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PI

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Operating Manual PZ 48 E

P-864, P-865, E-809

LVPZ Drivers and Controllers

supporting closed loop position control



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Operating Manual and Product Documentation

This Document is valid for following Products:

P-864.xx	LVPZT Driver
P-865.xx	LVPZT Driver
E-809.xx	Position Control Module
E-811.00	Display Module
E-812.xx	Power Supply
E-863.10	Amplifier Module
E-865.10	Amplifier Module

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1. General

P-864 and P-865 PZT-Drivers are designed to drive Low Voltage Piezoelectric Translators (LVPZT).

P-864 drivers offer three independent amplifier channels with an average output power of 6 Watts each, while the P-865 driver is equipped with a single 30 Watt amplifier. Depending on the dynamic requirements, either the 6 Watt or the 30 Watt system can be used. to drive the piezoelectric translators up to the requested frequencies.

P-864/P-865 drivers are designed as modular systems. They can be upgraded with an E-809.xx *Closed Loop Positioning Control Module*, that fits the free slot in the chassis. Piezoelectric Translators with strain gage sensors (SGS), inductive half bridges (IHB) and Linear Variable Differential Transformers (LVDT) can be used. In this combination, absolute positioning accuracies of less than 0.1% of the nominal expansion range can be achieved.

An analog input signal (control signal) is amplified and output as a power signal to drive the PZT Translator. The maximum output voltage ranges from -20 to +120 V to support the full expansion capability of Low Voltage Translators.

P-864/P-865 can be used for static and dynamic applications. Best output stability and low noise assures stable positioning. Using PZTs in open loop, position drifts are caused by the PZT itself due to crystalline effects. Position sensors can be optionally used to eliminate these hysteresis effects and to achieve stable positioning. Using PZT integrated LVDTs or strain gage sensors or external inductive plungers, a additional position control module is required.

P-864/P-865 drivers are prepared to take additional E-809.xx plug-in modules for closed loop positioning control and E-255.xx I/O modules for computer interfacing.

Extra high peak current output capability offer P-864/P-865 drivers to support dynamic applications. Excellent linearity of the output voltage allows the use of the P-864 series devices in high precision measurement and control systems.

For computer controlled operation three channel digital-analog converters with RS-232 or IEEE-488 interfaces are available. These programmable PZT controllers are designed as plug-in modules and can be installed in the reserved slot in the driver chassis.

Although the piezo driver was designed to drive PZT positioning elements, it can, within its capacity limits also be used to drive other systems which require controlled operating voltages in this range.

2. Model Description

2.1 Survey of Drivers and Modules

P-864/P-865 LVPZ-drivers have a modular design and are available as desk top devices as well as 19" rack mount units. Functional modules can be installed: Amplifiers, position control and interface modules.

Two different amplifier plug-in modules are available: E-863.10 is a three channel amplifier with 3x6 watt average output power and for more dynamic applications the E-865.10 amplifier module offers one channel with 30 watt output power. Both units are pin-compatible.

Overview of the LVPZ-drivers and the available plug-in modules:

Model	Chassis width	Display	Power supply	Amplifier	Option
P-864.00	42 TE	E-111.00	E-812.00	E-863.10	all units can be expanded with closed loop position control and interface-modules
P-864.10	19"	E-111.00	E-812.10	E-863.10	
P-865.00	42 TE	E-111.00	E-812.00	E-865.10	
P-865.10	19"	E-111.00	E-812.10	E-865.10	
P-865.20	19"	E-111.00	E-812.10	2 E-865.10	
P-865.30	19"	E-111.00	E-812.10	3 E-865.10	

(TE= Width unit of 1/5 inch (5.08 mm))

Modul	Description of plug-in modules
E-111.00	Display Module with power supply
E-812.00	Power supply for rear panel mounting
E-812.10	Power supply module
E-863.10	3-channel amplifier module
E-865.10	1-channel amplifier module
E-809.01	3-channel Position Control Module for 3 SGS
E-809.02	3-channel Position Control Module for 3 LVDT
E-809.03	3-channel Position Control Module for 2 SGS / 1 LVDT
E-809.04	3-channel Position Control Module for 1 SGS / 2 LVDT
E-809.11	1-channel Position Control Module for SGS sensor
E-809.12	1-channel Position Control Module for LVDT sensor
E-255.10	3-channel digital/analog with IEEE-488 interface
E-255.60	3-channel digital/analog with RS-232 interface

SGS: Strain Gage Sensor, LVDT:Linear Variable Differential Transformer

2.2 Modular Sub Systems

E-111.00 Display module with auxiliary power supply. Used in all drivers for displaying output voltage and expansion.

E-812.00 Power supply for amplifier. This unit is only used in P-864 and P-865 drivers and is mounted on the rear panel inside the chassis.

E-812.10 Power supply for amplifier. It is used alternatively to the E-812.00 for units that can not take rear wall power supplies. Used in systems with 19" chassis.

E-809.01 Closed loop position control module for three channels. It supplies the sensor with a DC signal and is designated for use with strain gage sensors. The module can be inserted in all P-864.xx and P-865.xx Drivers.

E-809.02 Closed loop position control module for three channels. It supplies the sensor with an AC signal and is designated for use with LVDT sensors. The module can be inserted in all P-864.xx and P-865.xx Drivers.

E-809.03 Closed loop position control module for three channels. It supplies two sensor channels with a DC signal and one with an AC signal. It is designated for use with two strain gage sensors and one LVDT. The module can be inserted in all P-864.xx and P-865.xx Drivers.

E-809.04 Closed loop position control module for three channels. It supplies two sensor channels with an AC signal and one with a DC signal. It is designated for use with one strain gage sensors and two LVDTs. The module can be inserted in all P-864.xx and P-865.xx Drivers.

E-809.11 Closed loop position control module for one channels. It supplies the sensor with a DC signal and is designated for use with a strain gage sensor. The module can be inserted in all P-864.xx and P-865.xx Drivers.

E-809.12 Closed loop position control module for one channels. It supplies the sensor with an AC signal and is designated for use with a LVDT sensor. Can be used in P-864.xx and P-865.xx Drivers.

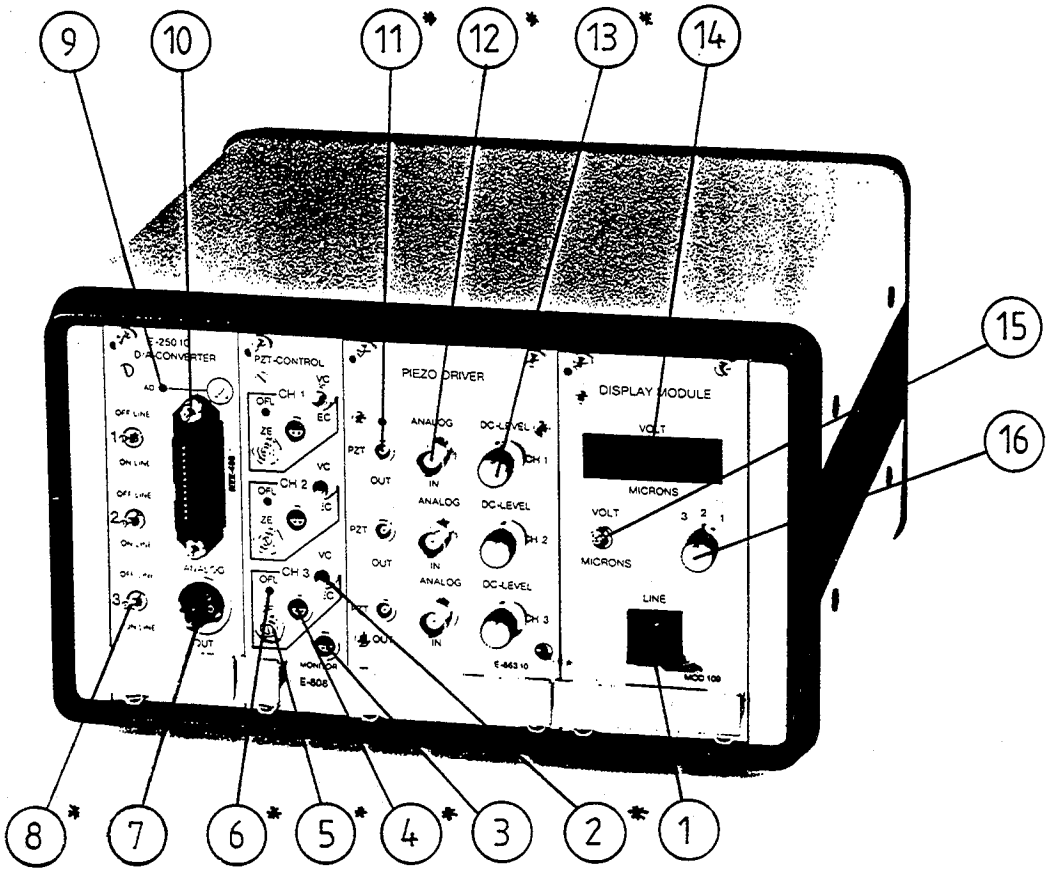
E-863.10 Three channel amplifier module with 6 Watt output each. Used in all P-864 units.

