

# AAF-3

Programmable, 2- to 8-Channel Low-Pass Filter and Differential Amplifier Board for the PC/AT

- Compatible with popular A/D converter boards
- 2, 4, 6, or 8 low-pass or high-pass filter channels
- Software-programmable gains of 0.5 to 1000 per channel
  8-pole elliptic, linear phase filters, optional Bessel,
- Butterworth, Cauer, or high-speed linear phase filters
- Software-selectable cutoff frequencies from 1 Hz to 200 kHz
- Up to 4 different cutoff frequencies on each board
- Optional high-pass and band-pass filters with maximum bandwidth of 200:1
- Graphical application software and driver libraries for Windows 98/95/NT/3.1, LabVIEW, HP VEE, and Dasylab

The AAF-3 series of PC plug-in boards provides 2 to 8 programmable channels of low-pass filtering and/or highquality instrumentation amplifiers (with optional band-pass and high-pass filters) for front-end signal conditioning with all popular A/D converter boards.

Each channel is available with a wide choice of filter characteristics using the AAF-3F software selectable 8pole elliptic and linear phase filters or the AAF-2F which is available as a Bessel, Butterworth, Cauer, high speed Cauer, linear phase, or high-speed linear phase filters. With a variety of filter types a high stop-band attenuation of 85 dB typical to as high as 90dB is available. When using the AAF-3G gain, a high common-mode rejection of 90 to 100 dB typical at high gains can be attained.

Using an AAF-2F filter without the AAF-3G amplifier increases the common-mode protection of the AAF-3 to  $\pm40V.$ 

High-quality instrumentation amplifiers on each channel provide software-selectable gain as well as differential inputs with high-common mode rejection. Channels are independently programmable for gain settings of 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 or 1000.

The cutoff frequency of each 2-channel pair of filters can be set with an external clock or programmed for a range of frequencies from below 1Hz to 50kHz for the AAF-3F linear phase filter or from below 1Hz to 100kHz for the AAF-3F elliptic filter. The AAF-2F filter types provide cutoff frequencies between 0.1Hz and 200kHz. Please refer to the AAF-2F data sheet for more information. Four different control sources are available allowing for up to four separate cutoff frequencies on each AAF-3.



AAF-3 Filter/Amplifier Board

## **Support Software**

The AAF-3 comes with the most complete collection of menu-driven programs and drivers available with any filter/amplifier card.

- DLL drivers for Windows 95/98/NT, Windows 3.1 and DOS with example application programs for popular compilers, including Visual Basic, Visual C++, and Borland C++.
- SETAFF3 for DOS and SystemViewAAF for Windows 95/98/NT is a graphical application that uses a few simple mouse clicks to program the board's filter type, cutoff frequency, and gain setting. Once selected, the desired parameters can be saved as an AAF-3 setup file that can be easily recalled and reapplied.
- Support for LabVIEW, HP VEE, and Dasylab (16- and 32-bit) is also supplied.

**DC Offset.** All filter modules for the AAF-3 feature automatic DC offset compensation and are highly suited in applications requiring minimal offset. The DC offset compensation may be optionally disabled and may exhibit higher values then specified.

**Input Connection.** The AAF-3G gain daughter board or the AAF-2F filter board provides differential input. If only an AAF-3F filter daughter board is used then the input is single ended.

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# AAF-3F Filter Module Specifications (Filter Type is Software-selectable)

