holes such hardware as is appropriate for the particular installation.

### 2.2.4 FLOWMETER CABLE

The flowmeter cable interconnecting a Meter Body and a Converter must have three 22 gauge (AWG) conductors surrounded by a foil shield with a stranded 22 gauge (AWG) drain wire (Belden 8771 or equivalent).

Insulated ring or spade tongue terminals must be used when connecting the cable to the Meter Body and Converter terminals. The shield of the cable must be insulated from the Meter Body and the Converter’s chassis and enclosure. Maximum cable length is 1000 feet.

### 2.2.5 OUTPUT WIRING

The Converter’s output signals are a 4 to 20 mA current and pulses. The pulses can be either positive going scaled pulses, negative going scaled pulses or negative going unscaled pulses depending on the setting of the Pulse Output Select Jumper. Refer to section 3.3 for details.

In addition, the pulse output circuit, located on the Deflection Sensor Baseboard, can be field modified to accommodate several different output load configurations. The circuit can provide any one of the following:

- **A.** Pulse output amplitude of 12V into a high impedance load of 10K ohms or greater. Refer to Figure 3a and section 2.2.5.1. Converters are shipped with this output load configuration.

- **B.** An open collector, NPN transistor output to switch a high impedance load as defined above. Refer to Figure 3b and section 2.2.5.2.

### 2.2.5.1 Pulse Output, High Impedance Load, 12V Pulses

1. On the Baseboard, if not already present, install R27, a 2.2K ohm resistor, between TP2 and TP3. Refer to Figures 3a and 4. Converters are shipped with R27 installed.
2. Connect output wires to terminals 7 (+) and 6 (-).

### 2.2.5.2 Pulse Output, Open Collector

1. On the Baseboard, remove R27 (see Figures 3b and 4).
2. Connect a pull-up resistor, typically 10K ohms, between converter terminals 7 and 8.
3. Connect high impedance load to terminals 7 (+) and 6 (-).
4. Connect external voltage source to terminals 8 (+) and 6 (-).

### 2.2.5.3 Pulse Output, Low Impedance Load, 12V Pulses

1. On the Baseboard, remove R27 (see Figure 3c and 4).
2. Determine load resistance and perform either step A or B.
   - **A.** If load resistance is greater than 60 ohms, install a wire jumper between TP1 and TP2 on the Sensor Board.
   - **B.** If load resistance is less than 60 ohms, install resistor R27 between TP1 and TP2. See Figures 3c and 4. Select value of R27 as follows:
     \[
     R_{27} = 60 - \text{Load Resistance}
     \]

**IMPORTANT**
Load current should never exceed 200 mA as calculated by the following equation.

\[
I_L = \frac{12V}{R_{27} + R_L}
\]

Where:
- \(I_L\) = Load current
- \(R_{27}\) = Resistance of resistor between TP1 and TP2
- \(R_L\) = Resistance of external load.
3. Connect low impedance load to terminals 8 (+) and 7 (-).

### 2.2.5.4 Current Output

1. Connect output wires to terminals 4 (+) and 5 (-).

### 2.2.6 POWER WIRING

AC power input wires should be at least 16 gauge (AWG) with ring or spade type wire terminals. Connect hot lead to Converter terminal H, neutral lead to terminal N, and ground lead to terminal G. See Figure 2.
DEFLECTION

(A) HIGH IMPEDANCE LOAD — 12V PULSES

(B) HIGH IMPEDANCE LOAD — OPEN COLLECTOR

(C) LOW IMPEDANCE LOAD — 12V PULSES

FIGURE 3 Pulse Output Circuits
FIGURE 4 Location of R27
3.0 SCALING AND POLARITY SELECTION

Before installing the Converter, the scaling switches and jumper should be set and the pulse output selected. This section describes these selections and provides several examples.

If these selections must be changed after installation, simply open the enclosure and remove the printed circuit board enclosure cover for access to the Range Board. Refer to the parts list at the rear of this instruction for an exploded view of the enclosure.

The location of divider switches, multiplier jumper, and pulse output selector jumper for the Range Board is provided by Figure 5.

3.1 DIVIDER SWITCHES

The divider circuit, on the Range Board, includes 4 binary switch packs. These switches must be set to the Calibration Factor of the meter body in order to scale the output pulses to the desired engineering units. Binary coded decimal switch packs S1, S2, S3 and S4 (see Figure 5) represent the four digits of the CAL FACTOR with S4 the most significant digit. The meter's CAL FACTOR is stamped on a stainless steel tag on the meter body and on the nameplate of the Converter. Refer to Table 2 and the scaling examples in section 3.4 for details of setting these switches.

3.2 MULTIPLIER JUMPER

Multiplier jumper W1, on the Range Board, places the decimal point in the meter calibration factor number set on the divider switches. Refer to the scaling examples in section 3.4 for details for placing this jumper, and to Figure 5 for its location.

