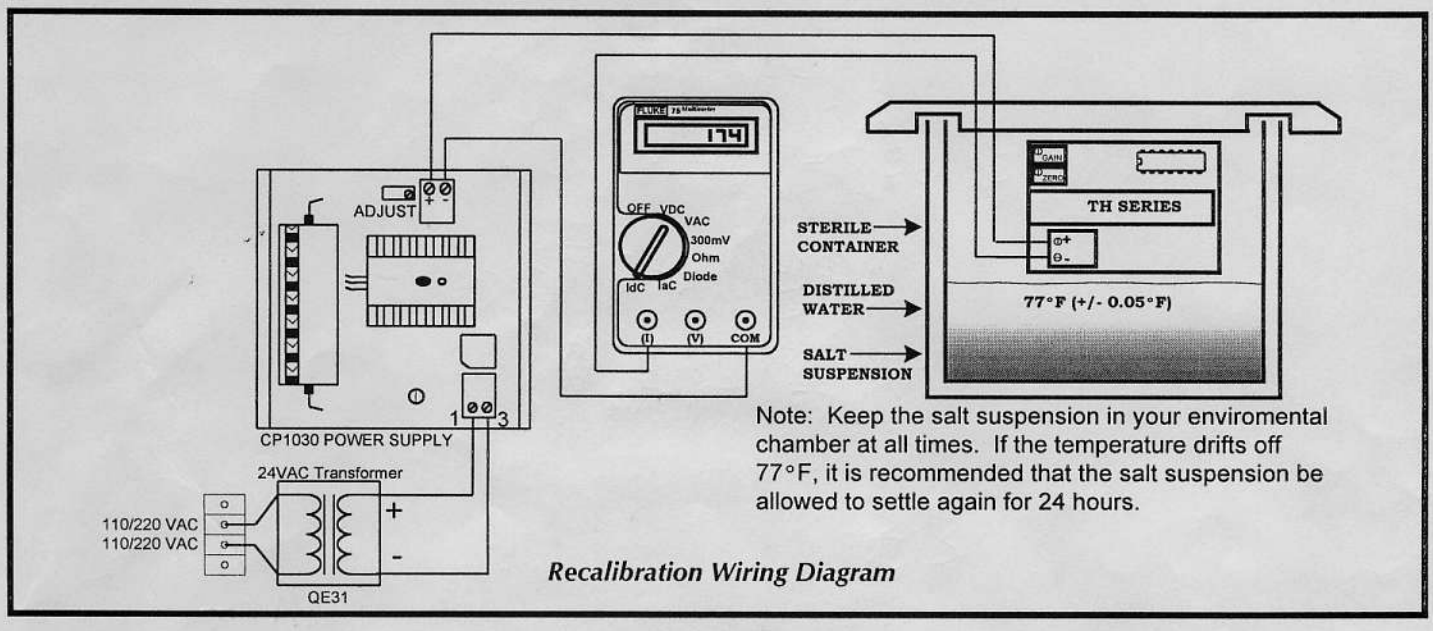
Humidity Transmitter Field Recalibration Procedure



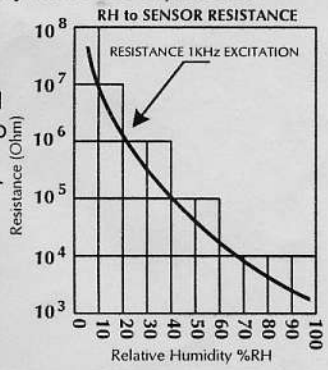
Note: Keep the salt suspension in your enviromental chamber at all times. If the temperature drifts off 77°F, it is recommended that the salt suspension be allowed to settle again for 24 hours.

Recalibration Wiring Diagram

PRECALIBRATION

1) A TCS relative humdity simulator or precision decade box
2) A 8-35VDC regulated power supply (CP1030 and QE31)
3) An accurate (DMM) current meter
4) Three sterile containers
5) An ample amount of distilled water
6) A set of calibration salt suspensions
7) An enviromental chamber set at 77°F +/-0.005°F

Simulated humidity: Before the humidity sensor can be matched to the 4-20mA humidity transmitter it has to be precalibrated. This is accomplished by simulating the humidity with a set of precision resistors. The below chart describes the approximate resistance, relative to humidity. Since the humidity sensor alters a frequency transmitted by the 4-20 mA transmitter, relative to humidity, using a precision resistor will only simulate the humidity sensor within +/- 15% RH. For the "precalibration" procedure, this is close enough. For this example, the precalibration is performed at 20%RH, 50%RH, and 80%RH of the overall range. The resistive values used will be 15 Meg. Ohms, 150K Ohms, and 15K Ohms respectively.



