KMC Input Wizards

Application Guide

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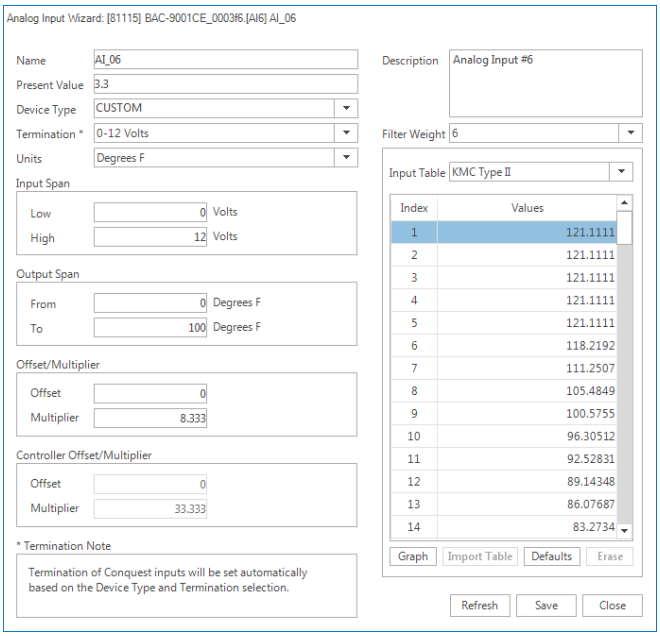

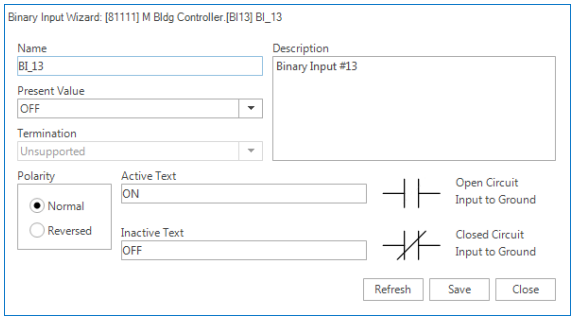

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Introduction to the Binary and Analog Wizards

An easy way to create custom inputs for KMC BACnet controllers is to use the Binary or Analog Input Wizard. The wizards work with all KMC BACnet controller models.

NOTE: The Building Controller (also) has an analogous analog input table wizard in its web interface. See the Creating Custom Tables section in the **BAC-A1616BAC BACnet Building Controller Application Guide** and the Tables section in the **BAC-A1616BAC BACnet Building Controller Installation and Operation Guide** for more information.

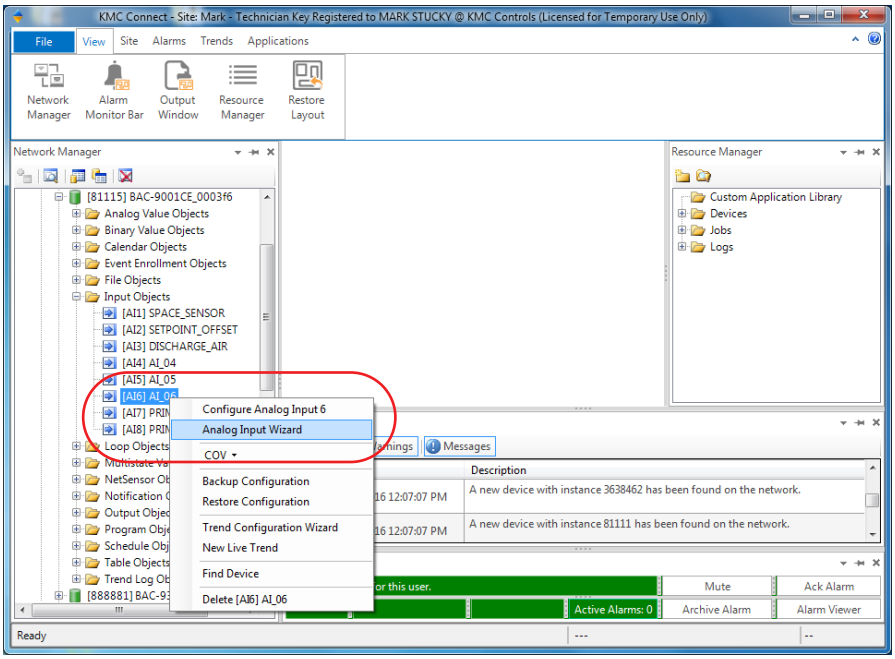
NOTE: WinControl has an option to make custom tables for KMDigital controllers. See the WinControl Help system for more information.

NOTE: Default controller input types and tables already conveniently cover a large number of sensor applications. Creating custom inputs is necessary in relatively few cases.

