Bilt System module - BE548

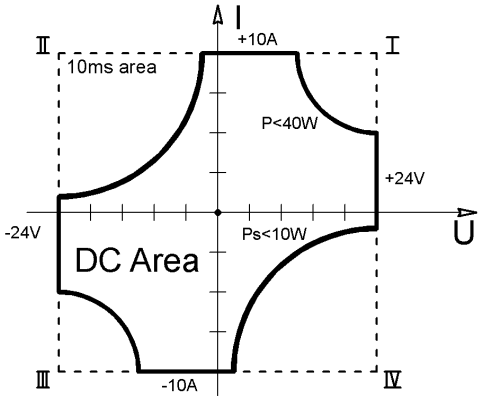
10A 24V fast bipolar current source

Switching power supply intended for fast and continuous setting applications

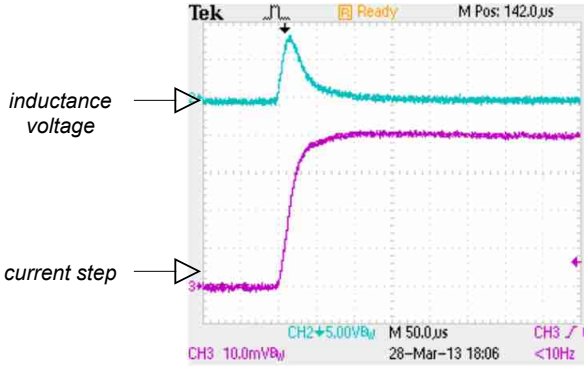
- ✔ *10KHz sampling rate*
- ✔ *60 µs settling time*
- ✔ *16 bit resolution*

Main features

- True 4-quadrant current source
- DC power limits: 120W sourcing and 10W sinking. 240W peak transient power.



- Fast current regulator optimized for a predefined inductance value.
- 16 bit setting resolution
- Fast setting update using a dedicated RS485 interface with a throughput up to 10KHz
- Small step settling time: 60µs



- Safe large steps using current saturation control

Bilt system features

- Up to 6 BE548 source modules into a 19" Bilt chassis.
- Host connections at chassis level including Ethernet and USB.
- Complete software package provided, including a turnkey PC software, Labview driver, and tools for developers like C++ Library.

Application example

Fast driving of a beam position corrector magnet using a small inductance value / air core

- the fast current setting is provided by a beam position monitoring equipment
- the Ethernet network connection to host performs DC current setting and read-back checking checking

BE548 module specifications

Operating range

Parameters	Conditions/Comments	Min	Max
Current setting range		**-10A**	**+10A**
Saturation voltage	differential voltage (Vp - Vn)	**-24V**	**+24V**
Optimal Load inductance range	factory tuned for optimal 2mH*	**1mH**	**3mH**
Load resistor range		**0Ω**	**1Ω**
DC output power	cutoff after 10ms over the limit (Quadrant I&III)		**120W**
DC sink power	cutoff after 10ms over the limit (Quadrant II&IV)		**10W**
Power efficiency @ Pmax	at chassis level, i.e related to mains input power	**75%**	
Output common mode voltage	H bridge / common ground close to mains Earth	**11V**	**14V**

**note: Predefined optimal inductance value can be set from 0,5mH up to 5mH (factory tuning).*

Current setting performances

Parameters	Conditions/Comments	Specification
Setting resolution	including polarity bit	**16bit (1LSB=300µA=30ppm)**
Differential linearity error		**15ppm**
Integral linearity error		**330ppm**
Long term drift	after 30mn self-heating, Tamb = ±0,5°C, for 8 hours	**100ppm**
Thermal drift	after 30mn self-heating, within the 16°C-26°C range	**50ppm/°C**
Absolute accuracy	2 years	**2000ppm**

Dynamic performances

All parameters for a 2mH 0,5Ω load + 10m cable, unless otherwise noted.

Parameters	Conditions/Comments	Specification
Settling time	- to 90%, 500mA step, max 2% overshoot - to 99,9%, 500mA step	**60µs** **5ms**
Slew rate		**8A/ms**
Current noise	- 10Hz-10kHz, peak-to-peak value, at 2A - at switching frequency (380kHz ± 70kHz), p-p	**1,5mA** **1mA**
Voltage noise	at switching frequency, peak-to-peak value	**0,6V**
Harmonic distortion	200Hz sine wave, 500mAp-p, 2nd and 3rd harmonics	**< -50dBc**
Small signal bandwidth	500mAp-p sine wave, at -3dB	**10kHz**
Large signal bandwidth	20Ap-p sine wave, at -3dB	**600Hz**
Setting sampling rate	continuous RS485 interface throughput	**1Hz to 13KHz**
RS485 transmission time	2 bytes straightforward binary encoding format	**18µs**
Setting digital delay	continuous RS485 interface throughput 10KHz	**22µs**