Wiring: Remove the humidity sensor from the transmitter and install the simulator. If using a precision decade box, a simple jig will have to be fashioned. Connect the (+) positive of the regulated power supply to the (+) positive terminal of the humidity transmitter. Connect the (-) negitive terminal of the humidity transmitter to the (+) positive input lead of your (digital) current meter. Connect the(-) common output lead of the (digital) current meter to the (-) negitive (Ground) of the power supply. See above diagram.

PRECALIBRATION PROCEDURE:

1) Apply power to the circuit (8-35VDC).
2) Set the simulator for 20%RH or approximately 15Meg ohm's.
3) Adjust the "Zero" pot until the 4/20mA. current output equals approximately 7.200mA.
4) Set the simulator for 80%RH or approximately 15Kohm's
5) Adjust the "SPAN" or "GAIN" pot until the 4/20mA current output equals approximately 16.8mA.
6) Redo steps 2 thru 5 until the accuracy desired is achieved.
7) Set the simulator for 50%RH or approximately 150K ohm's.
8) Verify that the 4/20mA current output if approximately 12mA.

This is the extent of the precalibration procedure.

MAIN CALIBRATION PROCEDURE

Salt suspensions needed: In order for the humidity transmitter to be fully calibrated. The humidity sensor must be matched to the transmitter. A set of salt suspensions will now have to be mixed. The below chart explains the chemicals needed.

Solusion Title	%RH Cnt.	Chem. Formula
Potassium Acetate	22.500%RH	CH_3 CooK
Magnesium Nitrate	52.900%RH	$Mg(NO_3)_2 \cdot GH_2O$
Potassiun Nitrate	93.600%RH	KNO_3

For this example: A 22.5%RH potassium acctate, 52.9%RH magnesium nitrate, and 93.6%RH potasium nitrate solution will be needed.

Mixing salt suspensions: Using the three sterile containers, cover the bottom of each container, about 1/4", with the above described chemicals. Using three separate mixing spoons in doing so, the chemicals cannot interact with each other. Mix the salt chemicals with FULLY distilled water, leaving about 1/8" of water just above the saturated salt brine. The salt suspension will now feel very warm and very cold. Cover the top of the distilled water for about 24 hours in an enviromental chamber set at 77°F +/- 0.05°F.

Wiring and setup: After 24 hours, reconnect the humidity transmitter to the current meter and power supply, same as described previously. The humidity transmitter must be placed inside the first container "22.50%RH suspension" The humidity transmitter can not, at any time, touch the salt suspension.If it does the transmitter could be damaged, and have to be replaced.

CALIBRATION:

1) Apply power to the circuit.
2) Monitor the 4/20mA current output.
3) Keep your enviromental chamber set at 77°F +/-0.05°F.
4) Your first test is at the 22.50%RH suspension. Allow the humidity transmitter to settle at this PPM%RH level for 1 hour.
5) Adjust the "ZERO" pot until the 4/20mA current output equals 7.60mA.
6) Remove the transmitter from the 22.50%RH suspension and place it in the 93.6%RH suspension. Allow the transmitter to settle at this PPM%RH level for an hour.
7) Adjust the "SPAN" pot until the 4/20mA current output equals 18.97mA.
8) Redo steps 4 thru 7 until the accuracy desired is achieved.
9) Remove the transmitter from the the 93.6%RH suspension and place it in the 52.9%RH suspension. Allow the transmitter to settle at this PPM%RH level for 1 hour.
10) Observe the 4/20mA current output. It should read 12.464mA. The deviation from this value, describes the inaccuracy at your midpoint of FSO. If this value is not within your desired accuracy, redo steps 3 thru 10 until that accuracy desired is achieved.

