

### Main Specifications

- Positive (BE556P) and negative (BE556N) versions
- 4 fully independent unipolar isolated DC sources
- Very low noise, 5mVp-p typ.
- High 24-hour stability, 16ppm typ.
- High accuracy, 0.03% typ.
- 16-bit measurement and setting resolution, 5 digit
- Stable on capacitive loads
- Voltage and current programmable
- Programmable rising/falling slope
- Programmable current breaker
- Low cost: up to 52 sources in a single Bilt chassis
- Customizable on demand (voltage and current ranges, accuracy etc...)
- SHV or Lemo® S00 output connectors

### Applications

- Burn-in/life-test of high voltage precision resistors and semiconductors
- MicroMegas detectors (MicroMESH Gaseous Structure)
- Gaseous ionization detectors (Geiger-Müller...)
- Scintillation counters
- Photomultiplier tubes
- Electron beam deflection
- Electrorheological fluids

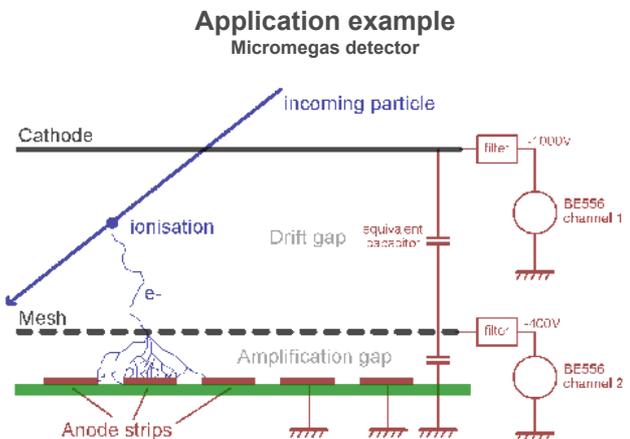
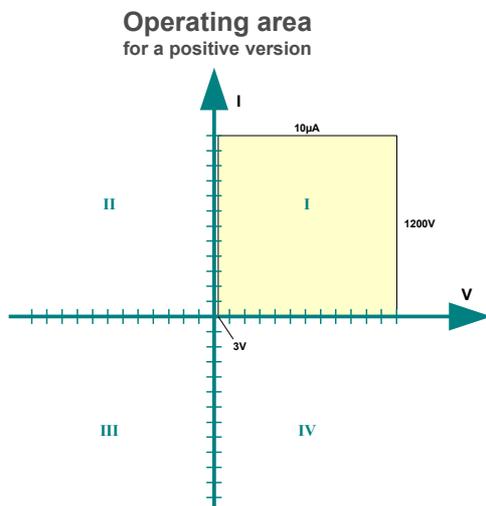


### Standard capabilities

- Large software capabilities: programmable thresholds on voltage and current, trace memory with envelope waveform, synchronous group of instruments with programmable start and stop delay...
- Easy-to-use SCPI commands with NI LabView, Agilent Vee...
- Large system connectivity : GPIB, USB, Ethernet ...
- Ready-to-use with EasyStress software for Burn-in and Life-test settings

### High reliability level

- High reliability and safety : no transient during On/Off phase, no line perturbation, safe stop on mains default...
- 2 year calibration periodicity
- 2 year warranty as standard



### Operating area

Parameters	Conditions/Comments	Min.	Typ.	Max.
<b>Voltage setting range</b>	Negative or positive version, absolute value	3V		1200V
<b>Voltage measurement range</b>	Negative or positive version, absolute value	1V		1210V
<b>Current setting range</b>	Programmed in absolute value	100nA		10 $\mu$ A
<b>Current measurement range</b>	Polarity depending on the source's polarity, here in absolute value	0		10,5 $\mu$ A
<b>Output/ground leakage</b>	Leakage resistance between the output and the ground of a source	1T $\Omega$		
<b>Insulation between sources</b>	Insulation resistance between the outputs of two sources	7T $\Omega$		
<b>Ground/earth insulation</b>	Max. voltage between the earth and the ground of a source, limited by a transil, max current 25mA, customizable on demand		30V	
	Insulation resistance between the earth and the ground of a source	50G $\Omega$		
	Insulation capacitance		10nF	
<b>Operating temperature</b>	Ambient temperature in front of Bilt's rear fan openings	15 °C		30 °C

### Ranges and Accuracy

Accuracy specified on a 18 °C-28 °C ambient temperature range, after 30min warm-up time and a one minute thermal stabilization following a large output voltage step.

