

# Digital Multi-Channel Piezo Controller with EtherCAT

Control Piezo Nanopositioning Systems via Fieldbus Interface



## E-727.xF

- Integration into an automation system thanks to EtherCAT
- Operating modes: CSP, PP, homing
- Cycle time 2 ms
- 20 kHz sampling rate control
- Autoloading of calibration data from stage ID chip for interchangeability of controller and mechanics
- 4th order polynomial linearization for mechanics and electronics

### Digital controller for piezo-based nanopositioning systems

Integrated low-noise power amplifiers for PICMA<sup>®</sup> piezo actuators. Output voltage -30 to +130 V. Supports strain gauge sensors, capacitive sensors or piezoresistive sensors. Delivery includes wide input range power supply and USB cable.

### EtherCAT fieldbus interface

Controller and nanopositioning system behave like an intelligent multi-axis drive according to CiA402 drive profile. Can be integrated seamlessly into automation systems in industry and research. Operating modes according to IEC 61800-7-201: Cyclic Synchronous Position (CSP), Profile Position (PP) and Homing (manufacturer-specific method: Autozero). Cycle time 2 ms.

### Operation via TCP/IP or USB

Operation via TCP/IP or USB is possible without EtherCAT master. The controller then has the same functionality as an E-727 without fieldbus interface and is commanded via PI GCS. Extensive software support, e.g., for NI LabVIEW, dynamic libraries for Windows and Linux.

### Extensive functionality

P-I controller with 2 notch filters. Linearization based on 4th-order polynomials. Optional Dynamic Digital Linearization (DDL). ID chip for fast startup and quick exchange of system components.

### Further interfaces

SPI for fast serial transmission of position values to / from an SPI master. 4 analog inputs and outputs each (optional) for external sensors, target values or external amplifiers. 4 digital inputs and outputs respectively.

