PiezoDrive

PDQ Series
High-Speed Charge Drives
with Dynamic Current Control™

The PDQ amplifiers are the first commercially available charge drives for piezoelectric actuators. A charge drive is similar to a voltage amplifier except that piezoelectric hysteresis can be reduced to less than 1%.

In many applications, a charge drive can immediately replace a voltage amplifier when improved dynamic linearity is required. This can reduce or eliminate the need for feedback or feedforward control of hysteresis.

PiezoDrive charge drives are designed for both high-performance and ease-of-use. Compared to a standard high-voltage amplifier, there is only one additional control, the DC-gain, which sets the voltage-gain at low-frequencies.

The PDQ charge drives have the same exceptional bandwidth and output current as the PDX voltage amplifiers. This includes Dynamic Current Control™ which dramatically improves the maximum output current and allows the reproduction of larger amplitude waveforms with higher frequency.

In addition to the fast response, the PDQ drives also include: comprehensive overload protection; external shutdown; voltage, charge and current monitor outputs; and front-panel bias-voltage adjustment.

A more detailed discussion of the performance specifications is contained on the following page.

An introduction to charge drives is also available: www.piezodrive.com/downloads/IntroToCharge.pdf

Brief Specifications

Model	PDQ150b	PDQ200b
Voltage	-30V to 150V*	-30V to 200V*
Peak Current	2A	1.5A
Overload Time	100ms	100ms
Average Current	0.7A	0.5A
Signal Bandwidth	Greater than 80 kHz (1uF Load)	
Power Bandwidth	9.5 kHz	7.2 kHz
Charge Gain	2.2, 6.2, 22, 62, 220, or custom uC/V	
Voltage Gain	20 – 66 V/V	
Offset	From 0V to Full-Range with front panel adjustment	
Input	Differential, Zin = 22 kΩ (to eliminate ground loops and noise)	
Connectors	BNC input, BNC Monitor Outputs, 2-Way LEMO 0B HV Output	
Overload	Thermal, current and voltage overload protection	
Noise	<3mV RMS	
Environment	0 - 40°C (32-104°F) Non-condensing humidity	
Enclosure	Rugged desktop enclosure. 19 inch rack compatible	
Dimensions	212.6 x 304.8 x 132.6 mm (w x d x h)	
Power Supply	115V or 230V AC (selectable)	

*This is the minimum peak voltage. The actual voltage range will be larger.

Performance Specifications

Charge Gain

The PDQ charge drives are preconfigured during manufacture to drive a certain range of capacitance values. This means that the charge-gain, resistance ratios, and transition frequency f_c are all optimally preconfigured and do not require user adjustment. The standard capacitance ranges and associated charge-gain, voltage-gain and cut-off frequencies are tabulated below.

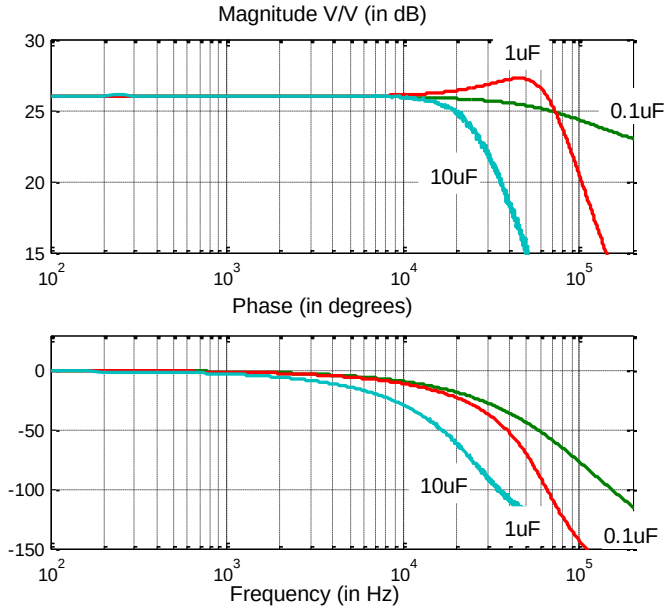
Load Capacitance	Transition Frequency	Voltage Gain	Charge Gain
30 – 100 nF	0.3 – 0.1 Hz	66 – 22	2.2 uC/V
100 – 300 nF	0.1 – 0.03 Hz	60 – 20	6.2 uC/V
0.3 – 1.0 uF	0.1 – 0.03 Hz	66 – 22	22 uC/V
1.0 – 3.0 uF	0.1 – 0.03 Hz	60 – 20	62 uC/V
3.0 – 10 uF	0.1 – 0.03 Hz	66 – 22	220 uC/V
10 – 1000 uF	0.1 Hz	40	Custom