---

**TABLE 2** Divider (CAL FACTOR) Switch Code

<table>
<thead>
<tr>
<th>Decimal</th>
<th>S1 Thru S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF   OFF  OFF  OFF</td>
</tr>
<tr>
<td>1</td>
<td>ON   ON   OFF  OFF</td>
</tr>
<tr>
<td>2</td>
<td>OFF  OFF  ON   ON</td>
</tr>
<tr>
<td>3</td>
<td>ON   ON   ON   ON</td>
</tr>
<tr>
<td>4</td>
<td>OFF  OFF  OFF  ON</td>
</tr>
<tr>
<td>5</td>
<td>ON   ON   ON   ON</td>
</tr>
<tr>
<td>6</td>
<td>OFF  OFF  ON   ON</td>
</tr>
<tr>
<td>7</td>
<td>ON   ON   ON   ON</td>
</tr>
<tr>
<td>8</td>
<td>OFF  OFF  OFF  ON</td>
</tr>
<tr>
<td>9</td>
<td>ON   ON   ON   ON</td>
</tr>
</tbody>
</table>

Example: For a CAL FACTOR = 1700

Switch | 1 | 2 | 4 | 8 | = Decimal
---|---|---|---|---|---
Set S4 to: | ON | OFF | OFF | OFF | = 1
Set S3 to: | ON | ON | ON | OFF | = 7
Set S2 to: | OFF | OFF | OFF | OFF | = 0
Set S1 to: | OFF | OFF | OFF | OFF | = 0

The decimal point is set by the Multiplier Jumper. For a CAL FACTOR of 1700, the multiplier is 1. For a CAL FACTOR of 170.0, the multiplier is 0.1.
3.3 PULSE OUTPUT SELECT JUMPER

The Pulse Output Selector, Jumper W2, on the Range Board, provides three choices of pulse output. The jumper position for each of these choices is given in the table below.

<table>
<thead>
<tr>
<th>W2 POSITION</th>
<th>PULSE OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>B to A</td>
<td>Negative Going-Scaled</td>
</tr>
<tr>
<td>B to C</td>
<td>Positive Going-Scaled</td>
</tr>
<tr>
<td>B to D</td>
<td>Negative Going-Unscaled</td>
</tr>
</tbody>
</table>

As shipped, jumper W2 is in the B to C position and the pulse output is positive going, 12 Volt, scaled pulses referenced to common.

3.4 SCALING EXAMPLES

3.4.1 EXAMPLE 1

Assume a meter CAL FACTOR of 1.700 pulses per gallon and the output is to be 1 pulse per gallon. The divider switches should be set as shown in Figure 6a and the multiplier jumper should be in the .001 position.

3.4.2 EXAMPLE 2

Assume meter CAL FACTOR of 15.60 pulses per gallon and the output is to be 1 pulse per gallon. The divider switches should be set as shown in Figure 6b and the multiplier jumper should be in the .01 position.

---

**FIGURE 6** Divider Switches

---
4.0 CIRCUIT DESCRIPTION

This section contains information pertaining to the functions of the circuits of both the Deflection Sensor Board and the Range Board. It includes a block diagram which illustrates the various circuits and also identifies the board on which each circuit is located. Also included are detailed descriptions of the function of each circuit referenced to the schematic diagrams at the rear of this Instruction.

4.1 BLOCK DIAGRAM

The block diagram in Figure 7 illustrates the various circuits of the Model 14CNB Converter. It is provided as an aid to understanding the functions performed by the Converter and to locating circuits.

The blocks within the area bounded by dotted lines represent circuits located on the Range Board, all other blocks represent circuits located on the Deflection Sensor Baseboard.

The Deflection Sensor, mounted in the Model 14 or 140 Meter Body, is connected to Terminals 9, 10, 11 and 12 of the Converter Terminal Board and through the flexible ribbon cable, to the Deflection Sensor Board. It becomes an integral part of the sensor circuit which produces a distorted sine wave signal whose frequency is proportional to the rate of flow of fluid through the Meter Body.

The sensor circuit’s output is passed to the Range Board as input to the filter circuit. It is also retained on the Baseboard as input to the filter control circuit. The filter control circuit’s output is passed to the Range Board as control input to the filter circuit.

The filter circuit filters high frequency noise from the signal and provides signal gain.

As the sensor circuit’s output signal increases in frequency, it also increases in amplitude. When these signal characteristics reach a predetermined level the filter control circuit’s output changes state causing the filter circuit to decrease its gain and reposition its passband higher in frequency.

Leaving the filter, the signal returns to the Baseboard to pass through an isolator and a frequency doubler. It then transfers to the Range Board again where it splits to become the input of both the output current control circuit and the scaling multiplier circuit.

The output current control circuit controls the level of the Converter’s output current. This current originates in the converter’s power supply on the Baseboard, leaves the Converter via converter terminal 4, passes through the external load circuit, and returns to the Converter via terminal 5. It then transfers to the Range Board for level control returning to the Baseboard and to the power supply.

The output of the multiplier passes through the divider and the pulse output select jumper. It then returns to the Baseboard, passes through an isolator and the pulser output circuit leaving the Converter by way of the Converter’s terminal board.

4.2 CIRCUIT DETAILS

This subsection contains a description of the function of the circuits contained by each block of the block diagram in Figure 7. Each subsection is referenced to the related schematic diagram at the rear of this Instruction.

4.2.1 SENSOR CIRCUIT (Reference Figure 12)

The sensing components of the Deflection Sensor are two resistive strain gauges. One strain gauge is connected between -6 Volts and the non-inverting input of operational amplifier U8C. The other is connected in a similar manner to U8D. The outputs of U8C and U8D become the non-inverting and inverting inputs, respectively, of differential amplifier U8B. U8B’s output is the sensor signal.

The sensor signal passes through an active, low pass filter formed by a resistor capacitor combination and operational amplifier U8A. The output of U8A, as measured at Test Point TP6, is a somewhat distorted sine wave, approximately 40 mV peak to peak at full scale flow rate. This signal is fed to the Range Board through pin 8 of the range board connector for processing as discussed in section 4.2.3. It is also delivered to the filter control circuit on the Baseboard, discussed in section 4.2.2.