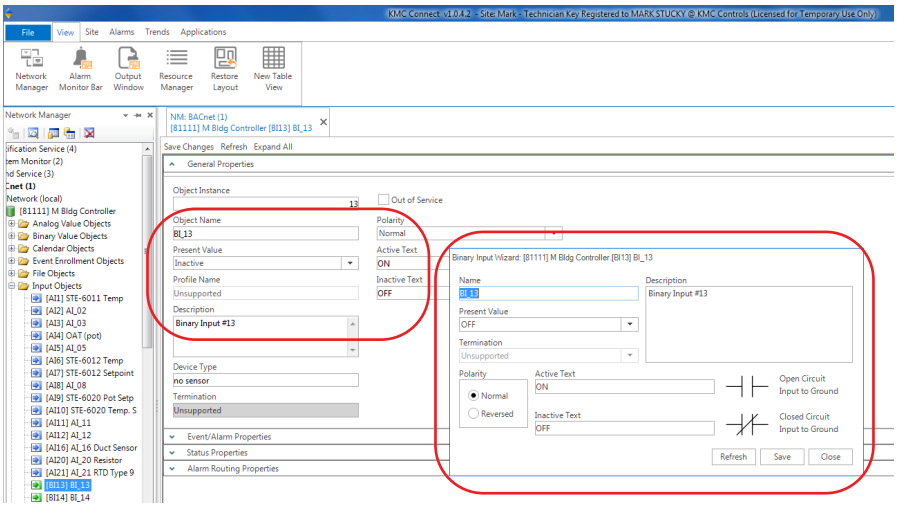
NOTE: To use the custom input, be sure to select the correct applicable hardware input termination jumper or switch position on the controller. (See the relevant controller documentation.) For Conquest controllers, the termination is automatically set by the Device Type and Termination selections in the wizard. For older controllers, a jumper or switch must be checked and physically moved as necessary.

To open the wizard in KMC Connect, TotalControl, or KMC Workbench for Niagara:

1. Right-click the desired input object.
2. Select **Analog Input Wizard** or **Binary Input Wizard**, depending on the type of input.



The Binary Input Wizard, duplicates the configuration function in the standard configuration screens, but it makes the relationship between Polarity, Active/ Inactive Text, and Present Value more intuitive and self-explanatory.

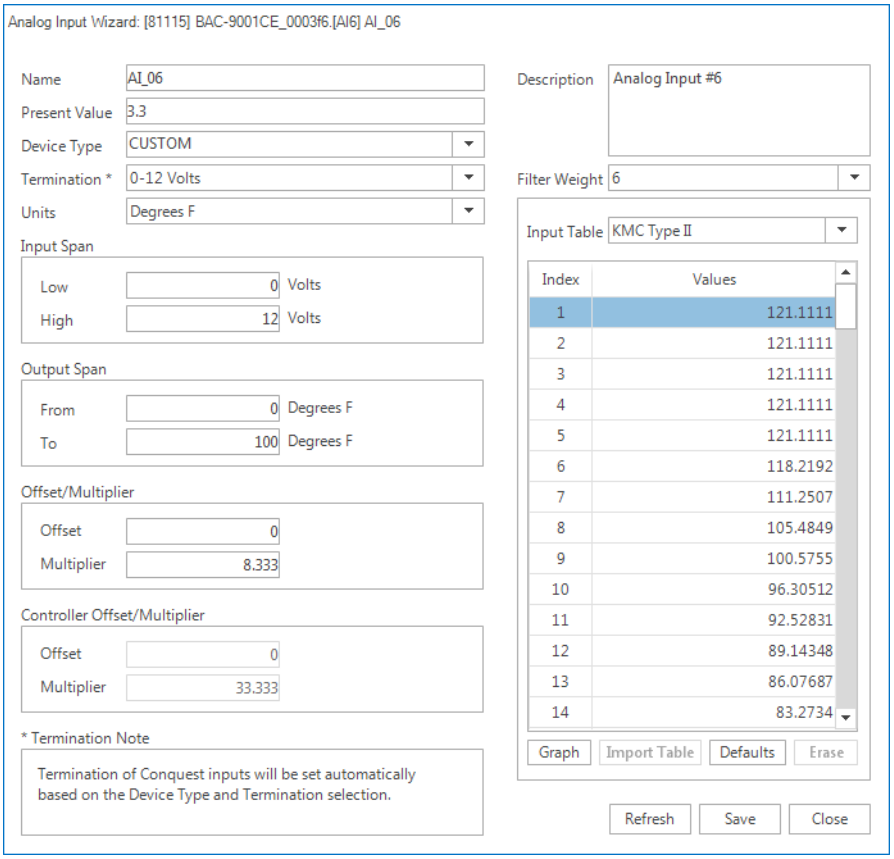


NOTE: The rest of this application guide is devoted to the Analog Input Wizard.

In the Analog Input Wizard, the **Input Span and Output Span** are used with **linear inputs, such as 0–5 VDC, 4–20 mA, or 0–10K potentiometer**. See **Custom Analog Linear Inputs on page 4**.

The **Input Table** is generally used for special **non-linear inputs such as thermistors or RTDs**. See **Custom Analog Inputs with Tables on page 10**.