E-865.10 Single channel amplifier module with average output power of 30 watts. Used in P-865 drivers and controllers.

E-255.10 Three channel digital/analog converter with IEEE-488 interface.

E-250.60 Same as E-250.10 but with RS-232 Interface.

2.3 Operating Elements



(1)	Line switch
(2)*	Switch for mode selection (VOLTAGE CONTROL or EXPANSION CONTROL).
(3)	Monitor output connector (LEMO)
(4)*	Sensor input connector (LEMO)
(5)*	Potentiometer for Zero adjustment
(6)*	Overflow LED
(7)	Monitor output for analog voltage of interface
(8)*	Switch for ON LINE / OFF LINE
(9)	Addressing-LED for interface
(10)	IEEE-488 or RS-232 connector
(11)*	Output connector for LPZT
(12)*	Control input connector
(13)*	DC-level potentiometer (BIAS)
(14)	3½ digit LED display
(15)	Switch for display (volts or micrometers)
(16)	Channel select switch

(*: There is one of this operating element or connector available for each channel.)

3. Starting Operation

At first verify that the driver is set to the correct line voltage. Check the specified line voltage on the model number identification label on the rear panel.

Test the basic functions of the amplifier. At the beginning, do not connect the PZTs to the output connectors. Select channel 1 on the display switch (16) and set the display to 'VOLT' using the switch (15).

If an E-809 Position Control Module is installed, set all channels to VC (Voltage Control).

If an E-250 Interface is installed, then set all channels to "OFF LINE" for manual operation.

Select channel 1 with switch (16) and turn the corresponding bias potentiometer (DC-Level). The display should show the current output voltage at the LEMO connector (11).

Set the output voltage to zero before you connect the PZTs. Otherwise the translator could generate an expansion shoc that might damage connected parts.

The piezo driver is ready for use immediately after being switched on. After having connected the translators, their expansion can be controlled with the DC level potentiometer or by an analog signal. In the latter case the potentiometer is used for offset adjustment and allows the use of symmetrical drive signals.

Warning Warning Warning

All piezo drivers described in this manual are voltage amplifiers with high output currents. They can cause serious or even lethal injuries. When working with these devices and when connecting PZTs or products of other manufacturers we strictly advice you to never touch any part that might have connection to the high voltage output. Follow the General Accident Prevention Rules. Working with this device requires adequate educated service personnel.

3.1 Operating Modes

The output voltage of the piezo drivers P-864 and P-865 can be controlled in different ways:

3.1.1 Manual Mode

The operating voltage for the PZTs can be set manually by turning the bias (DC-Level) potentiometer on the front panel. In this operation mode the entire nominal voltage range (0... +100V) can be set manually. At the BNC connector no voltage input is required.

3.1.2 Amplifier Mode

The operating voltage for the PZTs can also be controlled by an external analog signal in the range of -2 through +10 V. This input can be manually biased by the DC Level Potentiometer.

The maximum output voltage range covers -20 to +120 V and requires an input signal of - 2 to +12V.

To get an sine wave output from 0 to +100 V using a symmetric drive signal with an amplitude of -5 to +5 V, the manual bias can be set to +50 Volt.

4. Low Voltage Translators (LVPZT)

Low Voltage Piezoelectric Translators (LVPZT) can be used within their maximal operating voltage range from -20 through +120 Volts. The nominal operating voltage range covers 0 to +100 Volts and this is the voltage range all expansion data are referred to, so the listed expansion values in the general catalog. Therefore the real expansion capability of standard LVPZTs exceeds the given catalog value by about 40 %.

The advantages of low voltage PZT design is to get
the maximum expansion at the lowest possible voltage. The only physical limitation is the limited electrical field strength the ceramic can withstand without the risk of an electrical breakthrough.

If the LVPZT is operated with positive voltages, the electrical field lays parallel to the polarisation of the ceramics, in case of negative voltages it is opposite to it. Electrical fields opposite to the polarisation may depolarize the ceramic if the field strength is not limited to values of about 200 V/mm. Due to this reason, the maximum negative voltage that is allowd is limited to -20 Volts.

Operating the LVPZT with positive voltages, there is an upper level for the applied voltage: Voltages exceeding the allowed upper level may damage the ceramic stack by electrcal breakdown. To avoid this risc we recommend to not exceed the given +120 Volts. We must refuse all claims of warranty if the PZT is damaged by overvoltage breakdowns.

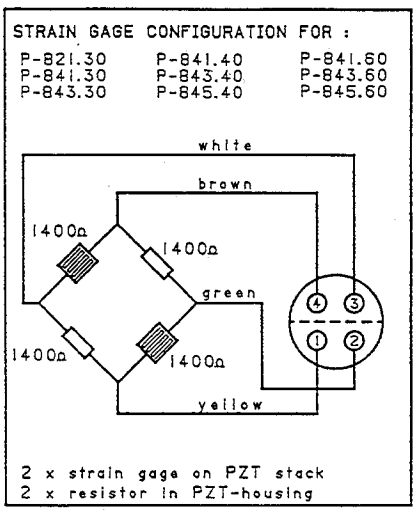
5. Expansion Sensor Types

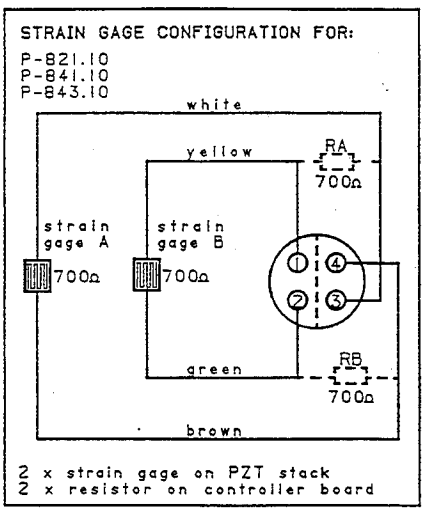
5.1 Strain Gage Sensors (SGS)

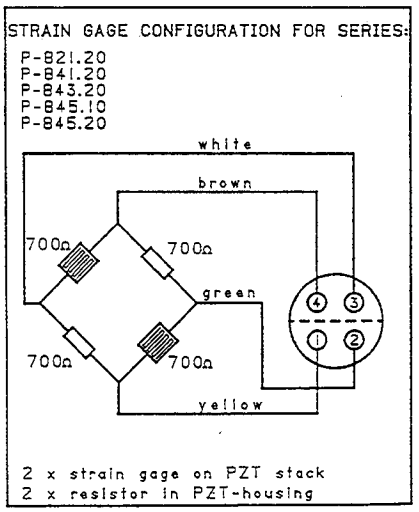
Strain Gage Sensors are used in the majority of LVPZT translators to detect the expansion of the ceramic. Most of the standard LVPZTs can be upgraded with the strain gages sensors option (order# P-177.xx). Two strain gage fields with 700 ohm each are attached on both sides of the ceramic stack. In conjunction with two bridge completion resistors (700 ohm each) the strain gages are wired in diagonal position like a Wheatstone bridge. The bridge is balanced indicating zero expansion if all four elements have the same resistance. Small tolerances can be compensated in the electronics.