#### Voltage :

Range	Resolution	24-hour stability <sup>(1)</sup>	90-day accuracy <sup>(2)</sup>	2-year accuracy <sup>(2)</sup>	Temperature drift <sup>(3)</sup>
<b>Setting</b>	19mV	$\pm 8\text{ppm} \pm 10\text{mV}$	$\pm 0,03\% \pm 56\text{mV}$	$\pm 0,05\% \pm 75\text{mV}$	$(\pm 20\text{ppm} \pm 0,8\text{mV}) / ^\circ\text{C}$
<b>Measurement</b>	19mV	$\pm 8\text{ppm} \pm 10\text{mV}$	$\pm 0,03\% \pm 43\text{mV}$	$\pm 0,05\% \pm 62\text{mV}$	$(\pm 20\text{ppm} \pm 0,5\text{mV}) / ^\circ\text{C}$

(1) Relative to absolute accuracy,  $\pm\text{ppm}$  of setting/measurement  $\pm\text{offset}$ , stable ambient temperature

(2)  $\pm\text{ppm}$  of setting/measurement  $\pm\text{offset}$

(3) add the temperature coefficient outside the specified 18-28 °C nominal ambient temperature range, ( $\pm\text{ppm}$  of setting/measurement  $\pm\text{offset}$ ) / °C, on a resistive load

#### Current :

Range	Resolution	24-hour stability <sup>(1)</sup>	90-day accuracy <sup>(2)</sup>	2-year accuracy <sup>(2)</sup>	Temperature drift <sup>(3)</sup>
<b>Setting &amp; Measurement</b>	170pA	$\pm 16\text{ppm} \pm 0,17\text{nA}$	$\pm 0,04\% \pm 0,7\text{nA}$	$\pm 0,065\% \pm 1\text{nA}$	$(\pm 20\text{ppm} \pm 20\text{pA}) / ^\circ\text{C}$

(1) Relative to absolute accuracy,  $\pm\text{offset} \pm\text{ppm}$  of setting/measurement, on a 10M $\Omega$  resistive load, stable ambient temperature

(2)  $\pm\text{offset} \pm\text{ppm}$  of setting/measurement

(3) add the temperature coefficient outside the specified 18-28 °C nominal ambient temperature range, ( $\pm\text{offset} \pm\text{ppm}$  of setting/measurement) / °C

### Noise

Range	Noise <sup>(1)</sup>		Voltage noise density <sup>(1)</sup>		CMRR
	0,1Hz-10Hz	10Hz-10kHz	100Hz	10kHz	50-60Hz
<b>1200V</b>	6mVp-p	5mVp-p	40 $\mu\text{V}/\sqrt{\text{Hz}}$	0,4 $\mu\text{V}/\sqrt{\text{Hz}}$	>110dB

(1) For an output voltage of 1000V, lower noise at lower voltage

### Regulation/measurements

Voltage and current measurements are digitally averaged to obtain maximum stability without altering the measurement bandwidth needed for the safety features.

Parameters	Conditions/Comments	Min.	Typ.	Max.
Voltage transient response time <sup>(1)</sup>	No output decoupling capacitor, analog regulation		10ms	
Voltage to current transient response time <sup>(2)</sup>	No output decoupling capacitor, digital regulation		200ms	
Line regulation	No line regulation error, guaranteed by design			0%
Load regulation	0 to max. source current, absolute error	-19mV		+19mV
Internal measurement sampling frequency	Current breaker monitoring at this rate		1kHz	
Measurements bandwidth	Voltage and current, -3dB		340Hz	
Digital filter	Moving average, number of samples		100	
Measurement throughput			10 SPS	

(1) response time to a 10% to 90% load step, time to stabilize to within 100mV of setting

(2) time to stabilize from a constant voltage (CV) regulation to a constant current (CC) regulation after a load step

