

PZ211E User Manual

E-835 Piezo Driver Module

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This document describes the following product:

- E-835.00
OEM Piezo Amplifier for DuraAct™ Patch Transducer



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Conformity

The E-835 OEM Module is intended to be integrated in other electrical equipment. As such, it does not carry the CE emblem but will conform to the standards cited below providing the user ensures a compliant connection when implementing the total system. Possible necessary measures are installation of the component in a suitable shielded enclosure and usage of suitable connectors.

Electromagnetic Emission: EN 61000-6-3, EN 55011
Electromagnetic Immunity: EN 61000-6-1
Safety (Low Voltage Directive): EN 61010-1

RoHS

The E-835 complies with the RoHS directive.

Disposal

In accordance with EU directive 2002 / 96 / EC (WEEE), as of 13 August 2005, electrical and electronic equipment may not be disposed of in the member states of the EU mixed with other wastes.

To meet the manufacturer's product responsibility with regard to this product, Physik Instrumente (PI) GmbH & Co. KG will ensure environmentally correct disposal of old PI equipment that was first put into circulation after 13 August 2005, free of charge.

If you have such old equipment from PI, you can send it to the following address postage-free:

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This manual has been provided for information only and product specifications are subject to change without notice.

About This Document

Users of This Manual

This manual is designed to help the reader to install and operate the E-835 Piezo Driver Module. It assumes that the reader has a fundamental understanding of piezoelectric drives and applicable safety procedures.

The manual describes the physical specifications and dimensions of the E-835 Piezo Driver Module as well as the installation procedures which are required to put the associated motion system into operation.

This document is available as PDF file. Updated releases are available for download from www.pi.ws or by email: contact your Physik Instrumente Sales Engineer or write info@pi.ws.

Conventions

The notes and symbols used in this manual have the following meanings:

DANGER

Indicates the presence of high voltage (> 50 V). Calls attention to a procedure, practice or condition which, if not correctly performed or adhered to, could result in injury or death.



CAUTION

Calls attention to a procedure, practice, or condition which, if not correctly performed or adhered to, could result in damage to equipment.



NOTE

Provides additional information or application hints.

The hardware components which might be delivered with E-835 Piezo Driver Modules are described in their own manuals. Updated releases are available for download from www.pi.ws or by email: contact your Physik Instrumente representative or write info@pi.ws.

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1 Introduction

1.1 Product Description



Fig. 1: E-835 OEM amplifier module with piezoceramic DuraAct™ patch transducer; CD for size comparison

The E-835 OEM piezo amplifier module is designed for driving P-876 DuraAct™ piezo patch transducers. It provides a peak output power of 30 W with a peak current of 120 mA in the semi-bipolar voltage range (-100 V / +250 V). The continuous output power is rated at 3 W (with heat sink, up to 10 W).

This compact piezo amplifier module supplies adequate power for a broad range of DuraAct™ patch transducer applications, e.g. active vibration damping, smart structures, structure monitoring and stabilization.

The E-835 piezo driver module provides precision control for DuraAct™ Patch Transducers both in static and dynamic operation. Its output voltage is determined by an external analog control signal in the -4 to +10 V-range applied to the respective input.

1.2 Prescribed Use

Based on their design and realization, the E-835 Piezo Driver Modules are intended to drive capacitive loads, in the present case, piezoceramic actuators. The E-835 must not be used for applications other than stated in this manual, especially not for driving ohmic (resistive) or inductive loads.

Observe the safety precautions given in this User Manual.

The E-835 may only be used for applications suitable according to the device specifications. Operation other than instructed in this User Manual may affect the safeguards provided.

The verification of the technical specifications by the manufacturer does not imply the validation of complete applications. In fact the operator is responsible for the process validation and the appropriate releases.