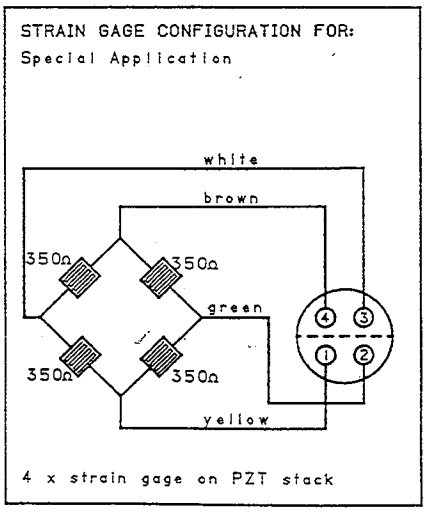
Wiring of Standard Strain Gages Sensors

Standard Configurations :









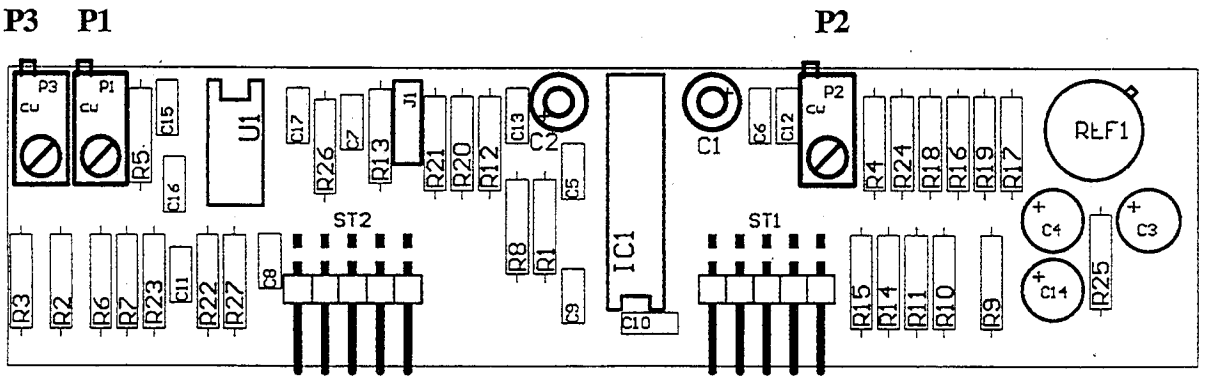
Because the resistance of the strain gages depends from the expansion of the piezos, at standard products the bridge gives an output signal of about 1 mV / V at full expansion. The bridge completion resistors are located inside the LVPZT casing to minimize cable influence and temperature sensitivity.

Only in some very small PZTs, where no space is available, the resistors have to be added on the controller board. For all LVPZTs which have 60 um expansion or more, two strain gages and resistors respectively are connected in series to measure with higher accuracy by covering a larger segment of the ceramic stack. Some special strain gages with four active elements (two Poisson gages) are available on request.

There is an easy way to test the correct wiring of the strain gages. This can be done by measuring the total bridge resistance at the LEMO connector. The value should be about 700 Ohm for the smaller LVPZTs and about 1400 Ohm for the bigger units if measured between pin 1,4 (supply) and pin 2,3 (outputs).

5.1.1 E-801.10 Processing Module for Strain Gage Sensors

Using strain gage sensors, the E-809 position control module (processes up to 3three channels) is equipped with E-801.10 submodules to supply the sensor with DC-signals. For each channel working with SGS, one E-801.10 submodule is installed on the E-809 basic module.



E-801.10 Sub Module for Strain Gage Processing

Calibration Potentiometers:

P1 Gain

P2 Zero PZT

P3 Display Monitor

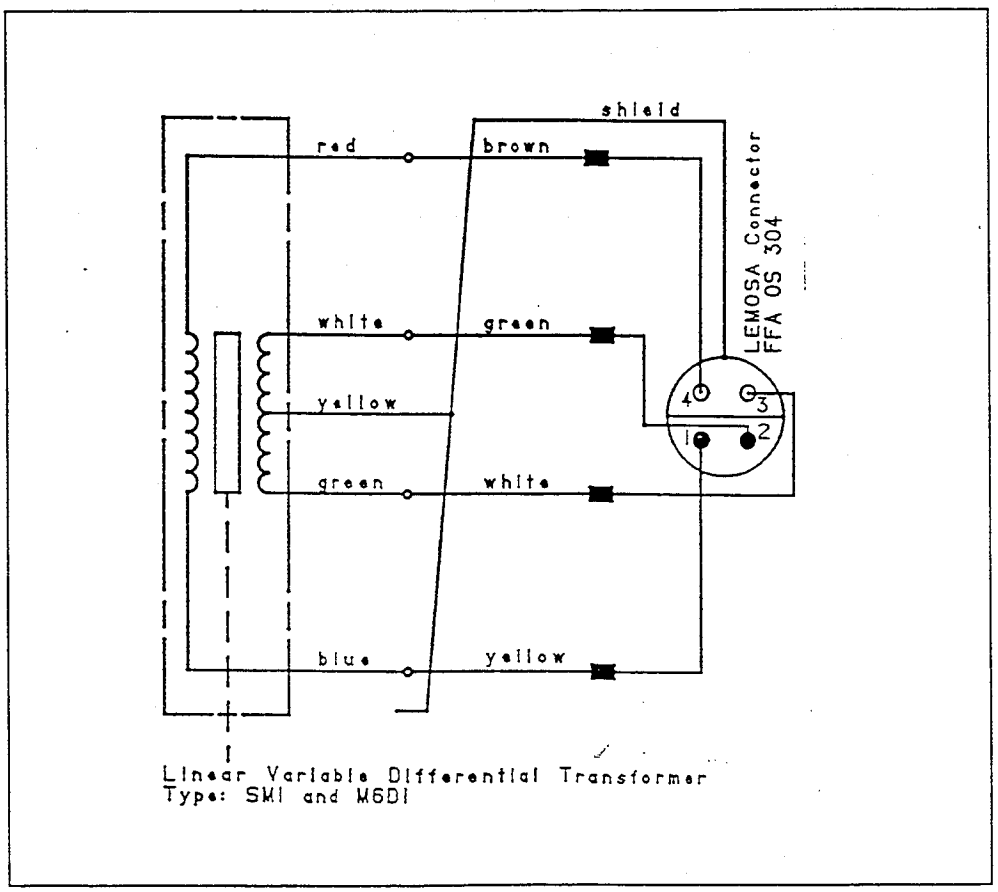
5.2 Linear Variable Differential Transformer (LVDT)

Sensors based on the principle of variable Transformers (LVDT) usually have a bobbin with a primary winding, two secondary windings and a moving core. The primary winding is supplied with an AC current generating a magnetic field squeezed by the soft iron or ferrite core. The magnetic field induces a voltage in both secondary windings. If the core is removed from central position, one secondary winding gets more magnetic flux than the other. The induced voltages are contrary and proportional to the movement. LVDT transducers normally operate at 3 to 5 Vrms and at frequencies between 1 and 20 kHz and have a typical current consumption between 10 and 50 mA.

The output signal from an LVDT is normally expressed as a sensitivity in mV output voltage per V supply voltage per Millimeter displacement. Typical transducers output sensitivity is in the range of about 100 to 250 mV / V / mm depending on type.

Pin Configuration of LVDTs

Fig.

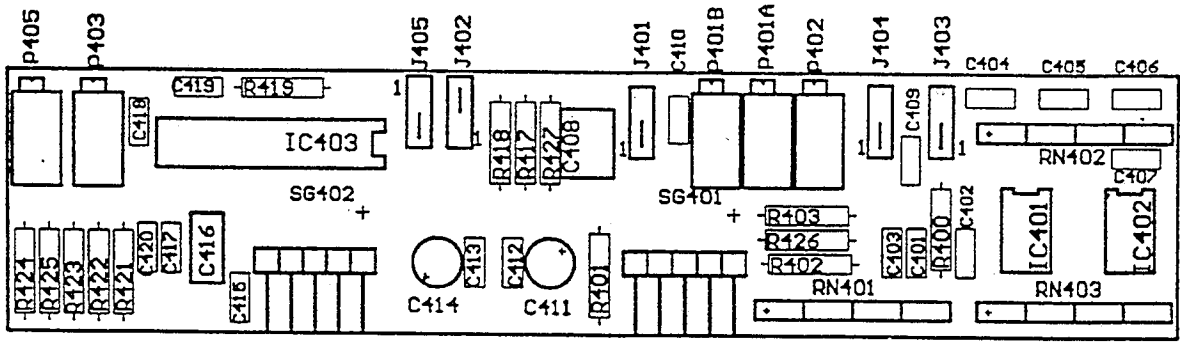


Because of the high sensitivity of LVDTs we recommend to set the preamplifier gain to "low". In some very special applications where the full stroke of the piezos including lever amplification is in the range of a few hundred micron to 1 mm, the preamplifier may be overdriven. In this case remove the Jumpers J403 and 404. Also, both preamplification stages have to be bypassed by wiring ....

