# BE2811

# 5A 18V low noise bipolar current source

# User Manual

## contents

# 1. Warnings and general information

## 1.1. Safety precautions

**IF ANY OF THESE CLAUSE IS NOT RESPECTED, THE MODULE, THE CHASSIS AND ALL OTHER MODULES MAY BE DAMAGED :**

- Modules may only be installed or removed when the chassis is powered off.
- Always screw the modules correctly in order to avoid accidental live ejection of the modules (M2.5*6 screws)
- When using a high current level, it is not safe to unplug at runtime a large inductive load

**Please read the "Safety Information" in the chapter I.1 of "BILT user manual"**

## 1.2. Calibration and maintenance

***Tracking method for each Bilt system part***
All Bilt modules and common unit boards have an embedded non volatile memory. It gathers the identification and tracking information, including hardware and software update references. The user can access all this information at any time. Each Bilt module performing an analog function uses calibration parameters stored onto the embedded non volatile memory.

*Initial test cycle*
Our products are delivered after going through a test cycle: preliminary check and calibration, Burn-In, initial check and calibration. For each module, an individual report of the initial check and calibration is delivered onto a CD-ROM.

*Standards*
compliance with directive CEM 2004/108/CEE :
EN55022 Class B (emission) / EN61000-4-X (immunity)
EN61000-3-2 (harmonics)
low voltage directive 2006/95/EC : EN61010-1:2006

**Initial guarantee**
Any Bilt product in the catalog comes with a two-year parts and labor guarantee, when returned to our workshops. A telephone support service is also available for the same period.

**Guarantee extension**
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.
- a further two-year guarantee, parts and labor

***Regular functional check and calibration***
The recommended periodicity is 2 years for standard modules. iTest offers to perform the regular check and calibration, while returning the hardware back to our workshop. For large hardware setups, iTest can proceed more efficiently at the customer's site. Moreover, its functional check and calibration bench allows operation without removing the Bilt chassis from their location.

# 2. Hardware description

*5 slot BE103 BILT mainframe*

The BILT chassis, with either 5, 8 or 13 slots, provides all the hardware and software features for any combination of Bilt modules.

## 2.1. Mains power input

The mains input performs both AC/DC conversion and smart input power switching:

- soft switch ON and OFF using power transistors with a limited inrush current.
- ON/OFF switch command using single pushbuttons (one at the front and one at the rear).
- memory of the state after mains interruption: if previously ON, the unit will restart without pressing the button.
- safety breaker function: the unit is switched off in case of any fault condition. It will stay OFF until the operator try to push again the ON/OFF button. The default can be either:
    - a drop down of the internal 25V common rail voltage (Overload conditions)
    - an internal thermal alarm
    - an overrun of the maximum mains input power

Note:


- The ON/OFF switch does not enable the power outputs of the modules. This requires either a network command or the START button command, as described in the next section.

- The mains input board includes a input fuse for redundant safety purpose, but this fuse is soldered and not intended for replacement by the user.

- In case of mains cut-off while the power outputs are ON, the unit is able to shut down properly and to memorize a warning message which will be acknowledged when resuming.

At the rear, the mains input board panel is fitted with:

- the mains input.
- a Earth connection point (either 4mm plug or screw)
- a red LED indicating when powered.
- a first push-button which controls the ON/OFF switch.
- An interlock connector, with a simple 2 points contact which has to be normally closed for operating the system. Ground referenced contact.

## 2.2. Local and remote control features

### START&STOP commands

Bilt module's output START and STOP are controlled by the software, according two different ways:

- single operation of one module.
- multiple synchronized operation of a group of modules.
  Any group setup can be defined and run using the remote interface.

For the purpose of local operation, two press buttons are available onto the front panel.
They are marked « F1 » and « F2 » because they can be programmed for any purpose.
The basic functions corresponding to the factory default configuration are:

- F1 = START for all module outputs at the same time
- F2 = STOP for all module outputs at the same time

### Front panel indicators and features

6 LEDs indicate the state of the unit:

| name | color | purpose |
|---|---|---|
| Listen | orange | incoming communication in progress |
| Talk | orange | outgoing communication in progress |
| Error | red | communication error |
| Alarm | red | at least one module sent an alarm |
| Output | green | at least one module output is enabled |
| Power | blue | internal power supply state |


For the purpose of advanced local control or maintenance using a laptop computer, both USB or RS232 are available onto the front panel.

