Technical Note

Using Alarms on the Honeywell HumidIcon™ Digital Humidity/Temperature Sensors: HIH-6130/6131 Series

1.0 Introduction

The Honeywell HumidIcon™ Digital Humidity/Temperature Sensors: HIH-6130/6131 Series support up to two configurable alarm outputs which can be used to monitor whether the ambient humidity has risen or fallen below preprogrammed values. The alarms have configurable thresholds, polarity and outputs to provide flexible interfacing with other components.

This document describes:

- Alarm functionality
- Configuration options
- How to combine alarms
- How do disable alarms

2.0 Alarm Output

The alarm output can be used to indicate whether a predefined humidity level has been reached. The alarms can be configured in two ways:

- As an open-drain output to drive a load connected to VDD (see Figure 1).
- As a full push-pull driver for interfacing with a microcontroller or to drive a high voltage external device, (see Figure 2).

If available, both alarms can be used at the same time. The alarm outputs are updated when a measurement cycle is completed.

3.0 Alarm Functionality

There are four registers associated with the alarm thresholds (see Appendix A for the EEPROM addresses):

- Alarm_High_On
- Alarm_High_Off
- Alarm_Low_On
- Alarm_Low_Off

Each register contains a 14-bit value that determines the humidity at which the alarm turns on or off. The two Alarm_High registers set the hysteresis of the Alarm_High pin, while the two Alarm_Low registers set the hysteresis for the Alarm_Low pin (see Figure 3).

Figure 3. Alarm Hysteresis

- Alarm_High_On register determines the humidity threshold where the high alarm is activated.
- Alarm_High_Off register determines the humidity threshold where the high alarm is deactivated.
- Alarm_Low_On register determines the humidity threshold where the low alarm is activated.
- Alarm_Low_Off register determines the humidity threshold where the low alarm is deactivated.

NOTICE

Alarm registers may only be accessed using Command Mode. (See Technical Note “Entering and Using Command Mode on Honeywell Digital/Temperature Sensors”.)

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The contents of the alarm registers correspond to humidity as follows:

\[
\text{Humidity (\%RH)} = \frac{\text{RegisterContents}}{2^{14} - 1} \times 100\%
\]

Thus, 0 \%RH = 0x0000 and 100 \%RH = 0x3FFF or 16383.

For example, to enable the Alarm_High output at humidity above 80 \%RH:

\[
\text{Alarm}_\text{High}_\text{On} = \frac{80 \%RH}{100\%} \times (2^{14} - 1) = 13107 \text{ or } 0 \times 3333
\]

Similarly, to enable the Alarm_Low output at humidity below 10 \%RH:

\[
\text{Alarm}_\text{Low}_\text{On} = \frac{10 \%RH}{100\%} \times (2^{14} - 1) = 1638 \text{ or } 0 \times 0666
\]

Alarm hysteresis is equivalent to the difference between the registers.

A minimum hysteresis of 3\% RH is recommended.

High and Low Alarm flow charts are shown in Figure 4.

4.0 Alarm Configuration

A fifth register, the Customer Configuration Register (see Appendix B), is associated with the alarm outputs and contains the configuration bits. Both alarms may be configured independently using the Alarm_Low_CFG and Alarm_High_CFG bits (see Table 1).

<table>
<thead>
<tr>
<th>Bit (No.)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Alarm_Low Polarity:</td>
</tr>
<tr>
<td></td>
<td>0 = Active_Low, 1 = Active_Low</td>
</tr>
<tr>
<td>8</td>
<td>Alarm_Low Output Configuration:</td>
</tr>
<tr>
<td></td>
<td>0 = Full_Push-Pull, 1 = Open_Drain</td>
</tr>
<tr>
<td>9</td>
<td>Alarm_High Polarity:</td>
</tr>
<tr>
<td></td>
<td>0 = Active_High, 1 = Active_Low</td>
</tr>
<tr>
<td>10</td>
<td>Alarm_High Output Configuration:</td>
</tr>
<tr>
<td></td>
<td>0 = Full_Push-Pull, 1 = Open_Drain</td>
</tr>
</tbody>
</table>

- For applications which interface to other logic circuits, such as a micro-processor or to drive an external device, Full Push-Pull is recommended.
- For driving loads directly connected to the sensor voltage supply open drain would be a typical choice (see Figures 1 and 2).

The polarity of the alarm output is configured using the Alarm Polarity bits. The ability to change the alarm polarity gives the user flexibility in how the sensor interfaces with an application.

