PiezoDrive

아이티비코퍼레이션
전화 02-549-8501
전자우편 sales@itbco.co.kr
홈페이지 www.itbco.co.kr

PD32 - 32 Channel Piezo Driver

Version 4

Manual and Specifications

Contents

1 Introduction

The PD32 is a high-bandwidth, low-noise linear amplifier for driving up to 32 piezoelectric actuators. The voltage range is configurable from +50V to +/-140V and includes asymmetric voltage ranges such as -20V to +120V. The PD32 works seamlessly with common multi-channel DAC cards and is easy to use with LabView and Simulink. The compact size and 19-inch rack compatibility provides a comprehensive off-the-shelf solution for driving hundreds or thousands of piezoelectric actuators.

The PD32 is designed for demanding applications such as Adaptive Optics, Acoustic Beam Forming, Materials Testing, Astronomy, Ultrasonics, and Vibration Control. With an output current of 150mA per channel, a large array of piezoelectric actuators can be driven simultaneously at high frequencies. Positive and negative high-voltage bias outputs are also included for compatibility with piezoelectric bender actuators.

Compatible Actuators	
Stack Actuators	60V, 100V, 120V, 150V
Plates and Tubes	up to +/-140V
Two Wire Benders	up to +/-140V
Three Wire Benders	Up to 140V, or +/-75V

Each channel is individually protected against short circuit and thermal overload. Status indicators on the front panel provide individual monitoring of all channels. A digital status signal and external shutdown command is also accessible from the input connector to allow remote monitoring and control. The input and output connectors are industry standard 37 Pin D-Sub connectors which are straight-forward to assemble. Adaptors are available for industry standard 32 Channel DAC cards.

2 Warnings / Notes

This device produces hazardous potentials and should be used by suitably qualified personnel under the supervision of an observer with appropriate first-aid training. Do not operate the device when there are exposed conductors.

3 Specifications

	Grounded Load	Floating Load
Output Voltage	+45V to +140V	+/-90V or +/-140V
Peak Current	150 mA per channel	75 mA per channel
RMS Current	106 mA per channel	53 mA per channel
Power Bandwidth	50 kHz (120 Vpp)	50 kHz (240 Vpp)
Signal Bandwidth	120 kHz	120 kHz
Slew Rate	19 V/us	38 V/us
Gain	15 V/V	20 V/V
Input Impedance	53 kOhm	6.25 kOhm
Input Offset	±5 mV	±5 mV
Load	Unlimited	Unlimited
Output Noise	200 uV RMS (1uF Load)	300 uV RMS (1uF Load)
Protection	Short-circuit and thermal overload	
Inputs	32 Analog inputs, shutdown command	
Outputs	32 HV Analog outputs, overload monitor	
Connectors	Industry standard DB-37 (input) and DD-78 (output)	

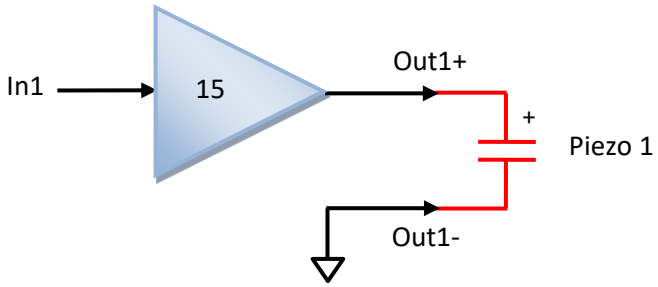
Mechanical Specifications	
Environment	0 - 40°C (-32 to 104°F) Non-condensing humidity
Dimensions	212 x 304.8 x 88 mm (8.35 x 12 x 3.46 in)
Weight	2 kg (4.4 lb)

4 Output Voltage Range

The output voltage range is configurable between +50V and +/-140V and the load can be either grounded or floating. For peak-to-peak voltages less than 140V, the grounded load configuration is recommended since this provides greater current. The floating load configuration is required for the +/-100V and +/-140V ranges. The desired configuration should be specified at the time of ordering.