4.2.2 FILTER CONTROL (Reference Figure 12)

The output of U8A enters the filter control circuit through capacitor C8 and passes through R24 and R22 to the inverting input of operational amplifier U6B. Diode CR2 allows only the negative portion of U6B’s output to pass to the integrator formed by C20 and R35. Operational amplifier U6A is arranged to produce a normally logic low output and to switch to a logic high output when its inverting input reaches approximately -4 Volts. Its output passes to the Range Board through pin 9 of the Range Board controller and controls the operation of bilateral switches U8A, B, C and D on the Range Board.

4.2.3 FILTERS (Reference Figure 13)

The output of operational amplifier U8A on the Baseboard is passed to the Range Board through pin 8 of the range board connector. On the range board, the signal passes through a series of five filters, alternately low frequency and high frequency. The passive low frequency filters are formed by C1 and R14; C2, R18 and R19; and C3, R22 and R23. The active high frequency filters are formed by U8A, C4, R15, R16 and R17; and R9B, C5, R20, R21 and R24. The response of the filters is controlled by the four bilateral switches U8A, B, C and D on the Range Board. At low frequencies these switches open and R16, R18, R22 and R24 are all ineffective in their respective circuits; the frequency response of the filter group is approximately as shown in Figure 8.

When the output of U8A, on the Baseboard, reaches approximately 30% of its maximum span value, U6A’s output switches from logic low to logic high closing switches U8A, B, C and D on the Range Board. This connects the open ends of R16, 18, 19 and 24 into their respective circuits which decreases the gain of the active filters and
repositions the passband of the combined filters at a higher frequency. The new filter frequency response is approximately as shown in Figure 8.

4.2.4 PULSE SCALING CIRCUITS

4.2.4.1 Isolation and Frequency Doubler (Reference Figure 12)

After passing through the filters on the Range Board, the signal is returned to the Baseboard, to Schmitt Trigger U4 which reconverts the signal to pulses and delivers the pulses to the LED portion of the opto-coupler U1. The rise time of pulses in U1’s output is shortened by exclusive OR gates U2A and U2B. U2A also inverts the pulses. U2A’s output passes through the pulse frequency doubler formed by U2D, C2, R1 and R2, which outputs a pulse at every transition of its input. These pulses are inverted by U2C and passed to the Range Board again, for scaling.

4.2.4.2 Multiplier (Reference Figure 13)

A pulse from U2C, on the Baseboard, is passed to the Range Board where it sets the flip-flop formed by USB and D. The output of USB goes low, and that of USD goes high. The high output of USD enables the clock and inverter formed by U6A, C8, R5, R6 and U6B. It also enables NAND gate USC. Trains of inverted clock pulses from USC become the input of both divide-by-N counter U1 and the decade counter comprised of U2 and U3.

Decade counters U2 and U3 produce outputs at 1, 10, 100 and 1000 pulses. Plug-in jumper W1 selects which output is to trigger the pulse-forming network USD, USB, C11, R7 and R8.

When the selected output of the decade counters goes to a logic high, a logic low pulse is produced at the output of USB. This pulse resets the USB-USD flip-flop, switching the output of USD to a logic low. The logic high from USD inhibits the clock and, because of the low at USB-9, prevents further pulse input to the counters until the next input pulse arrives at USD to repeat the same process.

For details on positioning jumper W1 see section 3 of this instruction.

4.2.4.3 Divider and Pulse Selection (Reference Figure 13)

The input to divide-by-N counter U1 is clock pulse trains. The trains occur at a frequency proportional to the rate of flow of fluid through the Meter Body. The pulses in each train are at clock frequency.

Counter U1 decrements one count per input pulse. When it reaches zero, it outputs a positive going pulse and resets to the value determined by the logic levels of its 16 jam inputs established by four 4 bit binary switch packs mounted on the Range Board.

U1 output pulses trigger single shot U4A to produce 50 to 70 msec output pulses.

For details on setting the divider switches see section 3 of this Instruction.
4.2.7 POWER SUPPLY CIRCUIT  
(Reference Figure 12)

The Baseboard contains the power supply for the entire Q/I Converter.

The power supply contains two transformers, each with a 103 to 129 Vac primary. One (T1) has an internal thermal fuse in the primary winding and a 12 Vac secondary, the other (T2) has two 18 Vac secondaries.

T1 secondary voltage is rectified by diode bridge CR1, filtered by C5 and C6 and regulated to 12 Vac by U5, R16 and R18 form a voltage divider across the output of U5. Operational Amplifier U4 compares the potential at the center of this divider with common #1 potential and outputs a current which will maintain the circuit common midway between the +6 and -6 Volt outputs.

One secondary of T2 is rectified by diode bridge CR3, filtered by C12 and regulated at 12 Volts by regulator U7. This 12 Volt output, referenced to common 2, is the power source for the converter's pulse output.

The other secondary of T2 is rectified by diode bridge CR5, filtered by C14 and regulated at 18 Volts by U11. This 18 Volts, referenced to common 3, is the power source for the converter's current output. It is also further regulated to +7 Volts (by VR1, U3 and Q1) and used to supply rail voltages for components on both the Baseboard and the Range Board.

4.2.8 CURRENT OUTPUT CONTROL  
(Reference Figure 13)

The current output control circuit receives positive going pulses (from the output of U2D on the Baseboard) which are delivered to and inverted by U6C on the Range Board. They become the input to single shot U4B which produces uniform pulses of required duration. The Q output of U4B is converted to an analog signal by the RC network consisting of C9, C10, C12, four sections of R9, and R12. This analog signal becomes the non-inverting input of U7B. The inverting input of U7B is taken from SPAN adjust pot R10. U7B's output is the base voltage of Q1. Q1 controls the 0-16 mA output current which is proportional to the rate of flow of fluid through the meter body.