Read-back measurements

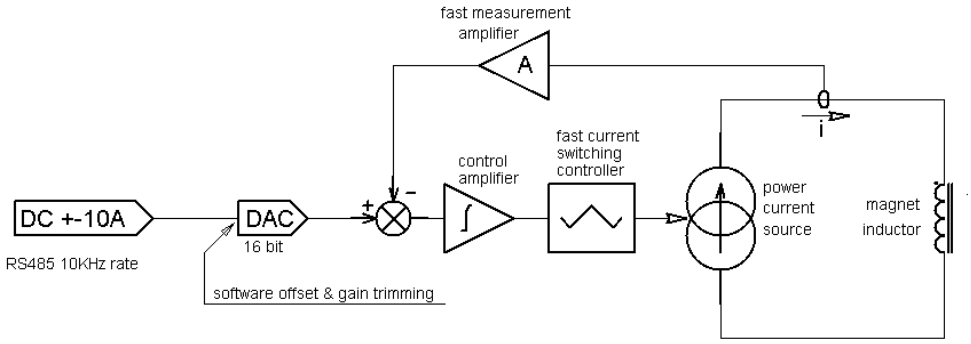
Parameters	Conditions/Comments	Specification
Current & voltage resolution	module model B&C	**12bit (1LSB = 3mA / 7mV)**
	module model D&E	**16bit (1LSB = 330µA / 0,9mV)**
Current & voltage accuracy	2 years	**2000ppm**
measurement bandwidth		**1KHz**

BE548 module features

Fast current setting

The dedicated RS485 input receives a straightforward and continuous 16 bit setting data flow at 10KHz.

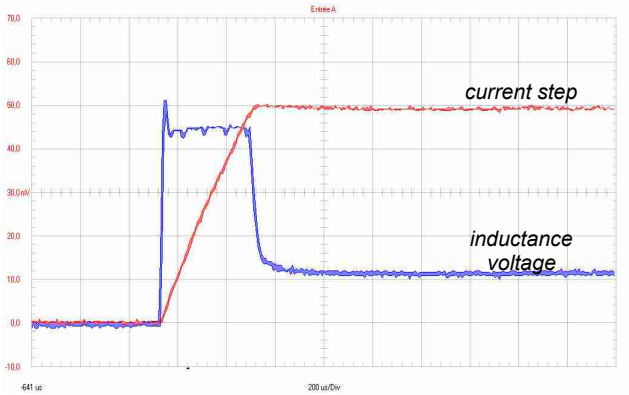
Gain and Offset are calibrated in order to obtain a straightforward 16 bit input integer format with full scale settings ±32767 points = ±10A.



Large step slew rate limitation

When a large step occurs, the internal control loop is fast enough to proceed instantaneous voltage saturation and then to resume for current regulation.

example: 5A step settling time on a 1,5mH + 1Ω load
rise time = 400µs



RS485 data flow monitoring

The on-board micro-controller monitors the data flow received at RS485 input.
At anytime, the network controller can read the following parameters:

- number of settings received within the last second
- min, max, average values within the last second
- number of erroneous data within the last second and since the beginning/reset command.

Connections

- Output power connector: 3 point Sabre header from Molex.
- Setting input connector: standard RJ12

BE548 module related products and documents

Including this BE548 model, a range of different modules are available for the purpose of magnet supplying:

Model	Current	Voltage	DC power	Inductance range	Settling	Ripple	Drift	Module size
BE548	±10A	25V	120W	0,5mH - 5mH (tuning required)	60µs	100ppm	100ppm	double
BE549	±2A	50V	40W	50mH - 900mH (tuning required)	75µs	100ppm	100ppm	double
BE2811	±5A	18V	90W	0mH - 200mH (no tuning required)	20ms	7ppm	24ppm	single
BE2812	±15A	8V	120W	0mH - 10mH (no tuning required)	20ms	7ppm	24ppm	double

According to the customer needs, any other combination of specification can be used to design a new model.

example of Bilt chassis fitted with proper power items convenient for a set of BE548 modules:

Chassis reference	Module qty per chassis	Rack size (W, H, D)	AC input power	DC output power
BN100 + power Kit BN084	6 modules /double width	**19" x 4U x 360mm**	1KW 220V	720W
BN103	2 modules /double width	**half 19" x 4U x 260mm**	330W	240W

Documentation			
BE548 Brochure	E1	2014/05/28	module data sheet / specifications and main features
BE548 User Manual	Ded3	2013/04/09	module user manual including chassis, network, software, connections description
BE548_applinote_A1			one Bilt chassis fitted with 4 BE548 module drives 2 quadrupole corrector magnets
BE548_applinote_A2	rev1	2013/03/13	frequency and transient performances using a 2mH inductor
http://www.bilt-system.com/			bilt user manual and any other Bilt modules specification

Standards, Calibration,Warranty, Maintenance & Integration
Bilt system is compliant with CE Standards. Each module comes with a two-years initial guarantee, which can be increased on request. Each module is fitted with an on-board memory for complete part tracking, software calibration and test report edition. iTest develops integrated test benches dedicated for each module, and therefore can proceed on request to on-site check and periodic calibration. The recommended periodicity for regular calibration is two years. According to the customer requirements, iTest can offer either on-site maintenance or return to workshop maintenance. When delivering large or dedicated systems, iTest performs on site integration and training for both software and hardware.

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