


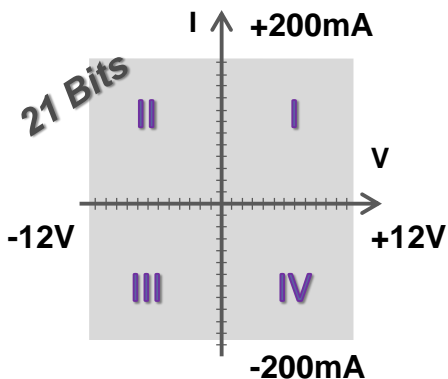
VOLTAGE to $\pm 12V$, CURRENT to $\pm 200mA$

- **High Resolution: 21 bits, 6 ½ digits**
- **Ultra Low Noise: down to $6\mu Vp-p$**
- **Clean output noise spectrum with no spike**
- **High Stability: a few ppm within 24-hour**

Powered by 

Main Features: (3 Source Models)

- BE2101: standard model with no current measurement
- BE2102: remote source, no current measurement
- **True 4-quadrant isolated modular DC source with sense lines**
- 2 voltage ranges: $\pm 1,2V$ and $\pm 12V$, current up to $\pm 200mA$
- High output and measurement resolution: **21 bits, 6½ digits**



Typical absolute accuracy: 100ppm

Very fast warm-up time, 10 minutes max.

- 2 programmable output filters to optimize output noise and settling time
- "Ready" output signal indicates optimal accuracy reached on output voltage
- **Excellent load regulation**, typ. error $<10\mu V$ (12V range)
- **Programmable ramp or staircase waveform**, synchronization between sources (external trigger)
- Cost effective: **up to 13 source modules** in a single Bilt chassis, 3 chassis sizes available: 5, 8 or 13 slots

System description

Complete free software package provided, including a turnkey PC software and NI Labview drivers.



- Host connections at chassis level including Ethernet, USB, RS422, RS232 and GPIB (optional)
- **High reliability and safety:** no transient during source On/Off phase or mains connection, no line perturbation, safe stop on mains default...

Application examples:

- Polarization of **nanoscale, mesoscopic, nanotube, graphene, molecular, quantum devices** ...
- Small superconducting coil
- High end power supplies for electronic devices, communication devices, micro-wave devices, signal converters (ADC,DAC), imaging devices.
- Battery replacement for ultra-low noise app.

System Specifications

Programming and measurement accuracy

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

Accuracy specified on a 18° C-28° C ambient temperature range, slow filter, after source warm-up (warm-up time 10min max, a SCPI command returns the temperature status of the source : “warming-up” or “ready”, the source can be started if not ready, consider then a slightly reduced absolute accuracy.

Range	Resolution	24-hour stability ⁽¹⁾	90-day accuracy ⁽²⁾	1-year accuracy ⁽²⁾	Temp. coefficient ⁽³⁾
± 12V(4)	12μV	±20μV±7ppm	±30μV±100ppm	±60μV±150ppm	±0,3μV±0,7ppm
± 1,2V(4)	1,2μV	±5μV±7ppm	±8μV±100ppm	±15μV±150ppm	±0,1μV±0,7ppm
± 200mA(5)	200nA	±1μA±15ppm	±15μA±150ppm	±15μA±200ppm	±0,02μA±1,5ppm

- 1) Relative to absolute accuracy, ±offset±ppm of setting/measurement, 18-28°C ambient temperature range
- 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) Programming and measurement accuracy are identical
- 5) Current measurement available on the BE2103 model only

Noise and settling time

Two output filters are user-selectable, slow or fast, each corresponding to a different small signal settling time. When the slowest settling time is chosen, the lowest output noise is obtained.

			Settling time ⁽¹⁾		Noise ⁽³⁾			Voltage noise density ⁽⁵⁾	
Range	Resolution	Filter	To 99%	To noise free accuracy ⁽²⁾	0,1Hz-10Hz ⁽⁴⁾	10Hz-10kHz	10Hz-100kHz	1kHz	10kHz
± 12V	12μV (±20 bits)	fast	<5ms	<10ms	6μV+2μV/V	80μVp-p	90μVp-p	90nV/√Hz	25nV/√Hz
		slow	<16ms	<100ms	6μV+2μV/V	25μVp-p	25μVp-p	15nV/√Hz	<5nV/√Hz
± 1,2V	1,2μV (±20 bits)	fast	<5ms	<10ms	1μV+3μV/V	10μVp-p	13μVp-p	10nV/√Hz	6nV/√Hz
		slow	<16ms	<100ms	1μV+3μV/V	6μVp-p	9μVp-p	6nV/√Hz	<5nV/√Hz