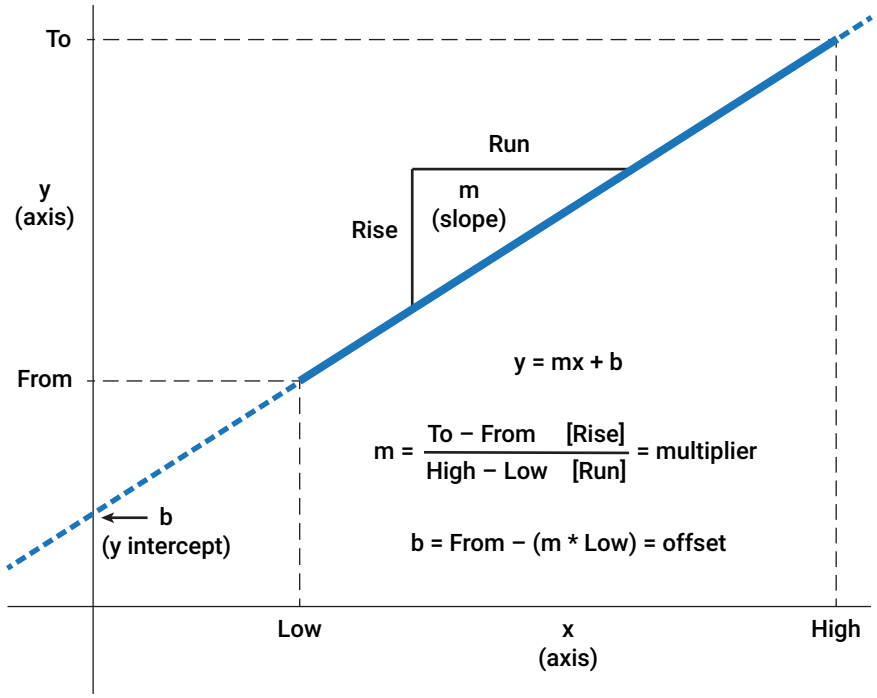
NOTE: For all the applications shown in this document to work properly, **software versions need to be** KMC Connect ver. 1.0.4.2 or later, TotalControl ver. 4.0.0.17 or later, and KMC Workbench ver. 4.1.1.4 or later for Niagara N4 or ver. 3.8.1.9 or later for Niagara AX.



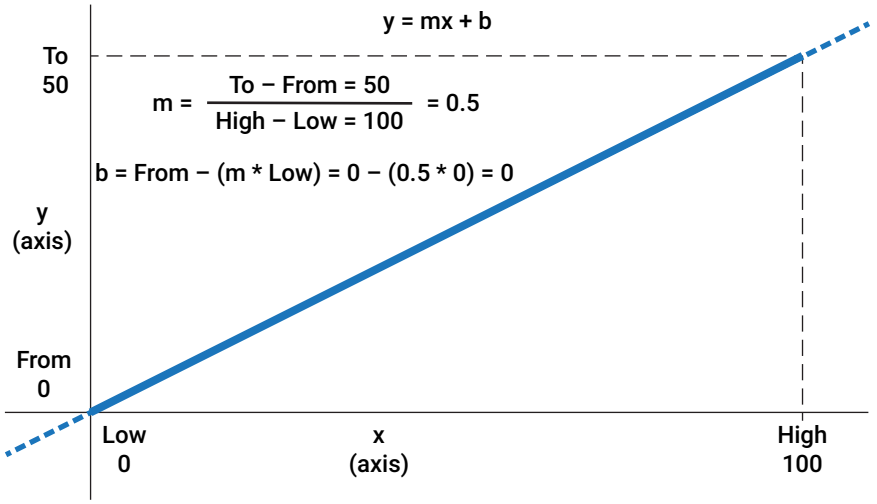
Custom Analog Linear Inputs

Understanding the Math

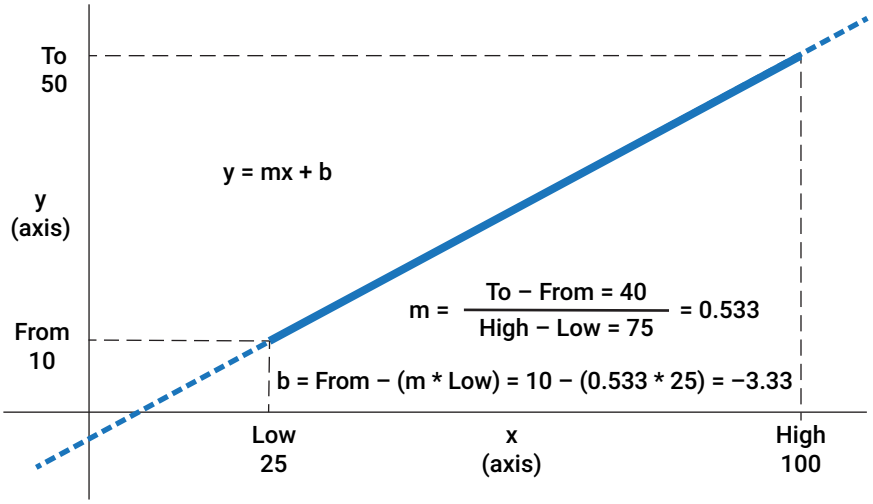
For linear inputs, knowing the calculations that occur behind the scenes is helpful for understanding offsets and multipliers. For linear inputs, the input wizard uses linear equation calculations. A linear equation (or the equation of any straight line) can be written as **y = mx + b**, where m is the slope of the line and b is the y intercept. The y intercept of this line is the value of y at the point where the line crosses the y axis. See the graphs on the following pages for examples.