5.2.1 E-801.20 Processing Module for LVDT Sensors

Using LVDT sensors, the E-809 position control module is equipped with E-801.20 submodules to supply the LVDT sensor with AC-excitation. For each channel one E-801.20 submodule is installed on the E-809 basic module.

E-801.20 Submodule for LVDT sensor processing



Calibrating Potentiometers:

P401A	Only needed with long cables (Zero Adjust A)
P401B	Only needed with long cables (Zero Adjust B)
P402	Only needed with long cables (Phase compensation)
P403	Gain
P405	Display Monitor

Jumper Settings for LVDTs:

J401	Internal bridge completion (1/2=disable, 2/3=enable	Set to 1/2
J402	Excitation (1/2=DC, 2/3=AC)	Set to 1/2
J403	Preamplifier #1 Gain (1/2 = high gain, 2/3 = low gain)	Set to 2/3
J404	Preamplifier #2 Gain (1/2 = high gain, 2/3 = low gain)	Set to 2/3
J405	Excitation 2 (1/2 = direct, 2/3 = GND)	Set to 1/2

5.3 Inductive Half Bridge Sensors (IHB)

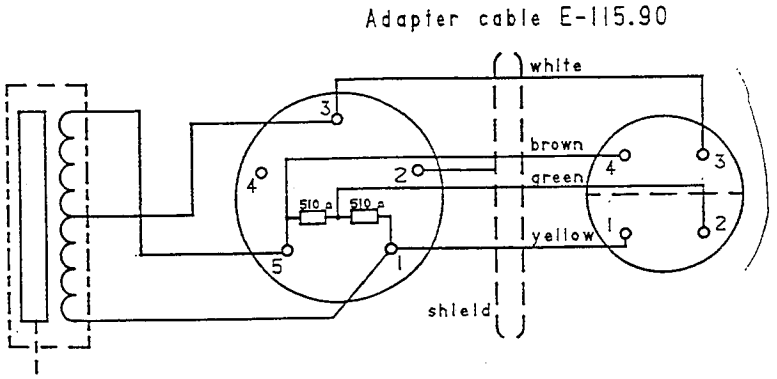
IHB sensors are mechanically very similar designed to LVDT sensors. The only difference is that there is no primary winding. The two remaining windings are half of a Wheatstone bridge housed in the transducers and the other half (typically two precision resistors) inside the connector or amplifier. Movement of the core changes the inductance of the windings thus giving an output. The sensitivity of IHBs is only about 50% compared to LVDTs and also the temperature stability is worse.

PHYSIK INSTUMENTE offers an adapter cable E-115.90 where most of the commercially available IHB gauging transducers can be adapted to the LEMOSA connector. The bridge completion resistors are integrated in the connector.

Jumper settings for Inductive Half Bridge Sensors:

J401	1,2 (Lower Position) Internal bridge completion disabled
J402	2,3 (Upper Position) Excitation1 AC coupled
J403	2,3 (Upper Position) Preamplifier gain low
J404	2,3 (Upper Position) Preamplifier gain low
J405	2,3 (Lower Positon) Excitation2 = GND

Standard Probes with IHB Sensors
Fig. PZ-41-007



Connections of LEMO-pins to main connector pins :

LEMOSA Pin 1	MAIN Connector Pin 24c
LEMOSA Pin 2	MAIN Connector Pin 26c
LEMOSA Pin 3	MAIN Connector Pin 28c
LEMOSA Pin 4	MAIN Connector Pin 30c

6. E-809 Position Controllers

For closed loop position control a sensor and the position control electronics is required. Most of the piezoelectric translators are available with integrated strain gages or LVDT sensors. Also external inductive probes can be used for position control. The E-809 position control modul is designed for support all these different kind of sensors. The module fits the chassis of the P-864 / P-865 controllers.

E-809 Position Control Modules are available in single and three channel versions to be used in P-864/P-865 PZT drivers.

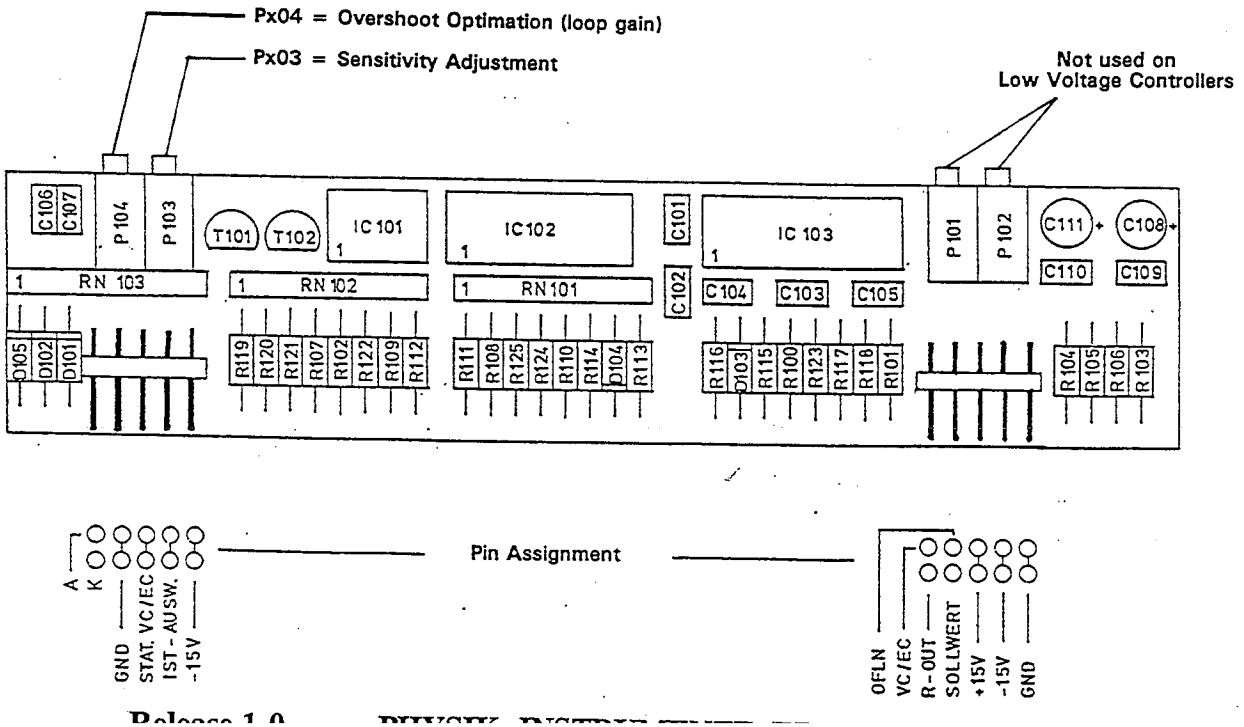
Each channel can be equipped individually for use with strain gage sensors (SGS) or with Linear Variable Differential Transformer (LVDT).

The E-809 basic module requires one sensor processing sub module for each channel. There are different sub modules for strain gages and for LVDTs. This design offers the flexibility to use different kind of sensors with the same three channel basic module.

6.1 E-802.00 Processing Submodule for Position Control

Besides the sub module for sensor processing, each channels has to be equipped with an additional E-802.00 submodule for closed loop position control. This small printed cuircuit board has the same size like the sensor processing submodule. Three of them are installed on a E-809 basic module.

