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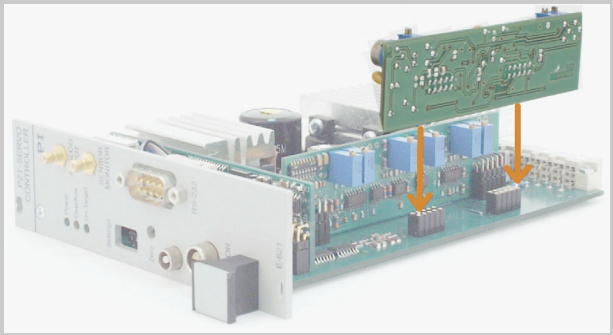
PZ 117E User Manual

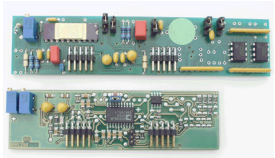
E-801 Sensor Submodule

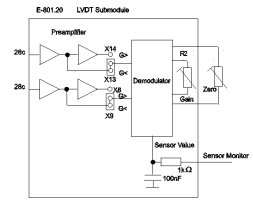
Release: 1.3.0 Date: 2004-11-12



This document describes the following product(s):

- **E-801.15**
  Excitation and Readout Submodule for SGS Sensor
- **E-801.20**
  Excitation and Readout Submodule for LVDT Sensor
- **E-801.25**
  Excitation and Readout Submodule for LVDT Sensor, Master
- **E-801.26**
  Excitation and Readout Submodule for LVDT Sensor, Slave





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Declaration of Conformity

The E-801 is a plug-in submodule for different PZT-controller/amplifiers. See the User Manual of the controller with which the submodule comes for the Conformity Declaration and Warranty Clauses applying to this product.

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About this Document

Users of this Manual

This manual is designed to help the reader to install and operate the E-801 Sensor Submodule. It assumes that the reader has a fundamental understanding of basic servo systems, as well as motion control concepts and applicable safety procedures.
The manual describes the physical specifications and dimensions of the E-801 Sensor Submodule as well as the software and hardware installation procedures which are required to put the associated motion system into operation.
This document is available as PDF file on the product CD. 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:

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.

WARNING

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.

Related Documents

The motion controller and the software tools, which might be delivered with E-801 Sensor Submodule, are described in their own manuals. All documents are available as PDF files on the Motion CD or special product CD. Updated releases are available via FTP or email: contact your Physik Instrumente sales engineer or write info@pi.ws.

Contents

1 Introduction

E-801 Sensor evaluation and excitation submodules are plug-in PCBs designed for use with a number of PI servo-control modules in the E-500 series as well as in the OEM LVPZT controllers E-610.L0 and E-610.S0 and in the LVPZT controller/amplifier modules E-621.SR/E-621.LR and E-665.SR/LR. The submodules normally come pre-installed on the modules/controllers with which they are ordered and the modules pre-installed in an appropriate PI chassis (except for OEM versions). The system is then calibrated at the factory with the associated PZT actuators.

Accessing the elements described in this User Manual is necessary only if the controller/actuator configuration is changed or elements are replaced. Do not hesitate to consult with PI before proceeding with calibration procedures.

1.1 Safety Precautions

DANGER

Failure to heed warnings in this manual can result in bodily injury or material damage. Only qualified personnel with special knowledge of handling high voltages should open the devices of which the E-801 submodule is a part.

!

CAUTION

The E-801 plug-in submodule is an ESD-sensitive (electrostatic discharge sensitive) device. Observe all precautions against static charge buildup before handling this device.

Avoid touching circuit elements, 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.

2 Version Survey

2.1 Sensor Types

E-801.1x versions are used for excitation and evaluation of strain gauge sensors (SGS). The strain gauges are excited with DC signals and the evaluated signal is proportional to the expansion of the gauge.

E-801.2x versions are used primarily with LVDT sensors, which require AC excitation. Master (E-801.25) and slave (E-801.26) versions are available to allow exact synchronization of the AC signals in multi-channel systems.

It is also possible to bypass sensor excitation and signal processing altogether and feed in a 0-10 V signal from external sensor circuitry.

There are no E-801 submodules for capacitive sensors. Capacitive sensor excitation and readout is implemented on the corresponding version of the various main modules (e.g. E-509.Cx or E-610.C0).