A simple example is shown below with a slope (multiplier) of 0.5 and a y intercept (offset) of 0.



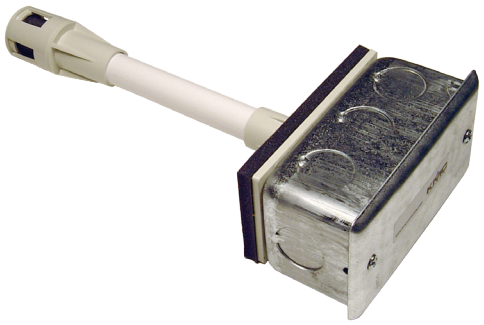
In the next graph, **From** is changed (from 0) to 10 and **Low** is changed (from 0) to 25. The y intercept drops below the x axis to –3.33.



NOTE: In the two previous examples, the x and y axes have the same scale to demonstrate the actual slope. In the examples that follow with actual devices, the x and y axes are **not** to scale.

NOTE: Temperature conversion between Celsius and Fahrenheit scales is also a linear equation. F = 9/5 * C + 32, with 32 as the offset and 9/5 as the multiplier.

NOTE: For more explanation of the formula, see **https://www.mathsisfun.com/equation_of_line.html**. For an interactive graph that demonstrates the relationship between m and b with y, see **https://www.mathsisfun.com/data/straight_line_graph.html**.

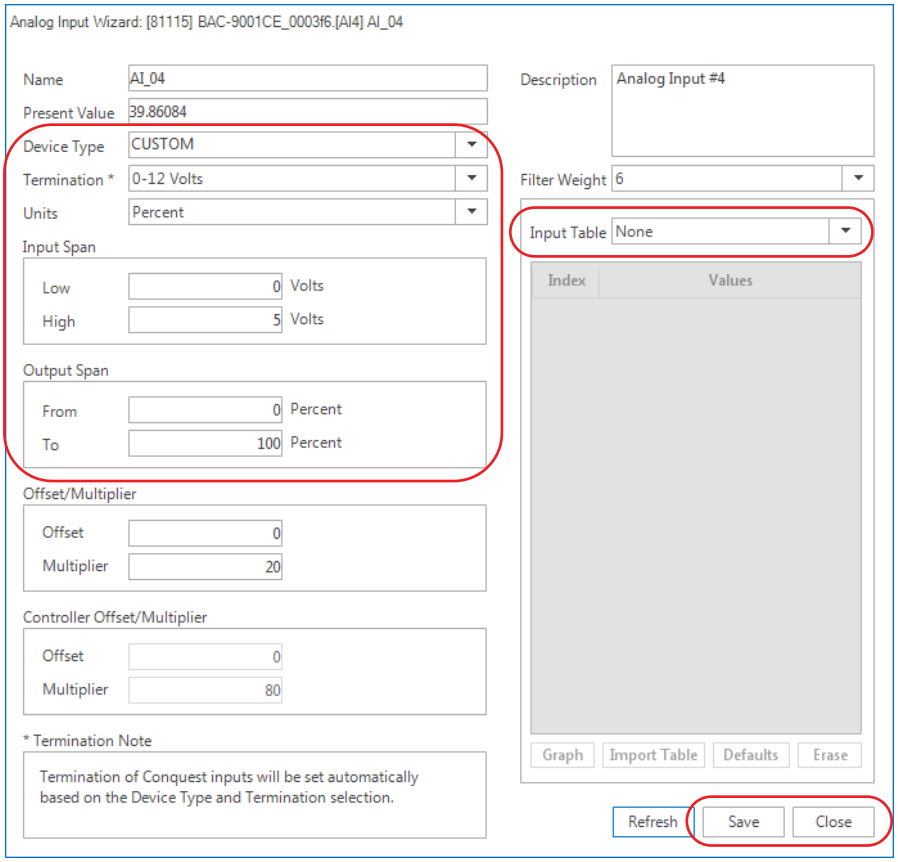


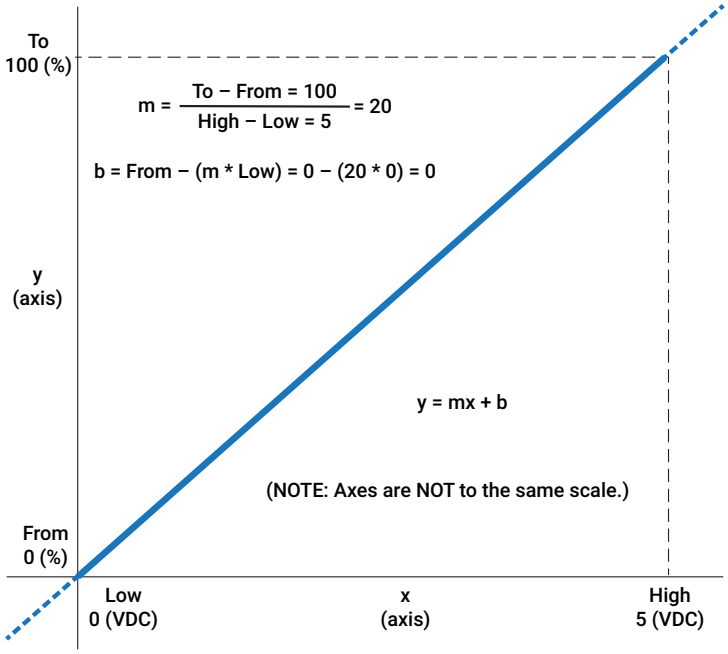
THE-1002 Duct-Mounted Humidity Transmitter (w/ Temp. Sensor)