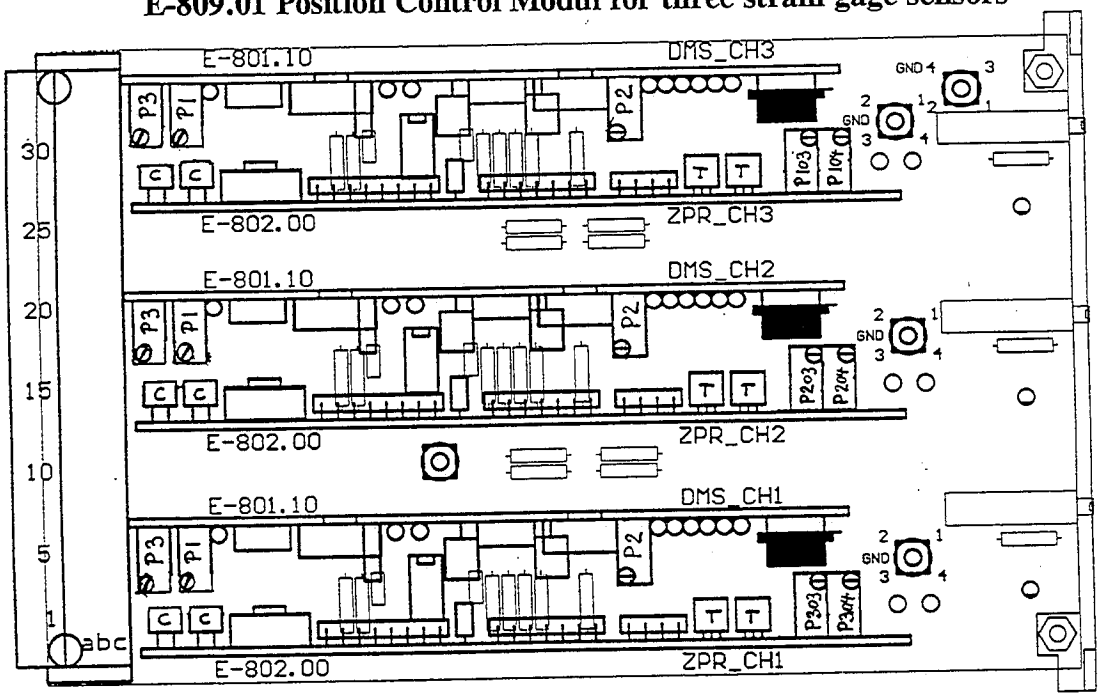
E-802.00 Submodule pc-board for closed loop control
(Numbering corresponds with channel 1)



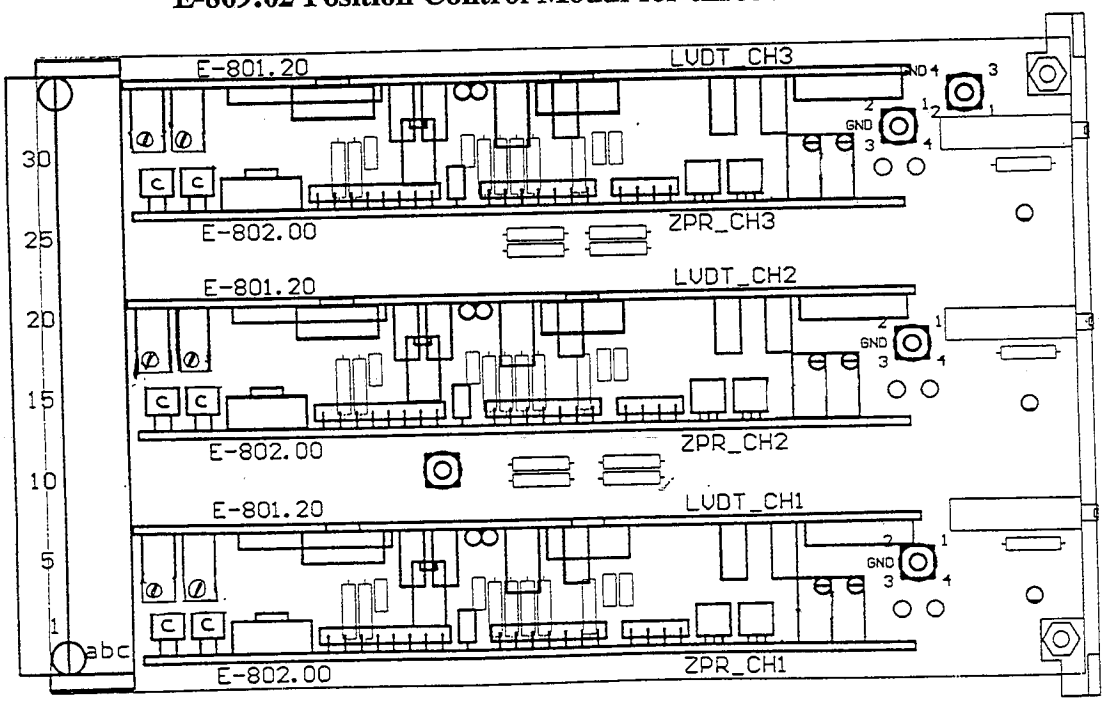
6.2 E-809 Position Control Modules

E-809 Position Control Modules are available as single or three channel units. For each channel two sub modules are installed, one for sensor processing (E-801.10 or E-802.20) and one for position control (E-802.00).

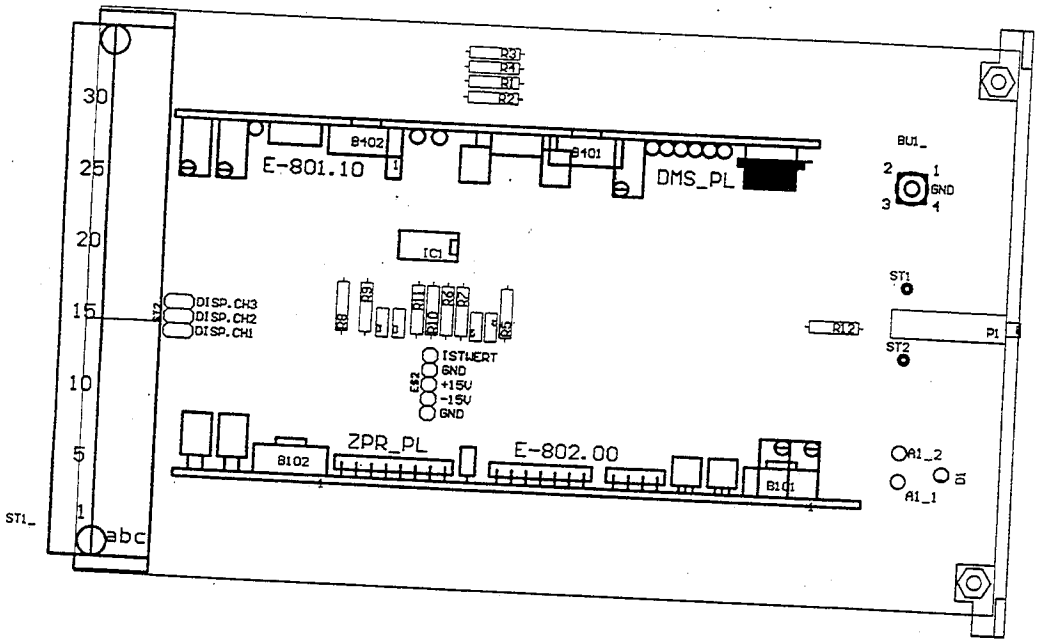
E-809.01 Position Control Modul for three strain gage sensors



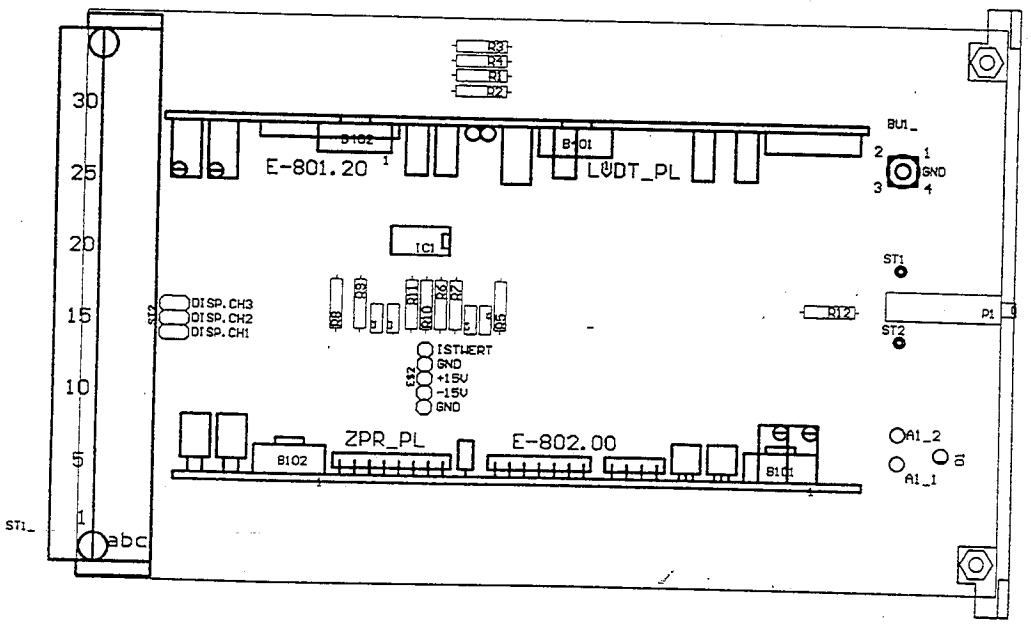
E-809.02 Position Control Modul for three LVDT sensors



E-809.11 Position Control Modul for one strain gage sensor



E-809.12 Position Control Modul for one LVDT sensor



7.0 E-809 Calibration

The full calibration procedure of a closed loop position control system includes the calibration of the sensor gain, zero point, amplifier gain (sensitivity), display reading, slew rate and step response.