The output of ZERO trim pot R11 is the non-inverting input of U7A. The inverting input of U7A is the emitter voltage of Q2, and its output is the base voltage of Q2. The current through Q2 is adjusted to a constant 4 mA.

The currents through Q1 and Q2 combine to produce the 4 to 20 mA output current of the converter. There is no interaction between ZERO and SPAN adjustments.

4.2.9 CONVERTER CURRENT OUTPUT  
(Reference Figures 12 and 13)

The converter's output current has its source at regulator U11 of the power supply. Current flows out of the converter via converter terminal 4, through the external devices and back into converter terminal 5. It then passes to the Range Board for control by Q1 and Q2 and returns to the power supply by way of common #3.

Plug-in jumper W2 on the Range Board selects the form of the converter's output pulses. As shipped, jumper W2 is in the B to C position which produces a normally low converter output with positive going, scaled pulses. The position of W2 can be changed to provide negative going, scaled pulses or negative going unscaled pulses derived from the Q output of single shot U4B. See section 3.3 for details.

4.2.5 PULSE OUTPUT ISOLATION  
(Reference Figure 13)

From jumper W2 the pulses are passed back to the baseboard and become the non-inverting input of buffer U3 and then the LED input of optocoupler U10.

4.2.6 CONVERTER PULSE OUTPUT  
(Reference Figure 13)

Figure 3 shows the converter's final pulse output circuit as arranged for three types of loads.

4.2.6.1 High Impedance Load, 12V Pulses  
(Reference Figure 3a)

Figure 3a shows the pulse output circuit arranged for high impedance, 10K ohms or more, load such as CMOS circuitry. Pulses from optocoupler U10, scaled or unscaled, control the base of transistor Q2 which in turn controls transistor Q4. The collector of Q4 is supplied with 12 Volts through pull up resistor R27. The load is connected to converter terminals 7 (+) and 6 (-) which places it in parallel with Q4.

When Q4 is in cutoff terminal 7 will be approximately 12 Vdc. When Q4 is at saturation terminal 7 will be approximately the potential of common #2.

4.2.6.2 Open Collector (Reference Figure 3b)

Figure 3b shows the pulse output circuit arranged for a high impedance load with an external voltage source. This connection scheme can be used with a load with TTL circuitry. R27 is removed from between TP2 and TP3 on the Baseboard. A pull up resistor, typically 10K Ohms, is connected to converter terminals 7 and 8 with the external voltage source connected between terminals 8 (+) and 6 (-).

The functioning of the circuit is essentially the same as in the arrangement in 4.2.6.1.

4.2.6.3 Low Impedance Load, 12V Pulses  
(Reference Figure 3c)

Figure 3c shows the pulse output circuit arrangement for a low impedance, 12 Vdc load such as a counter. Here R27 is a current limiting resistor whose value is selected. It is connected between TP1 and TP2. The external load is connected between converter terminals 6 (+) and 7 (-). If the external load is 60 ohms or more, a wire jumper is substituted for the resistor between TP1 and TP2.

When Q4 is off, terminal 7 is approximately 12 Vdc. When Q4 is in saturation, terminal 7 is approximately the potential of common 2.
5.0 MAINTENANCE
This section provides preventive maintenance, calibration, and troubleshooting procedures. These procedures usually require disassembly of the Converter. Refer to the parts lists at the rear of this Instruction for exploded views of the NEMA 4 enclosure.

5.1 PREVENTIVE
Preventive maintenance consists of cleaning and visual inspection. The severity of the environment in which the Converter is located will determine the frequency of maintenance.

To gain access to terminals and circuit boards perform the following steps:
1. Open the NEMA 4 enclosure.
2. Loosen two (2) screws holding Terminal Enclosure Cover and remove cover.
3. Loosen four (4) screws holding Printed Circuit Board Enclosure cover and remove cover.

Refer to parts lists at rear of this instruction for blow-up diagrams of the enclosure.

5.1.1 CLEANING
The Converter should be cleaned as often as environmental conditions require. The accumulation of dust and dirt on circuit boards prevents efficient heat dissipation and can cause overheating and component breakdown.

Blow off accumulated dust and dirt with dry, low velocity air. Any dust or dirt that remains should be removed with a small brush or cloth dampened with a mild detergent and water solution. Cotton tipped swabs are useful for cleaning narrow spaces.

**CAUTION**
Avoid using chemical cleaning agents which may damage plastic components or the circuit board coating.

5.1.2 VISUAL INSPECTION
Visual inspection consists of examining the Converter for defects such as loose or broken connections, damaged circuit board copper runs and heat damaged components.

The corrective action for most visible defects is obvious. However, if a heat damaged component is found, the cause of overheating must be corrected to prevent recurrence of the damage.

5.2 ROUTINE
The only routine maintenance required on the Q/I Converter is periodic calibration checks. Refer to section 5.3 of this Instruction for calibration procedures.

5.3 CALIBRATION

5.3.1 GENERAL
To assure instrument accuracy, it is suggested that the calibration of the Converter be checked at the time of installation, after 30 days of operation and at six month intervals thereafter.

Only the 4-20 mA current output of the Converter can be calibrated. Each Range Board includes both a ZERO and a SPAN adjusting trimpot. Pulse output is not affected by these adjustments. Current output is not affected by the multiplier jumper or the divider switches.

Each meter body has been given a calibration test. Its K-factor (pulses per gallon) and Reynolds number appear on a stainless steel tag that is attached to the meter body. The K-factor also appears on the Q/I Converter nameplate.

