PICOSCALE Vibrometer Stage Controller PV-STG-V1.5

The **PICO**SCALE *Vibrometer* contains two controllers, the system controller and the stage controller. The stage controller contains the electronics to operate the XYZ positioning stage in closed-loop. In addition, it provides access to internal system signals and contains a power amplifier to drive the shaker stage.

This document contains the specifications of the stage controller.

INTERFACES

Front Plate

Figure 1. *Front plate layout*

1. Scanning Stage
D-Sub 50 connector 'Scanning Stage', female, to connect the XYZ positioning system. The electronics to operate the XYZ positioning stage are based on SmarAct's modular control system **MCS**2. This allows to achieve the maximum performance of the used stick-slip positioners. Do not connect any other motion system.

2. Analog in
Through the '*Analog In*' BNC connector of the stage controller analog signals can be read in and recorded via the control software. This can be used to monitor electrical excitation signals. The specifications of the analog to digital converter are provided in Table 1.

Table 1. *Specifications of the high-speed analog input.*

Property	Value
Resolution	16 bits
Sample rate	10 MHz
Range*	±10 V
Bandwidth**	< 2.5 MHz
Impedance	7.5 kΩ
Connector	BNC

* The input is not calibrated. For an exact mapping of voltage to ADC values, a calibration can be performed by measuring 2 known voltages.
** Bandwidth at −3 dB.

3. Shaker
The stage controller includes a high-bandwidth power amplifier to drive the shaker stage. This amplifier is internally connected to the analog signal output and is designed to drive the shaker stage at MHz frequencies. As compared to the analog signal output, see below, the amplifier can generate much higher currents which is essential to drive high capacitive load such as the shaker stage. By default, the amplified signal caries a DC offset, so that the shaker stage is always operating at a positive voltage. Table 2 contains the specifications of the shaker stage amplifier output.

Table 2. *Specifications of the shaker stage amplifier (without load).*

Property	Value
Range	±2.5 V
Signal offset	7.5 V_{DC}
Bandwidth*	1.3 MHz
Impedance	1 Ω
Connector (Female)	2 pin Lemo
Matching Connector (Male)	LEMO FGG.0B.302.CLAD

* Bandwidth at −3 dB, at 2.5 MHz the attenuation is −9 dB. With a load of 0.1 µF the bandwidth at −3 dB remains identical but at 2.5 MHz the attenuation has increased to −16 dB.

An adapter cable (Figure 2) is available as accessory to connect other loads to the amplifier output via BNC connectors. In this case, the signal can be used to drive capacitive loads such as piezo actuators. Even capacitances of multiple µF can be connected although the bandwidth will be reduced. The adapter cable also offers an AC-coupled signal to drive inductive loads like voice coils and loudspeakers. The actual bandwidth will depend on the electrical resonance of the electronic circuit which in turn will strongly depend on the connected device.

Figure 2. *Adapter to make the shaker stage signal available through 2 BNC connectors, as DC-coupled and as AC coupled signal.*

4. GPIO 1 and 5. GPIO 2
The signals on the '*GPIO 1*' and '*GPIO 2*' BNC connectors of the stage controller depend on the operating mode of the device.
When the **PICO**SCALE *Vibrometer* is set up to output an internally generated signal, the '*GPIO 1*' and '*GPIO 2*' are configured as digital to analog converter (DACs). The specifications of the digital to analog converter are provided in Table 3. The analog output can drive currents of up to 30 mA. To be able to drive larger loads an additional amplifier will be required, either the built-in shaker stage amplifier or an external amplifier.

Table 3. *Specifications of the high-speed analog output (without load).*

Property	Value
Resolution	12 bits
Sample rate	10 MHz
Range	±10 V
Bandwidth*	1 MHz
Impedance	47 Ω
Connector	BNC

* Bandwidth at −3 dB, at 2.5 MHz the attenuation is −12 dB.

