Section M3: Basic blocks

These blocks appear at the top of the simulation area

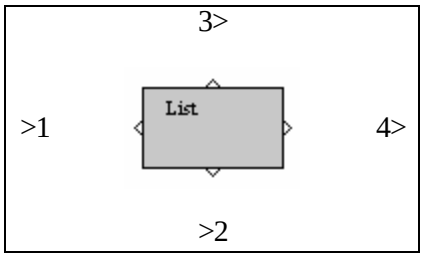
Table of blocks	
Block notation	Description
Parameters List	Lists the input parameter values
SNR	Calculates the signal-to-noise ratio between two signals
Statistics	Calculates signal statistics of the input signal
Window	Windows a time-domain signal
Mixer	Adds/subtracts two signals
D-Sampling	Down-samples a signal
U-Sampling	Up-samples a signal
Convolution	Performs convolution of two input signals

M3.1

Block name : Parameters list **Notation**: ***List***

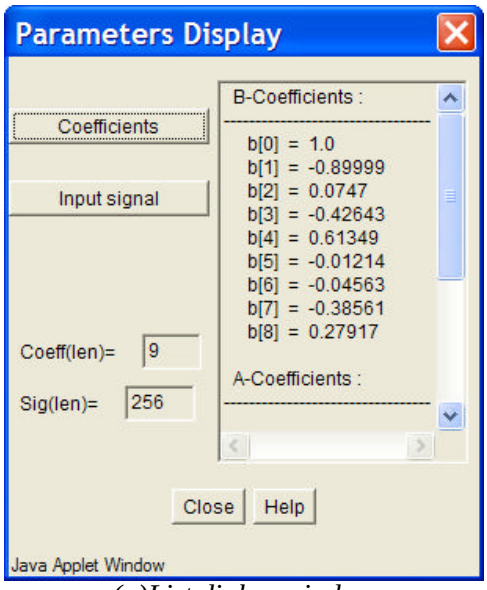
Description: This block tabulates the signal values applied at its input in a text box. No action is taken on the signals that are passed directly to the outputs. Typical signal types allowed are: filter coefficients, time domain, and frequency domain signals.

Pin assignment:



Pin	Description
1	Input signal, *x(n)*
2	Filter coefficients
3	Output coefficients
4	Output signal, *y(n) = x(n)*
5	
6	

Dialog window(s):



(a)List dialog window

Script use:

Name: list

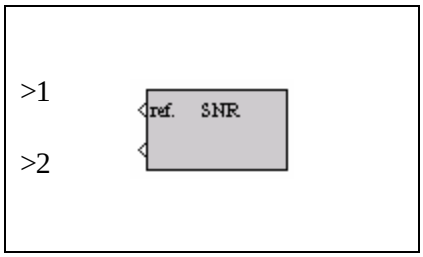
Example code: <param name = "3" value = "B3-list(3,1)">

M3.2

Block name: Signal-to-noise ratio **Notation**: ***SNR***

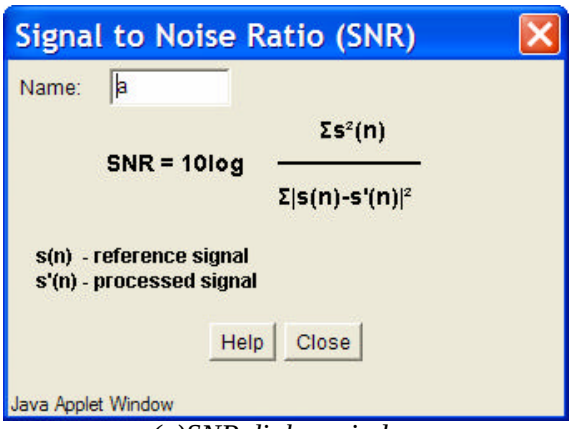
Description: This block calculates the signal-to-noise ratio (SNR) value in 'dB' between two signals. The reference signal is given as input to the upper input pin.