The ON/OFF switch is controlled by the “Power” push-button.

### Embedded controller

The chassis is fitted with 4 interface ports:

| name | feature | connector |
|---|---|---|
| Ethernet | 100 Base-T | RJ45 |
| USB | 2.0 slave | |
| RS422 | 56k/207k, insulated | DSub 9-p, dedicated pin-out |
| GPIB | IEEE488.2 | optional |

The address of the ongoing interface is indicated onto the 3 digit display.

### Hardware trigger

BNC connector , (Zin=1KOhm, $V_{IL}$ max 0,8V, 5Vmax, isolated from the ground)

## 2.3. Set-up and alarm management

### Plug and play module drivers

The Bilt unit controller is able to operate with any set of modules. iTest has developed one single embedded software which complies with any application of its customers.

After a new module has been plugged inside the backplane, the user has just to update the settings of the module, which have been reset to their factory default value.

### Reset and setup at power up

On request, iTest can supply the Bilt unit with a memorized complete setup, including a dedicated group configuration complying with the steerers and magnets requirements.
Consequently, even after a maintenance plug/unplug operation, the unit will be always ready to run according to the dedicated application.

### Tracking method for each Bilt system part

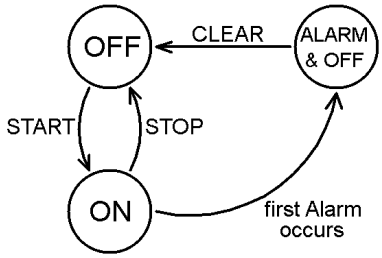
All Bilt modules and common unit boards have an embedded non volatile memory. It gathers the identification and tracking information, including hardware and software update references. The user can access all this information at any time.

### Alarm definition

The embedded controller is able to drive independently several groups of modules.

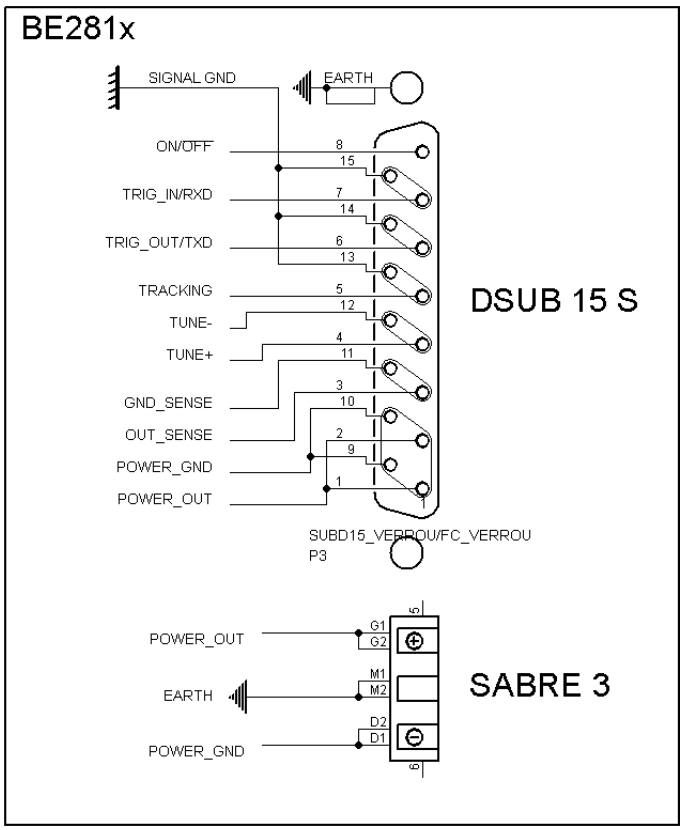
Whatever the setup, each single module or group of modules has 3 operational states: OFF, ON and ALARM.

