Configuring a 4-20 mA RH sensor

Effects: ASIC/1-8X55
Date: October 16, 1998

Note No. TE015

The ASIC/1-8X55 has eight inputs; however, not all eight are required for operation with most configurations. Spare inputs may be used to measure other conditions, including relative humidity. The ASI relative humidity sensor (Order Number ASI-RH#-X) converts a bulk polymer resistance change to a linear 4 to 20 mA output. The signal can be transmitted over long distances on unshielded twisted-pair wire as the current signal is not affected by lead wire resistance or electrical noise. This technical note provides further information about how to configure a linear 4 to 20 mA relative humidity sensor.

NOTE: A 4 to 20 mA transducer requires a 249 ohm, 0.1%, external resistor between the input and common, and the removal of the pull-up resistor. This will generate a 1 Vdc to 5 Vdc input voltage. CAUTION: The common input connection is identical with the building ground. The common of the transducer MUST be referenced to building ground.

Below is the step-by-step method to setting up the humidity sensor.

Using SET8055, press F5 and page down to Page 7. The screen will look like this:

```
F1-Help  F2-Next         F4-Calb F5-Setup F6-Balance F7-Poll F9-Trend F10-Exit
+ Dynamic Data  - 8055 Mode ----------------------------------------------------+
¦  State            :Occupied            Personality      : 1                  ¦
¦  Mode             :Deadband            AUX 1 Duct Temp  : 240.0  F           ¦
¦  Cooling SP       : 74        F        AUX 2 Duct Temp  : 240.0  F           ¦
¦  Zone Temp        : 75.6      F        Changeover Mode  :Off                 ¦
¦  Heating SP       : 72        F                                              ¦
¦  CLG Damper Status:Close                                                     ¦
¦  CLG Calculation  :    0    CFM        HTG Calculation  :  0 %               ¦
¦  Primary Airflow  :    0    CFM        Secondary Airflow:    0    CFM        ¦
+ Operating Parameters for Device # : 16000 ----------------------------------¦
¦  Input Convert 1 :1_4  Zone Temp degF              CustomSpan  IN-5:4094     ¦
¦  Input Convert 2 :3_0  -100%,0,+100%, Slide Switch CustomOffsetIN-5:   0     ¦
¦  Input Convert 3 :0_0  Raw, 12 bits                CustomSpan  IN-6:4094     ¦
¦  Input Convert 4 :2_2  Primary Airflow,   CFM      CustomOffsetIN-6:   0     ¦
¦  Input Convert 5 :2_3  Secondary Airflow, CFM      CustomSpan  IN-7:4094     ¦
¦  Input Convert 6 :1_2  Temp degF 1.82K             CustomOffsetIN-7:   0     ¦
¦  Input Convert 7 :1_2  Temp degF 1.82K             CustomSpan  IN-8:4094     ¦
¦  Input Convert 8 :1_2  Temp degF 1.82K             CustomOffsetIN-8:   0     ¦
¦                                                                             ¦
¦  Input Overrides :None                            Zone Sensor Bias:0.0      ¦
+-----------------------------------------------------------------------------¦
¦  Cursor Movement - Arrows, Scroll PgUp/PgDn, Value :                         ¦
+-----------------------------------------------------------------------------+
 Product: 8055 Ver: 1.6 F/W: 155A    15:31:59  10/15/1998  Remote        Page 7
```

Arrow down to the Input Convert 7 field and press the space bar, then press Enter. Press the up arrow until Custom Input is highlighted, then press Enter. The convert type should then read 6_1 Custom Input. Arrow down to the CustomSpan IN-7 field and type 125, then press Enter. After the field updates and displays 125, press the Alt and F2 keys simultaneously. You will then see a screen like this:

```
Table Write Utility, uses 7D Command
```

```
+------------------------------------------------------------------------------+
|        Device Address : 16000                                                |
|  Table =                                                                     |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
+------------------------------------------------------------------------------+
 Product: 8055 Ver: 1.6 F/W: 155A                          Remote Basic Host
```