- 1) Guaranteed small step settling time (step amplitude≤10% of the range), with no output capacitor, resistive load, exponential waveform
- 2) Settling to 21 bits in slow mode, to 18 bits in fast mode
- 3) 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)
- 4) Expressed in volt peak-to-peak, noise at 0V output + noise per volt applied
- 5) Detection limit is 5nV/√Hz

System Specifications

Operating area

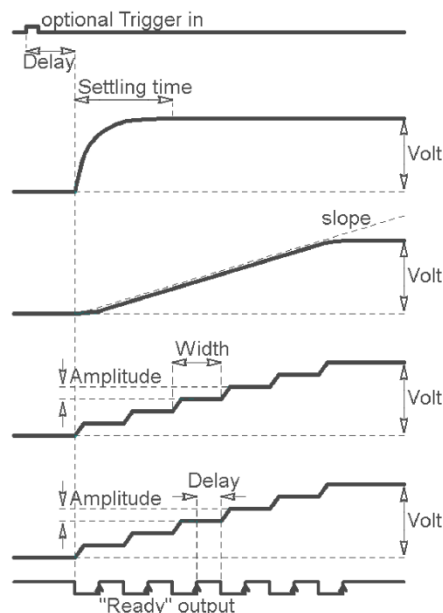
Parameters	Conditions/Comments	Min.	Typ.	Max.
Voltage setup & measurement range	12V range	-12V		+12V
	1.2V range	-1.2V		+1.2V
Output current	guaranteed	-200mA		+200mA
Short circuit current	Indefinite short circuit duration		±250mA	
Output capacitor⁽¹⁾	for stable operation and no overshoot ⁽²⁾ Slow mode	0µF 0µF		2200µF 47µF
	Fast mode			
Remote sense operating range	Max. voltage drop in the cable when sense connected, for proper operation	-0,2V		+0,2V
Output impedance	Sense not connected (internal mode)		20mΩ	
Insulation voltage⁽³⁾	Max. voltage between the earth and the source's negative terminal	-20V		20V
Operating temperature	Ambiant temperature in front of the chassis' rear fan openings	18°C		40°C

- 1) Connecting an output decoupling capacitor with reduce the noise bandwidth
- 2) The voltage slope should be reduced to avoid any output voltage overshoot when asking for a significant voltage setting step and when using large capacitors, due to the 200mA output current limitation of the source. Simply apply the formula: $Slope < 1 / (4500 \cdot C)$, C in Farad, Slope in V/ms.
- 3) Sources can be connected in serie to achieve higher voltage up to 24V

Sequential output control

The output voltage update can be performed in many ways, including the use of optional trigger input and delay functions:

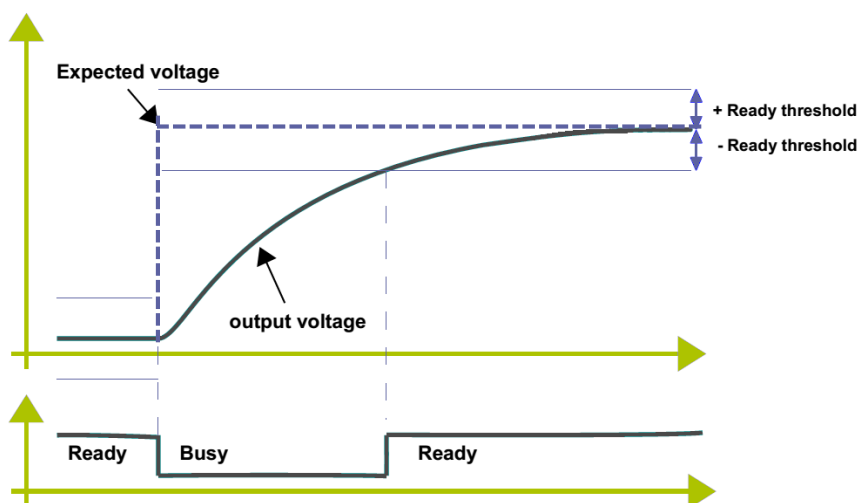
- **Single step with analog settling time**, according to the internal filter (fast 10ms or slow 100ms)
- **Single step with voltage slope control**, the slope value can be set down to 1,2µV / ms
- **Multi step voltage sweep**, well suited for device characterization requiring linear sweep.
- **Smart synchronization**, instead of using a constant duration step which has to comply with uncertain settling times or measurement times, smart synchronization allows to save time while improving reliability of the whole measurement process.



