Low-Pass Active Filter Modules

9-pole Linear Active Filters

Introduction

The DCP5BAF Series modules are 9-pole linear active filters, pinout- and package-compatible with the Analogic DCP5B Series of signal conditioning modules. They may be used together with, or independently from, the DCP5B signal conditioners.

The DCP5BAF filters are available in both Butterworth and Bessel configurations with 54 dB per octave roll-offs. The Series is ideally suited for use as anti-aliasing, noise reduction, or reconstruction filters. The ±10 volt input range with an overall gain of 1 makes the filters an excellent match to both the transducer output (from the signal source) and the data acquisition board input.

An internal DC/DC converter allows the modules to be operated from a non-critical +5 ±10% volt power source. This can be a key factor in many systems since logic power (+5V) is readily available in most systems while analog power (±12 or 15V) is much less common.

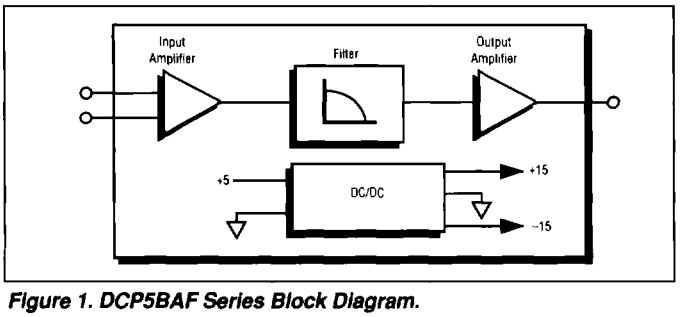
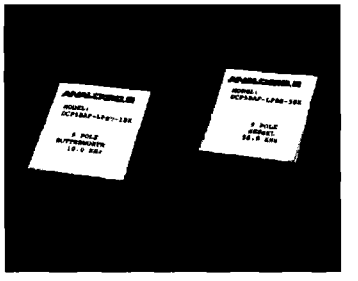


Figure 1. DCP5BAF Series Block Diagram.



Features

- Compatible with DCP5B Series Module
- 9-Pole (54 dB per Octave) Roll-offs
- Fully Differential Inputs
- 1, 2, 5, 10, 20 and 50 kHz Corner Frequencies

Applications

- Anti-aliasing Filters
- Industrial and Process Control
- Noise Reduction
- Reconstructive Filtering
- Test Systems

DCP5BAF SERIES

Specifications

ANALOG INPUT

Input Range
±10V

Differential Gain
1.0±0.03%

Input Impedance
20 kΩ ±10%

Common Mode Range
±20V

Common Mode Rejection
74 dB Min. at 1 kHz

Maximum Safe Input Voltage
±40V

ANALOG OUTPUTS

Offset Voltage
±3 mV

Offset Drift
±100 µV/°C

2Gain Drift
±30 ppm/°C

Noise (DC-50 kHz)
75 µV RMS Max.

Linear Operating Range
±10V at 2 mA

Output Impedance
1Ω Typ., 10Ω Max.

Max. Output Load
Short circuit protected

FILTER CHARACTERISTICS

Response Type
9-pole low-pass, Butterworth or Bessel characteristics

Cut-off Frequency Tolerance
±2%

Corner Frequencies
1.00 kHz, 2.00 kHz, 5.00 kHz, 10.0 kHz, 20.0 kHz and 50.0 kHz

POWER CONSUMPTION

+5V Supply
110 mA Typ., 125 mA Max. (1–20 kHz);
120 mA Typ., 135 mA Max. (50 kHz)

ENVIRONMENTAL

Operating Temperature
0 to +50°C

Storage Temperature
–20°C to +70°C

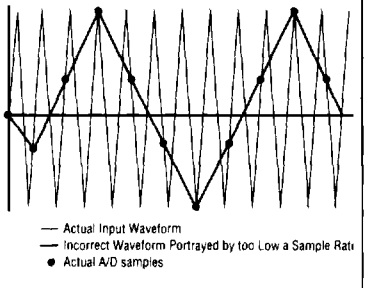
Humidity
0 to 95% non-condensing

Altitude
10,000 feet Max.

Specifications subject to change without notice.

Aliasing

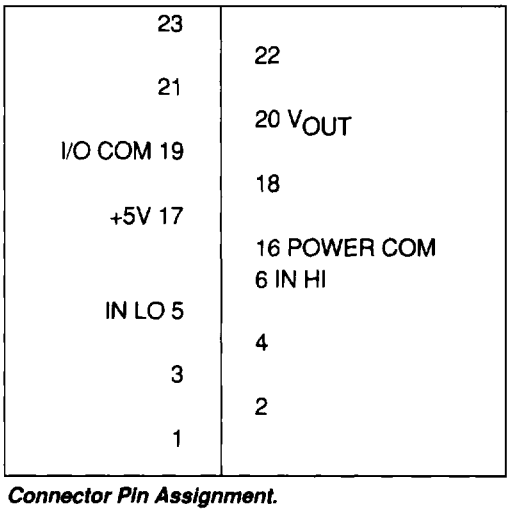
When sampling an analog input, the data acquisition system can incorrectly show a slow moving signal that, in actuality, is at a higher frequency. This aliasing effect is shown in the diagram below. It can be caused by either incorrect sampling speed of the data acquisition system itself or by imposed noise overlaying the desired signal to be sampled. In the case of incorrect sampling, the Nyquist criterion imposes a limit of 0.5 times the sampling rate of the data acquisition system on input signal bandwidth. Adhering to this specification ensures accurate signal sampling.