The first alarm which occurs is latched into the alarm memory buffer. This buffer is readable at any time. Clearing of the buffer is requested before restarting.




| name | level | alarm description | action |
|---|---|---|---|
| a1 | current source module BE2811 | Open circuit detection, voltage saturation | software alarm and stop |
| a2 | | DC source power limit | |
| a3 | | DC sink power limit | |
| a4 | | internal temperature limit | |
| a5 | chassis BN100 | External interlock | software alarm and stop |
| a6 | | Mains cutoff at run-time | |
| a7 | | transient internal common rail overload | |
| a8 | mains input converter BN603 | permanent internal common rail overload | hardware mains input cutoff |
| a9 | | internal temperature limit | |
| a10 | | mains input overload | |

## 2.4. Module connections




The front panel of the module is fitted with 2 connectors:

- The power output connector is a 3 pin "SABRE" header from Molex *(contact specification is up to 18A)*
- The Dsub15-S connector gathers both control and power signals *(contact specification is up to 5A)*

*available control signals:*

- ON/*OFF logic signal indicates the state of the source, according to the green LED onto the front panel.
- "TRIG_IN" logic input produces at module level the same synchronization function than the master TRIG input at chassis level (BE718 main controller).
- TRACKING logic output indicates the current setting process.
- Trig out, Tune-, Tune+, and alternate function RXD/TXD are spares connections for future optional purposes.
- out and gnd sense for accurate remote voltage sensing. *(Internal pull up and down connections are provided, therefore these signals can be left unconnected when not used).*

note:

- power ground must be returned to the module's connector. It is not isolated from the mains Earth (maximum voltage gap is up to 1,2V).
- control signals are referenced to the chassis internal common ground

# 3. Start up and programming

The sources programming can be performed using 4 ways:

- The simplest one is to use BiltLab, a free PC software supplied by iTest for the purpose of demonstration, training, and also maintenance.
- An other way is to include Bilt driver inside a LabView application. A free Labview library including BE2811 control is supplied by iTest. Any SCPI command at module level is included in this library.
- The more technical way is to use SCPI commands, either typing commands with any terminal software(*), or any programming source code. Of course, this way will concern customers who plan to include the control of a Bilt unit into their own software.
- According to the user application, iTest develops C++ library which adds an abstraction layer onto the standard SCPI commands.

(*) iTest supplies “BILtTerminal”, a free PC software for the purpose of test and maintenance.

## 3.1. Bilt software installation

Find and run “BiltUtilsPackage.exe” installer inside the “Software” folder of the CD.

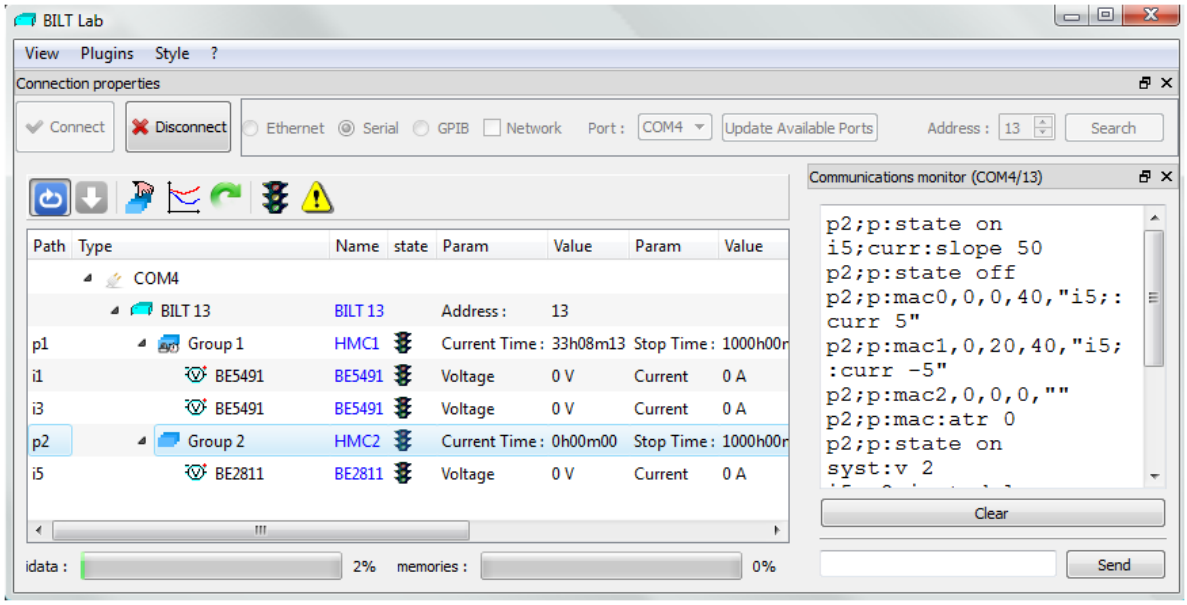
It will install on the computer at the same time BiltLab, Bilt Terminal, and TeleBilt.
TeleBilt is a tool intended for updating the embedded Bilt unit firmware.
It is a maintenance operation which must only be done under iTest advice.

