

Smart Piezo Drive Model Mk3-HV1 Programmable & Self-instrumented 200 Volt Amplifier



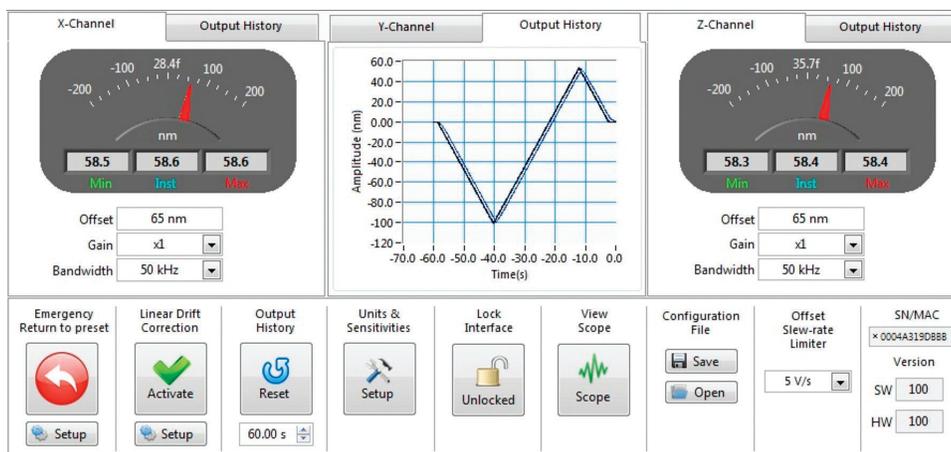
The *Smart Piezo Drive* is a 6-channel, very low-noise, low-drift, high-voltage amplifier for Scanning-Probe Microscopy applications. With three main inputs, three auxiliary inputs, a wide range of possible adjustments of the parameters (output offsets, gains and bandwidths), the *Smart Piezo Drive* is a feature-rich, extremely versatile product.

INDUSTRY FIRSTS

- Embedded high-precision DSP board allows the amplifier to be completely software-controlled through a USB or Ethernet link
- 3-channel real-time scope with unlimited recording function
- Low-pass filtering and adjustable slew-rate limit on offset changes to avoid crashes due to fast motions
- Emergency Return-to-Preset function immediately returns all outputs to a preset “safe” position, with a slew-rate limit during the return
- Drift-Correction function to track thermal drifts of the scanned surface
- Completely software-controllable parameters on all channels:
 - ✓ Bandwidth (1kHz to 50kHz)
 - ✓ Gain (x1 to x20)
 - ✓ Offset (full range)

SOFTWARE CONTROL INTERFACE

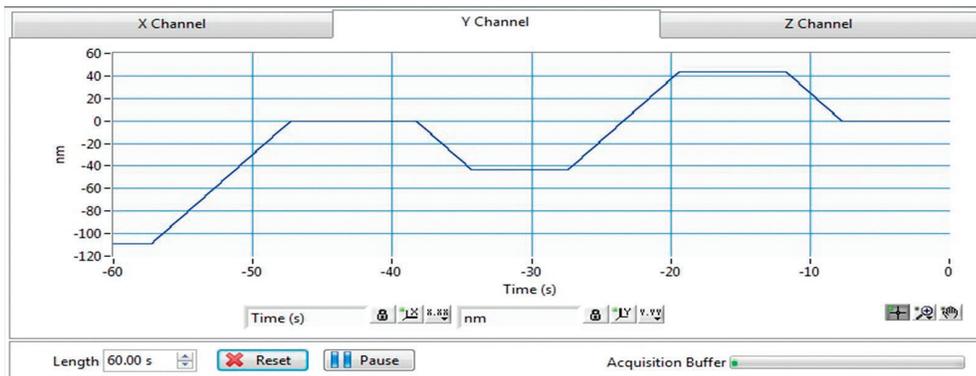
This interface, based on a DSP board, uses a USB or an Ethernet link to control the amplifier. The following interface allows the full control of the amplifier.



The user can monitor the output voltage history on all channels and adjust the gain, the offset and the bandwidth.

The entire set-up of the amplifier is automatically saved in the flash memory of the DSP board, so that it persists when the amplifier is powered off.

The USB version of the interface provides a high sampling rate scope function to monitor, in real-time, the output signal on all outputs, with an adjustable history length up to 60s.