The E-835 is a laboratory apparatus as defined by DIN EN 61010. It meets the following minimum specifications for safe operation (any more stringent specifications in the technical data table (p. 10) are, of course, also met):

- Indoor use only
- Altitude up to 2000 m
- Ambient temperature from 5°C to 40°C
- Relative humidity up to 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C
- Degree of pollution: 2

1.3 Safety Precautions

DANGER

E-835 OEM driver are high-voltage amplifiers capable of generating high output currents. They may cause serious or even lethal injury if used improperly. Working with high-voltage amplifiers requires adequately trained operating personnel. Strictly observe the following:

- Do not touch any part which carries the piezo output voltage, especially not the HVOUT pin. Voltages between -100 V and +250 V can be present on the HVOUT pin.
- The E-835 OEM amplifier does not contain any user-serviceable parts. Never disassemble the device. Hazardous voltage can be present on the internal components.



CAUTION—Connections

Connect the DuraAct™ patch transducer and the control input voltage to the E-835 only when the E-835 is powered down and de-energized. Use isolated wires of a suitable cross section only (see p. 6).



CAUTION—Protection against contact

Operate the E-835 only when it is protected against contact, e.g. installed in a suitable shielded enclosure.



CAUTION—Overheating

The high voltage output of the E-835 will be deactivated automatically if the hardware temperature is out of range (> 100 °C). After a cooling-down period, at a hardware temperature of 60°C, the high voltage output is reactivated automatically.



To avoid overtemp conditions, reduce the operating frequency and/or the load and/or the ambient temperature.



CAUTION—Electrostatic Hazard

PCB Cards Subject to Damage

Electronic components are sensitive to electrostatic electricity. Take appropriate electrostatic protection measures when handling these devices. Avoid touching components and conductors unnecessarily.

1.4 Contents of Delivery

Unpack the E-835 Piezo Driver Module with care. Compare the contents against the items ordered and against the packing slip.

The following items are included:

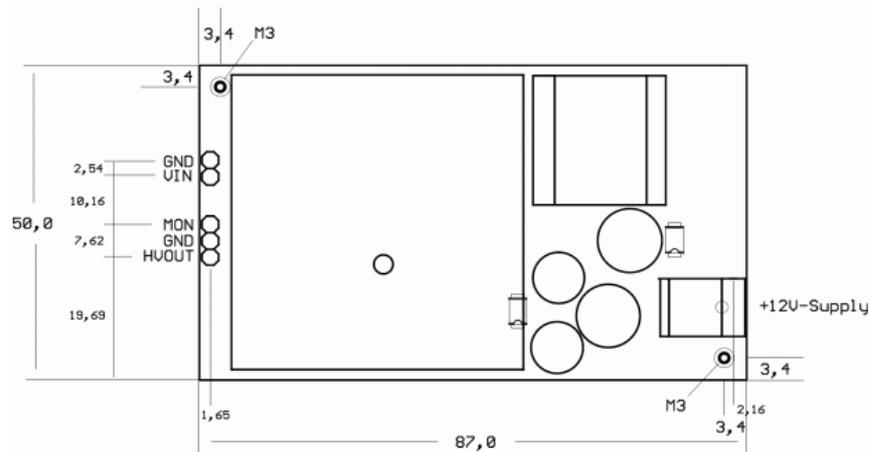
E-835.00	Piezo Driver Module
PZ211E	User Manual in printed form (this document)
E500T0011	Technical Note for Analog Drivers

2 Operation

2.1 Connections

CAUTION—Connections

Connect the DuraAct™ patch transducer and the control input voltage to the E-835 only when the E-835 is powered down and de-energized. Use isolated wires of a suitable cross section only (see below).



E-835 connections

Solder point description (seen top down in figure above):

- GND Ground for control input
- VIN Control input voltage, -4 to +10 V

- MON Output monitor = HVOUT / 100
- GND Ground for high voltage output
- HVOUT High voltage output, -100 to +250 V

12 V Supply power on 5.5 mm barrel connector, tip positive, input and output-ground are connected.

You can connect a measuring device to the MON solder point which carries a high-impedance output of 1/100th the voltage of HVOUT.

