

# Instruction Manual

**Brownlee Precision Model 410**

**Four-Channel Instrumentation Amplifier**



# **Operating instructions**

## **Brownlee Precision Model 410 Four-Channel Instrumentation Amplifier**

### **Power:**

The Model 410's power requirements are 120 VAC, 47-63 Hz unless otherwise indicated on the back panel near the power connector. Run an IEC line cord from a wall socket to the back panel power connector. The 2 Amp, 5x 20 mm type fuse is located in the back panel power connector.

Turn on the power using the front panel power switch. The "ON" will illuminate and, after a pause, the LED alphanumeric displays will spell the startup message. After another pause, the displays will spell out the amplifier settings and the amplifier is ready for operation.

*Troubleshooting: If the "ON" indicator does not light up, check the fuse and power connection. If the "ON" does light up, but the alphanumeric displays do not spell the startup message or amplifier settings, push the reset button on the front panel.*

### **Signal Connections:**

Each of the four channels is an independent voltage amplifier with a non-inverting (A) input, an inverting (B) input and an output, all with BNC connectors. The input and output voltage ranges are +/- 10 Volts. Each input has 1 M $\Omega$  resistance and each output is capable of driving +/- 100 mA.

## **Amplifier Settings:**

There are 5 main parameters, which can be adjusted on each amplifier channel: Gain, Lowpass Filter cutoff frequency, Output Offset voltage, Input Selection, and Input Coupling. There is a button corresponding to each one of these parameters. Pushing one of these buttons puts that parameter's value on the 8-digit alphanumeric display. The knob can be used to adjust that parameter.

To completely configure a channel of the amplifier, all 5 parameters must be set using the buttons and the knob. The parameters may be set in any order.

To set the gain, push the 'Gain' button and then turn the knob until the desired value is displayed. The gain ranges from 1 to 10,000. Gains of 1000 to 10,000 are abbreviated 1 K to 10 K, etc.

To set the Lowpass filter's cutoff frequency, push the 'Lowpass Filter' button and turn the knob until the desired value is displayed. The cutoff frequency ranges from 1 kHz to 25 kHz. There is also a wideband setting, abbreviated "WB".

To set the output offset voltage, push the 'Output Offset' button and turn the knob until the desired value is displayed. Output offset is abbreviated "OS". The offset voltage ranges from - 10 Volts to + 10 Volts in 0.5 Volts steps.

*Handy tips: pushing the Output Offset button twice will immediately reset the output offset voltage to zero.*

To select which input is to be amplified, push the ‘Input Select’ button and turn the knob until desired configuration is displayed. “Gnd” ignores both input lines and internally ties the inputs to 0 Volts for equipment setup and testing. The “A” setting amplifies the single-ended signal on the A input. The “-B” setting amplifies and inverts the single-ended signal on the –B input. The “A-B” setting amplifies the difference between the A and –B inputs.

To set the input coupling, push the ‘Input Coupling’ button and turn the knob until the desired value is displayed, AC or DC.

*Handy tips: For Input Select and Input Coupling, instead of turning the knob to change the setting, you may also simply hit the parameter button repeatedly to scroll through the values. For example, the first time you push Input Select, the present input setting is written to the alphanumeric display without changing it. Each additional push of the button, however, will advance the amplifier through its four options: Gnd, A, -B, A-B. The same holds for Input Coupling.*

It is important to remember that pushing a parameter button once does not change the amplifier settings; it simply changes the alphanumeric display. Turning the knob is the way to change the amplifier’s internal settings.

The amplifier’s output is not affected by which parameter happens to be displayed. You may want to leave the most frequently adjusted parameter on the display. The amplifier will retain all the settings for each channel when power is turned off, even if the unit is unplugged.

## **Memories**

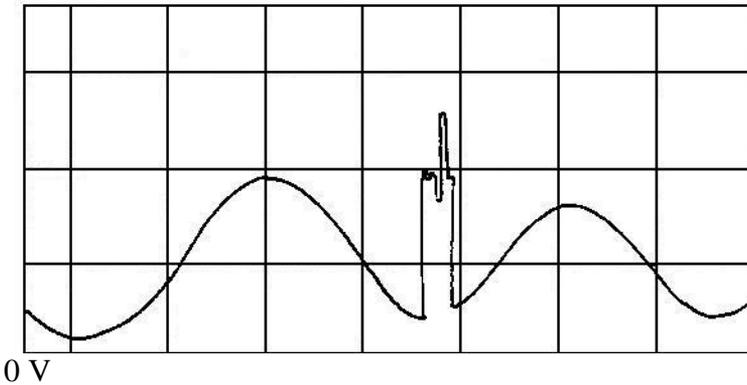
Each channel has one memory, which can hold a complete configuration. Pressing “STO” stores all the present parameter values for that channel without affecting the amplifier output. Later on, even if some or all of the parameters have been changed, pressing “RCL” will reset that channel to all the previously stored settings.

## **Internal Offset Voltage Trimming**

The electronic components at each stage of the amplifier have inherent offset voltages, which could appear as a shift of the “zero” level of the output. The Brownlee Precision Model 410 has a self-trimming feature, which compensates for these errors automatically.

Every time the gain is changed, the amplifier goes through a quick adjustment routine. This routine does put a brief artifact on the output signal as shown on the following page: The artifact’s duration is approximately 4 mS.

This self-trimming routine is only performed on the channel whose gain is being changed. The artifact will not appear on the other three channels.



User changes gain at this point



Horiz: 10 mS/div  
 Vert: 1 Volts/div  
 Sine signal w/ 1 Volts offset

If you notice the zero level of the output has drifted (as maybe seen in the first few minutes after the amplifier is turned on) you can invoke the self-trimming feature by changing the gain, or by just double-clicking the Gain button.

**Maintenance**

ALWAYS remove the line cord before opening the cover of the amplifier!

Lithium Rechargeable Battery: Very unlikely this battery will lose its charge. If the amplifier is no longer holding its settings when power is turned off, or you find you must frequently push the reset button to turn the amplifier on, then contact Brownlee Precision Company for replacement instructions.

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blank!)*

## Amplifier Specifications:

Gain Range	1 to 10,000
Gain Accuracy	< 2% error
Input Impedance	1 M $\Omega$ , 15 pF
Input Voltage Range	+/- 10 Volts
Input Bias Current	< 50 pA
Input Offset Voltage	< 5 $\mu$ V
Common Mode Rejection Ratio	> 70 dB
Wideband Voltage Noise, ref. to input	< 20 $\mu$ V <sub>p-p</sub>
Wideband Voltage Noise, ref. to output	< 15 mV <sub>p-p</sub>
Noise Spectrum. 1 kHz, ref. to input	10-nV/ $\sqrt$ Hz

At low gains, the total output noise is approximately RTO noise. At high gains, the total output noise is approximately Gain x RTO noise.

Lowpass filter characteristic	2 poles elliptic
High frequency roll-off	- 12 dB/octave

Slew Rate (input and output)	10 V/ $\mu$ S
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Output Voltage Range	+/- 10 Volts
Output Current	+/- 100 mA
Output Offset Control Range	+/- 10 Volts

### Cross-talk Rejections \*

No load on transmitting channel	130 dB
100 $\Omega$ load on transmitting channel	120 dB

\* Low impedance signal or ground on receiving channel

These specifications are believed to be accurate as of 7/2012, but are subject to change without notice.

**Warning: This instrument is not for use on human subjects.**

Model number: 410

Serial number: \_\_\_\_\_

Firmware version: V 3.0

Ship Date: \_\_\_\_\_

Warranty: 12 months, parts and labor

Instruction manual: 410 Rev. G

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