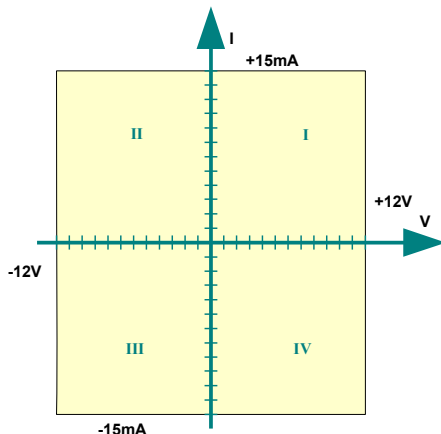


4 High Stability Voltage Sources

- ✓ Voltage to $\pm 12V$, current to $\pm 15mA$
- ✓ High Resolution: 21 bits, $6\frac{1}{2}$ digits
- ✓ Unrivaled noise level: down to $5\mu Vp-p$ ($< 1\mu V$ RMS)
- ✓ Clean output noise spectrum with no spike
- ✓ High Stability: a few ppm within 24-hour

Main features

- 4 independent sources in the same module, all sharing the same isolated ground
- 4-quadrant DC voltage sources and $6\frac{1}{2}$ -digit digital multimeter (DMM)
- 2 models (later upgrade possible):
 - BE2141, with no current measurement
 - BE2142, with current measurement
- No crosstalking between sources
- No voltage transient when powering on/off or switching on/off
- No more than the output noise of a very low-noise operational amplifier: $< 3nV/\sqrt{Hz}$
- 2 voltage ranges: $\pm 1,2V$ and $\pm 12V$
- 1 current range: $\pm 15mA$
- Voltage programming and measurement resolution: 21 bits, $6\frac{1}{2}$ digits. High accuracy, typ. 0,02%.
- 4-wire operation available (remote voltage sensing)
- Programmable waveform with triggering features: exponential, ramp, staircase or steps.
- Input and output triggers on SMB connectors
- Output and Sense on SMA connectors
- Operating area:



BiLT® System features

- Module to be inserted in a BiLT® chassis, 5 to 14-slot versions available, up to 1000W output power
- Cost effectiveness for multiple channels: up to 14 BE214x housed into a single 19" BiLT® chassis
- Chassis standard interface: Ethernet and USB
- Complete software package provided, including a free turnkey control PC software (Windows™ or Linux) and NI Labview® driver.

Application examples

- Noise-sensitive device power supply, such as PLL, cameras, signal converters (ADC, DAC)...
- Polarization of nanostructures, nanotube, graphene, quantum devices, 2D high conductivity gases...
- Small superconducting coil
- Battery replacement for ultra-low noise applications
- Ultra low level pressure and temperature sensors

BE214x Module

Programming and measurement accuracy

Range switching when the source is off, with automatic range selection capability.

Accuracy specified on an 18°C-28°C ambient temperature range, after a 30-min warm-up time, using sense signals.

Range	Resolution	24-hour stability ⁽¹⁾	90-day accuracy ⁽²⁾⁽⁴⁾	1-year accuracy ⁽²⁾⁽⁴⁾	Temp. coefficient ⁽³⁾
± 12V	12µV	±24µV±15ppm	±70µV±250ppm	±130µV±300ppm	(±0,6µV±6ppm)/°C
± 1,2V	1,2µV	±2,4µV±15ppm	±30µV±250ppm	±53µV±300ppm	(±0,2µV±6ppm)/°C
± 15mA (BE2142 only)	0,5µA	±0,5µA±35ppm	±2,3µA±350ppm	±3µA±450ppm	(±0,02µA±15ppm)/°C

(1) Relative to absolute accuracy, ±offset±ppm of setting/measurement, ambient temperature ±1°C

(2) ±offset±ppm of setting/measurement

(3) add the temperature coefficient outside the specified 18-28°C ambient temperature range, (±offset±ppm of setting/measurement)/°C

(4) add up to 15µV offset error is not using sense signals (at 0 current).

