

BC-535**Bilayer Clamp Amplifier**

bilayer workstation

The only amplifier specifically dedicated to research using the planar lipid bilayer

The **BC-535** is the newest version of our popular bilayer clamp amplifier. Warner Instruments is the only company to supply an instrument specifically designed for research using planar lipid bilayer technology and this device forms an integral component of the BLM Workstation.



Major improvements in this model include:

- Reduced noise and wider bandwidth
- Improved stability with gains to 1000 mV/pA
- Digital hold potential
- AutoZero function
- Digital readout of membrane capacitance
- Multi-step 4-pole Bessel filter
- Hold potentials to 1400 mV; currents to 20 nA

Resistive Feedback Headstage

The BC-535 sports an advanced, resistive feedback headstage which provides high bandwidth and low noise recording. The switchable headstage resistance is automatically selected based on the gain selection. The low current mode provides up to 100 pA of current carrying capability, while the high current mode provides up to 20 nA of current capacity!

Hold Control

The hold control for the BC-535 has been redesigned to function entirely within the digital domain. This unique approach allows the user to make holding potential adjustments in highly reproducible and discrete steps of 1, 10, and 100 mV, up to ± 400 mV. Hold potentials up to ± 1000 mV or step sizes greater than 100 mV can be applied at the Command Input BNC's located on the front and rear panels of the instrument. Internal and external hold potentials sum for a possible total of 1400 mV.

AutoZero

The large currents flowing through the low resistance aperture prior to bilayer formation saturates the amplifier input. Under these conditions, junction potential offsets can be easily nullified by using the AutoZero function. Once armed, the AutoZero measures and compensates for any offset potentials within the conducting pathway. Traditional manual controls remain for making small corrections or for resetting the offset potential without re-activating the AutoZero cycle.

Audio Output

The BC-535 sports a VCO circuit providing auditory feedback during membrane formation. This feature is selectable from the front panel and an internal speaker is included. An external speaker output is provided on the instrument rear panel.

Capacitance Test

This test circuit has been completely redesigned and is used to monitor the formation of the bilayer membrane. A calibrated triangular waveform is applied to the command input and the amplitude of the resulting square wave is proportional to the membrane capacitance. When selected, the membrane capacitance is read directly from the meter.

4-Pole Bessel Filter

The filtering capacity if the instrument has been expanded to include a low pass, 4-pole Bessel filter ranging from 0.05 to 20 kHz in 1-2-5 steps. The internal filter can be bypassed allowing realization of the instrument's full 75 kHz bandwidth.

Capacitance Compensation

Large capacitance transients are cancelled using both fast (0-10 μ s) and slow (0-2 ms) controls. Each control provides separate adjustment of both amplitude and time constant. Maximum capacitance compensation is 500 pF.

I/O

Input and output BNC's have been duplicated or moved to the instrument rear panel except for those requiring user interaction. Front panel BNC's include Command Input, $V_c \times 10$ and I_m Output. Rear panel BNC's include the headstage connector, I_m Output, Cap Sync, Command In, and Gain and Filter telegraphs. A speaker output is also available on the rear panel.

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Bilayer Clamp Amplifier (continued)

Specifications

Noise frequency	Measured with 8-pole Bessel filter at specified cutoff		
	Frequency Range	Open Input	100 pF at Input
	DC to 1 kHz	0.060 pA RMS	0.82 pA RMS
	DC to 100 Hz	0.009 pA RMS	0.28 pA RMS
Bandwidth	75 kHz		
Input Commands:			
Internal Hold	Digital; 1, 10 or 100 mV steps to ± 400 mV maximum		
Command In	Front and rear external input, 10 V/V (applied voltage is attenuated by 10/100/1000 at the command electrode)		
Junction zero	AutoZero or manual adjust. AutoZero lockout feature. Cycle time 1.5 s. Correction to ± 120 mV		
Audio	VCO with off switch and volume control. Internal speaker and external speaker output		
Capacitance Test	Triangle wave applied to command electrode. Derived membrane capacitance read from meter up to 1000 pF. Calibrated (1 mV/pF) square wave available at Im output. Cap Sync (rear panel) synchronized with input triangle wave		
Gain	Membrane current gain selectable from 0.5 to 1000 mV/pA in 1-2-5 steps		
Filter	4-pole Bessel selectable from 0.05 to 20 kHz in 1-2-5 steps, or bypassed for full amplifier bandwidth		
Capacity Compensation	Fast (0-10 μ s) and slow (0-2 ms) with adjustment of amplitude and time constant for each range. Maximum compensation 500 pF		
Headstage:			
<i>Switching:</i>			
Low Current Mode	50 gigohm feedback, 100 pA maximum current		
High Current Mode	500 megohm feedback, 20 nA maximum current		
I/O:			
<i>Front Panel:</i>			
Command Input	BNC input up to ± 10 V. Attenuated by 10, 100 or 1000		
Im Output	Membrane current scaled by amplifier gain setting		
Vc x 10 Output	Applied command voltage x 10		
<i>Rear Panel:</i>			
Im Output	Membrane current scaled by amplifier gain setting		
Cap Sync	TTL compatible		
Cap Out	Reports calculated membrane capacitance scaled to 1 mV/pF		
Command Input	BNC input up to ± 10 V. Attenuated by 10, 100 or 1000		
Gain Telegraph	Stepped DC voltage 0.5 to 5.5 V in 0.5 V steps for gain settings of 0.5 to 1000 mV/pA. Telegraphed value of 0.0 V for bypass		
Filter Telegraph	Stepped DC voltage 0.5 to 4.5 V in 0.5 V steps for filter settings of 0.05 to 20 kHz. Telegraph value of 5.0 V for full bypass		
External Speaker	Standard RCA jack		
Digital Meter:			
3.5 digit LED	± 1999 mV full scale		
Junction offset	± 120 mV full scale		
Cap Test	0 to 1999 pF		
Vc	± 1999 mV full scale		
Im	± 1999 pA full scale		
Power	100-125 or 220-240 VAC, 50/60 Hz		
Dimensions (H x W x D):			
Case	9 x 42 x 25 cm (3.5 x 16.5 x 10 in.)		
Headstage	2.3 x 2.8 x 5.8 cm (0.9 x 1.1 x 2.25 in.) 1.8 m connecting cable		

Order #	Model	Product
W4 64-0432	BC-535	Bilayer Clamp Amplifier