Converters can be calibrated in the enclosure using either a Moore Products Co. P/N 14943 Calibrator or a function generator.

5.3.2 TEST EQUIPMENT
1. Terminal Strip Bracket Assembly
   MPCo. P/N 15266-52. Recommended for troubleshooting and calibration when installed Converter’s bracket assembly will not be available for power and signal connections to circuit boards after they are removed from an enclosure.
2. Pulse Generator
   Moore Products Co. P/N 14943 Calibrator or Function Generator
   Output: square and sine wave
   Amplitude: Adjustable 0 to 5V peak-to-peak
   Freq. Range: 1 to 150 Hz.
   Freq. Accuracy: ±0.1% (A counter may be required to insure this accuracy)
3. Digital Multimeter
   Resolution: 3-1/2 digit
   Accuracy: ± 0.1% of reading

5.3.3 PREPARATION

5.3.3.1 General
The following steps must be performed.

A. Full Scale Frequency
   Determine the meter body’s full scale frequency with the following equation.
   \[
   \text{F.S. Frequency (pulses/sec)} = \frac{\text{F.S. Flow (gpm)xK-Factor}}{60}
   \]

B. Moore Products Co. Calibrator (P/N 14943)
   When the calibrator is used and the full scale frequency calculated in A above does not correspond with one of the calibrator’s preset frequencies, set the calibrator’s Pulses/Sec switch to the next lower frequency, and calculate the converter’s output with the following equation:
   \[
   \text{Output (mA)} = \left[ \frac{\text{Calibrator Setting}}{\text{F.S. Frequency}} \right] \times 16 + 4
   \]

C. Control Loop
   If the Converter is part of a control loop, the loop may need to be switched to the manual mode before calibrating the Converter.
5.3.3.2 Preparation Procedure

Perform the following steps:
1. Turn off power to Converter.
2. Open cover of NEMA 4 enclosure.
3. Loosen 2 screws holding Terminal Enclosure Cover and remove cover.
4. Loosen 4 screws holding Printed Circuit Board Enclosure Cover and remove cover.
5. Tag wires on terminals 4 and 5 and remove wires from terminals. See Figure 2
6. Connect test set-up as shown in Figure 9.
7. Restore power to Converter and turn on test equipment.

5.3.4 CALIBRATION PROCEDURES

This section provides two calibration procedures, one using the Moore Products Co. Calibrator and the other using a function generator and possibly a counter.

When using the calibrator, it is quite possible that the maximum pulse frequency produced by the calibrator (48 pulses per second) may be much lower than the frequency required to produce a Converter output equivalent to maximum flow. The Meter Body and Converter are amply linear to prevent this condition from causing a calibration problem.

NOTE
Because of the design of the current control circuit, there is no interaction between the ZERO and SPAN adjustments.

5.3.4.1 Procedure Using Calibrator

Perform the following steps.
1. Set calibrator to ZERO.
2. Adjust ZERO trimpot (see Figure 9) for DMM reading of 4 mA.
3. Set calibrator for frequency value determined in Section 5.3.3.1.
4. Adjust SPAN trimpot (see Figure 9) for DMM reading of value of output (mA) calculated in section 5.3.3.1.

Calibration is completed.

5.3.4.2 Procedure Using Function Generator

Perform the following steps.
1. Connect jumper between CAL terminals (TP1 and TP2) on Range Board.
2. Adjust ZERO trimpot (see Figure 9) for DMM reading of 4 mA.
3. Remove jumper from CAL terminals (TP1 and TP2). Connect function generator to Converter calibration terminals as shown in Figure 9. Set function generator for pulses per second value determined in section 5.3.3.1 and 5V peak-to-peak square wave.
4. Adjust SPAN trimpot (see Figure 9) for DMM reading (mA) calculated in section 5.3.3.1.

Calibration is completed.

5.4 TROUBLESHOOTING

A thorough understanding of the electronic operation of the Converter is necessary for efficient troubleshooting. Refer to the appropriate circuit description section in this Instruction as required.

5.4.1 TEST EQUIPMENT

1. Terminal Strip Bracket Assembly

MPCo. P/N 15266-52. Recommended for trouble-
shooting and calibration when installed Converter's bracket assembly will not be available for power and signal connections to circuit boards after they are removed from an enclosure.

2. Pulse Generator
   Moore Products Co. P/N 14943 Calibrator
   or
   Function Generator
   Output: square wave
   Amplitude: Adjustable 0-5V peak-to-peak
   Freq. Range: 1 to 150 Hz.
   Freq. Accuracy ±0.1% (A counter may be required to insure this accuracy)

3. Digital Multimeter
   Resolution: 3-1/2 digit
   Accuracy: ±0.1% of reading

4. Resistors
   Two 1.2 to 2.7K matched, film resistors should be used in lieu of a sensor.

5. Oscilloscope
   Bandwidth: DC to 5 MHz
   Probes: 10X High Impedance
   Sensitivity: 0.1V/Division

5.4.2 FIELD PROCEDURE
At the installation site, only minor repairs should be attempted. These should be limited to complete board replacement. Troubleshooting of circuit boards for defective components should be attempted only in a shop area with proper tools and test equipment available.

5.4.2.1 Visual Inspection
Before proceeding with specific troubleshooting, it is advisable to perform a general inspection of the whole instrument. Some of the items requiring attention are listed below.

1. Check wire connections at terminal board.
2. Check for proper mating of ribbon connector on the Baseboard.
3. Check for proper seating of range board in its connector on the Baseboard.
4. Examine all components for obvious physical damage or defects such as cracks, separations, and discolorations due to overheating.
5. Check for loose parts or presence of foreign materials.