Noise and settling time

Range	Settling time ⁽¹⁾		Noise ⁽²⁾			Voltage noise density ⁽³⁾	
	To 99%	To 21 bit	0,1Hz-10Hz	10Hz-10kHz	10Hz-100kHz	1kHz	10kHz
± 12V	45ms	<200ms	<30µVp-p	37µVp-p	37µVp-p	7nV/√Hz	<3nV/√Hz
± 1,2V	45ms	<200ms	<3,5µVp-p	5µVp-p	5µVp-p	<3nV/√Hz	<3nV/√Hz

(1) guaranteed settling time in EXPONENTIAL mode, with no output capacitor, resistive load

(2) peak-to-peak noise measured within the full voltage range, -3dB bandwidth, no output capacitor. For RMS values, divide by 6,6 (white Gaussian noise approximation)

(3) detection limit is 3nV/√Hz

Operating Area

Parameters	Conditions/Comments	Min.	Typ.	Max.
Voltage programming range	12V range	-12V		+12V
	1.2V range	-1.2V		+1.2V
Voltage slope	ramp mode	1mV/s		100V/s
Output current	Guaranteed; source automatically stops over 20mA	-15mA		+15mA
Output capacitor ⁽¹⁾	Output capacitor range for stable operation	0µF		22µF
Cable impedance	to guarantee accuracy using sense signals			1Ω
Earth isolation	Isolation voltage	-150V		+150V
	Isolation resistance	10GΩ		
	Capacitance between any terminal and the earth		100nF	
Operating temperature	Ambient temperature in front of the chassis' rear fan openings	15°C		40°C

(1) connecting an output decoupling capacitor will reduce the noise bandwidth thus further reducing the specified overall peak-to-peak noise

Regulation and measurement

Parameters	Conditions/Comments	Min.	Typ.	Max.
Line regulation error	No line regulation error, guaranteed by design			0%
Load regulation error	Sense lines connected, 0 to max. source current	-6µV	0µV	+6µV
Output impedance	Source ON, sense signals connected		0mΩ	
	Source ON, sense signals left open		20mΩ	
	Source OFF, between both outputs ; max. allowed current: 1A		50mΩ	
Measurement	Throughput (bandwidth 7,3Hz)		16SPS	
	Noise-free resolution		21 bit	
	Sense input current		300pA	1,2nA

BE214x Module

Settling waveforms and trigger

The output voltage update can be performed in many ways, using different settling waveforms and trigger functions (hardware or software trigger with individual programmable delay for each channel)

→ **Exponential**

Immediate output voltage update when entering a new voltage setting. Fixed settling time, no triggering feature available.

→ **Ramp**

Programmable slope. The ramp starts on a trigger event, after a programmable delay.

→ **Staircase**

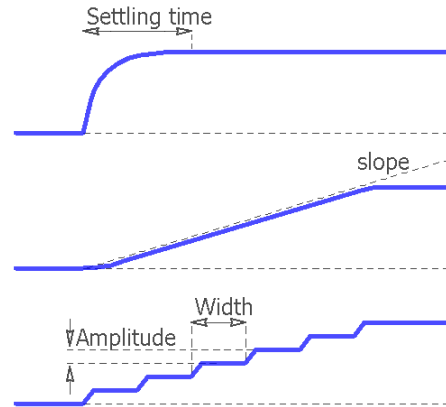
Programmable step amplitude and width. The staircase starts on a trigger event, after a programmable delay.

→ **Steps**

Programmable step amplitude. Each step occurs on a trigger event, after a programmable delay.

→ **Automatic Steps**

Programmable step amplitude. The first step occurs on a trigger event, after a programmable delay. The next steps occur as soon as the output voltage has reached the expected step voltage within a programmable gap amplitude.