When the **PICO**SCALE *Vibrometer* is set up for operation with externally generated excitation signals, the '*GPIO 1*' and '*GPIO 2*' connectors output digital signals (either clock signal, to synchronize an external function generator for example, or trigger pulses) that can be used to control an external function generator or synchronise a recording device.
The frequency of the clock signal can be adjusted up to 10 MHz through the control software but due to the rise time, the clock signal will look increasingly distorted above 2 MHz.
The latency of the trigger pulse flank with respect to the recorded data packages is ≈5 µs with a jitter of <40 ns (standard deviation from latency distribution).
Table 4 contains the specifications of the digital output. The best signal quality is achieved with short cable lengths and in a 50 Ω environment.

Table 4. *Specifications of the digital output.*

Property	Value
Output	0/5 V
Rise time*	50 ns
Connector	BNC

* From 10 to 90 %.

5. Power Button
Power switch controlling the controller.

Back Plate

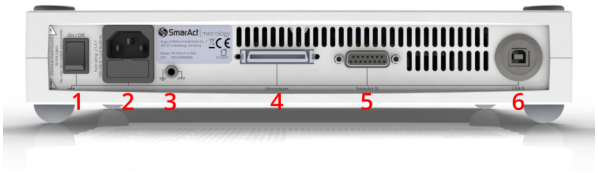

Figure 3. *Back plate layout*

1. On / Off
Power button to switch the stage controller on or off (standy).

2. AC power supply connector
The stage controller is powered with a 100-240 V at 50-60 Hz AC/DC power supply. For protection, a fuse (slow blow) of 2.5 A is added. The input current must be lower than 0.5 A at 230 V. System ground is connected to protective earth (PE) inside the external AC/DC power supply.

3. System ground
A 4 mm banana socket can be connected to system ground and to bring several devices to the same electrical potential.

4. Vibrometer
The stage controller has a mini ribbon 50 connector to be connected to the system controller.

5. SmarAct SI
Reserved for future use.

6. USB B
To configure the stage controller the system has to be connected to a PC. Therefore, a USB 2.0 cable can be connected here and the connection can be established with the graphical user interface, for example. The USB interface provides a USB 2.0 high speed connection with data rates of up to 480 Mbits/s.

DIMENSIONS AND CONDITIONS

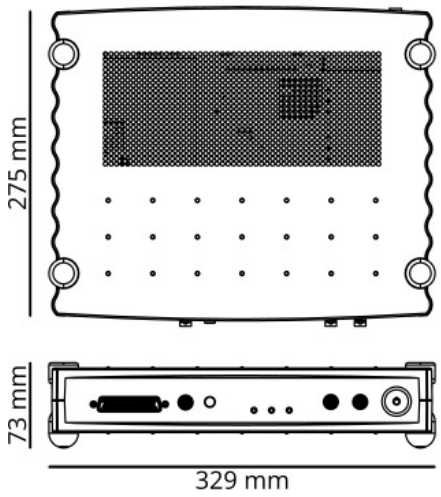

Figure 4. *Controller Dimensions. Weight 3.5 kg.*

Table 5. *Operation conditions for stage controller.*

Property	Parameter
Degree of Pollution (acc. to EN 60664-1:2007)	2
Power supply	100-240Vac, 1.2 A, 50-60Hz
Input current	0.5 A at 230V
Fuse (slow blow)	2.5 A
Operation temperature	15 °C - 30 °C ±2.5 °C dynamic*
Relative humidity	20% to 80% RH non-condensing
Storage temperature	0 °C - 50 °C
Transport temperature	0 °C - 50 °C
Altitude	up to 2000 m

*Maximum temperature fluctuations during measurement that guarantee performance.

Completeness of contents
The hazards and warnings listed in this section are incomplete. Before operation, the user has to read the user manual, which contains more safety information.

ORDER CODES

The order codes of the stage controller and its accessories are given in Table 6.

Table 6. *Order codes of the stage controller and accessories.*

Order code	Description
PV-STG-V1.5-TAB	**PICO**SCALE *Vibrometer* stage controller
PV-ACC-OUT-01	Adaptor cable for shaker signal, 2 BNC outputs, AC- and DC-coupled

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We maintain the complete production in house for a high level of customization so that we can always provide you the optimal individual or OEM solution. We also offer feasibility studies, measurement services and comprehensive support to accompany you along your projects.

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