Corrective action for most visible defects is obvious. However, if a heat damaged component is found, the cause of overheating must be corrected to prevent a recurrence of the damage.

5.4.2.2 Quick Checks
The following quick checks should be made on site.

1. Is the instrument receiving the proper electrical power?
2. Is the fuse on the Baseboard good?

5.4.2.3 Board Substitution
Substitute circuit boards known to be good for the suspect boards. If substitution reveals a failed board, refer to section 5.4.3 for in-shop troubleshooting.

5.4.3 SHOP PROCEDURE
This section describes in-shop troubleshooting aimed at locating a failure in a Converter's electrical circuitry.

Normal troubleshooting procedures can be used to isolate a problem and locate the faulty component(s) on a circuit board.

IMPORTANT
Both sides of circuit boards and all components are completely covered with HumiSeal, a transparent protective coating. Test probes should have sharp tips enabling them to penetrate this coating to assure good electrical contact.

5.4.3.1 Preparation
1. Set up a troubleshooting test circuit, as shown in Figure 9A.
2. Install suspect board in test Converter. The other board in the test Converter setup should be known to

---

**FIGURE 9A** TROUBLESHOOTING

---
be good. If a test Converter is not available, a terminal strip bracket assembly may be used for signal and power connections to the circuit boards.

5.4.3.2 Intermittent Problems
Intermittent problems are usually caused by poor connections, which may be either external, such as bad solder connections on PC boards, or they may be internal, as the wire bonds on transistor and IC chips. External problems are easily corrected by re-soldering, while internal defects are eliminated by replacing the affected components. Physical shock and abrupt temperature change have the greatest effect on poor connections. When troubleshooting such problems, the suspected components may be tapped with an insulated rod as appropriate test points are monitored, or a heat gun may be used to elevate the temperature in selected areas. In addition, it may be more convenient to temperature shock small components by the use of a spray-can cooling agent directed at suspected areas via a thin straw.

5.5 REPLACING CIRCUIT BOARD COMPONENTS
All circuit board components are identified on the parts list at the rear of this Service Instruction. Their locations on the circuit boards are shown in Figures 10 and 11.

WARNING
Before replacing circuit board components, disconnect the Converter from all power sources and remove the circuit board from the Converter.

5.5.1 CMOS HANDLING
The circuit boards contain CMOS integrated circuits. Care must be exercised when handling CMOS devices. Although most CMOS devices have built-in protection to prevent damage due to static electric discharge, additional precautions should be followed to assure trouble-free performance after reassembly. The following guidelines for handling CMOS devices are suggested:

1. Use a conductive, grounded working surface and a conductive wrist strap grounded to the working surface.
2. Keep the devices at a common potential.
3. Use special conductive envelopes for storing the devices. Never use non-conductive plastic.
4. Insert CMOS devices last to avoid excessive handling.
5. Use a grounded tip soldering iron.

5.5.2 SOLDERING
The following points are suggested when soldering on the circuit board.

1. The circuit board is coated with HumiSeal, a clear acrylic solder-thru coating which meets MIL-1-46058C.
2. Use a pencil-type soldering iron with a power rating from 15 to 30 Watts.
3. Use electronic grade 60-40 tin-lead solder.
4. Recoat both sides of the circuit board at the soldered area with HumiSeal 1B31 spray or 1B15 dip coating.

IMPORTANT
Moore Products Co. assumes no responsibility for product performance on devices repaired by users.

5.6 REPLACEMENT PARTS

5.6.1 GENERAL
All parts for the Model Series 14CNB Signal Converter can be obtained from Moore Products Co. (in Canada, Moore Instruments LTD/TEE); see Warranty Statement for address. Most of the circuit board components can be obtained from a local electronic parts supplier. Before purchasing locally, check the parts lists at the rear of this Instruction for the description, value, tolerance, and quantity of any given component.

IMPORTANT
All circuit board replacement parts should be identical replacements. An alternate should only be used if it is known that it will not affect the converter’s performance.

When ordering parts from Moore Products Co., include the following information:
1. Description of instrument.
2. Part number of major assembly or printed circuit board (e.g., M5721-1) and issue number.
3. Part number of needed component.
4. Description of component (e.g., resistor, 1K ohms, 10%, 1/4 W).

5.6.2 RECOMMENDED SPARES
All recommended on-hand spare components are identified in parts lists at the rear of this Instruction.

WARRANTY
The Company warrants all equipment manufactured by it and bearing its name plate, 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, guarantees, obligations, or liabilities, expressed or implied by the Company or its representatives. All statutory or implied warranties other than those hereby expressly negated and excluded.

Warranty repair or replacement requires the equipment to be returned to one of the following addresses.

Equipment manufactured or sold by MOORE PRODUCTS CO.
MOORE PRODUCTS CO.
Summittown Pike
Spring House, PA, 19477

Equipment manufactured or sold by MOORE INSTRUMENTS LTD/TEE
2KM West of Mississauga Rd. Hwy. 7
Brampton, Ontario, Canada

The warranty will be null and void if repair is attempted without prior authorization by a member of the MOORE PRODUCTS CO. Service Department.
FIGURE 10 Components Locations, Deflection Sensor Baseboard

FIGURE 11 Component Locations, Range Board
### PARTS LIST

**SIGNAL CONVERTER**

**MODEL 14CNB -- SIFI (SERIES)**

**MODEL 14CNB -- SICI (SERIES)**

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<td>P.C. Board Enclosure</td>
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<td>7418-288</td>
<td>Terminal Strip</td>
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<td>Filter &amp; Cable Assy.</td>
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<td>15631-17</td>
<td>Terminal Cover W/Label</td>
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<td>Barrier Plate</td>
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<td>9</td>
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<td>15500-1</td>
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<td>13</td>
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**Code Hardware**