4.1 Grounded Load

In the grounded load configurations, the actuator connections are illustrated below. The negative output is internally grounded.

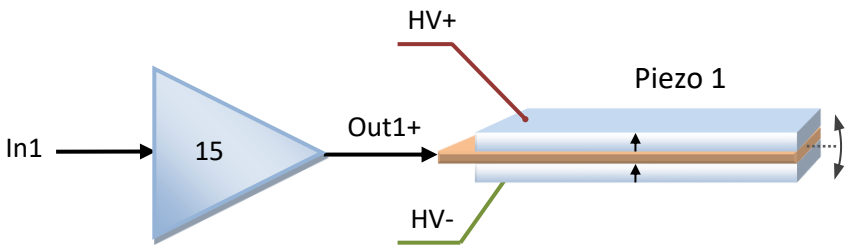


The desired output voltage range can be selected from the following table.

Min Voltage	Max Voltage	Order Code
0	+140	PD32-0,140
0	+120	PD32-0,120
0	+95	PD32-0,95
0	+70	PD32-0,70
0	+45	PD32-0,45
-20	+120	PD32-20,120
-20	+95	PD32-20,95
-45	+45	PD32-45,45
-70	+70	PD32-70,70

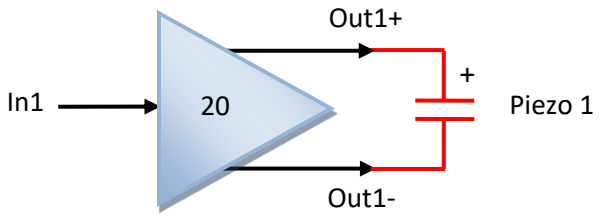
Grounded Load Voltage Ranges

Three wire bender actuators can be driven using the following connection diagram. The HV+ and HV- bias voltages are the minimum and maximum voltages listed in the table above and are accessible on the output connector.



4.2 Floating Load

The floating load configuration is useful for achieving higher peak-to-peak voltage swings. The connection diagram is illustrated below. Do not connect either of these signals to ground, for example, an oscilloscope probe.



The desired output voltage range can be selected from the following table.

Min Voltage	Max Voltage	Order Code
-140	+140	PD32-140,140
-95	+95	PD32-95,95

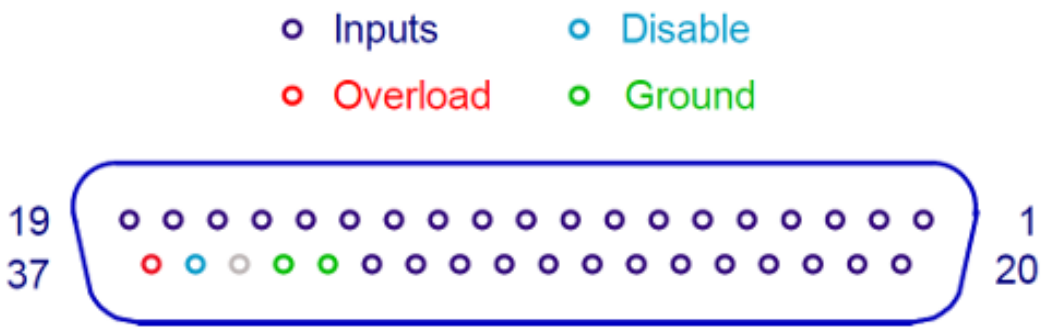
Floating Load Voltage Ranges

5 Input Connection Diagram

The front panel input connector is an industry standard DB37 Female Connector (TE 1658612-1). Any Male DB-37 cable plug is compatible. The connection diagram is illustrated below.