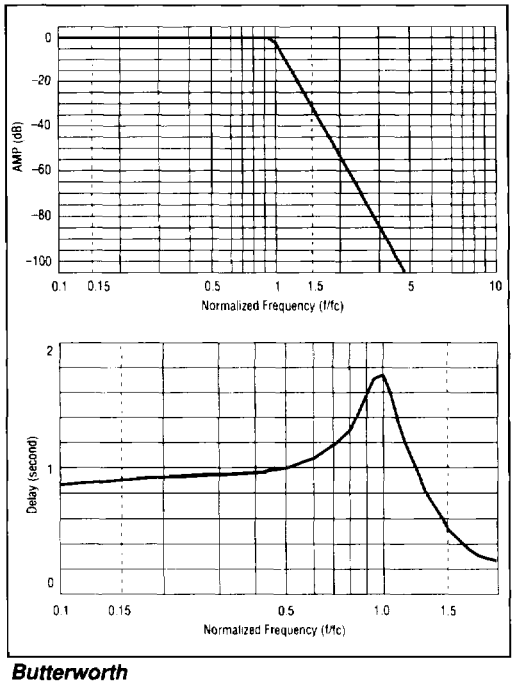
In the case of imposed random noise at a frequency greater than the system's sample rate, as is often encountered in less-than-ideal data acquisition conditions, erroneous sampling of the noise as well as the desired signal may occur.

An anti-aliasing filter is simply a low-pass filter with very sharp corner frequency roll-off that allows the true signal to pass while removing the undesired higher frequency noise component. Typically, the anti-aliasing filter cutoff frequency is set to 0.5 times the sample rate to assure the integrity of the measured signal.

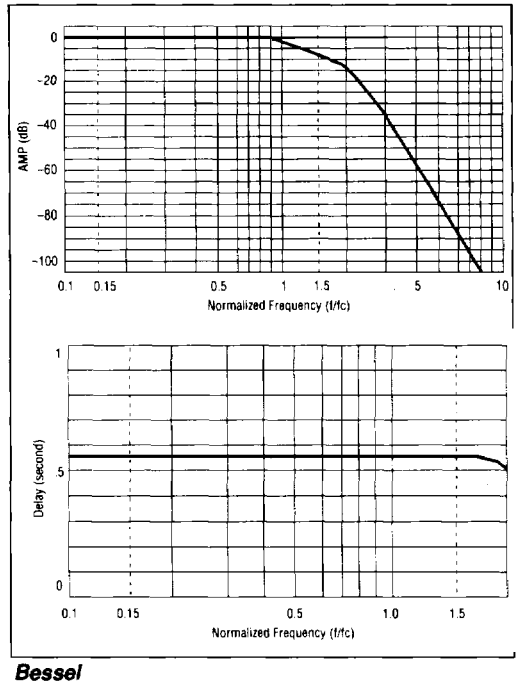
Top View



Connector Pin Assignment.



Butterworth



Bessel

Butterworth Versus Bessel

Depending on the application, either Butterworth or Bessel filter characteristics will provide the best performance. Butterworth filters offer the flat passband responses and sharp cut-offs required in anti-aliasing and noise-reduction systems. For these reasons, Butterworth filters are the most commonly used filter; however, they also induce significant distortion in the form of phase delay. In closed-loop systems and signal reconstruction applications, phase distortion can often be more important than pure roll-off rate. In these applications the Bessel filter is a better choice. The amplitude and phase performance of 9-pole Butterworth and Bessel filters are shown in the diagrams above.

Ordering Guide

	Butterworth
DCP5BAF-LPBU-1.0K	1.00 kHz 9-pole Butterworth Filter
DCP5BAF-LPBU-2.0K	2.00 kHz 9-pole Butterworth Filter
DCP5BAF-LPBU-5.0K	5.00 kHz 9-pole Butterworth Filter
DCP5BAF-LPBU-10.0K	10.0 kHz 9-pole Butterworth Filter
DCP5BAF-LPBU-20.0K	20.0 kHz 9-pole Butterworth Filter
DCP5BAF-LPBU-50.0K	50.0 kHz 9-pole Butterworth Filter
	Bessel
DCP5BAF-LPBE-1.0K	1.00 kHz 9-pole Bessel Filter
DCP5BAF-LPBE-2.0K	2.00 kHz 9-pole Bessel Filter
DCP5BAF-LPBE-5.0K	5.00 kHz 9-pole Bessel Filter
DCP5BAF-LPBE-10.0K	10.0 kHz 9-pole Bessel Filter
DCP5BAF-LPBE-20.0K	20.0 kHz 9-pole Bessel Filter
DCP5BAF-LPBE-50.0K	50.0 kHz 9-pole Bessel Filter
	Accessories
STB-5B	DAS-to-DCP5B Interface
DCPXPRT-003	Power Supply, 120 Vac Input
DCPXPRE-003	Power Supply, 220 Vac Input
DCPPB01	16-Position Mounting Rack