2.2 PCB Types

Both conventional and SMD (surface mount device) versions of E-801 submodules are in circulation, in some cases under identical part numbers. The versions differ in the presence and location of some adjustment elements.

The SMD versions have solder bridges instead of or in addition to jumpers. Both "single" and "double" solder bridges are used.

NOTE

In double bridges, the labeled top and bottom contacts share the same center contact.

Fig. 1: Single and double solder bridges. X3 and X4 are shown closed with solder (here depicted in gray) and X6 open.

3 Strain Gauge Sensor Submodules

E-801.15 submodules provide DC sensor excitation and are used with strain gauge sensors (SGS).

Gain and zero point can be adjusted with potentiometer R2 (Gain). (Potentiometer R30, sensor tolerance, is designed for correcting component variation. It is set at the factory and should not be changed.) The output of the preamplifier is an analog signal that is directly proportional to the piezo's expansion and is available at “Sensor Monitor” on the front panel.

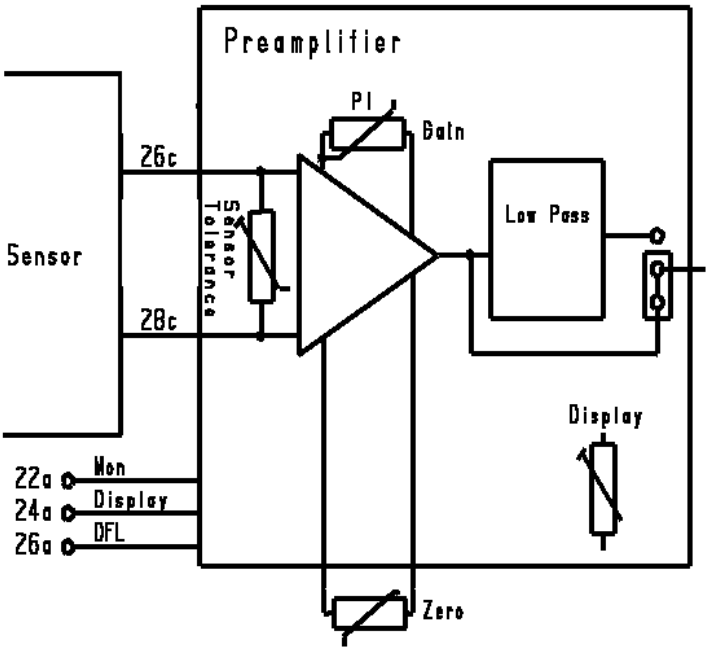

Fig. 2: E-801.1x signal path diagram; zero pot is on main module

3.1 SGS Operating Element Summary (E-801.15)

3.1.1 Conventional Version

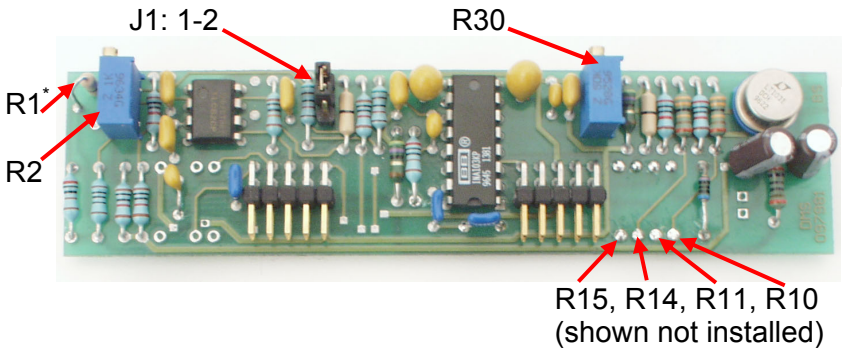

Fig. 3: E-801.15 conventional version

Sensor gain (factory set, do not change)	R2
Sensor zero	R30
Display level output adjustment*	R1*
100 Hz filter	J1: 1-2 disabled (default, shown) 2-3 enabled
Half-bridge configuration	R10/R11**: 703 ohms R14/R15**: 703 ohms

R30

* R1 not adjustable by default (as shown); if adjustable, trim pot installed.
** R10/R11 and R14/R15 are in parallel to facilitate assembling the required value.