FAST OPERATION WITH LOW NOISE AND DRIFT

The noise level is below 120 μ Vrms for a gain of 20 (input shorted and a bandwidth of 50 kHz). The low noise and thermal stability combined with the very high bandwidth (50 kHz) make the *Smart Piezo Drive* the best choice for high-speed Scanning Probe Microscopy applications.

INTERNAL POWER SUPPLY

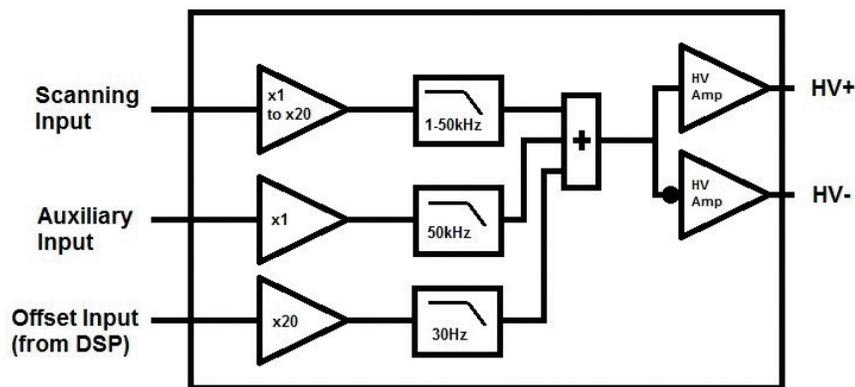
The amplifier uses an internal, very low-ripple, high-voltage power supply. This approach makes a compact one-box solution with better control over the amplifier's performance.

THERMAL MANAGEMENT

The fanless thermal management uses an aluminum plate that weights about 1 kg, and the aluminum enclosure itself acts as a thermal mass and radiator for a greater thermal stability. This mass can absorb the heat generated by high power transients.

VERSATILE AND SYMMETRICAL TOPOLOGY FOR EACH CHANNEL

The next figure presents the topology of the amplifier for one channel. The X, Y and Z channels have the same topology:



Smart Piezo Drive Model Mk3-HV1

Programmable & Self-instrumented 200 Volt Amplifier



SPECIFICATIONS

ANALOG INPUT CHANNELS (SCANNING)

Main Inputs (X,Y and Z)	$\pm 10V$
Input Impedance	10 k Ω
Coupling	DC
Input Connectors	BNC
Bandwidth	Software adjustable: 1 kHz, 10 kHz and 50 kHz
Gain	Software adjustable: x1, x2, x5, x10 and x20

ANALOG INPUT CHANNELS (AUXILIARY)

Auxiliary Inputs (X,Y and Z)	$\pm 10V$
Input Resistance	100 k Ω
Coupling	DC
Input Connectors	BNC
Bandwidth	50 kHz
Gain	x1

OFFSET (SOFTWARE CONTROLLED)

Software Adjustable Offset (X,Y and Z)	$\pm 200V$
Bandwidth	30 Hz
Slew Rate Limit	Software adjustable: 1 V/s to 10V/s or bypass

HIGH VOLTAGE OUTPUTS

Output Channels (X+, X-, Y+, Y-, Z+ and Z-)	$\pm 200V$
Maximum Current	15 mA
Maximum Capacitive Load	1 μF
Output Connectors	3x Hirose RM15 series circular connectors

SIGNAL QUALITY

Output Noise (gain x1 and 50 kHz)	70 μV_{rms}
Output Noise Spectral Density (gain x1 and 50kHz)	1.3 $\mu V_{rms}/\sqrt{Hz}$ @ 100 Hz 500 nVrms/sqrtHz @ 1 KHz
Output Noise (gain x20 and 50kHz)	120 μV_{rms}
Output Noise Spectral Density (gain x20 and 50kHz)	2 $\mu V_{rms}/\sqrt{Hz}$ @ 100 Hz 1 $\mu V_{rms}/\sqrt{Hz}$ @ 1kHz;
Maximum Slew Rate (10 nF load)	1500 V/ms
Output Thermal Drift	2 ppm-FSR/degC (max)

SELF-INSTRUMENTATION

Max History Length	Unlimited
Max Scope Function Depth	60 s
Scope Function Sampling Rate	150 kHz

DIMENSIONS

Chassis	18" x 12" x 5"
Weight	5 kg

ELECTRICAL SUPPLY

External Power Pack	Input 120VAC, Output 24VDC 5A (included)
Power Consumption (quiescent)	14 W