After, completion, connect your BILT unit to a computer using either Ethernet, GPIB, USB, RS232 or RS422 port.
For further details on connection details, please read chapter III.3 of “BILT user manual”

## 3.2. Using Biltlab software

BiltLab is a free and ready to use PC software performing the simple control of any Bilt module.
It works with any connection interface, it recognizes any module setup and offers a ready to use control screen.

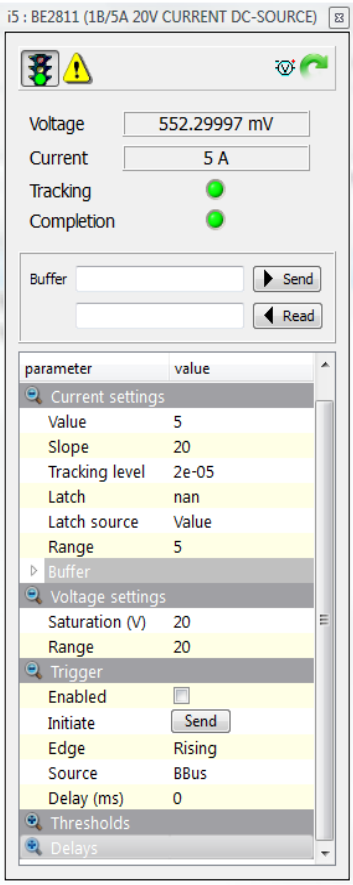
The Biltlab main window displays the communication properties and the overall chassis control.
The set of module is displayed using a tree.
The modules can be gathered into programmable groups, thus providing synchronization.




Each plugged module has its own dedicated window:

The standard module window contains:

- the module ON/OFF/Alarm state and the status register
- the current and voltage read back values
- each setting parameter is available through a property tree. A tool-tip box indicates the corresponding command name and a short description of its properties.




For further details please read chapter VI.3 and VI.5 of “BILT user manual”

## 3.3. Network interface

The communication with the overall system controller is performed with an Ethernet network.
Each Bilt chassis has its own TCP/IP interface(100BASE-T), using a fixed IP address. It can run up to 100 Mbps, full duplex, using up to 12 simultaneous connections.
The access to the different modular current sources is also provided by a dedicated command which performs the slot address switching.
The protocol uses ASCII character chains in an SCPI format. Thus, all the numerical values are transmitted using decimal floating format and standard units.
The response time of a current setting using Ethernet interface is within the range of 10ms.

## 3.4. C++ library

According to the user application, iTest develops a C++ library which adds an abstraction layer onto the *standard SCPI commands*.
Using this library, the customer will no longer take into account the Bilt specification details, but only a set of simple and robust parameters dedicated to the application.

The way the Ethernet link is implemented is optimized in order to be integrated within the customer software platform:
The delivered C++ library will be fully compliant with TANGO device server on GNU Linux.

supplied items:

- the tailor-made C++ library, including source code, tested using LINUX Fedora
- a code example and a tutorial using the tailor-made C++ library which performs the access to all parameters, for test and acceptance purpose.
- a technical documentation for any function definition.

*example of dedicated set of methods for 1 magnet object / fast current source (BE549)*

| |
|---|
| Tmagnet & magnet(const char * ip, int Num) |
| int num_magnet(void) |
| Const char *addrIP_magnet(void) |
| void clear_all_err(void) |
| void clear_alarm(void) |
| void set_switch(bool val) |
| void set_state(bool val) |
| void get_mdata(struct mdata *) |
| int get_state(void) |
| double get_measure_current_aver(void) |
| double get_measure_voltage_aver(void) |
| double get_measure_current(void) |
| double get_measure_voltage(void) |
| void get_idata(struct idata *) |
| int get_switch(void) |
| double get_current_DC(void) |
| int get_state(void) |
| int get_num_alarm(void) |
| const char * get_str_alarm(void) |
| void set_state(bool val) |
| void set_current_DC(double ValF) |
| void set_switch(bool val) |
| Void set_current_AC(double ValF) |
| void clear_alarm(void) |