3.1.2 SMD Version

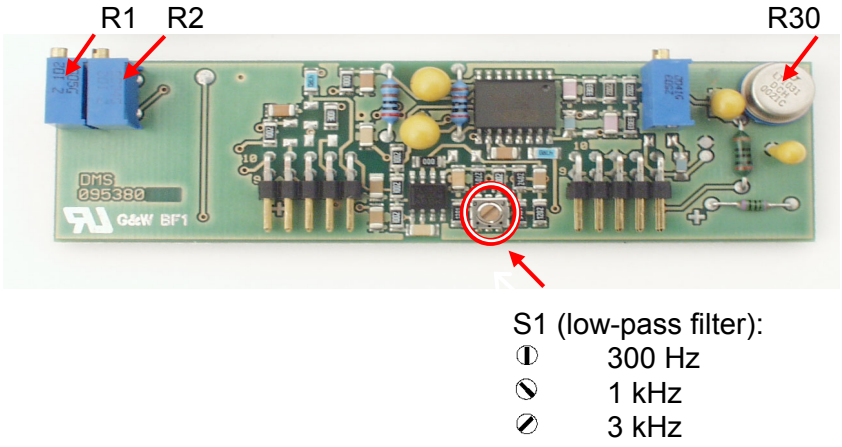

Fig. 4: E-801.15 SMD version, component side

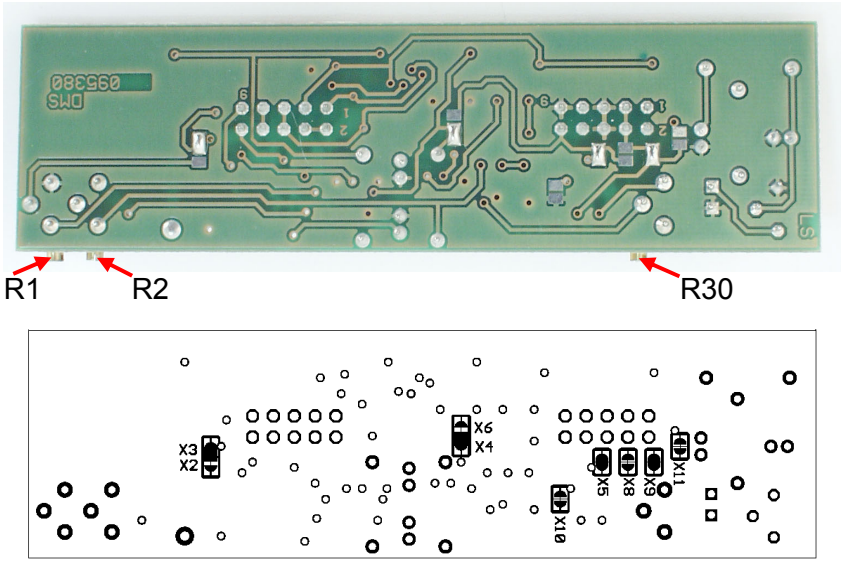

Fig. 5: E-801.15 SMD version, solder side, with corresponding drawing showing the solder bridges that replace the jumpers and provide additional settings

Settings and Adjustments

Sensor gain (factory set, do not change)	R2
Sensor zero	R30
Adjustment for "Display level" (optional)	R1 trim pot
Activate "Display Output" level adjustment pot R1: 0-2.5 V	X2 closed, X3 open
Deactivate "Display Output" level adjustment pot R1 and fix display output level at 10 V	X3 closed, X2 open
Internal use	X8
External signal mode (0-10 V)*	X6 closed; X4, X5, X9 open
Full-bridge mode (all 4 resistances on PZT)	X10, X11open, X5, X9 closed
Half-bridge mode	X10, X11, X5, X9, closed
Low-pass filter	see S1 in figure above

* External signal mode bypasses all sensor excitation and processing.

4 LVDT Sensor Submodules

The E-801.2x submodules provide AC sensor excitation and readout, as required by LVDT (linear variable differential transformer) sensors. Although primarily for use with LVDT sensors, AC excitation can also be used with SGS sensors.

Installed amplifiers and filters allow adaptation of the submodule to different configurations of main board electronics. AC signals are amplified in a dual-stage preamplifier.

The E-801.25 submodule is a master submodule, generating its own excitation frequency.

The E-801.26 is a slave, using the excitation frequency of a master on the same module (SMD versions have master/slave jumper setting).

