

# Technical Note

## Scaling Data in Kepware Products

The purpose of this document is to explain how scaling works in Kepware® products, including ThingWorx® Kepware® Server and LinkMaster.

### 1. What is Data Scaling?

Scaling is the process of taking raw data from your device and presenting it in a refined or appropriate value for your application. Kepware products support 2 types of scaling: linear and square root. The majority of scaling is linear scaling.

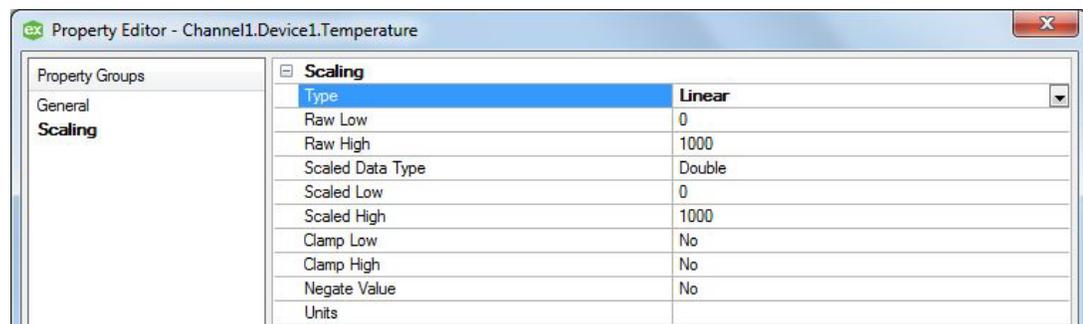
### 2. Scaling in ThingWorx Kepware Server

To configure scaling in ThingWorx Kepware Server do the following.

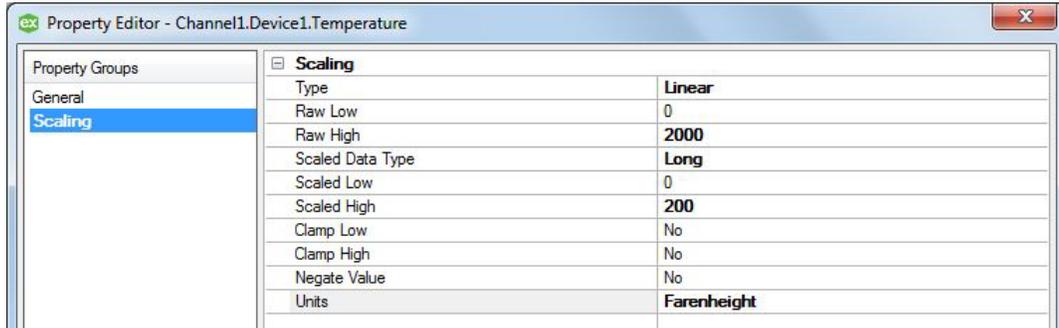
1. Open the tag properties by double-clicking the tag or right-clicking and selecting **Properties**.
2. Select the **Scaling** property group.



3. From the scaling Type drop-down, select **Linear**.



4. Set the value range for the tag in **Raw Low** and **Raw High**.
5. Set the scaled value range in **Scaled Low** and **Scaled High**.
6. Set the data type of the scaled value.



