# E-504 Piezo Amplifier Module

## High Power through Energy Recovery, E-500 Piezo Controller System


E-504.00F High-power amplifier module with energy recovery

- **Peak Power 280 W**
- **High Average Output Power 100 W**
- **Very Energy Efficient Through Energy Recovery**
- **Output Voltage Range -30 to 130 V**
- **Module for E-500 Piezo Controller Rack**
- **Prepared for Position Servo-Control Upgrade (optional)**
- **Prepared for Interface / Display Modules (optional)**

The E-504 power amplifier extends the E-500 modular piezo controller system with a high-output amplifier for low-voltage actuators and positioners.

The innovative, efficient energy recovery circuitry reduces power consumption and heat dissipation, especially in dynamic applications. This makes possible peak output currents up to 2000 mA and a peak power of 280 W, with an average output power of up to 100 W.

### Working Principle

Charge is transferred to the piezo actuator using low-loss PWM techniques. When the actuator is discharged, the energy not consumed is fed through the energy recovery circuitry for reuse in the next charging cycle.

The working principle of the E-504 series is perfectly qualified for high-dynamics scanning and switching applications. For applications where static position stability in the sub-nanometer range is essential, the E-505 (see p. 2-147) amplifier module is recommended.

### Modular Design for Flexibility: Optional Servo-Controller Upgrade

Up to three E-504 amplifier modules can be installed in one E-500 controller chassis. The flexible, modular design of the E-500 piezo controller system allows easy installation of an optional E-509 sensor- / servo-controller module for closed-loop operation. The output voltage of the E-504 is then set by the servo-control loop. Closed-loop piezo mechanics from PI can provide positioning accuracy and repeatability down to the nanometer range and below.

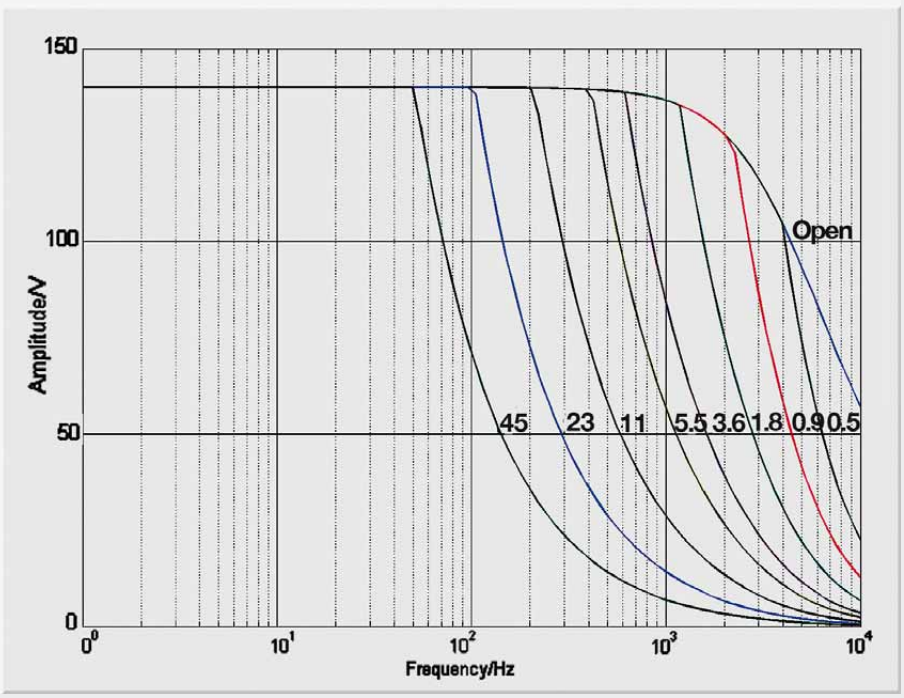
### Open-Loop Operation

In open-loop (voltage-controlled) piezo operation the amplifier output voltage is determined by an analog signal at the Control Input, optionally combined with the DC-offset potentiometer. Open-loop operation is ideal for applications where fast response and very high resolution with maximum bandwidth are essential. Here, commanding and reading the target position in absolute values is either not important or carried out by external position sensors. The precision 10-turn potentiometer can also be used alone to set the output voltage manually.

The same functionality and specifications are available in the E-617 amplifier module. (see p. 2-112).

### Ordering Information

**E-504.00F**
High-Power-Piezo Amplifier Module, 1 Channel, 280 W Peak Power, 100 W Average Power, -30 to 130 V




E-504: operating limits with various PZT loads (open-loop), capacitance is measured in µF

## Technical Data

| Model | E-504.00F |
|---|---|
| Function | Power amplifier with energy recovery, 1 channel |
| **Amplifier** | |
| Control input voltage range | -2 to +12 V |
| Output voltage | -30 V to 130 V |
| Peak output power <5 ms | 280 W |
| Average output power | Equivalent to 100 W reactive power |
| Peak output current <5 ms | 2000 mA |
| Average current | 1000 mA |
| Current limitation | Short-circuit-proof |
| Voltage gain | 10 ±0.1 |
| Ripple, noise, 0 to 100 kHz | 5 $mV_{RMS}$<br>20 $mV_{P-P}$ |
| Output impedance | 0,5 Ω / 2,5 µF |
| **Interfaces and operation** | |
| Piezo connector | LEMO ERA.00.250.CTL |
| Analog input | SMB |
| DC-Offset | 10-turn pot., adds 0 to +10 V to Control In |
| **Miscellaneous** | |
| Operating temperature range | +5 to +50°C |
| Dimensions | One 14T slot wide, 3H high |
| Mass | 0.9 kg |
| Operating voltage | E-500 System |
| Max. power consumption | <30 W |