In the example shown in Figure 1, the alarm outputs are used to control an LED. For the LED to light up when the alarm is on or active, the alarm output must be low, so the alarm polarity bit should be set to 1, Active_Low.

5.0 Creating Two High or Two Low Alarms

The Alarm Polarity bits also give the user the option to create two high alarms or two low alarms.

Consider an application requiring two high alarms. Conventionally, if the Alarm_Low Polarity is configured as Active High, then the Alarm_Low output will become active (goes high) when the humidity falls lower than the humidity value represented in the Alarm_Low_On register and becomes inactive (goes low) when the humidity rises above the humidity value represented in the Alarm_Low_Off register.

Similarly, if the Alarm_High Polarity is configured as Active High, then the Alarm_High output will become active (goes high) when the humidity rises above the humidity value represented in the Alarm_High_On register and becomes inactive (goes low) when the humidity falls below above the humidity value represented in the Alarm_High_Off register (see Figure 5).
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6.0 Disabling Alarms

If an application does not require the use of alarms, then the alarms may be disabled by setting registers Alarm_High_On and Alarm_High_Off to their maximum value (0x3FFF) and registers Alarm_Low_On and Alarm_Low_Off to their minimum value (0x0000). In this configuration the alarm outputs must be left unconnected in the application.

7.0 Appendices

7.1 Appendix A. EEPROM Memory Map

Table 2 shows the EEPROM Memory Map.

<table>
<thead>
<tr>
<th>EEPROM Address</th>
<th>Default</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00 to 0x15</td>
<td>N/A</td>
<td>reserved</td>
<td>do not change; must be left at factory settings; locked EEPROM locations</td>
</tr>
<tr>
<td>0x16</td>
<td>0x0000</td>
<td>reserved</td>
<td>do not change; must be left at factory settings</td>
</tr>
<tr>
<td>0x17</td>
<td>0x0000</td>
<td>reserved</td>
<td>do not change; must be left at factory settings</td>
</tr>
<tr>
<td>0x18</td>
<td>0x3FFF</td>
<td>Alarm_High_On</td>
<td>high alarm on trip point</td>
</tr>
<tr>
<td>0x19</td>
<td>0x3FFF</td>
<td>Alarm_High_Off</td>
<td>high alarm off trip point</td>
</tr>
<tr>
<td>0x1A</td>
<td>0x0000</td>
<td>Alarm_Low_On</td>
<td>low alarm on trip point</td>
</tr>
<tr>
<td>0x1B</td>
<td>0x0000</td>
<td>Alarm_Low_Off</td>
<td>low alarm off trip point</td>
</tr>
<tr>
<td>0x1C</td>
<td>0x0027</td>
<td>Cust_Config</td>
<td>Customer Configuration Register (see Section 4.0)</td>
</tr>
<tr>
<td>0x1D</td>
<td>0x0000</td>
<td>reserved</td>
<td>do not change; must be left at factory settings</td>
</tr>
<tr>
<td>0x1E</td>
<td>0xYYYY (Y=data)</td>
<td>Cust_ID2</td>
<td>customer ID word; for use by customer</td>
</tr>
<tr>
<td>0x1F</td>
<td>0xYYYY (Y=data)</td>
<td>Cust_ID3</td>
<td>customer ID word; for use by customer</td>
</tr>
</tbody>
</table>

7.2 Appendix B. Customer Configuration Register

The Customer Configuration Register (see Table 3) is located at EEPROM address 0x1C. It can only be accessed using Command Mode.
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Table 3. Customer Configuration Register

<table>
<thead>
<tr>
<th>Bit</th>
<th>Default</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:0</td>
<td>0101000</td>
<td>device ID</td>
<td>I²C slave address</td>
</tr>
<tr>
<td>8:7</td>
<td>00</td>
<td>Alarm_Low_Cfg</td>
<td>configures the Alarm Low output pin.</td>
</tr>
<tr>
<td>10:9</td>
<td>00</td>
<td>Alarm_High_Cfg</td>
<td>configures the Alarm High output pin.</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>reserved</td>
<td><strong>do not change</strong>; must be left at factory setting</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>reserved</td>
<td><strong>do not change</strong>; must be left at factory setting</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>Fast Startup</td>
<td>sets the Command Window duration: 0 = 10 ms, 1 = 3 ms</td>
</tr>
<tr>
<td>15:14</td>
<td>00</td>
<td>reserved</td>
<td><strong>do not change</strong>; must be left at factory setting</td>
</tr>
</tbody>
</table>

**WARNING**

**PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Failure to comply with these instructions could result in death or serious injury.

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