Basel Precision Instruments

Low-Noise High-Resolution (LNHR) DAC

outstanding resolution and noise performance

Model	**LNHR DAC** No longer available	**LNHR DACII-12** New	**LNHR DACII-24** New
Product #	SP927	SP1060-12	SP1060-24
Number of independent DAC channels	8	12	24
Resolution	24-bit		
Output voltage range / step size	±10 V range / 1.2 µV step size		
Leakage current detection	pA detection is possible using ad-on gate leakage box		
Integrated output voltage noise	75 Hz BW: typ. 0.5 µVrms	100 Hz BW: typ. 0.3 µVrms 100 kHz BW: typ. 4 µVrms	
Temperature drift (for entire ±10 V output range)	< 10 ppm/ °C (from voltage output)	typ. 1 µV/ °C + 1.5 ppm/ °C (ppm from actual voltage output)	
Drift over 8 hours at constant temperature	< 10 µV		
Bandwidth	75 Hz	switchable between 100 Hz and 100 kHz for each DAC channel	
Arbitrary waveform generation		2 AWGs assigned to any channel	4 AWGs assigned to any channel
Predefined standard waveforms		Sine, triangle, sawtooth, ramp, pulse, gaussian-noise	

Model	LNHR DAC No longer available	LNHR DACII-12 New	LNHR DACII-24 New
Ramping function		4 independent ramp generators with adaptive scan feature (gate compensation)	
Output current	±1 mA nominal		
		up to ±10 mA on one DAC channels	up to ±10 mA on two DAC channels
Grounding	Output ground is isolated from housing and computer interface		
External bias voltage between DAC output ground & housing	20 V max		
Output impedance	500 Ω	50 Ω	
Dimensions	48 x 10 x 43 cm		

New features offered by LNHR DACII-12 and LNHR DACII-24

- 12 or 24 independent DAC channels
- selectable bandwidth of 100 Hz (LBW) or 100 kHz (HBW) for each DAC channel
- four independent and versatile RAMP-generators
- predefined waveforms (via AWG): sine, triangle, sawtooth, ramp, pulse, Gaussian-noise
- two user-defined 24-bit arbitrary waveform generators (AWG) per 12 channel DAC-board
- AWG memory: 34'000 points; update-rate at 10 µs per point or longer
- up to 10 mA output current on one DAC channels for each 12 channel DAC-board
- external and internal synchronization for each 12 channel DAC-board

Applications

Applying ultra-stable DC bias-voltages and high-resolution sweep-voltages with very low fluctuations in sensitive experiments:

- driving high-ohmic gates in low-temperature quantum experiments
- applying source-drain voltages in quantum transport measurements
- controlling samples with high sensitivity to electrostatic charge, such as Josephson junctions or quantum dots