Type 8 next to Table =, then press Enter. Type 22 next to Start =, then press Enter. Type 2 next to Number =, then press Enter. Next to Byte 22: ?=, type E7, press Enter, then type FF and press Enter. Press Enter to download, then Esc to exit. Press the Ctrl and F3 keys simultaneously to refresh the static data, and your screen should look like this:

```
F1-Help  F2-Next         F4-Calb F5-Setup F6-Balance F7-Poll F9-Trend F10-Exit
+ Dynamic Data  - 8055 Mode ------------------------------------------------+
|  State            :Occupied            Personality      : 1               |
|  Mode             :Cooling             AUX 1 Duct Temp  : 240.0  F        |
|  Cooling SP       : 74        F        AUX 2 Duct Temp  : 1.0  FFF        |
|  Zone Temp        : 74.7      F        Changeover Mode  :Off              |
|  Heating SP       : 72        F                                           |
|  CLG Damper Status:Open                                                   |
|  CLG Calculation  :  463    CFM        HTG Calculation  :  0 %            |
|  Primary Airflow  :    0    CFM        Secondary Airflow:    0    CFM     |
+ Operating Parameters for Device # : 16000 ---------------------------------|
|  Input Convert 1 :1_4  Zone Temp degF              CustomSpan  IN-5:4094   |
|  Input Convert 2 :3_0  -100%,0,+100%, Slide Switch CustomOffsetIN-5:   0   |
|  Input Convert 3 :0_0  Raw, 12 bits                CustomSpan  IN-6:4094   |
|  Input Convert 4 :2_2  Primary Airflow,   CFM      CustomOffsetIN-6:   0   |
|  Input Convert 5 :2_3  Secondary Airflow, CFM      CustomSpan  IN-7: 125   |
|  Input Convert 6 :1_2  Temp degF 1.82K             CustomOffsetIN-7: -25   |
|  Input Convert 7 :6_1  Custom Input                CustomSpan  IN-8:4094   |
|  Input Convert 8 :1_2  Temp degF 1.82K             CustomOffsetIN-8:   0   |
|                                                                           |
|  Input Overrides :None                             Zone Sensor Bias:0.0   |
+---------------------------------------------------------------------------|
|  Cursor Movement - Arrows, Scroll PgUp/PgDn, Value :                      |
+------------------------------------------------------------------------------+
 Product: 8055 Ver: 1.6 F/W: 155A    15:45:11  10/15/1998  Remote        Page 7
```

Press F7 to view the Polling screens and page down to Page 3 to view the inputs. The Convert value for Input 7 should then read between 0 and 100 for % RH.

The Magic Behind the setup

Custom Span and Offset

The Custom Span is the signed difference between the input value at 5 Vdc minus the input value at 0 Vdc. The Custom Offset is the input value at 0 Vdc. When using a 4 to 20 mA sensor with a 249 ohm resistor, the controller reads a 1 to 5 Vdc signal corresponding to 0 to 100% RH. The 5 Vdc input value is 100, and the 1 Vdc signal is 0. This corresponds to 25% RH per 1 Vdc, so the 0 Vdc signal would be 0% RH – 25% RH = -25% RH. 100% RH – (-25% RH) = 125% RH, which is used as the Custom Span. Since the 0 Vdc signal has been calculated to be –25% RH, the Custom Offset must be set to –25. SET8055 is not able to set

the Custom Offset to negative values. When a negative Custom Offset is desired, the Table Write Utility must be used.

Table Write Utility

The Table Write Utility, accessed by pressing the Alt and F2 keys simultaneously, is used to directly write to tables in the ASIC/1-8X55. Custom Span and Offset values are stored in Table 8 as follows:

Custom Input Parameters LO Byte, HI Byte

Entry	Description
12,13	Custom Span IN-5
14,15	Custom Offset IN-5
16,17	Custom Span IN-6
18,19	Custom Offset IN-6
20,21	Custom Span IN-7
22,23	Custom Offset IN-7
24,25	Custom Span IN-8
26,27	Custom Offset IN-8

Values are stored in the ASIC/1-8X55 as hexadecimal values. The Custom Offset for IN-7 is stored in Entries 22 and 23. A –25 value is represented in hexadecimal form as FF E7. The Table Write Utility asks for Table, Starting Entry, and Number of Entries as Table, Start, and Number. To write to Table 8, Entries 22 and 23, you would enter Table = 8, Start = 22, and Number = 2. To set the Custom Offset for other inputs, you would only change the Starting Entry. For example, to set the Custom Offset for IN-6, the Starting Entry would be 18.