Operating Manual

Pathfinder Model CT2MR Conductivity Transmitter

4-20mA Current Loop Powered Transmitters

Description

The PFI-Series of Sensor Transmitters are designed to be easily adapted to meet specific OEM or end-user requirements for full scale mapping of the 4-20 mA loop current (or 1 to 5 VDC) to the desired sensor measurement range. Units are provided with on-board adjustments for span and offset or with fixed settings where calibration is performed in the loop receiver. Five jumper selectable ranges are available to work with any K-factor for additional ranges.

Specifications

- Response times After a 30 second warm-up, For conductivity: For settling time 1-3 seconds for maximum stability
- Offset & Gain Set per user’s specifications or selectable preset jumpers.
- Output levels 4-20 mA nominal with 13-24 VDC compliance voltage at the transmitter
- Loop Polarity Reverse polarity protected
- Shock& vibration Normal commercial/industrial use, extended protection on request
- Operating Temperature -40 to +85 °C
- Temperature Compensation Optional (special order), requires external temperature sensor
- Case Bud AN1301 metal, or PN1320 plastic enclosures (Shown above)
- Water Resistance NEMA-4/IP67 when properly closed
- Certifications ROHS, CE and others pending. Intrinsically safe on request
- Warranty One year, parts and labor, repair or replace at DASCOR’S option

Features & Options

- Pathfinder, Inc. or private labeled
- Common mechanical design
- Optional Submersible quick disconnect or cable glands
- Water resistant enclosure (NEMA 4)
- Local zero and span adjustments Multiple ranges and K-factors (1mS to 25mS Full Scale-at K=1)
- ESD, overvoltage, and reverse polarity protected
- Wide compliance voltage range
- Voltage or 4-20 mA Current loop outputs
- Operates with PLC's, alarm controllers, or panel meters
- Maintains galvanic isolation when used with an appropriate isolated power supply and receiver
- Design easily customized to meet specific requirements

Variations and Options

- Fixed gain and offset, case permanently sealed
- Internal zero and gain adjustments with O-ring sealed cover
- Connector type: multiple available—user to specify
- Instrumentation cable: length, wire gage, shielding and termination
- Internal terminal blocks, solder points, or Pin-headers brought outside the case for plug-in terminal blocks.

Set Up Instructions

Sensor:

Cut the cable coming from the sensor to the desired length, then strip and tin the lead ends if possible. About 1/4" of exposed lead is needed to mate correctly with the Terminal block. Be sure the terminal block is opened fully before inserting the wire end. Feed the stripped cable through the gland into the box, leaving an inch or two extra as a service loop. Connect the sensor cables to the terminal block labeled "SENSOR." If one side of the sensor is tied to the sensor case (i.e. to ground—common for stainless steel sensor bodies with pipe threads), this wire MUST be connected to the "Return" position. If this type of sensor is connected incorrectly, the measurements may be erroneous. However, if the sensor elements are galvanically isolated from ground, the wires may be connected to either position. If the sensor cable is shielded the shield may be connected to the "shield" pin the sensor connector if it improves performance.
Tighten the gland to seal the cable.

Transmitter:

Route the cable leading to the transmitter, and cut to the desired length. Strip and tin the ends of the wires, feed through the glands, and insert the ends into the terminal block. Leave a small service loop, and tighten the glands to seal the cable. For 4-20 mA Current loop, the Positive (+ lead) goes to the position marked "+." The Negative or Return lead goes to the position marked "-." Any shield should float at the transmitter (not connected) and tied to Earth Ground at the Meter.
To obtain a voltage output, place a precision resistor across the +/- input terminals at the meter/PLC. Use a resistor value to get the desired voltage out.

	Resistance in Ohms		
Loop Current in AMP	100	250	500
.004	0.4	1.0	2
.002	2.0	5.0	10.0

V out = Current X Resistance

In AMPS In OHMS

The required loop compliance voltage is 13 VDC minimum, 28 VDC Maximum. Internal overvoltage protection diodes will clamp the input voltage to 30 volts DC or less. An LED indicates proper operation (correct Loop Voltage Polarity)
A Handheld (isolated) mA Meter may be connected to the 2 pins labeled (Test). The Meter will display loop current (+/- 5mA) without interfering with the permanent Loop installation.

Full scale range selection:

The ZERO and SPAN adjustments will allow roughly +/- 20% variation from the table.

FOR "K=1.0"

JUMPER	NOM.F.S.	EQUIV.Ω
A	26mS	40
B	10mS	100
C	5mS	200
D	2mS	500
E	1mS	1000

Calibration

There are two methods available. The first gives a theoretically perfect signal based on using a fixed value resistor across the "Sensor" terminals of the Transmitter. This method does **not** compensate for variations in the actual K-factor of the sensor, or issues with cable impedance at the excitation frequency.

Resistance (in Ohms) = 1 / Conductivity (in Siemens)

The second method involves using a traceable calibration solution. Ideally the calibration solution should surround the sensor in the actual measurement fixture/process pipe. However, this is frequently not practical, and the sensor is immersed in a beaker of calibration solution. The solution should be under constant agitation. Calibration is normally performed at least two points. The first is Zero conductivity (infinite resistance), and simply requires that the sensor be **completely dry** during the measurement. For zero conductivity, the ZERO trim should be adjusted to give 4.00 mV, or 1 VDC for the voltage output option. The second point should be selected to be approximately 1/2 Full Scale range, (i.e. set current to 12mA at twice the table resistance) The output current is calculated as follows, where *Buffer* is the nominal conductivity of the calibration solution, and *Full Scale* is the desired full scale range:

Output (mA) = 4 + [(16 * buffer) / Full Scale]

The SPAN would then be adjusted to give the desired current (or voltage = current in mA * 250)

Temperature Issues

Calibration solutions and the process flow all exhibit a temperature coefficient: a change in the reading that varies directly with temperature. Calibration solutions are usually normalized to 25 °C, and will be accurate only at that temperature. Temperature coefficients range widely depending on the chemical content of the solution being measured. Tempco can vary from close to 0% / °C, to as much as 7% / °C! The higher values usually occur at very low conductivities (DI or distilled water, for example). In order to obtain a precise value for conductivity at a normalized temperature, such as 25 °C, you must know, and adjust the data for the actual Tempco. This can be determined by taking measurements of a stable sample (i.e. one with no chemical content changes with temperature) at several temperatures, and obtaining a best-line fit. This final correction can then be determined by measuring the temperature of the test solution, calculating the temperature correction, and then applying it to the raw data. However, in many processes, the absolute accuracy of the measurement is far less important than *changes* in the process flow, which indicate corrective action may be needed. In this case, Tempco may often be ignored.

Trouble Shooting

For signals that are out of range, and cannot be adjusted, try moving the Jumper, or using a sensor with a more appropriate "K" Factor. Different Models are available for accurate measurements below 100µS and above 250mS
If no current flows, check that the leads are wired correctly for polarity. If too much current flows, check for conductivity higher than the full scale range, a shorted sensor, or other low resistance path in parallel with the sensor.

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