0–5 VDC Transmitter

To configure a 0–5 VDC humidity transmitter for 0–100% humidity using the input wizard:

1. Set **Device Type** to **CUSTOM**.
2. Set **Termination** to **0–12 Volts**.
3. Set **Units** to P**ercent**.
4. Under **Input Span**, set **Low** to **0 Volts** and **High** to **5 Volts**.
5. Under **Output Span**, set **From** to **0 Percent** and **To** to **100 Percent**.
6. Under **Input Table**, select **None** if it isn't already selected.
7. Click **Save** and then **Close**.





NOTE: This is used as an example. An even easier method for this particular configuration is to simply select **Humidity (0–100% 0–5 V)** in Device Type.

NOTE: Offset and Multiplier are **calculated automatically** from the Input Span and Output Span values. These correspond to the "math" graphs where Offset = b (y intercept) and Multiplier = m (slope).

NOTE: **Controller** Offset/Multiplier cannot be changed by the user. Depending on the Termination setting, an additional multiplier may be needed to compensate for the voltage divider across the controller's input (in the controller's internal circuitry).

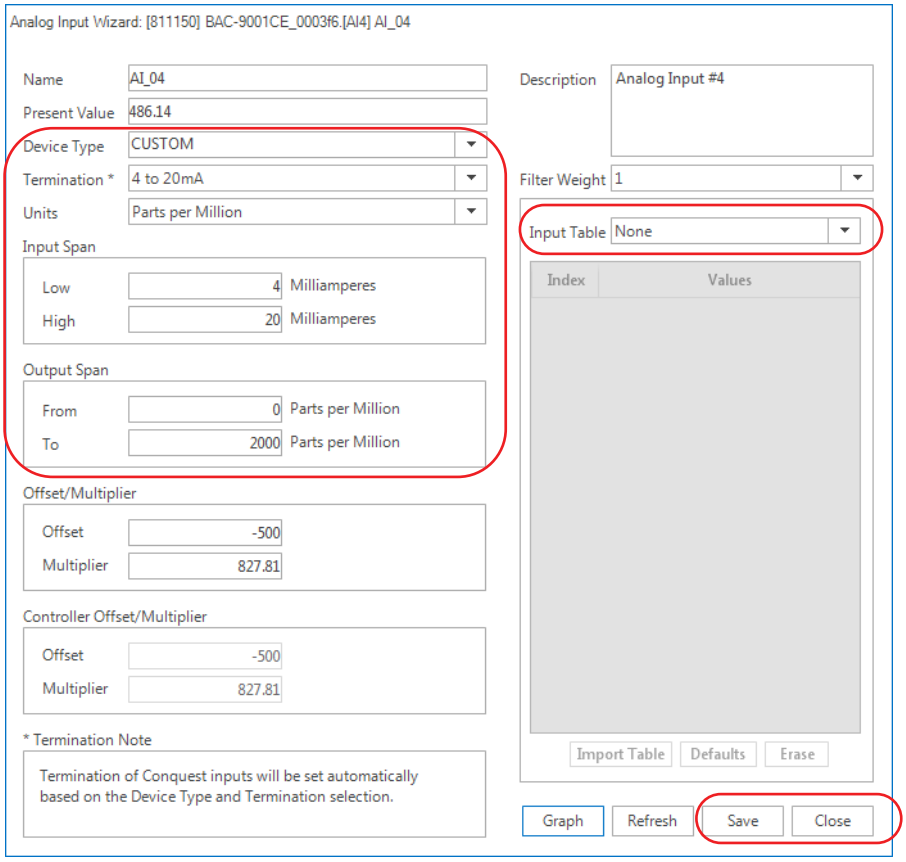
NOTE: Input termination on Conquest controllers can be configured through software, but termination on older controllers must be configured through a jumper or switch.

SAE-1011/1012/1062 CO_2 Transmitters

4–20 mA Transmitter

To configure a 4–20 mA CO_2 transmitter for 0–2000 ppm using the input wizard:

1. Set **Device Type** to **CUSTOM**.
2. Set **Termination** to **4 to 20 mA**.
3. Set **Units** to **Parts per Million**.
4. Under **Input Span**, set **Low** to **4 mA** and **High** to **20 mA**.
5. Under **Output Span**, set **From** to **0 Parts per Million** and **To** to **2000 Parts per Million**.
6. Under **Input Table**, select **None** if it isn't already selected.
7. Click **Save** and then **Close**.

