

PZ 97E Operating Manual

E-650 LVPZT Amplifier

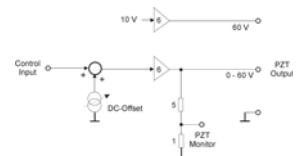
for Multilayer Bending Actuators

Release: 1.0.3 Date: 2005-05-12



This document describes the following product(s):

- **E-650.00**
LVPZT Amplifier
- **E-650.OE**
LVPZT OEM Amplifier



© **Physik Instrumente (PI) GmbH & Co. KG**
 Auf der Römerstr. 1 · 76228 Karlsruhe, Germany
 Tel. +49 721 4846-0 · Fax: +49 721 4846-299
 info@pi.ws · www.pi.ws

Declaration of Conformity

according to ISO / IEC Guide 22 and EN 45014

Manufacturer:	Physik Instrumente (PI) GmbH & Co. KG	
Manufacturer's Address:	Auf der Römerstrasse 1 D-76228 Karlsruhe, Germany	

The manufacturer hereby declares that the product

Product Name: **LVPZT Amplifier**
Model Numbers: **E-650**
Product Options: **all**

conforms to the following EMC Standards and normative documents:

Electromagnetic Emission: EN 61000-6-3, EN 55011

Electromagnetic Immunity: EN 61000-6-1

Safety (Low Voltage Directive): EN 61010-1

Electrical equipment, which is intended to be integrated in other electrical equipment, only conforms to the cited EMC Standards and normative documents, if 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.

August 24, 2004
Karlsruhe, Germany



Dr. Karl Spanner
President

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This manual has been provided for information only and product specifications are subject to
change without notice. Any change will be reflected in future printings.

About this Document

Users of this Manual

This manual is designed to help the reader to install and operate the E-650 LVPZT Amplifier for Multilayer Bending Actuators. It assumes that the reader has a fundamental understanding of applicable safety procedures.

The manual describes the physical specifications and dimensions of the E-650 LVPZT Amplifier for Multilayer Bending Actuators 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 via FTP or 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:

WARNING

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



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.



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1 Safety Precautions

WARNING

Failure to heed warnings in this manual can result in bodily injury or material damage. Note that E-650 Controller/Amplifier do not contain any user-serviceable parts.



CAUTION

The E-650.OE Amplifier PCB is an ESD-sensitive (electrostatic discharge sensitive) device. Observe all precautions against static charge buildup before handling these device.

Avoid touching circuit components, pins and PCB traces. Discharge any static charge you may have on your body by briefly touching a conductive, grounded object before you touch any electronic assembly. Pose PCBs only on conductive surfaces, such as ESD-safe transport containers (envelopes, foam). Electronic subassemblies must always be kept and transported/shipped in conductive packaging.

Make sure that no conductive particles of any kind (metallic dust or shavings, broken pencil leads, loose screws) contact the device circuitry.



DANGER

E-650s are amplifiers generating high voltages of up to 60 V for driving piezo actuators. The output power may cause serious injuries.

Working with these devices or using piezoelectric products from other manufacturers we strictly advise you to follow the General Accident Prevention Regulations.

All work done with and on the devices described here requires adequate knowledge of handling high voltages.





CAUTION

Handle bender actuators (ceramic elements!) with care! Do not drop a bender actuator; avoid subjecting it to any kind of mechanical shock.

2 Introduction

E-650.00 is a bench top amplifier especially designed for Low Voltage PICMA[®] multilayer bender actuators from PI ("Bimorphs"; see PI catalog) such as the PL-122 to PL-140. It contains one amplifier that can output and sink a peak current of 300 mA.

An OEM version is also available (E-650.OE, see p. 10).

Features:

- Specially Designed to Drive Multilayer "Bimorph" Actuators
- 18 W Peak Power
- LCD Voltage Display
- Output Voltage Range 0 to 60 V + One Fixed Voltage for Full Differential-Voltage Control

The PICMA[®] actuators require full differential-voltage control with constant voltages of 0 V and +60 V and a variable voltage from 0 V to +60 V (see Fig. 1). Note that a control input voltage of 0 V corresponds to a PZT variable output of about +30 V, which puts the actuator in the middle position (i.e. deflection $\approx 0 \mu\text{m}$).

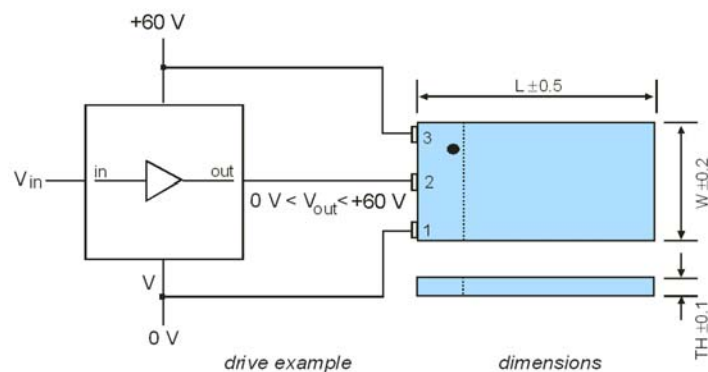


Fig. 1. PICMA[®] multilayer bender actuator with full differential-voltage control,

Pin assignment:

1	-0 V [or GND]
2	-0 V to +60 V
3	+60 V

2.1 Models and Accessories

- E-650.00** LVPZT Amplifier for Multilayer Bender Actuators
- E-650.OE** LVPZT OEM Amplifier for Multilayer Bender Actuators
- E-650.PS** Power Supply (ID#2580)
- E-650.90** OEM cable for PZT connection, DB9pin, open end, 1.5 m

3 Operating Elements

3.1 Front Panel Elements

A 3 1/2 digit LCD display reads the output voltage.