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<td>GHA</td>
<td>#6-32 x 1/8 Lg. Bind. Hd. Screw</td>
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<td>GHD</td>
<td>#6-32 x 5/16 Lg. Bind. Hd. Screw</td>
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<td>GTC</td>
<td>#10-32 x 1/4 Lg. Bind. Hd. Screw</td>
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<td>WJW</td>
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*Recommended On-Hand Spare Parts. Always specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.*
INSTRUCTIONS INVOLVED

Installation And Service Instructions for:

Model 140MX Meter Body, SD140-1

Model 14 Signal Converter for Fluidic Flowmeter with Deflection Sensor, SD14-3

SUBJECT

This Addendum provides guidelines for the installation, operation and maintenance of a Model Series 14 SSPH® Fluidic Flowmeter in various National Electrical Code classified hazardous locations. Information in the following sections amends that presented in the equivalent sections of the above Instructions.

IMPORTANT

Save this Installation And Service Instruction and make it available for installation and maintenance of the Flowmeter.
SIGNAL CONVERTER

Sample Model Number: 14CN B 21 S 1 F1

Type of Output:
- 14AN - 4-20mA Analog and Unscaled Pulse
- 14BN - Scaled Pulse Only
- 14CN - Combination, 4-20 mA Analog and Scaled Pulse

Input:
- B - Deflection Sensor

Range Designation:
- 00-99 - Selected by factory based on Meter Body size and flow rate

Output Response (Analog):
- S - Standard

Power Supply:
- 1 - 110 Vac, 50/60 Hz

Electrical Approval:
- C1 - CSA
- F1 - Factory Mutual
- Blank - No Approval

ELECTRICAL CLASSIFICATIONS

The electrical classification of each approved unit of an SSPH Fluidic Flowmeter system is included on a nameplate mounted on the unit. The classification for a Model Series 140 Meter Body and a Model Series 14 Signal Converter is given below.

Meter Body

Intrinsically safe for Class I, Division 1, Groups A, B, C, and D hazardous locations when connected in accordance with Figure 1 (drawing 15032-1404, Rev. 4). Equipment approved for Division 1 locations is permitted in Division 2 locations of the same class and group.
HAZARDOUS LOCATION
CLASS I, DIVISION 1, GROUPS A, B, C, D

BATTERY OPERATED
MPG, P/N 19943-15
9V EVEREADY #216
OR BURGESS #216

HAZARDOUS LOCATION
CLASS II, DIVISION 1, GROUPS E, F, G
CLASS III, DIVISION 1

OPEN COLLECTOR OR
12V SCALED OR
UNSCALE PULSE

NOTE:
METER BODY MUST BE GROUNDED. USE SCREW PROVIDED.
SHIELD MUST BE INSULATED FROM METER BODY AND
CONVERTER CHASSIS. USE 22GA OR LARGER, 3 COND.
FOIL SHIELDED CABLE (Belden 8771 OR 83345,
ALPHA 2403 OR EQUAL).

WATTMETER OUTPUT OF CONVERTER DELIVERS 4-20 MA
INTO 600 OHMS MAX. ALL DEVICES MUST BE CONNECTED IN SERIES.

EXCEPT OF 250 VRMS (360 V PEAK).

FIELD WIRE PARAMETERS:

<table>
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<tr>
<th>GROUP A</th>
<th>GROUP B</th>
<th>GROUP C</th>
<th>GROUP D</th>
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<td>L1 425 MH</td>
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<tr>
<td>C 5uF</td>
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<td>1.5uF</td>
<td>4.0uF</td>
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MOORE PRODUCTS CO.
SPRING HOUSE, PA. 18977 U.S.A.

SYSTEM WIRING DIAGRAM
SPECIALSENSE
G/I CONVERTER

FM CSA APPROVED
Registration of Changes Required

DRAWING ISSUE 5

UNLESS OTHERWISE SPECIFIED
UNLESS OTHERWISE SPECIFIED
ALWAYS USE 22GA OR LARGER

FOR GENERAL MANUFACTURING STANDARDS
REFER TO DRAWING SHEET.
INSTRUCTION INVOLVED

Installation And Service Instruction; SSPH® Fluidic Flowmeter, Model 14 Signal Converter For Fluidic Flowmeter With Deflection Sensor, SD14-3.

SUBJECT

This Addendum provides additional information pertaining to calibration of the analog output from the range boards and to the adjustment of the hysteresis band potentiometer on the Deflection Sensor Baseboard. The following comments amend section 5.3 Calibration.

DISCUSSION

Analog Output Calibration

It is possible to calibrate the analog output circuit while the Fluidic Flowmeter is on-line and the pulse output is being used to totalize or otherwise monitor the flow. Neither injecting a calibrating signal into test points TP1 and TP2 on the Range Board nor adjustment of the calibration potentiometers have any affect on the Converter's pulse output.

Hysteresis Adjustment

Converter output pulses produced while the meter body flowrate is zero are usually caused by electrical noise induced in the flowmeter system. The problem can usually be eliminated by clockwise adjustment of hysteresis adjusting potentiometer R13 (on the Deflection Sensor Baseboard) until pulses cease at zero flowrate. However, excessive clockwise adjustment of R13 will increase the minimum measurable flowrate of the flowmeter.

SERVICE PUBLICATIONS DEPT.

