# USBPGF-S1 USB Programmable
## Single Channel Instrumentation Amplifier and Low-Pass Filter

- Available 8-pole Butterworth, Bessel, elliptic(Cauer), linear phase filter types
- Software select any corner frequency from 0.1 Hz to as high as 200 kHz (refer to filter characteristic specification for details)
- Filter rejection band attenuation up to -90dB
- Software-programmable gains of 1 to 10000
- Compatible with any 12-, 16, or 24-bit A/D converter device
- Differential or single ended input
- ± 10Vmax Signal Input and Output with input protection up to ±40V
- Selectable AC or DC coupling for input offset nulling
- factory calibrated for unity gain and very low DC offset filter output
- Use multiple USBPGF-S1 units for multi-channel applications
- Each USBPGF-S1 can be used as a dynamic tracking filter
- USB 2.0 compatible communication for setup and control
- Non-volatile configuration retains all settings through power cycles
- Does not need to be attached to a PC to operate
- AC/DC converter included for 115VAC or 220VAC power
- Optional 9 to 12V battery operation
- All Windows OS compatible menu setup software and SDK



## Adaptable to most applications in the field, on the factory floor, or in the lab

The USBPGF-S1 stand alone USB controllable module provides a single channel low-pass filter and high-quality instrumentation amplifier, with optional AC coupling, for front-end signal conditioning. It is compatible with all popular A/D converter devices.

The USBPGF-S1 is powered with 9 to 12VDC so it can be connected to a battery voltage source or alternatively the supplied 115-220VAC adapter may be used for operation with wall power anywhere in the world.

When programmed from the USB port, the USBPGF-S1 will remember all of the programmed properties between power cycles. Program once and operate as a stand-alone signal conditioner without having to reprogram for every use. This is perfect for turn-key applications.

It's easy to connect the USBPGF-S1 into the data collection system. Input and output signals can be routed through BNC connection or using the detachable screw terminal connectors. Optional SMA type adapters are available.

## Mix and match filter characteristics at will

Each USBPGF-S1 is factory configured with a wide choice of filter characteristics. Choose from Butterworth, Bessel, elliptic(Cauer), or linear phase filters. High stop-

band attenuation of -90dB is available. The USBPGF-S1 Instrumentation Amplifier provides an excellent common-mode rejection of 80 to 100 dB typical at high gains.

## Protection from high input voltages

The USBPGF-S1 provides strong input protection and can withstand up to +/-40V at the analog signal input.

## Amplify and then filter to improve signal

The USBPGF-S1 high-quality instrumentation amplifier provides software-selectable gain combined with differential input high-common mode rejection. Gain can be set at 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, or 10000. Most A/D devices provide a gain amplifier stage. For applications where the target signal is imbedded in high voltage noise, the USBPGF-S1 gain can be set to 1 to filter the signal first and then amplify with the A/D converter gain. For all other applications it is recommended to amplify small voltage input signals before filtering to maximize the signal to noise ratio of the sampled signal.

## Software select any corner frequency

The corner frequency of each USBPGF-S1 filter is software controlled to select any corner frequency from 0.1Hz to the maximum frequency of each factory installed filter characteristic. Control the Butterworth filter up to 100kHz. Control the Bessel filter up to 66kHz. Control the Elliptic filter up to 50kHz and the high frequency Elliptic to 100kHz. Control the Linear Phase filter up to 200kHz. Each USBPGF-S1 module in a multi-channel data collection system can have a unique filter

characteristic, a unique corner frequency, and a unique amplification. Optionally, an external clock signal can be used to control the corner frequency in tracking filter applications.

## AC couple at any time

The USBPGF-S1 can AC couple or DC couple the input signal under software control. This feature is useful in applications where the input signal is riding on a large DC offset. AC coupling will remove the DC offset.

## DC Offset continuously compensated

The filter section in the USBPGF-S1 features automatic electronic DC offset compensation and is highly suited in applications requiring minimal offset from the sampling system. The DC offset specification is listed with the DC offset compensation enabled. The DC offset compensation circuitry may be optionally disabled at the factory.

The DC offset specification reflects the actual electronic operation and does not require extra software normalization techniques using stored constants

## All Software is Included

The USBPGF-S1 comes with complete easy-to-use menu-driven software and SDK tools to custom build control. **SystemViewUSBPxx** is a ready-made application compatible with all versions of Windows. Use a few simple mouse clicks to program the parameters of each USBPGF-S1 connected to the PC. Once selected, the desired parameters are set and saved to non-volatile memory in the USBPGF-S1 so that they are reapplied after every subsequent power up.