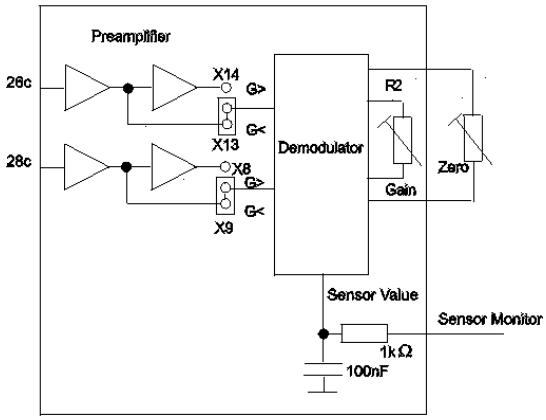

Fig. 6: E-801.20 LVDT submodule sensor readout signal flow. Zero pot is on main module.

NOTE

On conventional versions X14+X13 = J5, X8+X9=J6 and R2=R603.

4.1 LVDT Operating Element Summary (E-801.2x)

Different versions of the E-801.2x are in circulation: conventional versions designated E-801.25 (master) and E-801.26 (slave) and the SMD version, E-801.20, which is jumper-settable as master or slave.

4.1.1 Conventional Version (E-801.25 & E-801.26)

Jumpers J5 and J6 select between medium- and high-gain settings to optimize piezo performance. An analog signal is available at the output of the demodulator which is directly proportional to the piezo expansion (it appears at the *Sensor Monitor* connector on the front panel of most main modules in which the E-801 is used). This signal can be fine tuned in amplitude with the gain potentiometer (R603) and zero-adjusted with a trim pot on the main module (do not confuse with P406 on an E-802 servo submodule). Full piezo expansion should be calibrated to occur at +10 V sensor output.

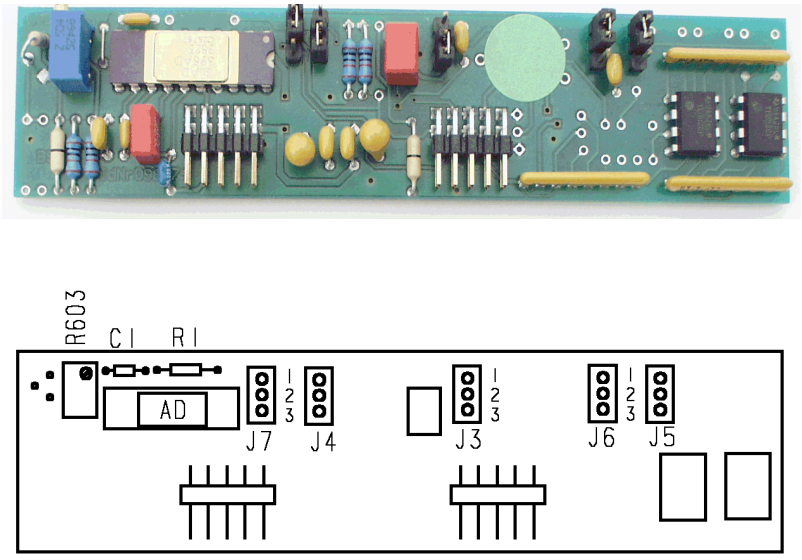

Fig. 7: LVDT conventional version (here E-801.25) with adjustment element location diagram

Settings and Adjustments

R603:	Sensor gain
J3:	Jumper: Internal bridge completion 1-2: installed, **2-3: not installed**
J4:	Jumper: Excitation capacitor coupled 1-2: C installed, **2-3: C not installed**
J5:	Jumper: Gain pre-amplifier #1 **1-2: high gain**, 2-3: low gain
J6:	Jumper: Gain pre-amplifier #2 **1-2: high gain**, 2-3: low gain
J7:	Jumper: Excitation **1-2: direct**, 2-3: one side grounded