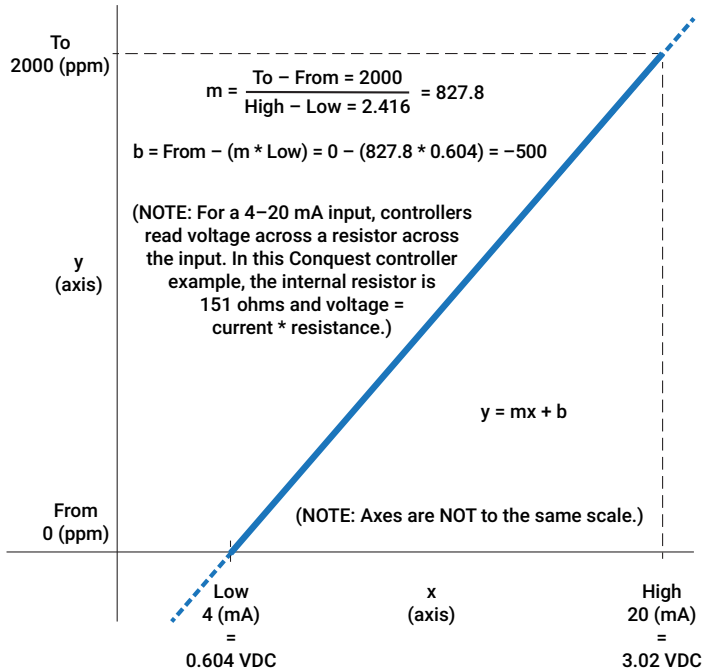


NOTE: This is used as an example. An even easier method for this particular configuration is to simply select **CO2 (0–2000 PPM 4–20 mA)** in Device Type.

NOTE: Offset and Multiplier are **calculated automatically** from the Input Span and Output Span values. These correspond to the "math" graphs where Offset = b (y intercept) and Multiplier = m (slope).

NOTE: **Controller** Offset/Multiplier cannot be changed by the user. Depending on the Termination setting, an additional multiplier may be needed to compensate for the voltage divider across the controller's input (in the controller's internal circuitry).

NOTE: KMC Conquest controllers, the BAC-A1616BC Building Controller, and the KMD-5220 (input module for the LAN Controller) can natively read a 4–20 mA signal on their input terminals (with an internal resistor after proper configuration via a jumper or software). Older KMC controllers require an external 250 ohm (or more readily available 249 ohm) resistor wired across the input and ground terminals. The (internal or external) resistor converts the mA signal into a voltage signal that the controller can recognize. The controller's physical input is then set (via jumpers or switches) for an active voltage sensor, and software configures the internal functioning for 4-20 mA. See the **4–20 mA Wiring for Controllers Application Guide (AG150421)** for more information.

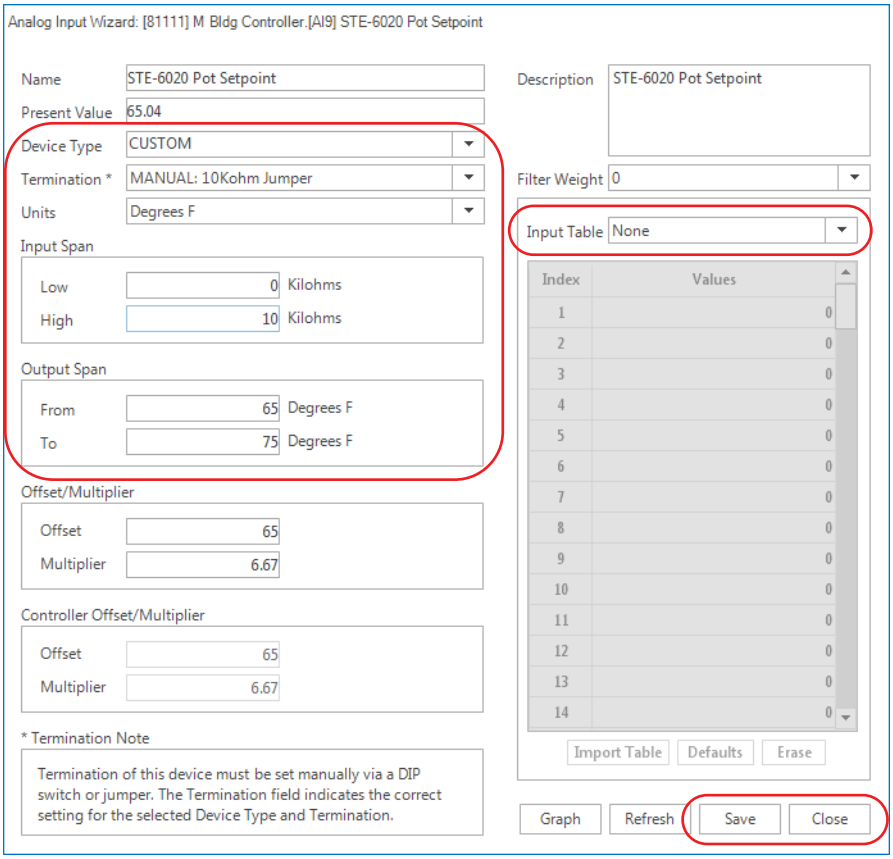


STE-6014 Temperature Sensor with Setpoint

0–10K Ohm Potentiometer

STE-6014/6017/6018/6019 temperature sensors with rotary dial (potentiometer) setpoints had a printed range of 55–90 (°F or equivalent in °C) before 2008. In 2008, the printed numeric °F or °C range on the case was replaced with warmer (sun) and cooler (snowflake) icons. This change allows for a custom setpoint range of nearly any value. To configure a 10K potentiometer for a 65 to 75° setpoint (for an example range on a BAC-A1616BAC Building Controller) using the input wizard:

1. Set **Device Type** to **CUSTOM**.
2. Set **Termination** to **MANUAL: 10K Ohm Pullup**. (Physically place the jumper in the **10K Pull-up** position if it is not already positioned there.)
3. Set **Units** to **Degrees F**.
4. Under **Input Span**, set **Low** to **0 Kilohms** and **High** to **10 Kilohms**.
5. Under **Output Span**, set **From** to **65 Degrees F** and **To** to **75 Degrees F**.
6. Under **Input Table**, select **None** if it isn't already selected.
7. Click **Save** and then **Close**.