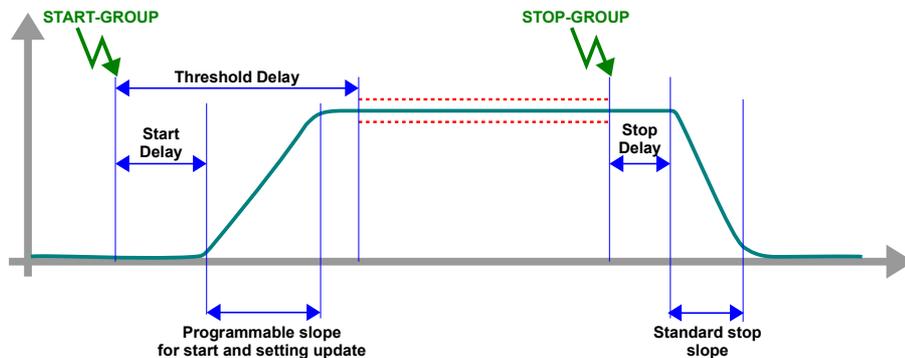
### Module start/stop

After a start command or for any voltage setting change, the output voltage settles as a first order low pass filter (exponential waveform) which slope is limited by a user programmable *voltage slope*. For a significant voltage step amplitude, the waveform is then a ramp with smooth borders.

Following a stop command (*output off*), the voltage settles as explained above but the voltage slope is fixed.

Parameters	Conditions/Comments	Min.	Typ.	Max.
Small signal settling time <sup>(1)</sup>	95% of the step amplitude, first order step response time waveform		15ms	
Voltage slope	Programmable value to limit the voltage rising or falling slope	0,02V/ms		0,5V/ms
Stop voltage slope	Voltage slope used by the source when the stop command is sent (used to quickly null the output voltage in case of mains default)		0,5V/ms	
Start delay	Delay for the source to start when asked to start	5ms		60s
Stop delay	Delay for the source to stop when asked to stop	0ms		50ms
Threshold delay	Time after which the measurement thresholds are monitored	0ms		60s
Off output voltage	Source off, chassis powered, negative value for the negative source version		1,6V	
Transient at power-up	Output voltage transient amplitude when the chassis is powered-up, negative value for the negative source version, transient duration 200ms			6V

Start-Stop sequence overview:



## Safety features

The following safety features are divided into two categories: alarms and warnings. Warning features can stop the source or let it operate (user selectable thanks to group commands), alarms features always stop the source. In all cases, a warning message is sent by the triggered safety feature, this message can be read thanks to the *fail?* command.

- Current breaker (warning): this feature monitors the actual current and triggers if it exceeds a programmable value (1ms response time). This feature is only enabled when the output voltage surrounds the voltage setting to avoid unwanted detection during voltage transients. The threshold absolute accuracy is typically  $\pm 0,1\% \pm 1,7nA$  and is programmable from 10nA to 10,5µA. An additional feature can automatically reduce the voltage setting of a programmable value each time the threshold is exceeded (useful against arcing phenomena in gaseous particle detectors).
- Limit thresholds (warning): this features monitors the digitally filtered voltage and current measurements. The user can program maximum and minimum values that the measurement should not exceed. This feature activates after a programmable delay following the source switch on (specified in the “module start/stop” section). The thresholds absolute accuracy is the same as the measurement.
- Short-circuit (alarm): the source output is deactivated within 1ms then shut down if a short-circuit is detected.

## Primary power requirements

*Power specifications needed to determine a chassis' primary power supply requirement*

Parameters	Conditions/Comments	Min.	Typ.	Max.
Primary power needed	consumption on +25V rail		12W	

## Connection

4 SHV or Lemo® S00 connectors

Source #1 is above on the module's front panel.