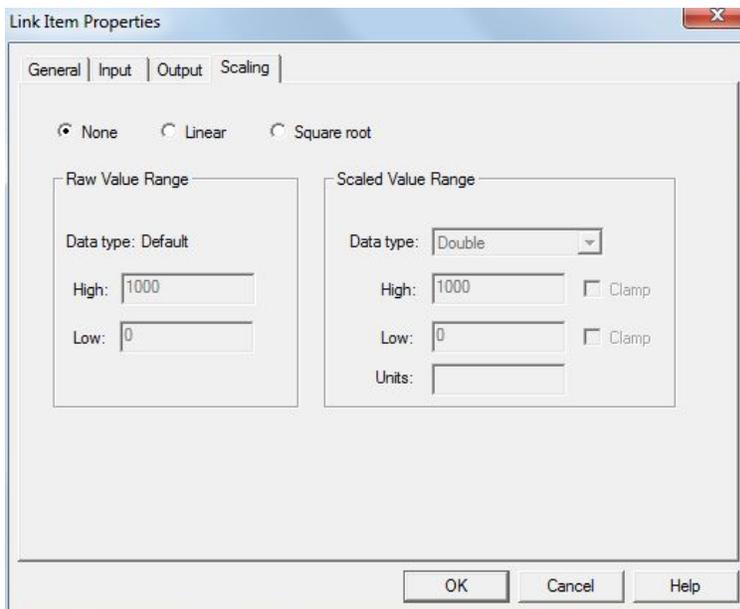
7. Click **Apply** to accept the changes.
8. At this point, a client connecting and getting data from this tag receives the scaled value rather than the raw value. If writes can be completed, the written scaled value is converted to the raw value the device is expecting.

### 3. Scaling in LinkMaster

LinkMaster uses the same scaling as ThingWorx Kepware Server. Scaling is applied to the link input side of a link item and the scaled value is written to the link output or provided to a client application that connects to LinkMaster and reads link items.

To add scaling to a link item:

1. Double-click on a link item or right-click and select **Properties** to open the Link Item Property window.
2. Select the **Scaling** tab.
3. Select the **Linear** radio button.



4. Enter the scaling values as they would be entered in ThingWorx Kepware Server.
5. Click **OK** to accept.

**Note:** Scaling should only be applied in one location. If scaling is applied in the input server, it should not also be set up in LinkMaster.

### 3.1 Linear Scaling

Linear scaling increases or decreases uniformly. A common example would be to take a raw value with a range of 0-1000 as a Word and scale it from 0-100.0 as a Float. Devices such as Loop or Thermo Controls might display a scaled value on the panel, but store that value as a whole number. Scaling is a division by 10 or 100 in linear scale, as shown at right.

Raw Value	Engineering Value
1000	100
900	90
800	80
700	70
600	60
500	50
400	40
300	30
200	20
100	10
0	0

#### 3.1.1 Linear Scaling Formula

Scaling is applied to both reads and writes. Below are the formulas for reading and writing a raw value with linear scaling.

Raw to Scaled (Reading)
$(x - RAW_{Low}) \left( \frac{Scaled_{High} - Scaled_{Low}}{Raw_{High} - Raw_{Low}} \right) + Scaled_{Low}$

Scaled to Raw (Writing)
$(x - Scaled_{Low}) \left( \frac{Raw_{High} - Raw_{Low}}{Scaled_{High} - Scaled_{Low}} \right) + Raw_{Low}$

### 3.2 Square Root Scaling

Square root scaling is for use when higher precision is required in the engineering or scaled value. If the raw value is a 64-bit double-precision float and the client application is not able to handle numbers that high, a linear scale cannot reduce the number to a usable value. Scaling of this nature is typically accomplished in the client application.

#### 3.2.1 Square Root Scaling Formula

Scaling is applied to both reads and writes. Below is the formula for reading and writing a raw value with square root scaling.

Raw to Scaled (Reading)
$\sqrt{(x - RAW_{Low})} \left( \frac{Scaled_{High} - Scaled_{Low}}{\sqrt{Raw_{High} - Raw_{Low}}} \right) + Scaled_{Low}$

### Scaled to Raw (Writing)

$$(x - Scaled_{Low})^2 \left( \frac{Raw_{High} - Raw_{Low}}{(Scaled_{High} - Scaled_{Low})^2} \right) + Raw_{Low}$$

### 3.3 Other Scaling Types

Keeware products currently do not support other scaling types. More advanced scaling can usually be accomplished in client applications. It is also possible to create a Visual Basic application that reads the raw value, applies the formula, and writes the output to another tag or address in the OPC server. Visit the Keeware website Knowledge Base for code examples.