To connect the DuraAct™ patch transducer and the control input source, solder wires to the corresponding solder points on the E-835 board:

- Control input source connection:
Use the VIN solder point and the adjacent GND solder point.
- DuraAct™ patch transducer connection:
Respect the polarity of the DuraAct™ patch transducer which is reflected by the solder point markings in the figure below. Use isolated wires of a suitable cross section, e.g. the isolated wire LIY 0.25 mm² (corresponds to AWG 23 wires). After soldering, it is recommended to cover the solder points on the DuraAct™ patch transducer with electrical tape.
 - HVOUT solder point must be connected to +
 - GND solder point (located between MON and HVOUT) must be connected to -

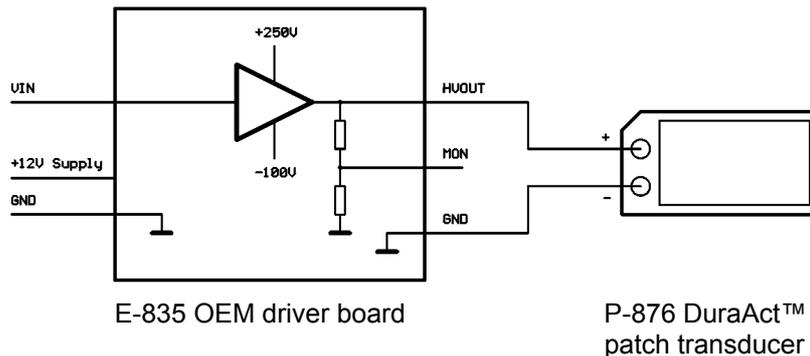


Fig. 2: E-835 block diagram and connection to DuraAct™ patch transducer

2.2 Control Input Signal

E-835s are operated as simple power amplifiers, i.e. the HVOUT output voltage depends directly on the VIN input control voltage (-4 to +10 V).

The control input can be generated by a PC using a DAC-board. PI offers a LabVIEW™ driver set which can be used with certain D/A boards. This driver set is compatible with the PI General Command Set (GCS) LabVIEW driver set available for all newer controllers from PI. The Analog Controller LabVIEW™ Driver (E-500.ACD) is free of charge, but requires the LabVIEW™ environment from National Instruments for operation.

The PI Analog Controller drivers support all D/A converter boards from National Instruments that are compatible with DAQmx8.3. LabVIEW™ compatibility is given from version 7.1 upwards. Instructions for downloading the Analog Controller drivers are given in the included E500T0011 Technical Note.

2.3 Start-Up

CAUTION—Protection against contact

Operate the E-835 only when it is protected against contact, e.g. installed in a suitable shielded enclosure.



NOTES

When the E-835 is powered on, the control input should be 0 V.

The HVOUT output is limited to -100 V to +250 V even if the control input voltage exceeds the limits (-4 to 10 V).

Most dynamic applications require the power amplifier to deliver a short peak current higher than an average value. Because of the limited power of the transistors, this peak is limited to about 5 ms in length. After this time the current decreases to the average value.

- 1 Connect the control input source and the DuraAct™ patch transducer to the E-835 as described in Section 2.1.
- 2 Protect the E-835 against contact, e.g. install it in a shielded enclosure.
- 3 Set the control input to 0 V.
- 4 Supply the board with the 12 VDC power (a DC-DC converter on the main board generates all the voltages required from the single 12 V supply).
- 5 Drive the control input with a control voltage over the range of -4 to +10 V. The corresponding output range will be -100 to +250 V, and the DuraAct™ patch transducer will be contracted/expanded accordingly.

2.4 Monitoring the Output Voltage

The HVOUT drive voltage is proportional to the analog signal input. The HVOUT output voltage can be monitored either directly (in parallel with the DuraAct™ patch transducer) or on the MON solder point, which carries a high-impedance output of 1/100th the voltage of the HVOUT.