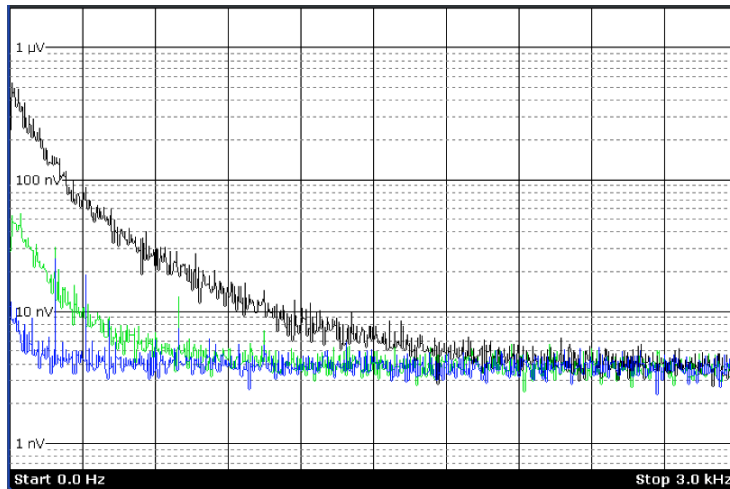
Noise Spectrum

Linear frequency axis, from 0Hz to 3kHz. Amplitude in V/√Hz. No spike above 3kHz is visible.

Blue line: measurement noise (4nV/√Hz noise floor above 200Hz)

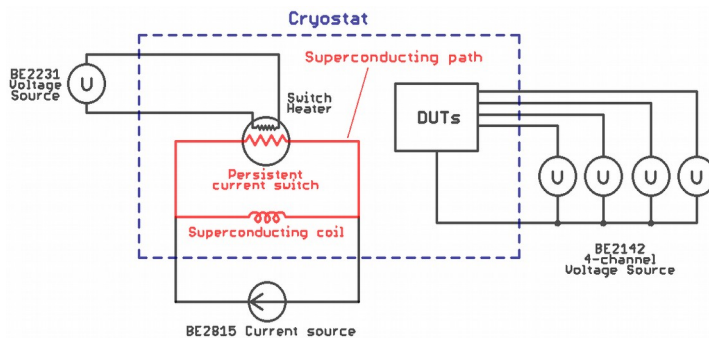
Green line: 1,2V range

Black line: 12V range



Application example

[Very low noise sources for physics applications requiring a superconducting magnet](#)



BE214x Module

Related products

BE2101 BE2102	Very low noise, very low drift, 21-bit resolution DC Voltage source modules, up to $\pm 12V \pm 200mA$, down to $1\mu V$ resolution
BE2231	Low noise, low drift, 19-bit resolution DC voltage source module, $\pm 50V \pm 500mA$
BE2811	Low noise, low drift, 19-bit resolution DC current source modules, $\pm 18V \pm 5A$
BE2812	Low noise, low drift, 19-bit resolution DC current source modules, $\pm 8V \pm 15A$

Documentation

BE214x Brochure	Rev 1.6	8 Oct. 2018	Module's specifications and main features
BE214x Manual			Manual with additional specification, quick-start guide and SCPI commands
http://www.bilt-system.com			Itest website

Standards, Calibration, Warranty and Maintenance

Bilt system is compliant with the applicable European Directives and holds the CE mark.

Any iTest product comes with a two-year parts and labour guarantee and a calibration certificate if applicable. A telephone support service is also available for the same period.

Our calibration laboratory performs according to ISO/CEI 17025 "General requirements for the competence of testing and calibration laboratories". All measurements are traceable to the International System of Unit.

The recommended calibration interval of this product is 1 year.

On request, Itest can proceed to scheduled calibration (in our workshop or at the customer's site).

Maintenance can also be performed on-site or in our workshop.



119 rue de la providence 31500 TOULOUSE - FRANCE
Tel + (33) 5 61 54 81 30 <http://www.bilt-system.com>

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