|  |  |   |  | Stopband                                    | Total                  | Phase         |  |
|--|--|---|--|---|------------------------|---------------|--|
|  | Cutoff Frequency   | Passband Performance                                |  | Rejection                                   | Wideband Noise         | Match         |  |
| Elliptic   | 10 Hz - 100 kHz standard                                   | +0.4dB -0.2dB max, to 0.8                           | 85 cutoff  | 90 dB Typ.                                  | 110μVRMS Typ.          | -             |  |
|  | 1 Hz - 100 kHz optional                                    |   |  |   |                        |               |  |
| Linear Phase   | e 10 Hz - 100 kHz standard                                 | Group delay $\pm 0.5\%$ max a                       | and -1dB droop max   | 90 dB Typ.                                  | 90μVRMS Typ.           | -             |  |
|  | 1 Hz - 100 kHz optional                                    | at 0.75 cutoff, low-freq gai                        | in +0.4dB -0.2dB ma  | ax  |                        |               |  |
| AAF-2F Filter Module Specifications (Filter Type is not Software–selectable) |  |   |  |   |                        |               |  |
|  | Corner Frequency Range                                     |   |  | Stopband                                    | Total                  | Phase         |  |
|  | band is software selectab                                  | le Passband Performance                             |  | Rejection                                   | Wideband Noise         | Match         |  |
| Bessel   | 10 Hz – 33 kHz narrow                                      | Group delay $\pm 1\%$ max to $f_c$ , 2              | dB droop type84 dB   | Typ. 60μVF                                  | RMS Тур. 1.2° Т        | yp.           |  |
|  | 10 Hz – 67 kHz wide  | at 0.75 f <sub>c</sub> ; low-freq gain –0.5d        | B +0.15dB max  |   |                        |               |  |
| Butterworth  | 10 Hz – 50 kHz narrow                                      | +0.15dB to -0.5dB max, to 0.8                       | 35 f <sub>c</sub>  | 90 dB Typ.                                  | 80μV RMS Typ.          | 1.2° Typ.     |  |
|  | 10 Hz – 100 kHz wide                                       |   |  |   |                        |               |  |
| Cauer  | 10 Hz – 50 kHz   | $\pm 0.4$ dB max, to 0.85 f <sub>c</sub>            |  | 75 dB Typ.                                  | 165μVRMS Typ.          | 2.5° Typ.     |  |
| High-Speed   | 10 Hz – 50 kHz narrow                                      | Low-freq gain +0.1 dB - 0.5dB                       | B max; ripple  | 90 dB Typ.                                  | 135μVRMS Typ.          | 1.0° Typ.     |  |
| Cauer  | 10 Hz - 100 kHz wide                                       | 0.75dB max to 0.95 f <sub>c</sub>                   |  |   |                        |               |  |
| Linear Phase   | Linear Phase10 Hz – 50 kHz narrow +.65dB,6dB max; -2dB,35d |   |  | 90 dB Typ.                                  | 115μVRMS Typ.          | 3.0° Typ.     |  |
|  | 10 Hz – 100 kHz wide                                       | +5.75dB, -3.75dB @ fc narrow                        | v band   |   |                        |               |  |
| -4.5dB, -2.5dB @ f <sub>c</sub> wide band                                    |  |   |  |   |                        |               |  |
| High-Speed   | 10 Hz – 100 kHz narrow                                     | +.4dB,2dB max.85dB at $f_c$                         |  | 90 dB Typ.                                  | 175μVRMS Typ.          | 1.7° Typ.     |  |
| Linear Phase   | e 10 Hz – 200 kHz wide                                     | z – 200 kHz wide output voltage swing $\pm 3V$ typ. |  |   |                        |               |  |
| AAF-HP Filter Specifications   |  |   |  |   |                        |               |  |
| High-Pass/   | 1 Hz to 10 kHz   | $0\pm 5~\text{dB}$ max to cutoff, low-free          | 90 dB Typ.   | 135μVRMS Typ.                               | -                      |               |  |
| Band-Pass  | (pseudo elliptic)  | max, <10hm output impedane                          | ce, 0mV offset   |   |                        |               |  |
| Cables for output make for easy integration into an                          |  |   |  |   |                        | o any         |  |
|  |  | system.   |  |   |                        |               |  |
| Amplifier gain   | +0.08 dB may   | AT-BNC-3/I  | 8 channe   | BNC input box with                          | cable                  |               |  |
| Common-mor   | 1 = rejection 75 dB in 86 (                                | AT-BNC-3/O  | 8 channel BNC output box with cable                            |   |                        |               |  |
| Common-mode voltage $\pm 10 \text{ V max}^*$                                 |  |   | STA-AAF-3  | Screw Terminal adapter for I/O              |                        |               |  |
| Input voltage (gain = 0.5) $\pm 10$ V max                                    |  |   | CA31   | input cable open ended                      |                        |               |  |
| Input protection   |  |   | CA32   | output cable open ended                     |                        |               |  |
| Input impedance  |  |   | CA33   | output cable with mating connector to A/D   |                        |               |  |
| Input bias current   |  |   | CA35   | input cable with mating connector to source |                        |               |  |
| Input offset current±1 pA type, ±100 pA max                                  |  |   | CA39   | output cable with mating connector to A/D   |                        |               |  |
| Amplifier bandwidthGain = 0.5 - 5, 1.2 MHz typ                               |  |   |  | and seco                                    | nd connector for auxil | iary A/D pins |  |
| •  | Gain = 10 - 1  | 00, 600 kHz typ                                     | CK-A3  | AAF-3 m                                     | ating connector kit    |               |  |
| Gain = 200 - 1000, 250 kHz typ   |  |   |  |   |                        |               |  |
| Amplifier slew rate9/gain V/µsec typ   |  |   | your distributor for details on how to specify and order cable |   |                        |               |  |

#### Analog Output

| Output voltage   | ±5 V min               |
|------------------|------------------------|
| Load resistance  | 1KΩ min                |
| Output impedance | $\dots .27\pm 3\Omega$ |

#### **Miscellaneous**

Power consumption ......10mA at +5V, 1A at +12V Operating temperature......0°C to 70°C

 $^{*}$   $\pm 8V$  if differential input greater than 5V/gain (or greater than 5V at gain = 0.50.

## **System Accessories**

The AAF-3, when used with any A/D board, provides for a more accurate data acquisition system. BNC boxes and screw terminal panels for AAF-3 input and direct-connect



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