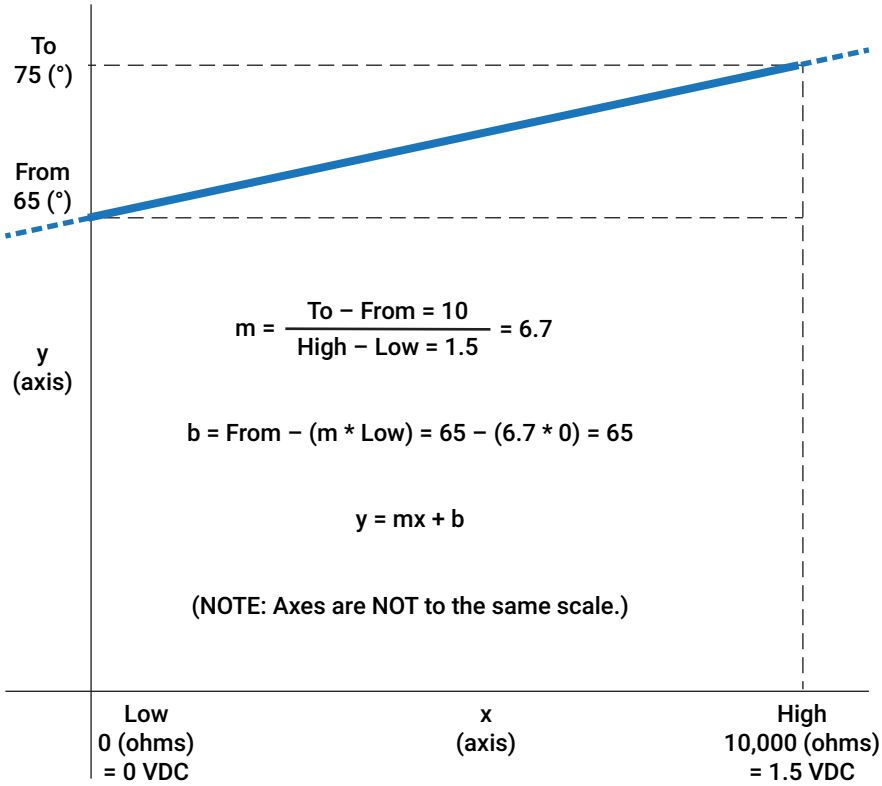
NOTE: Input termination on Conquest controllers can be configured through software, but termination on older controllers must be configured through a jumper or switch.

NOTE: Controllers read the **voltage** across the appropriate termination on their inputs. A potentiometer at 0 ohms (with the potentiometer turned all the way in one direction) produces 0 VDC voltage drop across the 10K ohm pull-up resistor termination of a BAC-A1616BAC Building Controller input. With the potentiometer turned all the way the other direction, 10K ohms produces 1.5 VDC across the BAC-A1616BAC's pull-up resistor. (Other controllers may have different voltage values for a corresponding resistance.)

NOTE: The default range of the offset in Conquest controllers is plus or minus 3° F. This means that, **with the STE-6014/6017, users can adjust the scheduled setpoint by a maximum of three degrees up or down**. To change the range, follow the equivalent of the steps above.

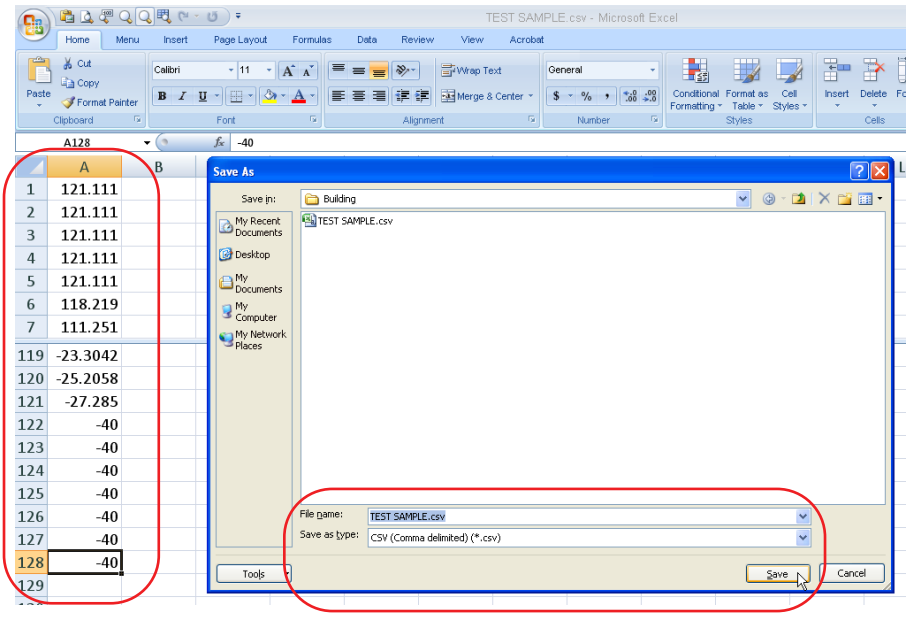
NOTE: Offset and Multiplier are **calculated automatically** from the Input Span and Output Span values. These correspond to the "math" graphs where Offset = b (y intercept) and Multiplier = m (slope).