Pin assignment:



Pin	Description
1	Reference signal
2	Processed signal
3	
4	
5	
6	

Dialog window(s):



(a)SNR dialog window

Script use:

Name: snr

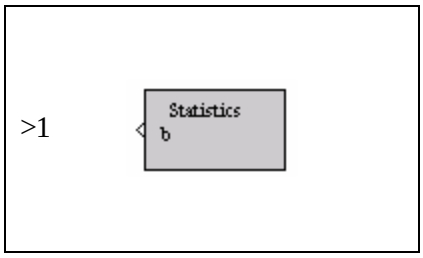
Example code: <param name = "3" value = "B3-snr(3,1)">

M3.3

Block name : Statistics **Notation**: ***Statistics***

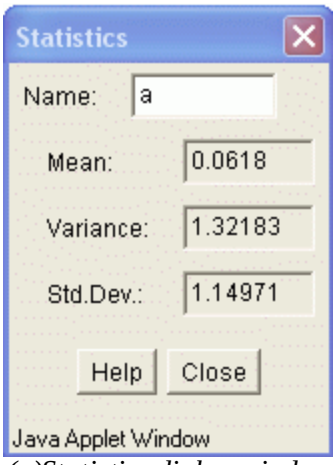
Description: This block computes the first-order statistics of the input signal i.e. the mean, the variance, and the standard deviation. The mean is calculated as the sum of the individual samples of the input, divided by the number of samples. The variance is a measure of the deviation from the mean. Standard deviation is the square root of the variance.

Pin assignment:



Pin	Description
1	Input signal
2	
3	
4	
5	
6	

Dialog window(s):



(a)Statistics dialog window

Script use:

Name: stats

Example code: <param name = "3" value = "B3-stats(3,1)">

Equation(s) Implemented :

Mean: $m_x = \frac{1}{N}\sum_{n=1}^{N} x(n)$, Variance: $s_x^2 = \frac{1}{N}\sum_{n=1}^{N}(x(n) - m_x)^2$, Standard deviation $= s_x$

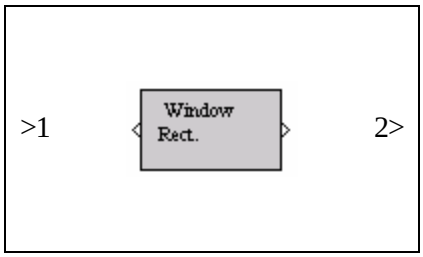
$x(n)$ = input signal of length N

M3.4

Block name : Window **Notation**: ***Window***

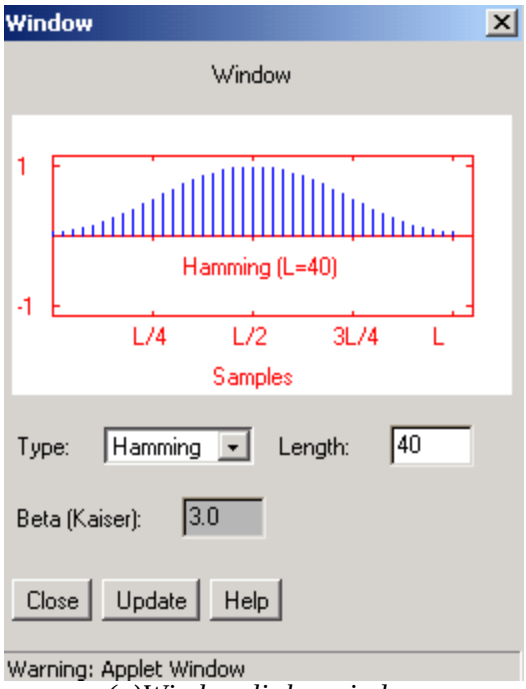
Description: This block performs a windowing operation on the input signal. The available window functions are: Hamming, Hanning, rectangular, Bartlett, Blackman, and Kaiser. The maximum window length is 256 samples.

Pin assignment:



Pin	Description
1	Input signal, *x(n)*
2	Windowed signal, *y(n)*
3	
4	
5	
6	

Dialog window(s):



(a)Window dialog window

Script use:

Name: window

Example code: <param name = "3" value = "B3-window(3,1)">

Equation(s) Implemented :

$$y(n) = w(n)x(n)$$

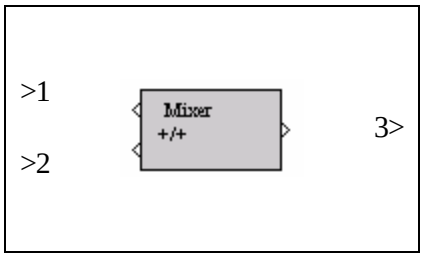
x(n) = input signal
w(n) = windowing function
y(n) = windowed signal

M3.5

Block name : Mixer (or Adder) **Notation**: ***Mixer***

Description: Adds or subtracts two signals

Pin assignment:



Pin	Description
1	Input signal $x_1(n)$
2	Input signal $x_2(n)$
3	Output signal $y(n)$
4	
5	
6	

Dialog window(s):

(a)Mixer dialog window

Script use:

Name: mixer

Example code: <param name = "3" value = "B3-mixer(3,1)">

Equation(s) Implemented :

$$y(n) = x_1(n) \pm x_2(n)$$

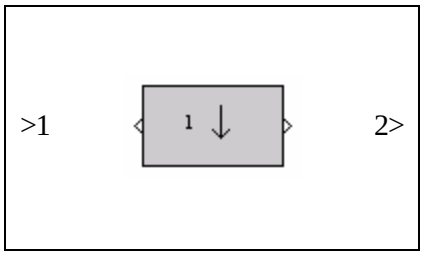
$x_1(n)$ = input signal at pin 1
$x_2(n)$ = input signal at pin 2
$y(n)$ = output signal

M3.6

Block name : Down-sampling **Notation**: ***D-Sampling***

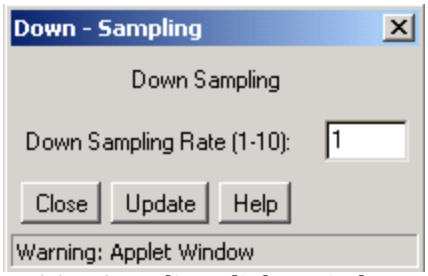
Description: Down–samples the input signal by an integer factor M

Pin assignment:



Pin	Description
1	Input signal
2	Down-sampled signal
3	
4	
5	
6	

Dialog window(s):



(a)D-Sampling dialog window

Script use:

Name: dsample

Example code: <param name = "3" value = "B3-dsample(3,1)">

Equation(s) Implemented :

$$y(n) = x(nM)$$

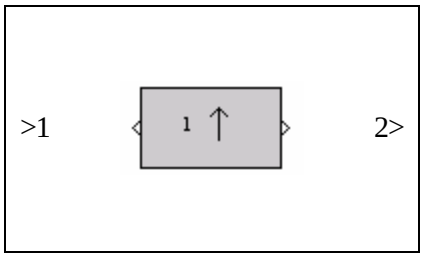
x(n) = input signal
y(n) = output signal
M = down-sampling factor

M3.7

Block name : Up-sampling **Notation**: ***U-Sampling***

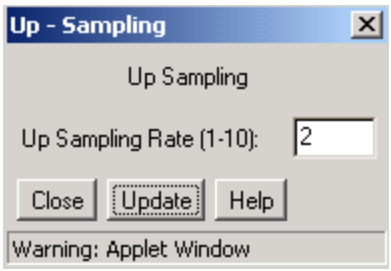
Description: Up-samples the input signal by an integer factor *L*. *L* is allowed to take values from 1 to 10.

Pin assignment:



Pin	Description
1	Input signal
2	Up-sampled signal
3	
4	
5	
6	

Dialog window(s):



(a)U-Sampling dialog window

Script use:

Name: usample

Example code: <param name = "3" value = "B3-usample(3,1)">

Equation(s) Implemented :

$$y(n) = x(n/L)$$

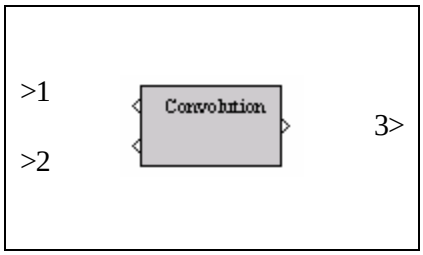
x(n) = input signal
y(n) = output signal
L = up-sampling factor

M3.8

Block name : Convolution **Notation**: ***Convolution***

Description: This block performs a convolution operation between its input signals.

Pin assignment:



Pin	Description
1	Input signal *x1(n)*
2	Input signal *x2(n)*
3	Convolved signal *y(n)*
4	
5	
6	

Dialog window(s):

-None-

Script use:

Name: conv

Example code: <param name = "3" value = "B3-conv(3,1)">

Equation(s) Implemented :

$$y(n) = x_1(n) * x_2(n), \qquad y(n) = \sum_{m=0}^{N-1} x_1(m)\, x_2(n-m)$$

x1(n) = input signal
x2(n) = input signal
y(n) = convolved signal