

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 | 2 A | 1.5 A |
| Overload Time | 100 ms | 100 ms |
| RMS Current | 1.6 A | 1.1 A |
| 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.

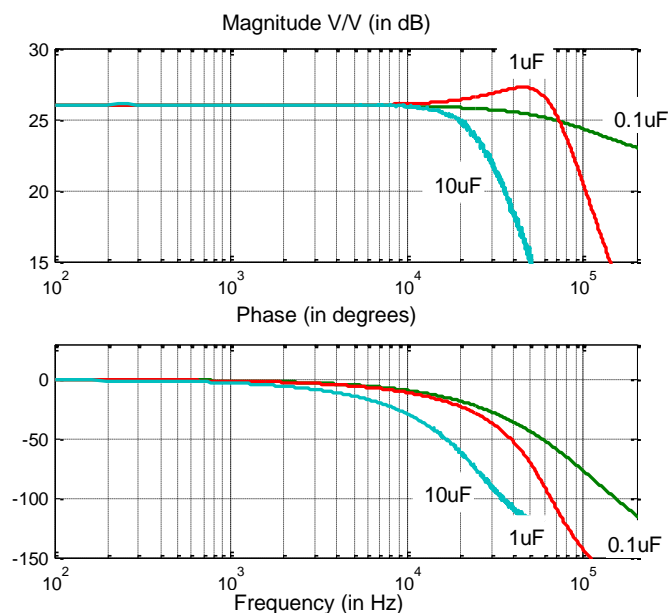
| Load Capacitance | Transition Frequency | Voltage Gain | Charge Gain |
|------------------|----------------------|--------------|-------------|
| 30 – 100 nF | 0.3 – 0.1 Hz | 66 – 22 | 2.2 uC/V |
| 100 – 300 nF | 0.1 – 0.03 Hz | 60 – 20 | 6.2 uC/V |
| 0.3 – 1.0 uF | 0.1 – 0.03 Hz | 66 – 22 | 22 uC/V |
| 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 uF | 84 kHz |
| 10 uF | 27 kHz |
| 100 uF | 2.7 kHz |

Approximate bandwidth versus load capacitance.

Power Bandwidth

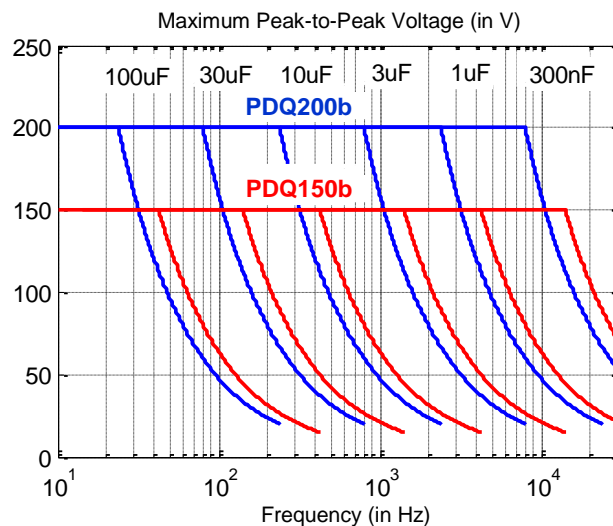
The power bandwidth is the maximum frequency sine-wave that can be reproduced at full voltage. The PDQ150 and PDQ200 are designed to maximize the power bandwidth in general purpose and scanning applications. With a capacitive load, the maximum frequency sine wave is

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

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 uF | 4.2 kHz | 2.3 kHz |
| 3.0 uF | 1.4 kHz | 790 Hz |
| 10 uF | 424 Hz | 230 Hz |
| 30 uF | 141 Hz | 79 Hz |
| 100 uF | 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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