3 Technical Data

3.1 Specifications

Model	E-835.00
Function	Power amplifier for DuraAct™ piezo patch transducers
Channels	1
Amplifier	
Input voltage	-4 to 10 V
Output voltage	-100 to 250 V
Peak output power	30 W (<15 ms)
Average output power	3 W (10 W with heat sink)
Peak current	120 mA (<15 ms)
Average current	40 mA
Current limitation	Short-circuit-proof
Voltage gain	25
Amplifier bandwidth, small signal	4.2 kHz (60 nF)
Amplifier bandwidth, large signal	4.2 kHz (unloaded) 500 Hz (60 nF)
Ripple, noise, 0 to 20 MHz	2 mV peak-to-peak
Output impedance	33 Ω
Amplifier resolution	<10 mV
Input impedance	100 kΩ
Interfaces and operation	
Piezo voltage	Solder pads
Control input	Solder pads
Piezo voltage monitor	Solder pad, 1:100
Miscellaneous	
Operating temperature range	+5°C to +50°C (10% derated over 40°C)
Overtemp protection	Deactivation at 100°C
Dimensions	87 x 50 x 21 mm
Mass	67 g
Operating voltage	12 V, 1.7 A 5.5 mm barrel connector, tip positive
Max. power consumption	20 W

3.2 Operating Limits

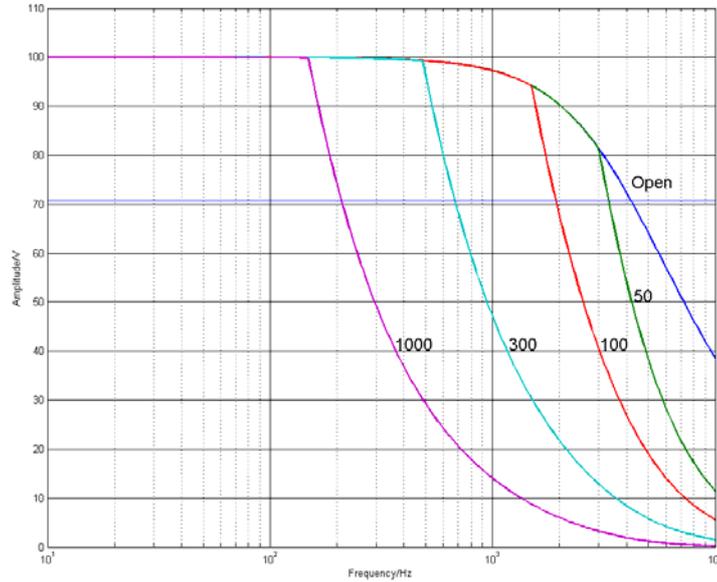


Fig. 3: E-835 open-loop frequency response with various PZT loads. Values shown are capacitance in nF. Voltage amplitude 0 to 100 V.

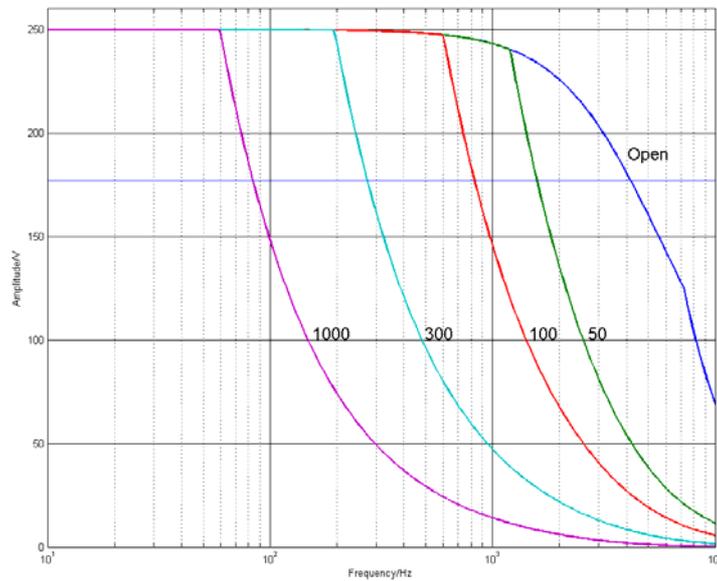


Fig. 4: E-835 open-loop frequency response with various PZT load. Values shown are capacitance in nF. Voltage amplitude 0 to 250 V.