Signals	Input Connector	Notes
Analog Inputs 1 to 32	Pins 1 to 32	+/- 10V max
Ground	33, 34	
Non Connected	35	
Digital disable command	Pin 36	3.3V or 5V logic
Overload indicator	Pin 37	5V logic

Input Connector Signals



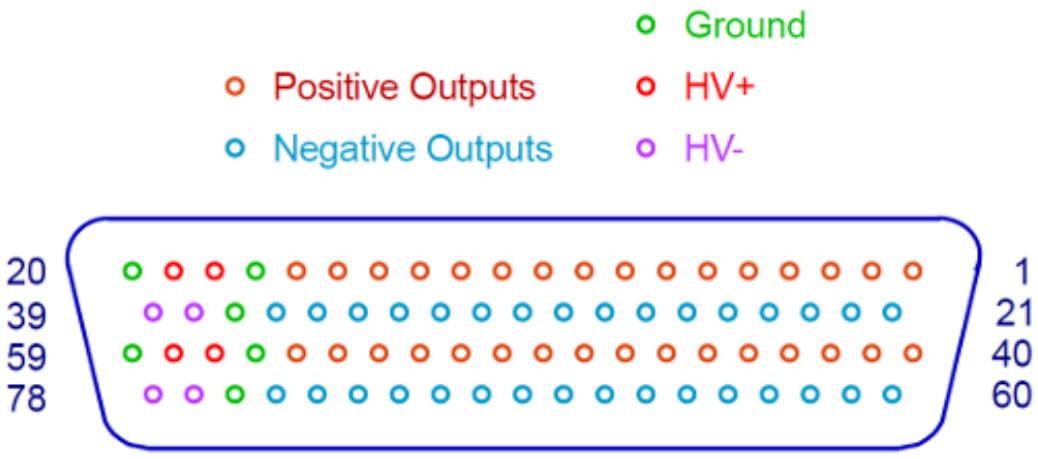
Input Connector Pinout

6 Output Connection Diagram

The front panel output connector is an industry standard DB37 Female Connector (TE 5748483-5). Any Male DD-78 cable plug is compatible. The connection diagram is illustrated below.

Signals	Connector 1	Notes
Outputs 1 to 16 (positive)	1 - 16	
Ground	17, 20	
HV+	18, 19	For driving benders
Outputs 1 to 16 (negative)	21 - 36	
Ground	37	
HV-	38, 39	For driving benders
Outputs 17 to 32 (positive)	40 - 55	
Ground	56, 59	
HV+	57, 58	For driving benders
Outputs 17 to 32 (negative)	60 - 75	
Ground	76	
HV-	77, 78	For driving benders

Output Connector Signals



Output Connector Pinout

7 Output Current

The peak output current is 150 mA per channel in the grounded load configuration or 75 mA per channel in the floating load configuration. The maximum RMS current is 106 mA in the grounded configuration and 53 mA in the floating load configuration.

The maximum simultaneous output current from all channels is 3 Amps RMS.

8 Power Bandwidth

The nominal slew-rate of the PD32 in the grounded load configuration is 19 V/us. Therefore, the unloaded maximum frequency sine-wave is

$$f_{max} = \frac{19 \times 10^6}{\pi V_{L(p-p)}}.$$

That is, the power bandwidth for a 120 Vp-p sine-wave is 50 kHz. In the floating load configuration, the slew-rate is doubled to 38 V/us, therefore, the power bandwidth for a 240 Vp-p sine-wave is 50 kHz

With a capacitive load, the power bandwidth is limited by the output current. The maximum frequency sine wave is