4.1.2 SMD Version (E-801.20)

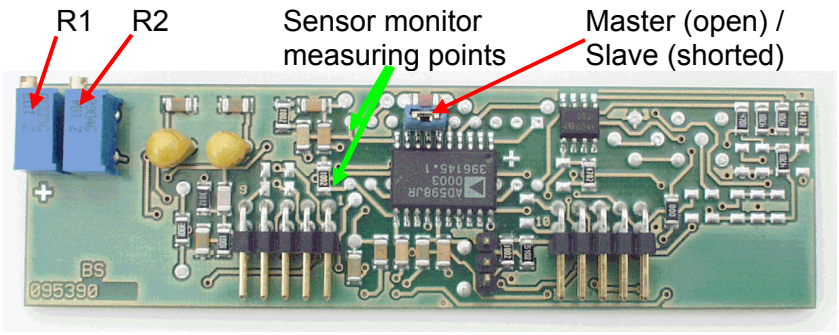

Fig. 8: SMD version, component side; note jumper for master/slave setting makes the E-801.20 equivalent to either an 801.25 or an 801.26

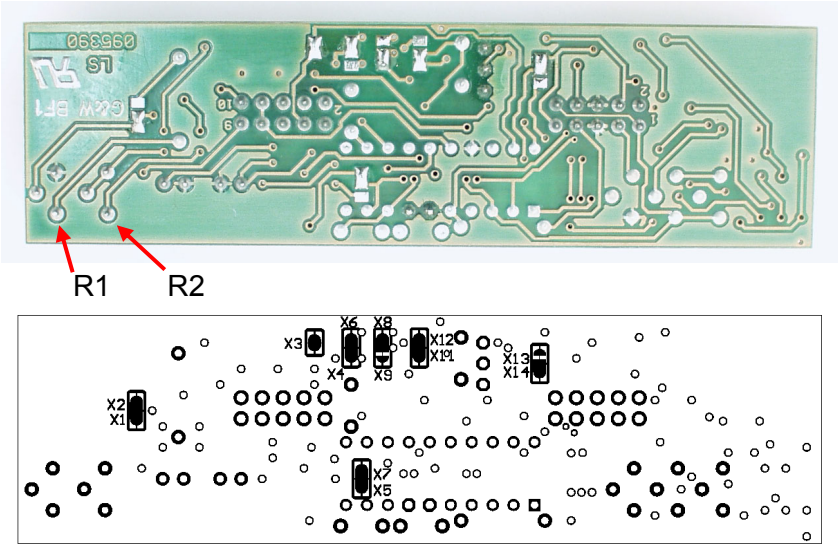

Fig. 9: SMD Version, solder side, with corresponding drawing showing the solder bridges that replace the jumpers.

Settings and Adjustments

Sensor gain (factory set, do not change)	R2
Adjustment for "Display level"	R1
Activate "Display Output" level adjustment pot R1: 0-2.5 V	X1 closed, X2 open
Deactivate "Display Output" level adjustment pot R1 and fix display output level at 10 V (default)	X1 open, X2 closed
Internal use (bandwidth setting)	X4, X5, X7, X11, X12
External signal mode (0-10 V)*	None: Use E-801.15
High-gain range	X14 & X8 closed X13 & X9 open
Low-gain range	X14 & X8 open X13 & X9 closed
Sensor gain	R2
Off-board zero potentiometer enable/disable	X3: closed = enabled X3: open = disabled

* External signal mode bypasses all sensor excitation and processing.

4.2 Alignment of Mechanical Zero of LVDT Sensors

Models connected to LVDT sensors may need to have the mechanical zero-point of the sensor adjusted. LVDT sensor readout is based on differential measurement of the inductive excitation of two secondary coils with a common, moving, ferrite core. The first step of the alignment procedure is to balance the bridge by moving the ferrite core (probe) to the zero position.

To verify the balance of the bridge, display the sinusoidal voltages on connector X18 pin 9 and pin 4 on a 2-channel oscilloscope (pins shown in figure above). If the bridge is balanced properly, both sine curves have the same amplitude and phase.

If there is any deviation, move the LVDT mechanically until both curves become identical.

5 E-801 Calibration Routines

Systems containing an E-801 submodule are delivered precalibrated with the PZTs and for the intended application. Be sure to connect the PZTs as indicated with the labels on the system chassis.

Except for zero adjustment, recalibration is only necessary if modules, submodules or PZTs are exchanged or modified, or if operating conditions (e.g. temperature range) are drastically altered.

For calibration, the E-801 submodule must be installed on the module with which it is to be used. The same PZT actuators must be connected to the system and loaded with the same loads they have to move in the application. Because successful E-801 calibration requires proper configuration of the module on which the E-801 is installed (e.g. servo mode, remote operation, ...), the exact procedure to follow is described in the manual for that module.