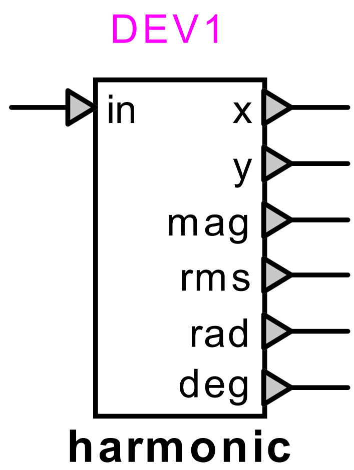
Meter : harmonic detailed



1 Description

This device converts the *k*-th harmonic of the instantaneous value of a signal to a phasor in a reference frame rotating at the fundamental frequency. The (x,y) representation consists of the x-y coordinates of the measured harmonic in the reference frame. The polar representation are the corresponding magnitude and angle of the phasor in the reference frame.

1.1 Pins

This meter has seven pins:

pin	*type*	*description*	*units*
in	input pin	input signal	any
x	output pin	x-coordinate of *k*-th harmonic phasor	same as input
y	output pin	y-coordinate of *k*-th harmonic phasor	same as input
mag	output pin	magnitude (peak) of *k*-th harmonic phasor	same as input
rms	output pin	magnitude (rms) of *k*-th harmonic phasor	same as input
rad	output pin	angle (radians) of *k*-th harmonic phasor	rad
deg	output pin	angle (degrees) of *k*-th harmonic phasor	deg

1.2 Parameters

The following parameters must be defined:

parameter	*description*	*units*
freq	fundamental frequency of the probed signal	Hz
k	index of the harmonic	

1.3 Input

The input pin may be connected to any control signal.

1.4 Output

The output is the phasor representation of the *k*-th harmonic of the instantaneous value of the probed signal. The (x,y) coordinates are the *x*-axis and *y*-axis projections of that phasor on a reference frame rotating at the fundamental frequency.

The x-y coordinates of the phasor in that reference frame are calculated over a sliding time window of period equal to *1/freq*, as follows.

For *k*>0,

$$x = \frac{2}{\text{period}} \cdot \int_{t-\text{period}}^{t} \text{in}(t) \cdot \cos(k \cdot 2\pi \cdot \text{freq} \cdot t) \cdot dt$$
$$y = \frac{2}{\text{period}} \cdot \int_{t-\text{period}}^{t} -\text{in}(t) \cdot \sin(k \cdot 2\pi \cdot \text{freq} \cdot t) \cdot dt \qquad (1)$$

where the negative sign for *y* follows the engineering convention for an inductive (lagging) current to have a negative angle when phasor rotation is counterclockwise.

For *k*=0,

$$x = \frac{1}{\text{period}} \cdot \int_{t-\text{period}}^{t} \text{in}(t) \cdot dt$$
$$y = 0 \qquad (2)$$

The polar coordinates are the magnitude and angle of the phasor in the reference frame. They are calculated from the (x,y) coordinates as follows:

$$\text{magnitude} = \sqrt{x^2 + y^2}$$
$$\text{angle} = \tan^{-1}\left(\frac{y}{x}\right) \qquad (3)$$

The phasor magnitude is available as the peak amplitude and its RMS equivalent (magnitude divided by $\sqrt{2}$). The phasor angle is available in radians and in degrees.