Load capacitance ranges of the PDQ drives

Frequency Response

The small-signal frequency response for a range of capacitive loads is shown in the figure and table below.

Note that the load capacitance is the maximum permitted under each charge range which results in a voltage gain of 20. When the load capacitance is lower, the voltage gain is increased and the bandwidth may reduce.



Frequency response for a range of capacitive loads

Load Capacitance	Bandwidth
0.1 uF	200 kHz
1.0 µF	84 kHz
10 µF	27 kHz
100 µF	2.7 kHz

Approximate bandwidth versus load capacitance.

Power Bandwidth

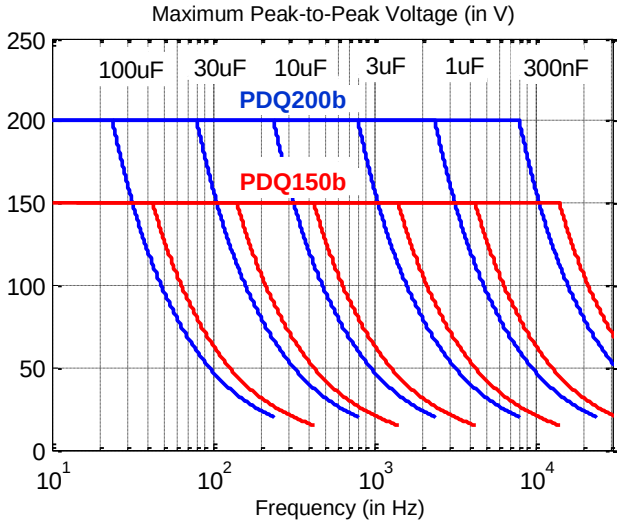
The power bandwidth is the maximum frequency sine-wave that can be reproduced at full voltage. The PDX150b and PDX200b are designed to maximize the power bandwidth in general purpose and scanning applications. With a capacitive load, the maximum frequency sine wave is

$$f^{max} = \frac{I^{pk}}{V_{p-p}\pi C}$$

The power bandwidth for a range of capacitive loads is shown below.

Load Cap.	PDQ150b	PDQ200b
100 nF	*9.5 kHz	*7.2 kHz
300 nF	9.2 kHz	*7.2 kHz
1.0 µF	4.2 kHz	2.3 kHz
3.0 µF	1.4 kHz	790 Hz
10 µF	424 Hz	230 Hz
30 µF	141 Hz	79 Hz
100 µF	42 Hz	23 Hz

Approximate power bandwidth (*max)



Maximum sine-wave amplitude versus frequency

Signal Conditioning

The differential input circuit eliminates ground-loops and noise resulting from the interconnection of different instruments.

Enclosure.

The PDQ drives are housed in a desktop enclosure that can be bolted together in a side-by-side configuration. Mounting in a standard 19-inch rack is also possible with the addition of rack-mount handles.

Options

The PDQ drives can be customized to meet a range of industrial or scientific requirements. Specific options include:

- 19-inch rack kit for two amplifiers
- 19 inch rack kit for a single amplifier

Contact

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