Using Cyclic Measurements
Chart v5.2 or later for Windows

ADINSTRUMENTS

Introduction

Chart 5.2 or later for Windows has a new feature used in calculating and analyzing periodic waveforms. The feature can be used in real time online as well as offline with previously recorded data. Cyclic Measurements detects cycles in the waveform, and then uses those detected cycles to perform various cyclic calculations (cyclic minimum, maximum, mean, rate, period and so on). The feature is simple to use by setting the cycle detection parameters, and choosing an output measurement.

In the following exercise a finger pulse recording or similar is recommended.

Offline Cyclic Measurements

To look at some of the functions of Cyclic Measurements a second channel to calculate heart rate from a pulse waveform will be used.

1. Open a previously recorded data file containing a waveform, ie. ECG, pulse or blood pressure.
2. The Cyclic Measurements dialog is opened by choosing the Cyclic Measurements…… command from the Channel Function pop-up menu of the channel that is to display the results.
3. The Cyclic Measurements dialog window will appear (Figure 1)

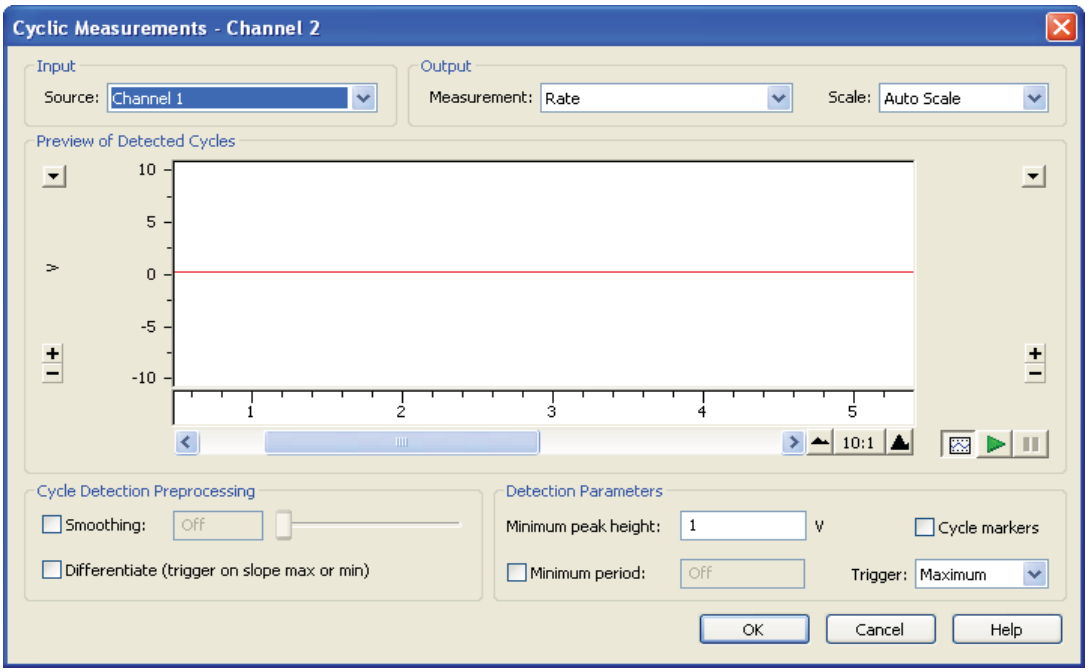

Figure 1: Cyclic Measurements dialog

4. Choose the channel or input that has the data of interest from the Source drop-down list. The source data to be measured may be a signal available from an input, raw data already recorded in a channel, or the result of a channel calculation. The signal will appear in the signal display area (Figure 2).