Marking	Element
"DC-Offset"	10-turn potentiometer for DC bias 0 to +60 Volts
"PZT Monitor"	control voltage output monitor, 0 ...+10 V
"PZT Output"	DB 9-pin connector for PZT connection
"Control Input"	Analog control voltage input, BNC connector
"Power"	Power on/off toggle switch

3.2 Rear Panel Elements

Power connector for +15 VDC input

4 Operation



DANGER

E-650s are amplifiers generating high voltages of up to 60 V for driving piezo actuators. The output power may cause serious injuries.

Working with these devices or using piezoelectric products from other manufacturers we strictly advise you to follow the General Accident Prevention Regulations.

All work done with and on the devices described here requires adequate knowledge of handling high voltages.



CAUTION

Handle bender actuators (ceramic elements!) with care! Do not drop a bender actuator; avoid subjecting it to any kind of mechanical shock.

4.1 Operating Requirements

A power supply for 2A @ 15 VDC is required.
Recommended is the use of the 650.PS power supply.

4.2 Operating Modes

External operation:

Output voltage is controlled by an analog signal applied to the BNC input, ranging from 0 to 10 V. Multiplying by the gain factor of 6, an output voltage range of 0 to 60 V results. The DC offset potentiometer can be used to bias the control input voltage. The control voltage is applied to the input socket (BNC connector) "Control Input", Input range: 0 ...+10 V.

Manual Operation:

Output voltage can be set by a 10-turn, DC offset potentiometer in the range of 0 to 60 V.

5 E-650.00 Technical Data

5.1 Block Diagram

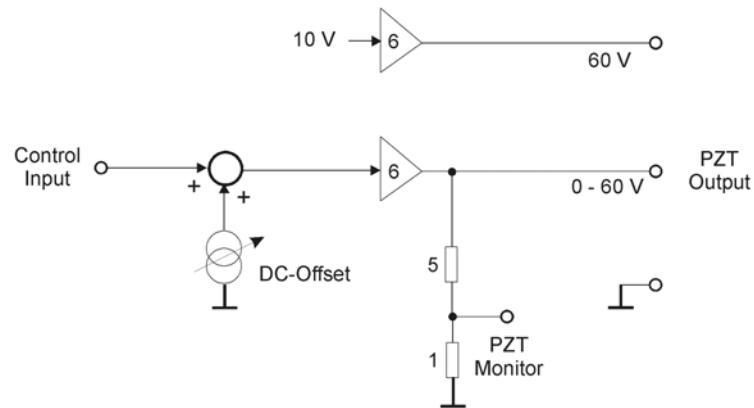


Fig. 2: Block Diagram

5.2 Pin Assignment

"PZT Output" connector

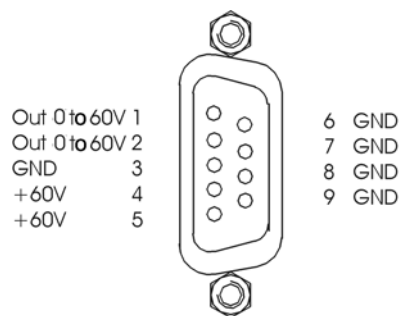


Fig. 3: Pin Assignment

Pin 1 is internally connected to pin 2 and pin 4 is internally connected to pin 5, so that the appropriate output voltages are present on both pins of such a "pair" in parallel. It is also possible to connect two bender actuators (sharing the same connector), but they can not be commanded separately.

5.3 E-650.PS Power Supply

2A @+15VDC output,
90-240 VAC input

- 1: center pin, +15Vdc, 2.1 mm diameter
2: GND



5.4 Specifications

TECHNICAL DATA: E-650.00	
Function	Power amplifier
Channels	1
Maximum output power	18 W
Average output power	6 W
Peak output current < 5 ms	300 mA
Average output current > 5 ms	60 mA per channel
Current limitation	Short-circuit proof
Control input voltage	0 to +10 V
Output voltage	0 to 60 V; one additional fixed voltage of 60 V
Polarity	positive
DC offset setting	0 to 60 V w / 10-turn pot
Voltage gain	6 ±0.1
Input impedance	100 kΩ
Frequency response	600 Hz @ 1000 nF load 6 kHz @ no load
Display	3 1/2 digit, LCD
Control input socket	BNC
PZT voltage output socket	9 pin D-Sub
Dimensions	160 x 125 x 50 mm
Weight	0.7 kg (w/o P/S)
Operating voltage	90-240 VAC, 50-60 Hz (external switched P/S)

6 E-650.OE OEM LVPZT Amplifier

CAUTION

The E-650.OE Amplifier PCB is an ESD-sensitive (electrostatic discharge sensitive) device. Observe all precautions against static charge buildup before handling these device.