$$f_{pwr} = \frac{I_{pk}}{\pi V_{L(p-p)} C_L}$$

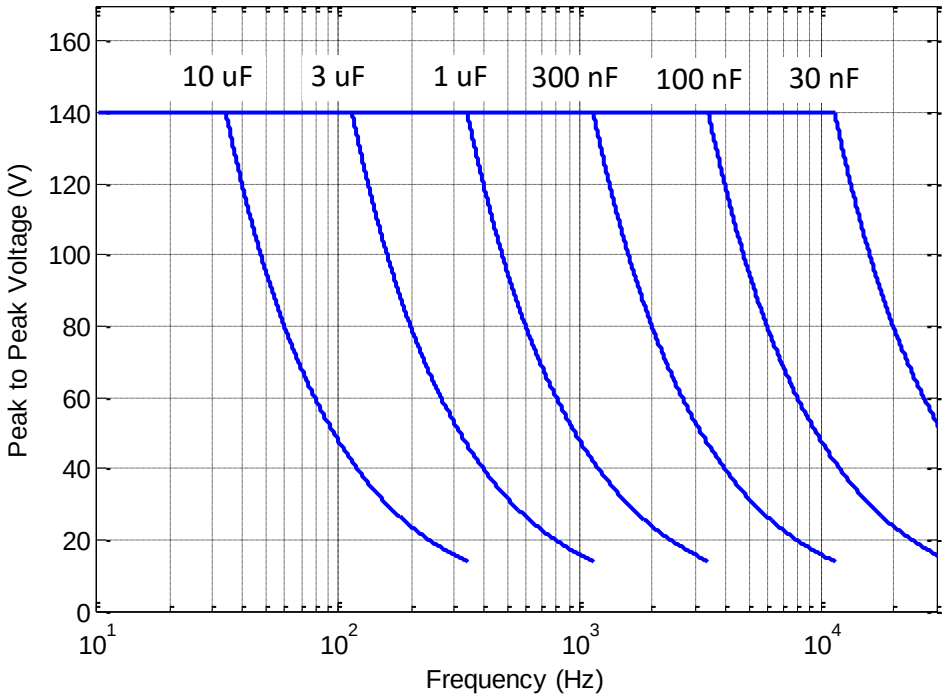
where I_{pk} is the peak current limit, $V_{L(p-p)}$ is the peak-to-peak output voltage, and C_L is the effective load capacitance. The power bandwidth versus load capacitance is listed below.

Load	Grounded Load Voltage (pk-pk)		
Cap.	50	100	140
10 nF	95 kHz	47 kHz	34 kHz
30 nF	31 kHz	15 kHz	11 kHz
100 nF	9.5 kHz	4.7 kHz	3.4 kHz
300 nF	3.1 kHz	1.5 kHz	1.1 kHz
1 uF	950 Hz	470 Hz	340 Hz
3 uF	310 Hz	150 Hz	114 Hz
10 uF	96 Hz	48 Hz	34 Hz
30 uF	32 Hz	16 Hz	11 Hz

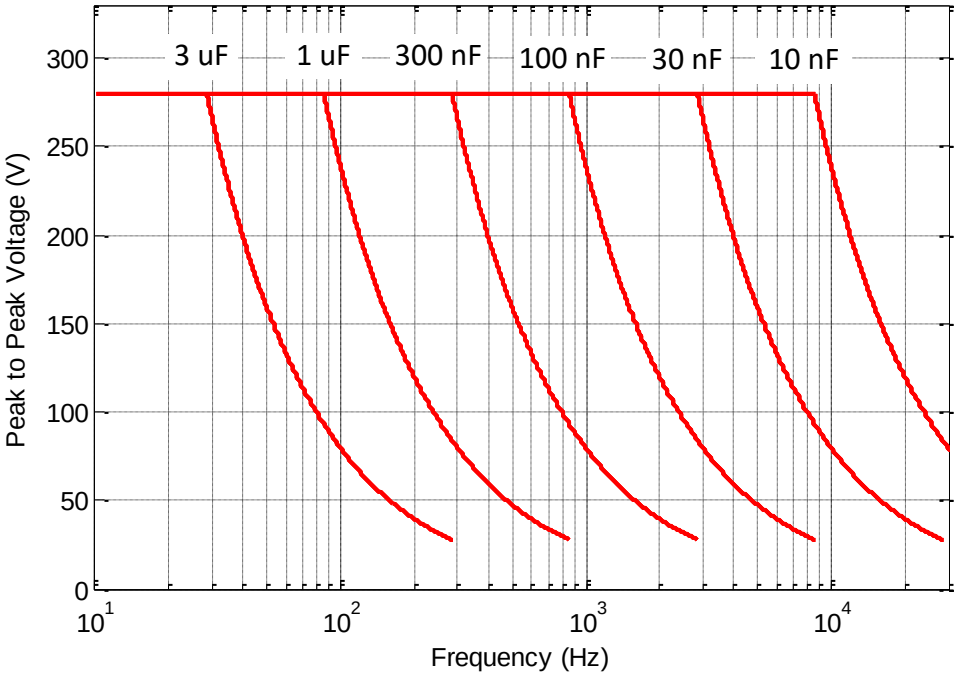
Load	Floating Load Voltage (pk-pk_		
Cap.	100	200	280
10 nF	23 kHz	11 kHz	8.5 kHz
30 nF	7.9 kHz	3.9 kHz	2.8 kHz
100 nF	2.3 kHz	1.1 kHz	850 Hz
300 nF	790 Hz	390 Hz	284 Hz
1 uF	230 Hz	119 Hz	85 Hz
3 uF	80 Hz	40 Hz	28 Hz
10 uF	24 Hz	12 Hz	9 Hz
30 uF	8 Hz	4 Hz	3 Hz