Basic calibration is done in our lab before shipment. In the regular case there is no need to care about this. The PZTs are delivered with performance test documents to verify the system accuracy. They are ready for operation. Because of this calibrating procedure, PZT element and controller belong together can not be exchanged without performing a new calibration. Also a new calibration run is recommended if connecting or extension cables are replaced.

The only adjustment that has to be done more often, at least one time after powering up the system, is the zero point calibration.

7.1 Zero Point Calibration

The zero point calibration shifts the point of zero expansion to the point of zero voltage signal input.

There might be some small zero point shifts of the sensor caused by changed load or temperature drift during warm up. Therefore you should wait a few minutes to get stable test conditions before starting the procedure.

A proper zero point calibration ensures that in closed loop operation the full output voltage swing of the amplifier can be used and it prevents overflow conditions.

Procedure to adjust the zero point:

(1) Connect the PZT and the sensor to the controller while the device is not powered.

(2) Set the board to Voltage Control (VC) mode. Set the bias potentiometers 'DC-LEVEL' to zero (CCW) and power up the device.

(3) Run some cycles from 0 through +100 Volts back and forth using the Bias potentiometer (or DC signals) to get the PZT prepared for calibration.

(4) Check the monitor output signal and wait some minutes until it has stabilized. If the output is not around zero Volt (+/- 0.2 Volt), adjust it: Take a small screwdriver and turn the "Zero Adjust" potentiometer on the frontpanel until the monitor output is around zero.

(5) Switch to the closed loop mode EXPANSION CONTROL (EC). The sensor signal is now exactly zero while the PZT output is somwhere around zero because of the hysteresis. When driving with the full input voltage (+10 Volt) the PZT output should be below +120 Volts.

(6) Applications needing the full expansion capability of the LVPZT, the full input range of -2 to +12 Volt may be used. At zero volt control input set the PZT output to zero (+/- 2 Volt) by turning the front Zero Adjust potentiometer.

7.2 Equipment needed for Basic Calibration

There may be some cases where the user need to adjust more than only the zero point. Compensating larger preloads or special mountings to get stable operation, gain and filter settings may be required.

Calibrating a PZT micropositioning device means to compare its position at a given input signal with an external reference system like high resolution inductive gages or interferometers.

- Rigid and stable mechanical platform to clamp the PZT to the mechanical gage.
- Position gage with 0.1 micron resolution
- Reference voltage source with constant +10 V output or an adjustable voltage source with a 4 digit voltage display.
- Function generator to generate square wave signals.
- Oscilloscope.
- Connector Extension board (P-895.00)

7.3 Setting the Gain

Sensor gain has to be calibrated to set the sensor output level at nominal expansion to +10 Volts (monitor output). This adjustment also influences the display reading.

The gain calibration requires an external position gage as reference.

Procedure :

1. Set the E-809 module to VC (Voltage Control).
2. Set the DC-Level Potentiometer to 0 (CCW) and reset the external expansion gage.
3. Turn the DC-Level Potentiometer CW until you get the nominal expansion of the connected PZT. Use your external expansion gage.
4. Read the voltage of the monitor output at the front panel socket. At nominal expansion there should be +10 Volts. If not, select one of the following cases:

   Using LVDT sensors:
   Adjust gain potentiometer P403 (channel 1), P503 (channel 2) or P603 (channel 3) to set the monitor output to 10 Volts.

   Using SGS sensors (Strain Gages):
   Adjust potentiometer P1 to trim the monitor output to 10 Volts. P1 is available for each channel.
5. Because of PZT drifting, the readings might not be stable. Repeat points 3 and 4 until you get a sufficient stable reading.

7.4 Sensitivity Adjustment

Using closed loop operation, the mechanical set up and the mass connected with the PZT have considerable influence on stable operating conditions. Therefore the closed loop calibration, which also influences the pulse response of the translator, should be adjusted while the PZT is mounted at its actual working site.

Procedure :

1. Turn the DC-Level Potentiometer to 0 (CCW)
2. Select the EC (Expansion Control) mode.

3. Now check whether the PZT oszillates. If so, you can't miss to hear it. In this case, a special adjustment has to be done. If the PZT does not oszillate, you can proceed with the next step.

4. Now the sensitivity has to be adjusted. Feed a +10.00 Volt signal from a reference voltage source to the BNC input socket on the E-863 amplifier module.

5. Adjust potentiometer P103 on position control sub module (channel 1), P203 (channel 2) or P303 (channel 3) to adapt the external expansion gage reading to the nominal expansion value of the used PZT.

6. At this point, also the internal display reading (in micron) can be checked.

7.5 Setting the Display

The last step in the calibration procedure is to adjust the output voltage for the display module.

Procedure :

1. Switch the display to "MICRON"

2. *Using LVDTs :*
   Use Potentiometer P405 (channel 1), P505 (channel 2) or P605 (channel 3) to adjust the micron value on the display to the reading of the external gage.

   Using Strain Gage Sensors:
   Adjust Potentiometer P3 to trim the micron value on the display to the reading of the external gage. P3 is available on each channel.

7.6.2 Step Response Optimization

For dynamic operation, the step response of the mechanical system is important. The amount of damping and overshooting can be optimized by tuning the differential and integral term of the amplifier.

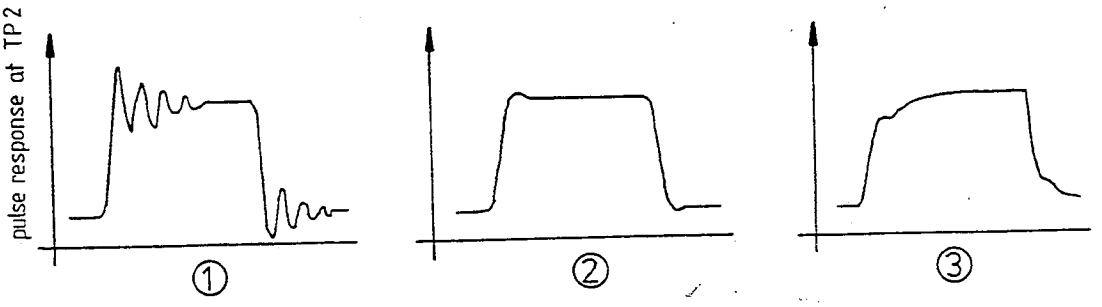
Procedure :

1. Mount the PZT at the place where it is operated.
2. Use a square wave function generator and supply the BNC signal input with a square wave of 5 Vpp and a frequency of 5 to 10 Hz.
3. Connect an oszilloscope to the monitor output.
4. Optimize the transient expansion curves by tuning the potentiometer P104 (channel 1), P204 (channel 2) or P304 (channel 3).

The settling curve could look like th efollowing :

Case 1 : Large overshoot, unstable
Case 2 : Optimal
Case 3 : Settling time too long

If the range of the P104 (Px04) potentiometer is not large enough, the capacitor C105 (Cx05) can be inserted to increase the integral term.



ɔtion of Modules

) LVPZT Piezo Amplifier

mplifier is a 3 channel driver for Low Voltage Translators. range covers -20 through +120 V. The amplifier is designed n module and is used in the P-864.00 and P-864.10 PZT

and 6 Watt average output power per channel make the E- ndard amplifer for static and dynamic PZT applications.