JHO/vrb

MOORE PRODUCTS CO., Spring House, Pa. 19477
INTRODUCTION

Installation and adjustment of the Noise Compensation Kit, PN 15841-10, is described in this Supplement. The Kit is installed in a Model 14CNB Signal Converter when the Converter and a Model Series 14 Meter Body with a deflection sensor produce inaccurate output signals while monitoring a process operating at zero or low flow rates. The inaccuracy is caused by excessive noise, which exceeds the hysteresis setting, overriding the desired flow signals.

The major Kit component is a variable resistor. When installed in the Converter, the resistor will be in series with one of the sensor leads from the Meter Body and, therefore, becomes a part of the flow sensing bridge network.

The variable resistor is adjusted to modify bridge balance, compensating for the static pressure effect on the sensor signal at a zero or low flow condition. In the event that compensation cannot produce accurate output signals, it will be necessary to adjust the hysteresis potentiometer.

Once satisfactory compensation is achieved, no further adjustment is required unless the deflection sensor is replaced. Replacement of the sensor requires readjustment of the variable resistor.

KIT COMPONENTS

<table>
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<tr>
<th>Qty</th>
<th>Description (see Figure 1)</th>
<th>Part Number</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Circuit Board Assembly</td>
<td>15841-1</td>
</tr>
<tr>
<td>1</td>
<td>Jumper Wire Assembly</td>
<td>15750-211</td>
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<td>2</td>
<td>#6 Screws and Pressure Plates</td>
<td>7418-365</td>
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SUGGESTED EQUIPMENT

A. Test Equipment: One or more of the following may be used to monitor Converter signals during noise compensation. Items 1 and 2 are suggested. Items 3 and 4 can be used, however, compensation is more difficult.

1. Dual Channel Oscilloscope; Vertical - 0.5V/division
   Horizontal - 0.1 second to 1 millisecond

2. Series 36 Recorder

3. Analog or Digital Milliammeter; Range - 4 to 20mA

4. Totalizer
B. Other equipment:
   1. Common electronic hand tools
   2. Jeweler's screwdriver
   3. SD14-3, Installation And Service Instruction, SSPH Fluidic Flowmeter, Model 14 Signal Converter For Meter Body With Deflection Sensor.

KIT INSTALLATION

1. Remove ac line power from the Signal Converter to prevent electrical shock hazard.

2. Refer to SD14-3, section 2.2.2. Open enclosure cover, then remove the terminal enclosure cover.

3. Locate wiring terminals 10, 11 and 12 and note the two unused terminals between 11 and 12.

4. Remove the red wire from terminal 11.

5. Refer to Figures 1 and 2. From the Kit, use the two screws and pressure plates to mount the circuit board assembly, the red wire, and ring terminal end of the jumper wire as shown.

6. Connect the spade lug end of the jumper wire to terminal 11.

7. Check all connections.

EQUIPMENT CONNECTIONS

A. Oscilloscope
   Refer to Figure 3 and connect oscilloscope probes as indicated.

B. Recorder or Milliammeter
   Connect recorder to Converter current output terminals 4 and 5. See Figure 2.

C. Totalizer
   Connect to pulse output as described in SD14-3, section 2.5.

NOISE COMPENSATION

1. Rotate variable resistor screw counterclockwise (to minimum resistance) until a soft clicking noise is heard or a slight resistance is felt at each complete rotation.

2. If an oscilloscope is used, ground the input to each channel and adjust each trace to the mid-screen graticule. Readjustment may be required during the procedure.

   Release the inputs from ground.
3. Apply power to the Converter.

4. Activate the process and set it to zero or low flow.

5. Note the indications on the test equipment. A noisy signal will be indicated as follows.

   Oscilloscope - Noise pulses will exceed the hysteresis waveform. Refer to Figure 4 for a low noise display.

   Recorder or Milliammeter - Noise will cause a higher than normal reading that will also be quite variable.

   Totalizer - Noise will cause the totalizer to increment at a higher than normal rate and the counting rate may be variable.

6. Rotate the variable resistor screw clockwise one-half turn at a time pausing for several seconds after each adjustment to allow the circuit to stabilize. Continue this adjustment until the noise begins to decrease, then very slowly fine adjust the resistor reducing the noise to minimum.

   IMPORTANT

   a. Noise compensation response is in the form of a notch about two turns (of the resistor screw) wide at the point where noise reduction begins. See Figure 5. If the screw is turned too fast, or if test equipment is not carefully monitored, it is possible to pass the notch without seeing it. If this occurs, repeat steps 1 and 6.

   b. The screwdriver, and human body, may pick-up radiated power line energy and inject it into the Converter. Check for this effect by comparing the noise level while touching and not touching the screw with the screwdriver. Pick-up can make a fine setting difficult.

   c. The variable resistor is a 25-turn potentiometer.

   If indicated noise is unaffected or increased by adjusting of variable resistor, proceed to steps 7, 8, and 9.

   If noise can be reduced, but not to where satisfactory flow measurement is achieved or noise amplitude is within the hysteresis waveform, proceed to step 10.

   If noise can be reduced permitting acceptable flow measurement, proceed to step 11.
7. Refer to Figure 2. Transfer the resistor to the other bridge leg as follows:
   - Disconnect the jumper wire from terminal 11.
   - Remove the red wire from the board assembly and connect the wire to terminal 11.
   - Remove the white wire from terminal 10 and connect it to the board assembly in place of the red wire.
   - Connect the jumper wire to terminal 10.

8. Rotate the variable resistor counterclockwise as directed in step 1.


10. Only if necessary, increase the hysteresis setting by rotating R13 clockwise (See Figure 3). This will reduce turn-down.

11. Disconnect test equipment, install terminal enclosure cover, and close enclosure cover.

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