Power Bandwidth versus Load Capacitance (Grounded and Floating Load Configuration)

In the following figures, the maximum frequency periodic signal is plotted against the peak-to-peak voltage.



Maximum frequency versus voltage and capacitance (Grounded Load)



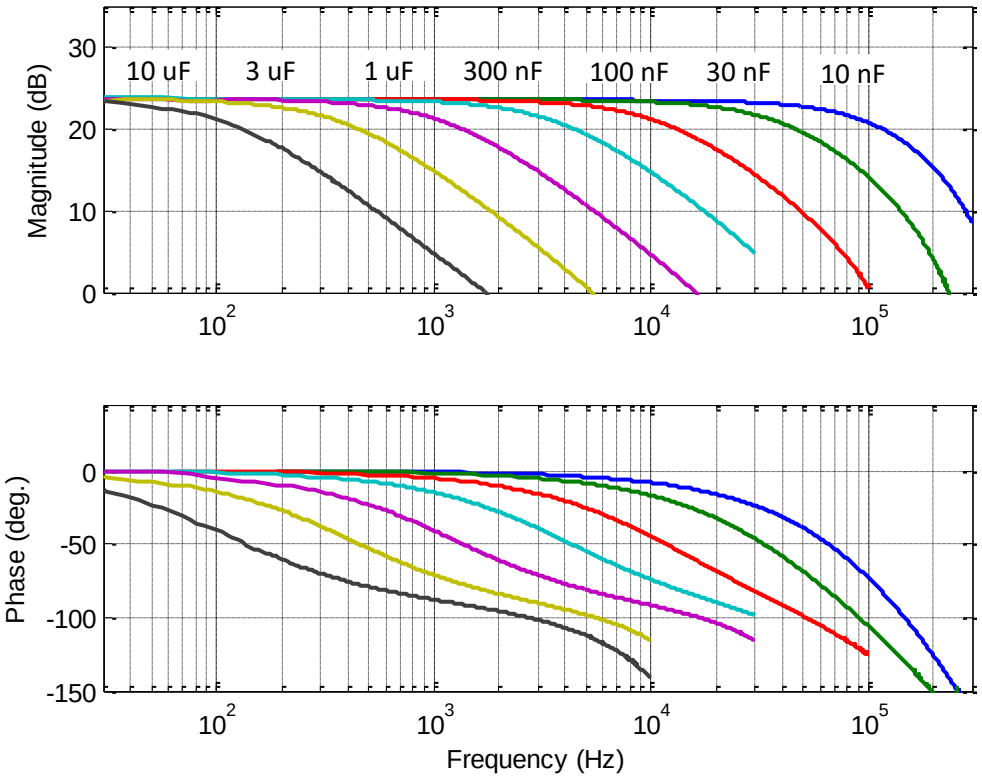
Maximum frequency versus voltage and capacitance (Floating Load)

9 Small Signal Bandwidth

The small-signal bandwidth for a range of capacitive loads is listed below. The small-signal frequency responses are also plotted.