CHARTS & FORMULAS

Equilibrium Relative Humidity Values for the Selected Saturated Aqueous Salt Suspensions

TEMP. (°F)	Potassium Acctate PPM%RH@ (°F)	Potassium Nitrate PPM%RH@(°F)	Potassium Nitrate PPM%RH@(°F)
32.00	----------	60.4 +/- 0.6	96.3 +/- 2.9
41.00	----------	58.9 +/- 0.4	96.3 +/- 2.1
50.00	23.4 +/- 0.5	57.4 +/- 0.3	96.0 +/- 0.7
59.00	23.4 +/- 0.3	55.9 +/- 0.3	95.4 +/- 1.0
68.00	23.1 +/- 0.3	54.4 +/- 0.2	94.6 +/- 0.7
77.00	22.5 +/- 0.3	52.9 +/- 0.2	93.6 +/- 0.6
86.00	21.6 +/- 0.5	51.4 +/- 0.2	92.3 +/- 0.6
95.00	----------	49.9 +/- 0.3	90.8 +/- 0.8
104.00	----------	48.4 +/- 0.4	89.0 +/- 1.2
113.00	----------	46.9 +/- 0.5	87.0 +/- 1.8
122.00	----------	45.4 +/- 0.6	84.8 +/- 2.5

Current to %RH Calculation Formula:

$$\%RH = 100 \times \left(\frac{C-4}{16}\right)$$

%RH to Current Calculation Formula:

$$C = \left(\frac{\%RH}{100}\right) \times 16 + 4$$

C = Current "4/20mA" %RH = Relative Humidity

CONVERSION TABLE: %RH TO mA

% RH	mA	% RH	mA	% RH	mA
0.000	4.000	35.000	9.600	70.000	15.200
5.000	4.800	40.000	10.400	75.000	16.000
10.000	5.600	45.000	11.200	80.000	16.800
15.000	6.400	50.000	12.000	85.000	17.600
20.000	7.200	55.000	12.800	90.000	18.400
25.000	8.000	60.000	13.600	95.000	19.200
30.000	8.800	65.000	14.400	100.000	20.000

FIELD CALIBRATION ADJUSTMENT SUGGESTIONS

Once the relative humidity transmitter is installed in the field, verify that the 4/20mA current output is proportional to the %RH. If the transmitter is installed in new construction, dirt and debris may have clogged the sensor input screens. This will cause the 4/20mA current output to read low, and out of calibration. Using FULLY distilled water, simply dip the sensor into the water, with a gentle shaking motion. This will clean the sensor out. Allow the sensor to dry for an hour before applying power. If the 4/20mA current output is still reading incorrectly, within + or - 10% only, "using a relative humidity reference" adjust the "ZERO" pot only to correct the readings.

FIELD WIRING SUGGESTIONS

When running 2 conductor cable for your transmitter, it is highly suggested that a shielded cable be used. Also keeping the cable away from high current and inductive loads will retain your transmitters original signals. Many high voltage cables can actually add more power to a transmitter signal, giving it the appearance that the calibration is incorrect. When in fact, because your signal lines are running too close to those inductive loads, your transmitters signal has now been corrupted. Using a shielded cable, that is grounded at one end, can eliminate this problem. Also running your signal lines in separate conduit, can greatly reduce inductive transfers to transmitter lines.

CONVERSION TABLE: °F TO °C

°F	°C	°F	°C	°F	°C
0.00	-17.78	55.00	12.78	110.00	43.33
5.00	-15.00	60.00	15.56	115.00	46.11
10.00	-12.22	65.00	18.33	120.00	46.89
15.00	-9.44	70.00	21.11	125.00	51.67
20.00	-6.67	75.00	23.89	130.00	54.44
25.00	-3.89	80.00	26.67	135.00	57.22
30.00	-1.11	85.00	29.44	140.00	60.00
35.00	1.67	90.00	32.22	145.00	62.78
40.00	4.44	95.00	35.00	150.00	65.56
45.00	7.22	100.00	37.78	155.00	68.33
50.00	10.00	105.00	40.56	160.00	71.11

The electrical drawings and wiring suggestions described in this engineering article, are strickly intended for the TCS Basys Controls product line. Temperature Control Specialties will not be held liable for any damage inflicted.