# PI

Piezo · Nano · Positioning

# E-753 Digital Piezo Controller

## High-Speed, Single-Axis Controller



E-753 Single-channel digital controller together with the
PIHera® P-629.1CD nanopositioning stage with 1500 μm travel

- **Next Generation Digital Controller Provides Higher Flexibility, Accuracy and Speed**
- **100 kHz Sensor Sampling; 32-bit Floating Point DSP; 24-bit Low-Noise D/A Converters**
- **Ethernet (TCP/IP) Interface for Remote Control Capability, RS-232**
- **Auto-Loading of Calibration Data from Stage ID-Chip for Interchangeability of Controller and Mechanics**
- **Additional High-Bandwidth Analog Control Input / Sensor Input**
- **Digital I/O Lines for Task Triggering**
- **Extensive Software Support**
- **For Nanopositioning Systems with Capacitive Sensors**

The E-753 next-generation digital piezo controller is the result of PI's 30+ years of experience with piezo motion control systems. It is ideal when it comes to meeting the most demanding accuracy and dynamic-performance requirements of nanopositioning systems of the highest precision class. The E-753 replaces the E-750 controller.

## Digital Linearization and Control Algorithms for Highest Accuracy

Linearization algorithms based on higher-order polynomials improve the positioning accuracy to 0.001 % of the travel range. During fast periodic motion, as typical for scanning applications, the tracking accuracy can be further improved with

Dynamic Digital Linearization (DDL, E-710.SCN). This optionally available control algorithm reduces the tracking error by a factor of up to 1000 and enables the spatial and temporal tracking during a dynamic scan.

## Higher Velocity and Bandwidth for Dynamic Applications

The controller is perfectly suited for high-dynamics operation thanks to its high-resolution DA-converter and high-performance voltage amplifier. The high-speed processor with a sensor sampling rate of 100 kHz assures settling times in the millisecond range and below.

## Flexibility for a Variety of Applications

PI nanopositioning systems which are equipped with an ID-chip and calibrated with a digital controller have the mechanics-related calibration and servo-control parameters stored in the chip. The controller automatically adapts to the connected mechanics by the appropriate use of this data, so that recalibration is not necessary when system components are replaced.

The integrated wave generator can save and output periodic

motion profiles. In addition to sine and triangle waves, arbitrary, user-defined profiles can be created.

## Simple System Integration

All parameters can be checked and reset via software. System setup and configuration is done with the included NanoCapture™ and PIMikroMove™ user-interface software. Interfacing to custom software is facilitated with included LabVIEW drivers and DLLs. System programming is the same with all PI controllers, so controlling a system with a variety of different controllers is possible without difficulty.

P-725 PIFOC® objective Z-positioner and E-753 controller constitute an optimal system for high-speed, high-resolution positioning and scanning.

## Technical Data

| Model | E-753.1CD |
|---|---|
| Function | Digital controller for single-axis piezo nanopositioning systems with capacitive sensors |
| Axes | 1 |
| Processor | DSP 32-bit floating point, 60 MHz |
| Sampling rate, servo-control | 25 kHz |
| Sampling rate, sensor | 100 kHz |
| **Sensor** | |
| Servo characteristics | P-I, two notch filters |
| Sensor type | Capacitive |
| Sensor channels | 1 |
| Sensor bandwidth | 5.6 kHz |
| Sensor resolution | 17-bit |
| Ext. synchronization | Yes |
| **Amplifier** | |
| Output voltage | -30 V to 135 V |
| Amplifier channels | 1 |
| Peak output power <5 ms | 15 W |
| Average output power >5 ms | 5 W |
| Peak current <5 ms | 110 mA |
| Average current >5 ms | 40 mA |
| Current limitation | Short-circuit-proof |
| Resolution DAC | 24-bit |
| **Interfaces and operation** | |
| Communication interfaces | Ethernet, RS-232 |
| Piezo connector | Sub-D special connector |
| Sensor connection | Sub-D special connector |
| Analog input | LEMO, ±10 V, 18 bit |
| Digital input | 2 x LEMO, TTL |
| Digital output | 2 x LEMO, TTL |
| Command set | GCS |
| User software | NanoCapture™, PIMikroMove™ |
| Software drivers | LabVIEW drivers, DLLs |
| Supported functionality | Wave generator, trigger I/O, data recorder |
| Display | Status LEDs |
| Linearization | 4th order polynomials, DDL (optional) |
| Separate protective ground connector | Yes |
| **Miscellaneous** | |
| Operating temperature range | 5 to 50 °C |
| Overtemp protection | Deactivation of the piezo voltage output at 85 °C |
| Mass | 0.9 kg (controller) |
| Dimensions | Controller: 264 x 125 x 48 mm (with rubber feet) Power supply: 174 x 95 x 58 mm (with rubber feet) |
| Power consumption | 10 W max. |
| Operating Voltage | 24 VDC from external power supply (included) |
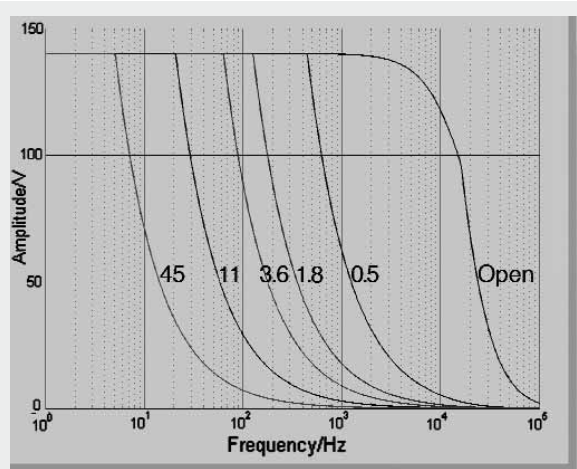


E-753 open-loop operating limits with various PZT loads. Graphs reflect the large signal-current limitation of the amplifier circuit, not the actual bandwidth.