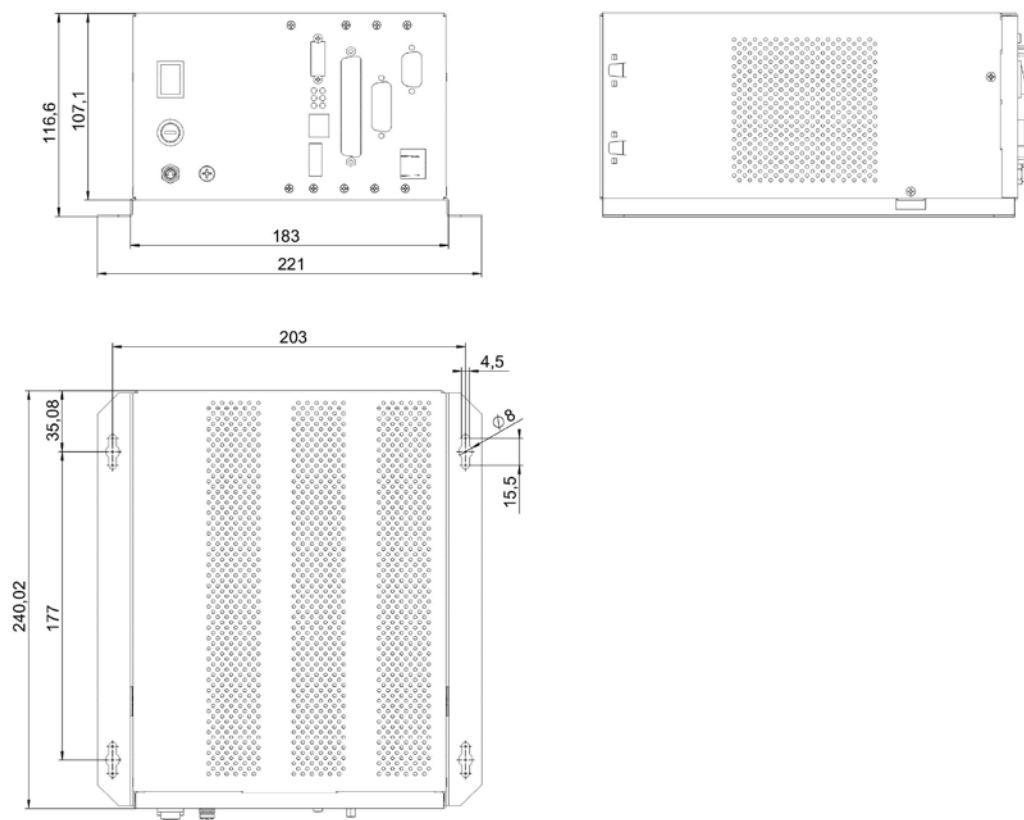
## Specifications

	E-727.3xDf, E-727.3xDaf
Function	Digital controller for multi-axis piezo nanopositioning systems. Fieldbus integration via EtherCAT interface. Additional functions with .3xDaf: Analog interfaces
Axes	3
Processor	DSP 32/64-bit, floating point, 375 MHz
Sampling rate, servo control	20 kHz
Sampling rate, sensor	100 kHz
<b>Sensor</b>	
Controller type	P-I, two notch filters Optional: Advanced piezo control
Sensor type	E-727.xCxxx: Capacitive E-727.xSxxx: Strain gauge sensors E-727.xRxxx: Piezoresistive
Sensor channels	E-727.xCxxx: 3 E-727.xSxxx, E-727.xRxxx: 4
Sensor bandwidth (-3 dB)	10 kHz
Sensor resolution (at 1 kHz oversampling)	20-bit
<b>Amplifier</b>	
Output voltage	-30 to 130 V ( $\pm 3$ V)
Amplifier channels	4
Peak power / channel	28 W max. 30 ms
Average output power / channel	14 W
Peak current / channel	180 mA max. 30 ms
Average output current / channel	75 mA
Current limitation	Short-circuit proof
Resolution DAC	20-bit
Amplifier bandwidth	6.5 kHz
<b>Communication</b>	
PC	TCP/IP, USB
SPI	Connector for SPI master for fast serial transmission of target and current position
Fieldbus	EtherCAT (CoE = CANopen over EtherCAT)
<b>Interfaces</b>	
Piezo / sensor connection	E-727.xCxxx: Sub-D 25W3 (f) E-727.xSxxx, E-727.xRxxx: Sub-D 37 (f) E-727.3xDaf only: Sub-D 15 (f)
Analog inputs	4 inputs $\pm 5$ V or $\pm 10$ V 18-bit A/D converter
Analog output	E-727.3xDaf only: Sub-D 15 (f) $\pm 10$ V 20-bit D/A converter
Sensor monitor output	E-727.3xDaf only: Sub-D 15 (f) Sensor channels 1 to 3
Digital input/output	MDR14; 4 inputs, 4 outputs
Separate protective earth connection	Yes

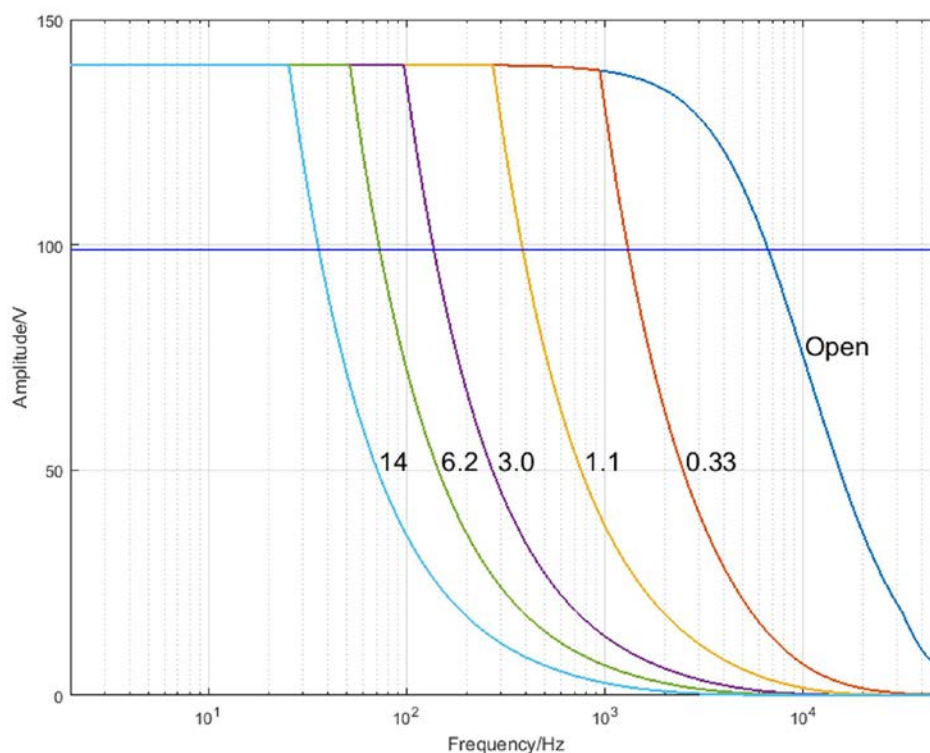
E-727.3xDF, E-727.3xDAF	
<b>Operation</b>	
Communication via PC	Command set: PI General Command Set (GCS) User software: PIMikroMove Software drivers: NI LabVIEW and MATLAB driver, shared libraries for Windows and Linux, extensive example code
Communication via fieldbus (EtherCAT)	Drive profile CiA402 (IEC 61800-7-201) Operating modes: Cyclic Synchronous Position (CSP), Profile Position (PP), Homing Min. cycle time: 2 ms
Supported functions	Autozero, ID chip detection Addressable with GCS commands only: Wave generator, data recorder, macros
Display and indicators	LEDs for Power, Servo, Error, Overflow, EtherCAT communication
Linearization	4th-order polynomials, DDL (Dynamic Digital Linearization)
<b>Miscellaneous</b>	
Operating temperature range	5 to 40 °C
Overheat protection	Max. 72 °C, deactivation of the voltage output
Mass	2.4 to 2.6 kg
Fuse	1 x T3.15 AH, 5 x 20 mm
Max. power consumption	80 W
Max. power consumption without load	24 W
Operating voltage	24 V DC (external power adapter in the scope of delivery)

Ask about customized versions.

## Drawings / Images



E-727.xxxF, E-727.xxxAF: dimensions in mm



*E-727.xxxF, E-727.xxxAF: Operating limits (open loop) with various piezo loads, capacitance values in  $\mu F$*

## Ordering Information

### E-727.3CDF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, capacitive sensors, Sub-D 25W3 socket, EtherCAT interface

### E-727.3DAF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, capacitive sensors, Sub-D 25W3 socket, EtherCAT interface, analog inputs

### E-727.3SDF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, strain gauge sensors, Sub-D 37 socket, EtherCAT interface

### E-727.3DAF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, strain gauge sensors, Sub-D 37 socket, EtherCAT interface, analog inputs

### E-727.3RDF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, piezoresistive sensors, Sub-D 37 socket, EtherCAT interface

### E-727.3RDAF

Digital multi-channel piezo controller, 3 axes, -30 to 130 V, piezoresistive sensors, Sub-D 37 socket, EtherCAT interface, analog inputs

## Accessories

### E-710.SCN

Firmware extension DDL (Dynamic Digital Linearization)