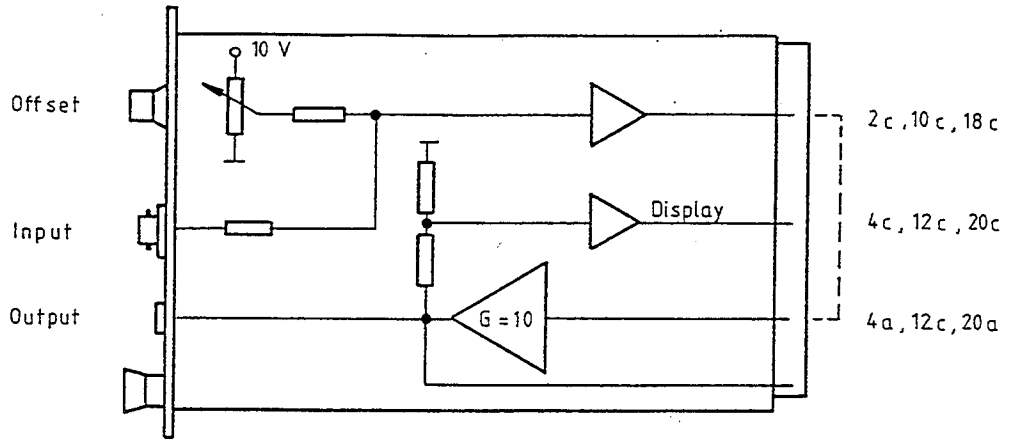
the E-863 amplifier module, a E-812 power supply can be

ɔecifications

	3
ge Range:	-20 to +120 Volts
ıut current:	60 mA (max)
:urrent:	140 mA (for 5 ms)
ıut power	6 Watt
ge input range	-2 to +12 Volts
	10
nce:	> 100 kOhm
Adjustment:	5-turn Potentiometer
ıent Range:	0 ... +100 V
	see frequency diagram
t:	< 15 mVpp
ltage Supply:	-33, -10, +33, +127 Volts DC
d Power Supply:	E-812
:or:	BNC (3x)
ctor:	LEMOSA 00S250 (3x)
	14 TE (2.8") module for 19" chassis
	32-pin connector, DIN 41612,

P-863.10

Basic Circuit:

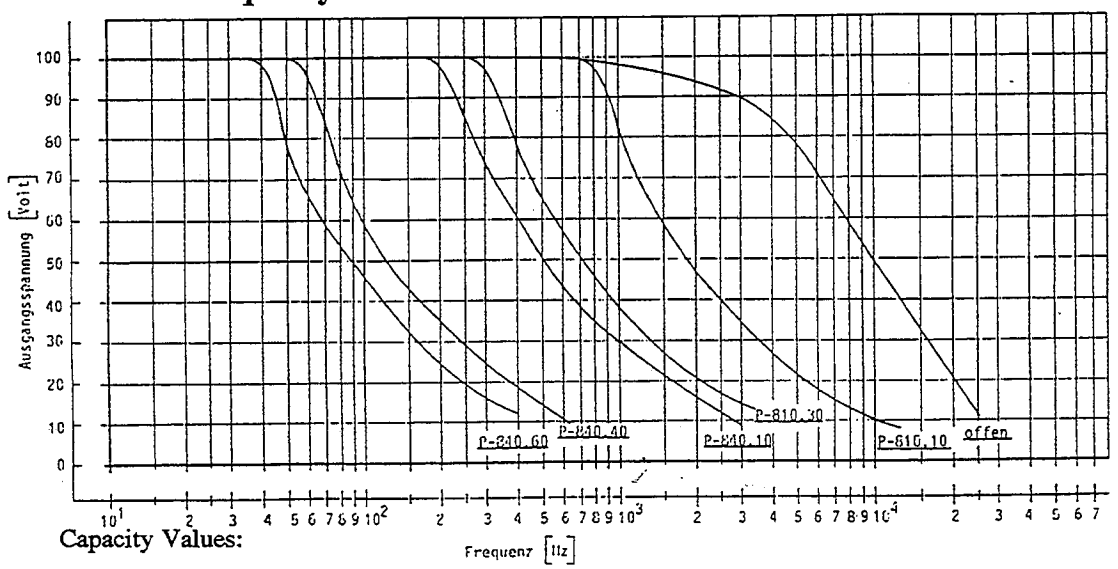


Without E-809 position controller in the chassis, connect 2c to 4a(ch1), 10c to 12a (ch2) and 18c to 20a (ch3).

With E-809 position controller in the chassis, connect:

[E-863.10]		[E-809]	
2c	--->	20a	[Control input CH1]
4a	<---	4c	[Control out, CH1]
10c	--->	22c	[Control input CH2]
12a	<---	12c	[Control out, CH2]
18c	--->	22a	[Control input CH3]
20a	<---	20c	[Control out, CH3]

E-863.10 Frequency Behavior



Capacity Values:

P-840.10 : 1.6 nF P-810.10 : 0.4 nF
P-840.40 : 6.4 nF P-810.30 : 1.2 nF
P-840.60 : 9.6 nF

8.2 E-865.10 LVPZT - Amplifier (30 Watt)

Function:

The LVPZ-driver E-865.10 is a single channel 30 Watt amplifier for Low Voltage Translators. The output power allows dynamic operation of LVPZTs with high capacities.

The module is pin compatible with the E-863.10 Amplifier (channel 1).

E-865.10 Specifications

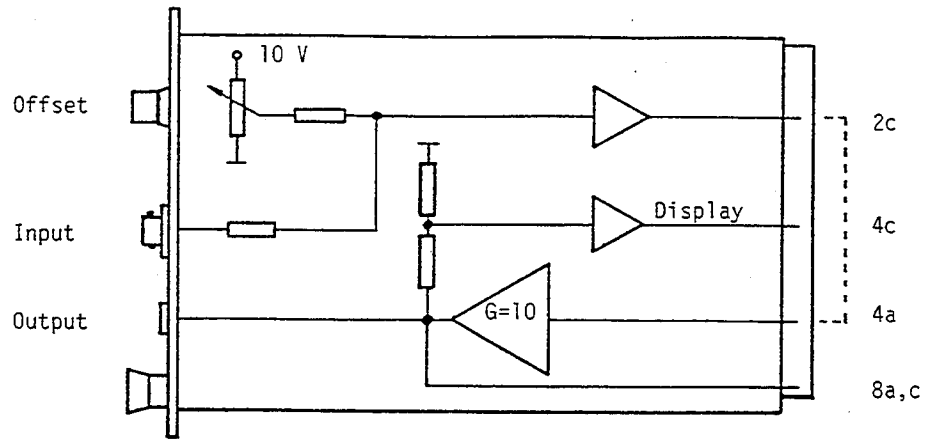
Channels:	1
Output Voltage Range:	-20 to +120 Volt
Average output current:	0.22 A
Peak output current:	2.0 A
Average output power :	30 W
Control voltage input range:	-2 to +12 V
Voltage gain :	10
Input impendance:	> 100 kOhm
Manual BIAS Adjustment	5-turn Potentiometer
BIAS Adjustment Range:	0 to +100 V
Bandwidth	see frequency diagram
Ripple of Uout:	< 15 mVpp
Input connector :	BNC
Output connector :	LEMOSA 00S250
Casing:	14 TE (2.8") for 19"-chassis
Main connector :	Plug DIN 41612, 32 pin

Pin Assignment 32 Pin Connector

	PIN	
N.C.	a 2 c	Output: BNC input + offset
Control Input	a 4 c	Output: monitor Uout (100 V => 1V)
GND	a 6 c	GND
Uout	a 8 c	Uout
Measuring ground	a 22 c	Measuring ground
GND	a 24 c	GND
+33 V Input	a 26 c	+33 V Input
-33 V Input	a 28 c	-10 V Output
+125 V Input	a 30 c	+ 125 V Input
Protective Ground	a 32 c	Protective Ground

E-865.10

Basic Circuit :

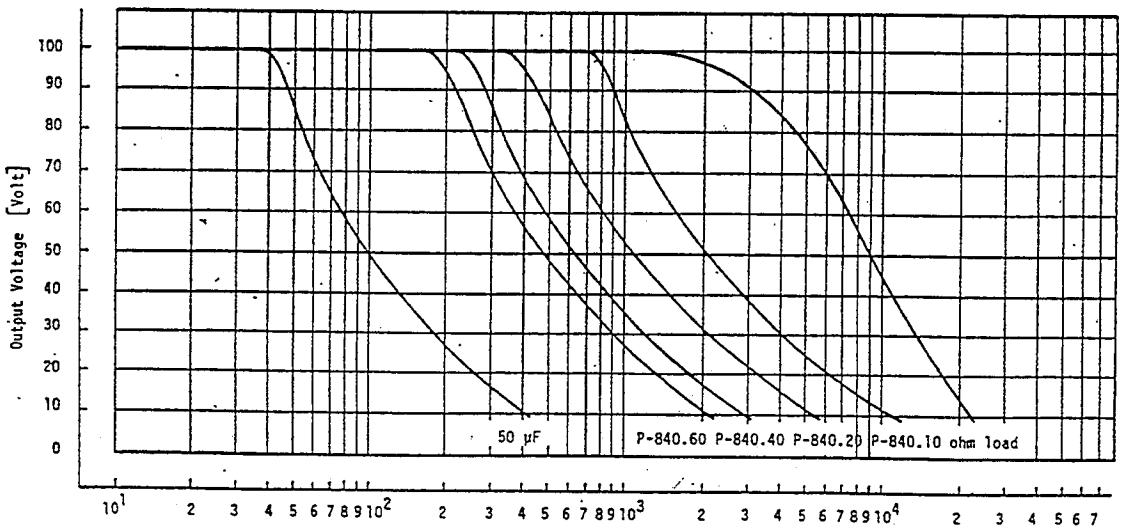


NOTE :

Using E-809 in conjunction with E-865.10 connect:
Pin 2c (E-865) ----- Pin 20a (E-809)
Pin 4a (E-865) ----- Pin 4c (E-809)

IF no E-809 Position Control Module is used in the system, connect: pin 2c and 4a on E-865.10.