Load Capacitance	Signal Bandwidth
No Load	120 kHz
10 nF	90 kHz
30 nF	40 kHz
100 nF	11 kHz
300 nF	3.8 kHz
1 uF	1.0 kHz
3 uF	320 Hz
10 uF	62 Hz
30 uF	24 Hz

Small signal bandwidth (-3 dB)



Small signal frequency response versus load capacitance

10 Overload Protection

Each channel is protected against short-circuit and thermal overload. If the thermal overload on any channel engages, the front panel indicator for that channel will illuminate. In addition, an overload on any channel will cause the overload signal (pin 37) on the input connector to go high (+5V).

The amplifier can also be disabled by applying a logic high (3.3V to 5V) to the disable pin (pin 36).

11 Enclosure

The PD32 has a side air intake and rear exhaust. These vents should not be obstructed. If sufficient air-flow is not available, the amplifier will enter a thermal overload state as discussed above.

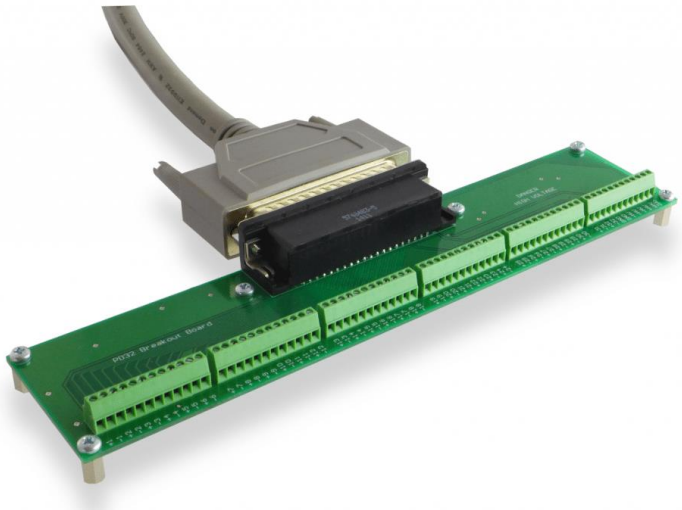
The PD32 amplifier can be rack-mounted in a single or side-by-side arrangement. The DAC card adaptor can also be rack mounted in a single or side-by-side arrangement with another adaptor or the amplifier itself. A single amplifier or adaptor can be mounted with the PD32-Rack1 kit. Two adaptors, amplifiers, or a combination of both can be mounted side-by-side with the PD32-Rack2 kit.

12 Input Test Connector and Cable

An adaptor PCB is supplied which connects all input channels to a single BNC connector. A 2.5ft DB37 (Male-Male) input cable is also supplied.

13 Breakout Board and Cable (PD32-Breakout)

A screw-terminal breakout board is included which connects to the amplifier via a Female DD78 connector (TE 5748483-5) and HD78 Male-Male cable (2.5 ft). If required, the board can be mounted onto a base structure using the installed M3 hex spacers.



Breakout Board

14 Signal Adaptors

The signal adaptors allow a direct connection to common multi-channel DAC cards. Standard adaptors are listed below; however, custom adaptors can also be created.

Manufacturer	DAC Card	Signal Adaptor	Notes
National Instruments	PCI-6723	PD-6723	Requires NI SH68-C68-S Cable
National Instruments	PXI-6723	PD-6723	Requires NI SH68-C68-S Cable

Standard Signal Adaptors

The adaptors are contained in a compact desktop enclosure which can be mounted in a side-by-side arrangement to another adaptor or an amplifier. A single amplifier or adaptor can be mounted with the PD32-Rack1 kit. Two adaptors, amplifiers, or a combination of both can be mounted side-by-side with the PD32-Rack2 kit.

15 Warranty

The PD32 is guaranteed against manufacturer defects for a period of 12 months.