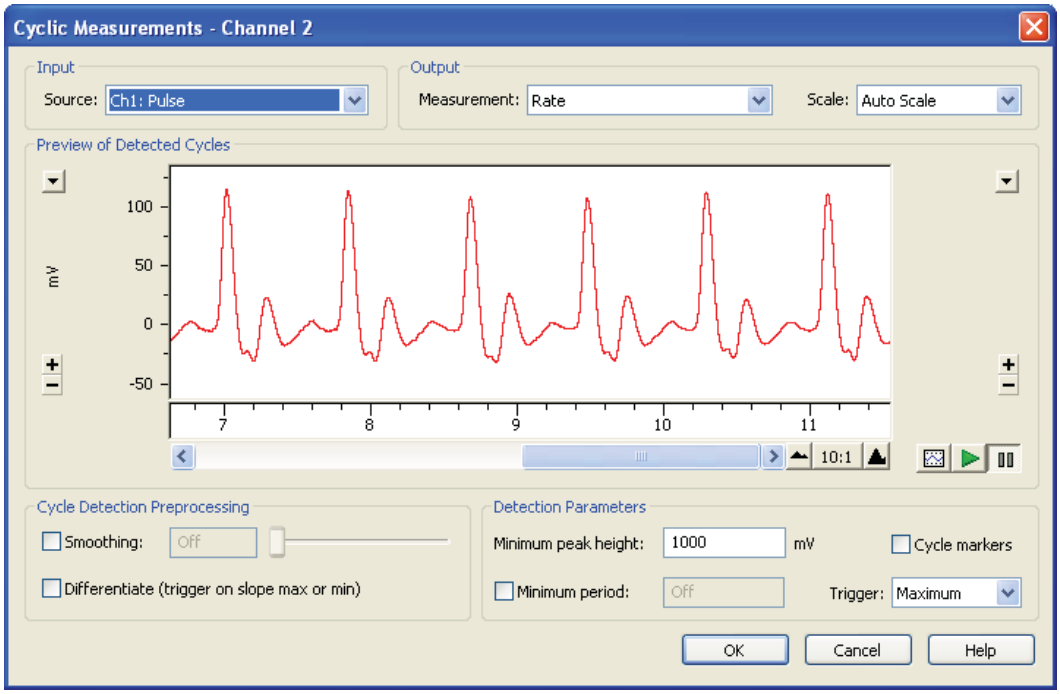

Figure 2: Cyclic Measurements dialog showing a pulse wave in the signal display area

5. Cycle detection preprocessing is used to improve the reliability of cycle detection. It has no effect on the calculation of the measurements. Smoothing helps to reveal a signal buried in noise or to reduce detection of false cycles as a noisy signal passes through a threshold. You can change the period of the smoothing window using the text box or slider; the effect of your changes can be observed in the signal display area.
6. The differentiated signal can be used for baseline tracking by triggering cycle detection from the slope of a peak rather than the absolute height of the peak, which may be drifting over time.

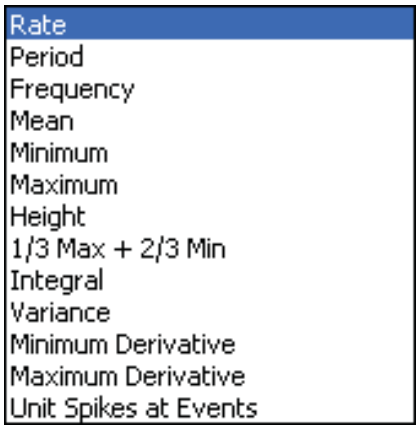

Figure 3: Measurement drop-down list

7. The output is selected from the Measurement drop-down list (Figure 3).
8. Detection parameters relate to the waveform displayed in the signal display area. If any preprocessing (smoothing or differentiation) is applied then cycle detection is relative to the (black) preprocessed waveform and you may need to refer to the right-hand Amplitude axis for peak heights.
9. The Minimum peak height entered is the height the waveform must rise, after the previous peak, and then subsequently fall, for the current position to be taken as a peak/cycle.
10. Setting a Minimum period prevents two peaks from both being recognized within the same time period (the second peak will be ignored). Cycle markers are always shown for detected peaks in the signal display area (Figure 4), but are only shown in the Chart View if the Cycle markers checkbox is selected.

Figure 4: Cyclic Measurements dialog showing a pulse wave in the signal display area

11. The Trigger drop-down list allows you to chose whether cycle detection triggers on the maximum or the minimum point of the detected cycle.
12. Press OK and the channel will now display the heart rate calculated from the data collected in Channel 1 (Figure 5).

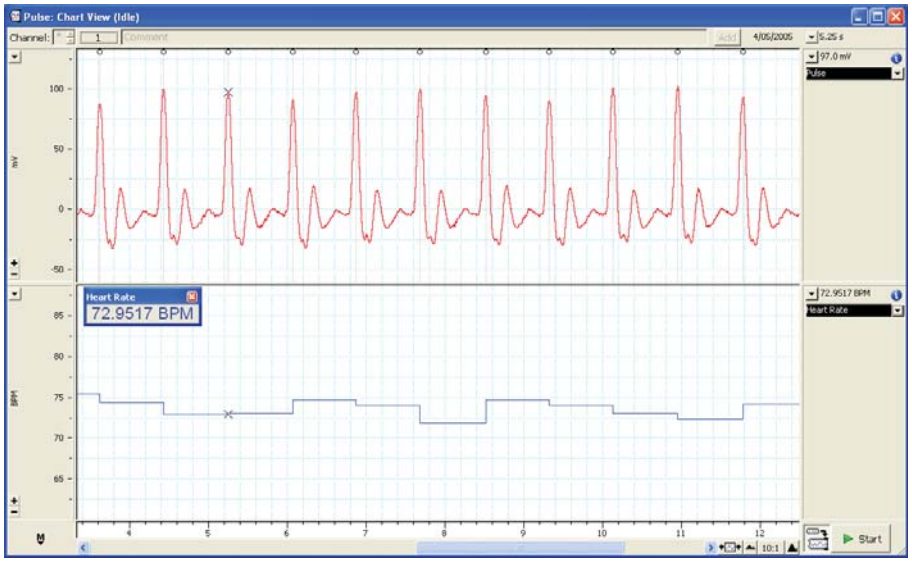

Figure 5: Chart View displaying a recording of the pulse wave and heart rate

Online Cyclic Measurements

13. Follow the procedures described above while recording a signal, which can be seen in the signal display area. If the detection parameters are set correctly the signal will be annotated with the cycle markers.
14. Press OK and Start in Chart and the cyclic measurement channel will calculate the parameter selected and display it in the channel.

NOTE: The calculated cyclic measurement does not appear immediately after starting the recording as it takes a few seconds for the software to detect and make the first calculations.