NOTE: **Controller** Offset/Multiplier cannot be changed by the user. Depending on the Termination setting, an additional multiplier may be needed to compensate for the voltage divider across the controller's input (in the controller's internal circuitry).



Custom Analog Inputs with Tables

Default controller input types and tables already conveniently cover a large number of sensor applications. But custom tables can be created in Microsoft Excel or equivalent software, saved as CSV (Comma Separated Values) files, and imported into the wizard. To create an input table, fill in 128 values and save the file as a CSV (Comma Delimited *.csv) file type.

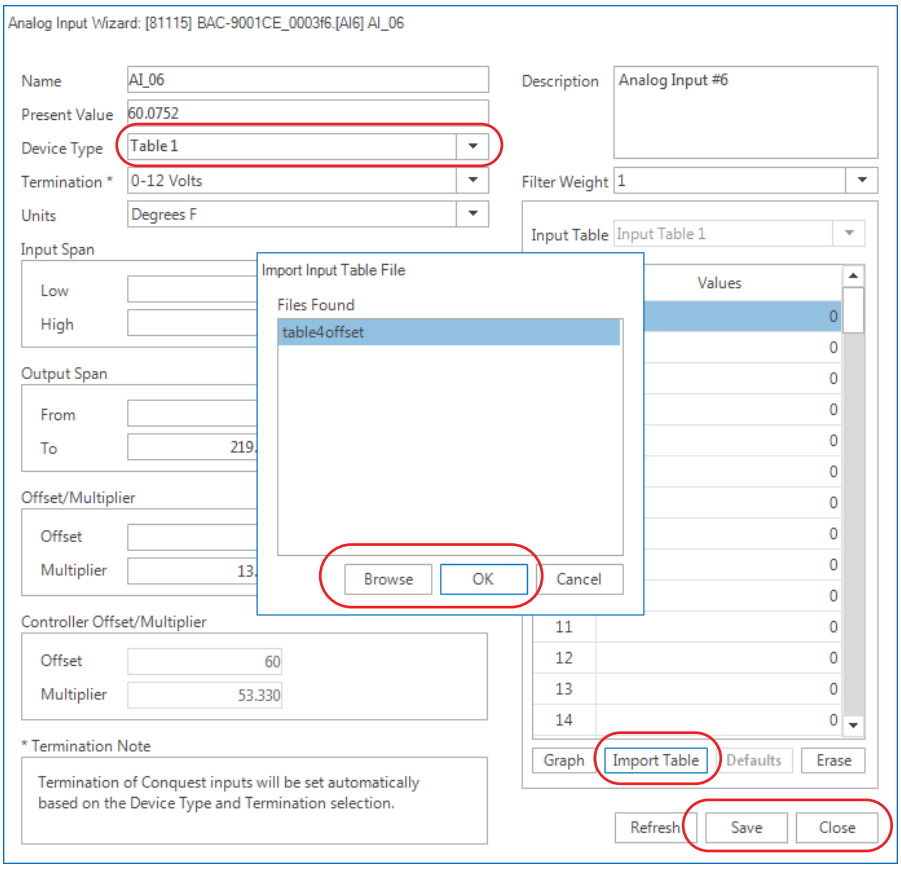


	A
1	121.111
2	121.111
3	121.111
4	121.111
5	121.111
6	118.219
7	111.251
119	-23.3042
120	-25.2058
121	-27.285
122	-40
123	-40
124	-40
125	-40
126	-40
127	-40
128	-40
129	

NOTE: The input table import function imports the first 128 values from the CSV file even if there are more values in the file. Input tables must have 128 values even if many of them are 0. All indexes in all tables must have values, which default to 0. Values should be in a column (not a row).

To use a custom CSV table in the wizard:

1. In **Device Type**, select an unused table.
2. In the **Input Table** section, click the **Import Table** button.
3. Click **Browse** and select the desired file.
4. Click **OK**.
5. Click **Save**.
6. Click **Close**.



Handling Precautions

For **digital and electronic** sensors, thermostats, and controllers, take reasonable precautions to prevent electrostatic discharges to the devices when installing, servicing, or operating them. Discharge accumulated static electricity by touching one's hand to a securely grounded object before working with each device.

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Support

Additional resources for installation, configuration, application, operation, programming, upgrading and much more are available on the KMC Controls web site (**www.kmccontrols.com**). To see all available files, log-in to the KMC Partner site.

For video tutorials on Conquest and Connect, see also the videos on **KMC's YouTube channel**.

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