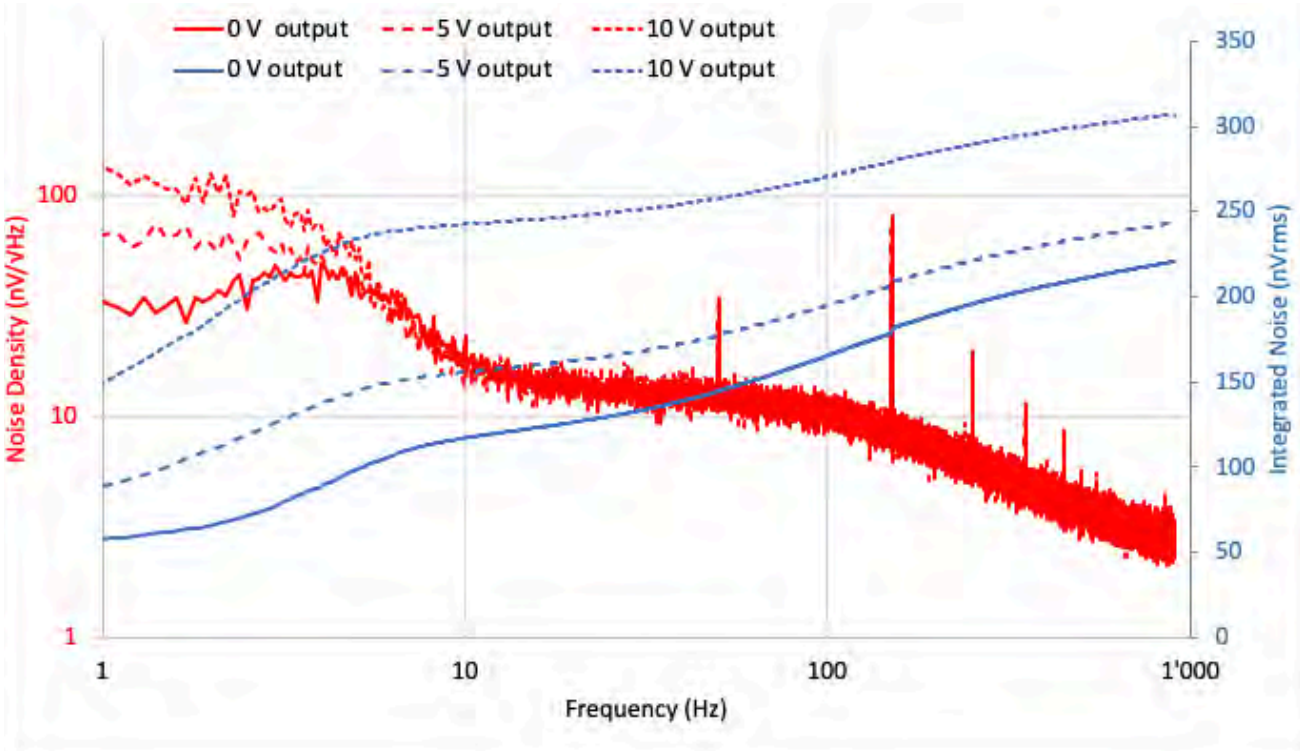
Grounding, noise management and device protection

The LNHR DAC is a designed to optimize the grounding scheme for low-noise setups and to protect the device:

- ground loops are avoided; DAC channel output ground is isolated from the housing and computer interface; ground is provided by the shield of the cable coming from the experiment
- low-noise measurements are performed with the DAC connected to the mains AC voltage without a need for batteries
- DAC channels are connected directly to the device; excellent noise and resolution specs render further filtering and dividing unnecessary
- the DAC is built for devices with high sensitivity to electrostatic charge; in the unlikely event of power failure or computer crash the device is protected by the DAC

Noise Density Spectrum and Integrated Noise (single trace)

The outstanding noise performance of the LNHR DACII is shown here. This plot shows the noise density spectrum (red) and the integrated noise (blue) at 0 V, 5 V, and 10 V output and the low-bandwidth setting (BW = 100 Hz). Data for high bandwidth setting (100 kHz) is shown in the user manual. For this specific measurement, the integrated noise from 0.1 Hz to 100 Hz ~170 nVrms at 0 V output; even better than the 300 nV stated in the table above. The European mains-frequency of 50 Hz and some of its harmonics can be identified on the noise density spectrum. However, those peaks do not add significantly to the total noise voltage as seen on the integrated noise. For frequencies above 100 Hz the noise density drops due to 100 Hz LP-filter and reaches the noise floor of 1 nV/√Hz at 900 Hz originating from the differential amplifier used for measurements.



Gate leakage current measurement box

BASPI offers a gate leakage measurement box (GLMB) for monitoring gate leakage on up to 6 leads in parallel during a running experiment without added noise or instability. See the GLMB flyer for more details.

- 6 channels in parallel
- pA to 10 µA leakage detection
- 10 Hz bandwidth
- two gain modes: 1 V/nA or 1 V/µA
- With remote control and current overload alarm

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Gate Leakage Current Measurement Box

monitor gate leakage during a running experiment without increasing noise or deteriorating stability

Model	**SP1046**
Number of channels per box	6
Detection range	pA to 10 µA
Gain	1 V/nA or 1 V/µA
Bandwidth	10 Hz
With remote control and current overload alarm