System Specifications

Whatever the chosen mode, a “Ready” output signal allows to optimize settling synchronization. “Ready” comparator tracks the gap between the expected voltage and the actual sensed voltage. Following the actuation of a new voltage setting, it allows to trigger any measurement process as soon as the output settles within a requested amplitude.

The absolute threshold value of the comparator is to be set by the user, depending on the speed versus resolution compromise.



As the BE2100 source offers a true resolution of 21 bit

It is possible to set the threshold down to $1,2\mu\text{V}$ (using 1.2V range),

And to know exactly when the output settles down to the guaranteed LSB.

BE210x source models and external connections

Each BE2100 source is a single channel module to be plugged inside a Bilt chassis. Three different models using the same design are available:

- The standard models, BE2101 and BE2103, provide an isolated voltage source located inside the chassis. **Sense connections will ensure long cable compensation.** Unlike the BE2101, the BE2103 model is able to measure the output current.
- The remote model, BE2102, provides an isolated voltage source embedded inside a miniature case which can be located quite far from the chassis. This will maintain a **very high isolation level** for both DC and AC noise, between signal ground and the chassis ground. The source is delivered with a 4-meter robust shielded cable. No current measurement is available.
- The case's overall dimensions are 130 x 80 x 37mm.



System Specifications

signal / function	Reference ground	BE2101 module connectors		BE2102 module connectors
Power output	floating signal ground	SMA 1 / module panel	9 D-SUB / module panel	SMA 1 / remote case
sense high		SMA 2 / module panel		SMA 2 / remote case
sense low		SMA 3 / module panel		SMA 3 / remote case
LED = Output ON				
Trigger input	mains earth	SMB 1 / module panel		SMB 1 / module panel
Ready output		SMB 2 / module panel		SMB 2 / module panel
remote probe				SUBD15

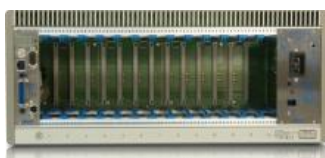
DC source features and protections

- The DC source output is regulated for constant sensed voltage operation
- An internal current limitation withstands indefinite overload conditions
- Sense connections with internal switch allowing to choose between internal or remote voltage sense operation
- Mains switching protection: When the source is OFF, an internal relay pulls the output down to the signal ground, avoiding any transient voltage when the chassis is powered up or down.
- Over Voltage Protection: When supplying a device requiring to keep apart from absolute voltage limits, it is possible to reduce the allowed output setting range and also the absolute working range of the internal power amplifier. Useful in case of wrong or missing sense connections.
- START and STOP synchronization: When using multiple source setup, it is possible to delay the starting and the stopping of each source with respect to individual programmable delays.
- Emergency stop on alarms: internal temperature, remote probe unconnected, output short-circuit...

Chassis

Different chassis are available according to 4 different sizes and formats (5, 8, 13 Slots). See BN100 datasheet for more information

This Low noise DC solution has been developed in partnership with the CNRS institute (French National Centre for Scientific Research) and the LPA Laboratory (Laboratoire Pierre Aigrain)



Warranty

Any Bilt product comes with a two-year parts and labour warranty, when returned to our workshops. A phone support service is also available for the same period.

At the end of the initial two-year period, a further contract can be subscribed, including:

- a preventive functional check and calibration of the modules (on site or in our workshop)
- a further two-year warranty period

Quality Regulations & Environment

The Bilt System and all modules are compliant to the applicable European directive and hold the CE mark.

- Products are designed and manufactured in France.
- ISO/CEI 17025 compliant calibration for any DC source or measurement module, calibration certificate provided.
- Serial number based life cycle management
- All products are 100% tested (test reports on demand)
- iTest only uses RoHS compliant components and does not use substances banned by the COSHH regulation.
- iTest complies with the relevant national regulations related to the safety and health of its employees against hazardous substances.
- The protection degree of the Bilt system is IP20 according to CEI 60529.

BILT® systems are Powered by Itest

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