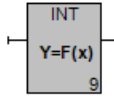


## Function Block 169      Function Generator

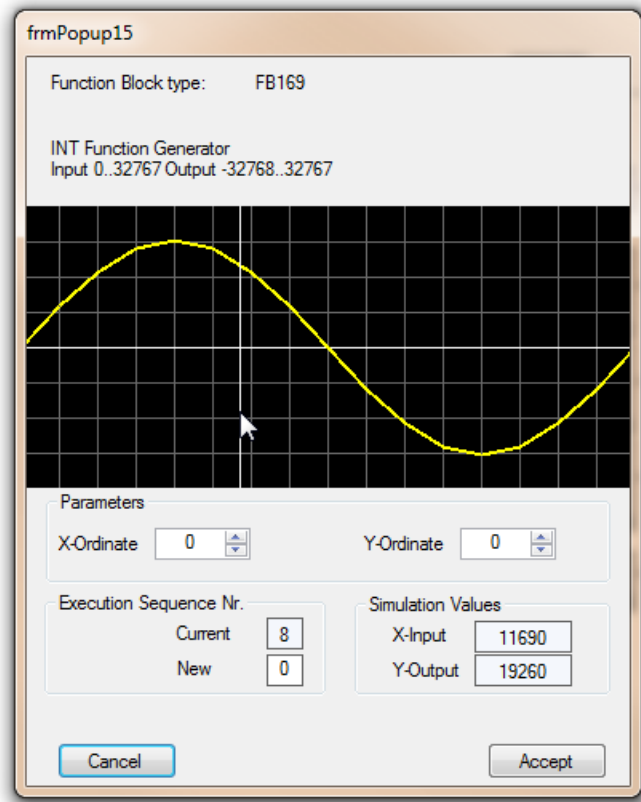
### Function Description

This function enables the user to define the output to input relationship of the function block by specifying a set of 17 X/Y ordinate pairs.



### Popup Parameters

The user must enter a corresponding Y-ordinate value for each of the 17 X-ordinates. The current X-Ordinate is selected using the up-down scroll buttons. The Y-Ordinate value is entered using your keyboard (and Enter key) or the up-down scroll buttons. The actual values that will be produced by the function can be observed in the Simulation Values frame by placing the cursor inside the graph window.

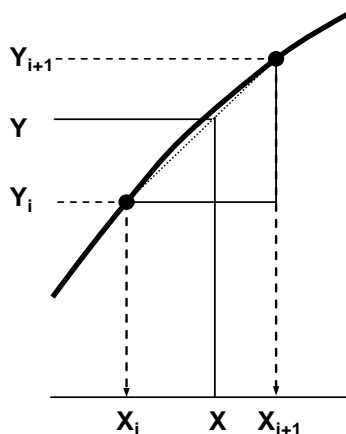


### Algorithm Description

An output/input relationship can be approximated by a number of straight-line segments, and visualizes by the well-known format of an X-Y graph, where the input values are represented on the X-axis and the output values on the Y-axis. The X input range (0...32767) is divided into 16 equal-size segments of length 2048, giving X-ordinates  $X_0$  to  $X_{16}$ . A corresponding  $Y_i$ -ordinate exists for every  $X_i$ -ordinate.

The graph is approximated by 16 straight line segments. The complete graph is defined using a table containing 17 pairs of  $X_i$ ,  $Y_i$  values. In fact we only need to define the 17  $Y_i$  values because the corresponding  $X_i$  value can be calculated as  $X_i = 2048 \cdot (i-1)$ .

The next figure indicates how an output value Y is obtained for a particular input value X, making use of linear interpolation.



From the figure:  $\frac{(Y_{i+1} - Y_i)}{(X_{i+1} - X_i)} = \frac{(Y - Y_i)}{(X - X_i)}$

Extracting Y gives:  $Y = Y_i + \frac{(Y_{i+1} - Y_i) * (X - X_i)}{(X_{i+1} - X_i)}$

This calculation is easily implemented in software if we keep the following in mind:

$$X_{i+1} - X_i = 2048 \quad \dots 2048 = 2^{11}$$

$X - X_i$  is the remainder value of  $X/2048$

The index i is the integer value of  $X/2048$

The index value is then used to obtain  $Y_i$  and  $Y_{i+1}$  from a lookup table.

#### Inputs and Output

Type	Description	Data Type	Range
Input	Input signal (X-value)	INT	0.....32767
Output	Output signal (Y-value)	INT	-32768.....+32767

#### Application

Function Block 169 can be used to approximate non-linear relations and is very useful when linearizing signals.

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