Avoid touching circuit components, pins and PCB traces. Discharge any static charge you may have on your body by briefly touching a conductive, grounded object before you touch any electronic assembly. Pose PCBs only on conductive surfaces, such as ESD-safe transport containers (envelopes, foam). Electronic subassemblies must always be kept and transported/shipped in conductive packaging.

Make sure that no conductive particles of any kind (metallic dust or shavings, broken pencil leads, loose screws) contact the device circuitry.

E-650.OE is an OEM amplifier especially designed for Low Voltage Multilayer Bender Actuators ("Bimorphs") such as the PL-122 to PL-140. It contains one amplifier that can output and sink a peak current of 140 mA.



Fig. 4: E-650.OE OEM LVPZT Amplifier for Piezo Bender Actuators

Features

- Specially Designed to Drive Multilayer "Bimorph" Actuators
- 8 W Peak Power
- Output Voltage Range 0 to 60 V + One Fixed Voltage
- +/-15 V Operating Voltage

Operation :



DANGER

E-650s are amplifiers generating high voltages of up to 60 V for driving piezo actuators. The output power may cause serious injuries.

Working with these devices or using piezoelectric products from other manufacturers we strictly advise you to follow the General Accident Prevention Regulations.

All work done with and on the devices described here requires adequate knowledge of handling high voltages.



CAUTION

Handle bender actuators (ceramic elements!) with care! Do not drop a bender actuator; avoid subjecting it to any kind of mechanical shock.

Output voltage is controlled by an analog signal ranging from 0 to 10 V. Multiplying by the gain factor of 6, an output voltage range of 0 to 60 V results. A fixed voltage of 60 V is also available for biasing the bender actuator.

6.1 E-650.OE Block diagram

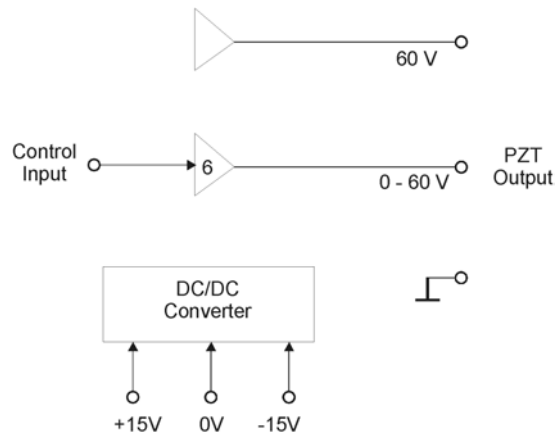


Fig. 5: E-650.OE Block diagram

6.2 E-650.OE Technical Data

TECHNICAL DATA: E-650.OE	
Function	Power amplifier
Channels	1
Maximum output power	8 W
Average output power	4 W
Peak output current < 5 ms	140 mA
Average output current > 5 ms	60 mA per channel
Current limitation	Short-circuit proof
Control input voltage	0 to +10 V
Output voltage	0 to 60 V; one additional fixed voltage of 60 V
Polarity	positive
Voltage gain	6 ±0.1
Input impedance	100 kΩ
Frequency response	200 Hz @ 1000 nF load 3 kHz @ no load
Input/Output	Via 8 pins on bottom
Dimensions	70 x 42 x 30 mm
Weight	0.1 kg
Operating voltage	+/- 15 V, 315 mA max.

6.3 E-650.OE Pin Assignment

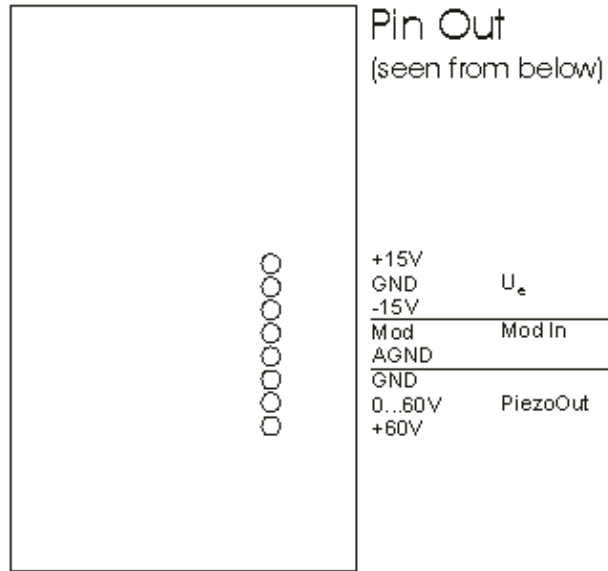


Fig. 6: E-650.OE Pin Assignment