### SCPI specific commands

Command	Comments	Default
*idn?	Complete identification of the module: Revision, date, serial number, software revision, calibration date...	--
CHANnel [val][?] or C [val][?]	Channel or source selection. All the next typed commands are then related to this channel.	1
CHAN:NAME[string][?]	Channel name setting	1
VOLTage [val][?] CURRent [val][?]	Voltage and current setting. Use of m,μ,n coefficient allowed , Ex : volt -1,12k. = volt -1,12e3 = volt -1120 When module is off and autorange active (volt/curr:rang:auto ? → on), the range closer to the setting value is automatically set. Polarity is imposed by the voltage set up sign.	3V (SV) 100nA (SV)
VOLTage:SLOPe[val][?]	Max slope of the voltage setting, in V/ms	0,5
VOLTage:SATuration[val/MIN][?]	Sets the maximum voltage value accepted by the VOLTage command to protect the DUT against typing error. MIN stands for -1200V.	MIN
MEASure:VOLTage ?	Reading of the voltage measurement	--
MEASure:CURRent ?	Reading of the current measurement	--
MMX:VOLTage ?	Reading of the voltage envelope. Returns min and max values of the output voltage since the last request.	--
MMX:CURRent ?	Reading of the current envelope. Returns min and max values of the output current since the last request.	--
OUTPut [on/off][?]	Enabling / Disabling output	OFF
START:DElay [val][?] STOP:DElay [val][?]	Start/Stop delay in ms. Useful when synchronized start are requested (groups). See the "Module start/stop" section of this document for the range of these parameters.	100 / 0 (SV)
CURRent:BREAker:THreshold [val][?]	Fast over-current threshold setting. The threshold is not activated during output voltage rise/fall time.	11μA
CURRent:BREAker:STEP:STATe[0/1][?]	Activates the current breaker voltage drop function. If activated (1), each time the current breaker threshold is exceeded, the output voltage will decrease of a fixed value. This value is programmable by the next SCPI command. The minimum time between two voltage drops is 20ms.	0
CURRent:BREAker:STEP:VAMPLitude [val][?]	Amplitude of the output voltage drop after each current breaker over threshold	0
LIMit[:STATe][on/off][?]	Enabling / Disabling of the software thresholds monitoring .	OFF (SV)
LIMit:VOLT:UPP[val][ ?] LIMit:VOLT:LOW[val][?] LIMit:CURR:UPP[val][ ?] LIMit:CURR:LOW[val][?]	High/low measurement threshold programming. Any values are accepted, without any warning message if out of range. It's then possible to disable one threshold monitoring using any inaccessible out of range value : limit:upp 500u;low -2m;state on (set only UPP threshold to 500μA)	0 (SV)
LIMit:DElay [val][?]	Setting of delay before applying thresholds. This delay start at OUTP ON or P:STATE ON received. It is independent of the start:delay .	150 (SV)
LIMit:CLEar	Threshold alarm reset	--
FAIL?	Reading of the warning status related to the selected channel. Data format: voltage status,current status "NO": NO alarm "LOW": LOWer software threshold occurred "HIGH": UPPer software threshold occurred "CB": Current Breaker (fast over-current threshold exceeded) "OVI": Over I (short-circuit detection)	--

**Notes:**

Default: Value after \*rst command or new module installation. SV: Parameter in nonvolatile memory.  
See "Bilt programming manual" for general use and standard Bilt SCPI command set.

#### Revision History

Rev	Date	Changes
1	February, 2011	Preliminary
3	June, 2011	Final, updated specifications, new datasheet format
4	March, 2012	New current breaker features
5	April, 2012	Corrected specifications

#### Related product

<b>BE539</b>	1100V 100mA 1 channel unipolar low cost DC source	80W	
<b>BE538</b>	500V 240mA 1 channel unipolar low cost DC source	80W	
<b>BE587</b>	$\pm$ 250V 1mA 4 independent channels bipolar, very low noise 6mVp-p	1W	

#### Metrology and maintenance

##### Initial calibration principle

For each kind of module, iTest develops a test and calibration programs. They use external references which are regularly checked by authorized companies.

Our products are delivered after going through a test cycle: preliminary calibration, Burn-In, initial calibration.

For each module, an individual report of the initial calibration is delivered onto a CD-ROM.

##### Regular calibration

The recommended periodicity is 2 years for standard modules (13 to 16 bit), and 1 year for high accuracy modules (18 to 21 bit).

iTest offers to perform the regular calibration, either on site or while returning the hardware back to our workshop.

Some customers have to proceed regularly to their own accuracy check. In case the modules have drifted out of their specification limits, they have to be sent back to iTest.

##### Guarantee and maintenance

All the Bilt products come with a two-year parts and labor guarantee, when returned to our workshops.

A telephone 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 new calibration and a further two-year guarantee.

In any case, iTest will supply on request maintenance and calibration.



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