E-865.10 Frequency Behavior:



Capacity Values: P-840.60: 9.6 nF
P-840.40: 6.4 nF
P-840.20: 3.2 nF
P-840.10: 1.6 nF

8.3 E-809 Position Control Module

Specifications

Function :	High performance position controller
Sensors :	Strain Gages, inductive probes,LVDTs
Sensor supply :	Voltage range 1 ... 20 Vrms Frequency : 20 to 20000 Hz
Filter cut off frequency	1 Hz to 5 kHz
Monitor output :	0 to +10 V (+10 V Ref. Expansion)
Display output	2 V max.
Controller :	PI controller (adjustable)
Controller output.:	0 to +10 V, overflow : <-2, > +12 V)
Supply Voltages:	+15 V, -15 V
Control signal outputs:	- Overflow, 5 V TTL - VC/EC (voltage/expansion control) - relay contact to ground
Main connectors.:	32-pin connector (DIN 41612)
Sensor socket :	LEMO, type RA0304
Size :	Plug-in module for 19" chassis, width: 1.6"

Pin Assignment, Sensor Input (LEMO connector)

Pin 1 :	sensor excitation (out)
Pin 2 :	+ input from sensor (non inverting)
Pin 3 :	- input from sensor (inverting)
Pin 4 :	GND

Pin Assignment 32-pin main connector

GND	a 2 c	GND
	a 4 c	control out, CH1
+15 V	a 6 c	+15 V
-15 V	a 8 c	-15 V
	a 12 c	control out, CH2
display CH2	a 14 c	display CH1
	a 16 c	display CH3
control in, CH1	a 20 c	control out, CH3
control in, CH3	a 22 c	control in, CH2
status VC/EC,CH2	a 26 c	status VC/EC, CH1
status OFL, CH1	a 28 c	status VC/EC, CH3
status OFL, CH3	a 30 c	status OFL, CH2
nc	a 32 c	nc

8.4 E-111.00 Display Module

Function:

The E-111 display module has a LED display for volts and micrometers and serves as voltage supply for the E-809 control modules

E-111.00 Specifications:

Display:	**- 3½ digit LED display**
Operating elements:	**- Mains switch with indicator light** **- Toggle switch Volts/Microns** **- Channel select for CH1, CH2, CH3**
Output voltages:	**+5 V, 1A** **-5 V, 200 mA** **+15 V, 350 mA** **-15 V, 350 mA**
Main connector:	**32 pin DIN 41612**
Module size :	**12 TE (2.4") for 19" chassis**

Pin Assignments:

a	PIN	c
GND power	2	GND power
	4	
Out +15 V	6	out -15 V
	8	
	10	
Monitor Volt CH2	12	Monitor Volt CH1
Monitor µm CH1	14	Monitor Volt CH3
Monitor µm CH3	16	Monitor µm CH2
	18	
	20	
GND measurement	22	GND measurement
Phase in 220/110 Vac	24	
Phase in 220/110 Vac	26	
Neutral	28	
Phase out switched	30	
GND	32	GND

8.5 E-812.xx Power Supply Modules

Function:

The E-812.xx power supply modules provide all operating voltages for the E-863.10 / E-865.10 LVPZ drivers.

The E-812.00 Power Supply is designed as an open frame module and is used in the P-864 drivers, mounted on the rear panel.

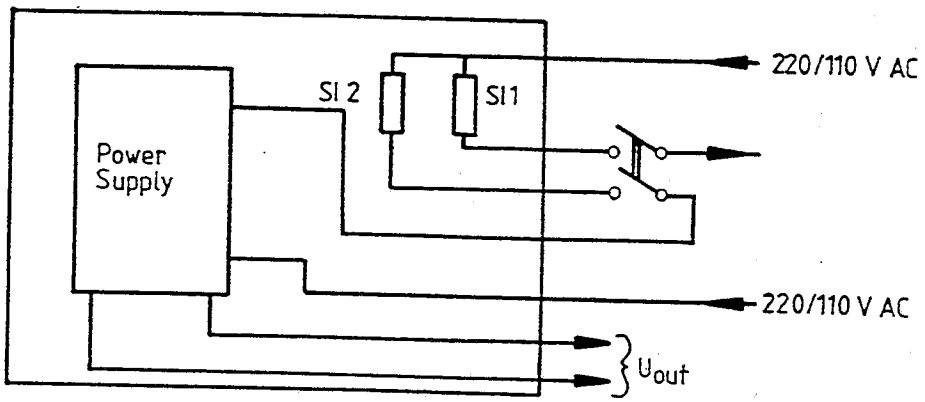
The E-812.10 version is designed as a 14 TE plug-in module to fit 19" chassis. It has the same spcifications like the E-812.00 unit.

The E-812.20 is the 100 Watt version of the E-812.10 module.

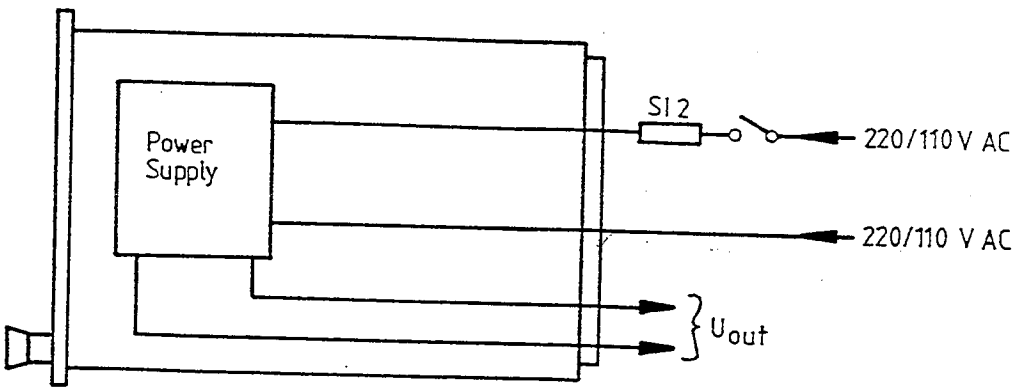
Applications:

E-812.00 used in : P-864.00, P-865.00
E-812.10 used in : P-864.10, P-865.10 ... P-865.30
E-812.20 used in : P-864.10, P-865.10 ... P-865.30

E-812.00 Wiring (Open frame Power Supply)



E-812.10 / E-812.20 Wiring (19"-module)



E-812 Specifications :

Input voltage :	220/110 Vac, 50-60 Hz (reversible)
Output voltages :	+127 V, 220 mA - 33V, 220 mA + 33V, auxilliary voltage
Output power :	30 W (E-812.00 and E-812.10) 100 W (E-812.20)
Fuses for 220 Vac :	SI1 : 0.315 A, medium slow SI2 : 0.625 A, medium slow
Fuses for 110 Vac:	SI1 : 0.625 A, medium SI2 : 1,25 A, slow

E-812 Pin Configuration

Plug 1 (Uout): pin 1 : + 127 V
pin 2 : -10 V shut down
pin 3 : -33 Volt
pin 4 : +33 V
pin 5 : GND
pin 6 : ground contact

Plug 2 (mains): pin 1 : 220/110 V out (Si 2)
pin 2 : 220/110 V out (Si 1)
pin 3 : n.c.
pin 4 : 220/110 V in
pin 5 : n.c.
pin 6 : 220/110 V in

Pin Configuration E -812.10, E -812.20

a	PIN	c
Shut down	20	shut down (-10V on, OV off)
GND	22	GND
-33 V	24	+33 V
+127 V	26	+127 V
	28	220/110 Vac in
	30	220/110 Vac in
GND	32	GND

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