An ActiveX/COM control is provided for custom software development. The COM interface of the ActiveX control can be integrated into any high level language application. Example code is provided in a variety of software languages.

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## Low pass Filter Options

Continuously tunable from 0.1Hz to maximum bandwidth

USBPGF-S1/B ......................8-pole Butterworth 100kHz bandwidth
 Stop band rejection 90dB Typ. Phase Match 1.2°Ty p.
 Total Wideband Noise 80uVrms Typ.

USBPGF-S1/L .....................8-pole Bessel 66kHz bandwidth
 Stop band rejection 84dB Typ. Phase Match 1.2°Ty p.
 Total Wideband Noise 60uVrms Typ.

USBPGF-S1/CE ...................8-pole Cauer Elliptic 50kHz bandwidth
 Stop band rejection 72dB Typ. Phase Match 2.5°Ty p.
 Total Wideband Noise 165uVrms Typ.

USBPGF-S1/HC ...................8-pole Cauer Elliptic 100kHz bandwidth
 Stop band rejection 90dB Typ. Phase Match 1.0°Ty p.
 Total Wideband Noise 135uVrms Typ.

USBPGF-S1/LP ...................8-pole Linear Phase 100kHz bandwidth
 Stop band rejection 88dB Typ. Phase Match 3.0°Ty p.
 Total Wideband Noise 115uVrms Typ.

USBPGF-S1/HLP ................8-pole Linear Phase 200kHz bandwidth
 Stop band rejection 75dB Typ. Phase Match 1.7°Ty p.
 Total Wideband Noise 175uVrms Typ.

**Filter Frequency control sources** 1 internal or 1 external

### Instrumentation Amplifier

| Software selectable steps | max gain error | -3dB bandwidth |
|---|---|---|
| 1 | 0.06% | LPF |
| 2 | 0.10% | LPF |
| 5 | 0.19% | LPF |
| 10 | 0.06% | LPF |
| 20 | 0.10% | LPF |
| 50 | 0.19% | LPF |
| 100 | 0.06% | LPF |
| 200 | 0.10% | LPF |
| 500 | 0.19% | LPF |
| 1000 | 0.07% | 60kHz |
| 2000 | 0.12% | 60kHz |
| 5000 | 0.24% | 60kHz |
| 10000 | 0.44% | 60kHz |

## General

CMRR ................................ 80dBmin, 100dB typ. at gain of 1
Common Mode Voltage ....... +/-10V max
Input Voltage....................... +/-10V max at gain of 1
Input Protection................... +/-40V max, with power off or on
Input Impedance ................. 20MΩ differential (10MΩ each side to analog ground)
DC offset, Factory Adjusted..<±.0.01mV @ gain of 1
DC offset vs. temperature.....<±20 µV/℃
DC offset, long term drift.......<±5 µV/Month
Output impedance.................<0.01 Ω

## AC/DC Couple

AC Couple Frequency.......... 0.03 Hz
AC/DC Coupling Software Selectable

## Physical

Number of channels ............. 1
Size                108mm(4.25")x83mm(3.25")x28mm(1.125")
Power consumption.............. 500mA at +9VDC
Operating temperature......... 0°C to 70°C

## Software

GUI, API, and SDK Included for all versions of the Windows OS

## System Accessories

### Connectors

| | |
|---|---|
| **USBPGF-S1/STA** | Screw terminal adapter kit(one 2-lead STA and two 3-lead STA) |
| **USBPGF-S1/SMAM** | two BNC to SMA Male adapters |
| **USBPGF-S1/SMAF** | two BNC to SMA Female adapters |

### Power Adapters

| | |
|---|---|
| **USBPxx-S1/DCR** | 9V to 30V DC power regulator |
| **P9V500MA** | Universal to 9V DC 500mA |
| **PAP-NA** | Power Adapter Plug North America |
| **PAP-EU** | Power Adapter Plug Europe |
| **PAP-AS** | Power Adapter Plug Australia |
| **PAP-UK** | Power Adapter Plug United Kingdom |

### Multi-channel mounting

| | |
|---|---|
| **USBDR-8** | 8-channel power/USB rack |