## 3.5. SCPI commands summary

| *Command* | *Comments* | *Default* |
|---|---|---|
| ***idn?** | Complete module identification | |
| **OUTPut [on/off][?]** | Enabling / Disabling output | |
| **CURRent [val][?]** | Current setting.<br>Use of m,µ,n coefficient allowed, Ex : curr *541 m.* = curr *541E-3* = *curr 0,541* | |
| **CURRent:LATCH [val][?]**<br>**CURRent:LATCH:SOURce [0/1][?]** | Latch value in A<br>0 = Value, 1 = Buffer | |
| **CURRent:SLOPe[val][?]** | Current slope in A/s | |
| **CURRent:TRACKing ?**<br>**CURRent:TRACKing:LEVel [val][?]** | resolution tracking reading (between 0 and 1)<br>Maximum gap between output current and setting value (range : 20µA - 5mA) | |
| **CURRent:BUFFer [index,val][index ?]**<br>**CURRent:BUFFer:LOOP [on/off][?]**<br>**CURRent:BUFFer:RANGe [index,val][?]**<br>**CURRent:BUFFer:SAMPLe [val][?]** | Index in buffer and current value for specified index<br>Enables loop mode<br>Index of the first value and values count<br>Period between each value in seconds | |
| **CURRent:COMPletion ?** | ongoing current setting completion reading | |
| **VOLTage:SAT[val][?]** | saturation voltage setting (absolute value) | |
| **MEASure:VOLTage ?**<br>**MEASure:CURRent ?** | Measurement readback | |
| **TRIGger:STATe [on/off][?]**<br>**TRIGger:INITiate**<br>**TRIGger:EDGe [0/1][?]**<br>**TRIGger:SOURce [0/1/2][?]**<br>**TRIGger:DELay [val][?]** | Enables/disables triggering feature<br>Creates a software trigger event<br>Trigger active edge, 0 = rising, 1 = falling<br>0 = Bbus, 1 = Ext, 2 = Both<br>Trigger delay in second | |
| **START:DELay [val][?]**<br>**STOP:DELay [val][?]** | Start / Stop delay in ms for the between-sources sequences when synchronized start are requested (groups). | |
| **LIMit[:STATe][on/off][?]**<br>**LIMit:DELay [val][?]**<br><br>**LIMit:CLEar**<br>**LIMit:FAIL?** | Enabling / Disabling of the software thresholds monitoring.<br>Setting of delay before applying thresholds. (0-60000 ms). This delay start at OUTP ON or P:STATE ON received. It is independent of the *start:delay.*<br>Thresholds reset<br>Reading of alarm return | |
| **LIMit:VOLTage:UPPer [val][?]**<br>**LIMit:VOLTage:LOWer [val][?]** | High/low threshold programming<br>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:CURRent:UPPer [val][?]**<br>**LIMit:CURRent:LOWer [val][?]** | High/low threshold programming | |

Refer to the “Bilt programming” section of the Bilt user manual for complete Bilt system commands description.

### General purpose commands (abstract from Bilt programming manual)

| *Command* | *Comments* | *Default* |
|---|---|---|
| **INST [val][?] or I [val][?]** | module position selection within the chassis for all the next commands | 1 |
| ***idn ?** | Identifies the module i*ncluding* reference, *description, SN Serial number, LC calibration date, DC date code, VL software review* | |
| **SYSTem : VERSion ?** | chassis embedded software version | |
| **SYSTem : ERRor ?** | Reads oldest error not yet read (first happened first read process). | |
| ***RST** | stop the unit and reset all the parameters to default value | |
| **SYSTem : SERial :ID [ ?][Val]** | RS422 network address (range: two digits in hexa, excluding 00 and FF). | 2 last digits of serial number |
| **SYSTem : GPIB :ADDRess [ ?][Val]** | GPIB address | 5 |
| **SYSTem:ETHernet:ADDRess [?][a,a,a,a]**<br>**SYSTem:ETHernet:ROUTe [?][a,a,a,a]**<br>**SYSTem:ETHernet:MASK [?][a,a,a,a]**<br>**SYSTem:ETHernet:MAC [?]** | TCP/IP address, gateway and mask.<br>Reads the physical address (MAC).<br>Example :<br>SYST:ETH:ADDR 192,168,0,1;ROUT 192,168,0,255;MASK 255,255,255,0 | 192,168,0,1xx<br>255,255,255,255<br>255,255,255,0<br>(xx=2 last digits of serial number) |

| Revision History | | |
|---|---|---|
| **Rev** | **Date** | **Changes** |
| **1.1** | 2014-05-20 | initial version |
| **1.2** | 2015-01-20 | |
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