



# Bilt User Manual



**Mainframes BN100, BN101, BN103 and BN105**

## Contents

I Important information (Must be read).....	3
1. Safety information.....	3
2. EC Declaration of Conformity.....	5
3. Technical characteristics.....	6
II Bilt Presentation.....	7
1. Bilt unit overview.....	7
2. Power management of the Bilt units.....	9
3. Bilt unit connections and panels features.....	13
4. Modules.....	14
III Hardware installation.....	17
1. Main frame installation.....	17
2. Modules installation.....	18
3. Communication interfaces : connection to a computer.....	19
IV Bilt Programming.....	20
1. General presentation.....	20
2. BILT operating principle.....	21
3. BILT SCPI commands.....	22
4. SCPI program samples.....	33
V Front panel display usage (BE740 option).....	35
VI Software tools.....	36
1. Overview.....	36
2. Installation.....	37
3. Setting up communication.....	37
4. Using Bilt with BiltTerminal.....	38
5. Using Bilt with BiltLab.....	41
6. Updating Bilt's CPU board firmware with TeleBilt.....	51
VII Calibration.....	56
VIII Maintenance.....	57
IX Warranty and customer support.....	58

Itest reserves the right to modify the content of this document without prior notice. Itest may improve or upgrade any product presented in this manual. Itest may not be held responsible for any error or omission. All equipments and options described may vary according to customer requirements.

Copyright © 2011 Itest S.A.R.L.

All Rights Reserved. Bilt trademark and logo are registered trademarks of iTest SARL.

All other trademarks are the property of their respective owners.




## I Important information (Must be read)

### 1. Safety information

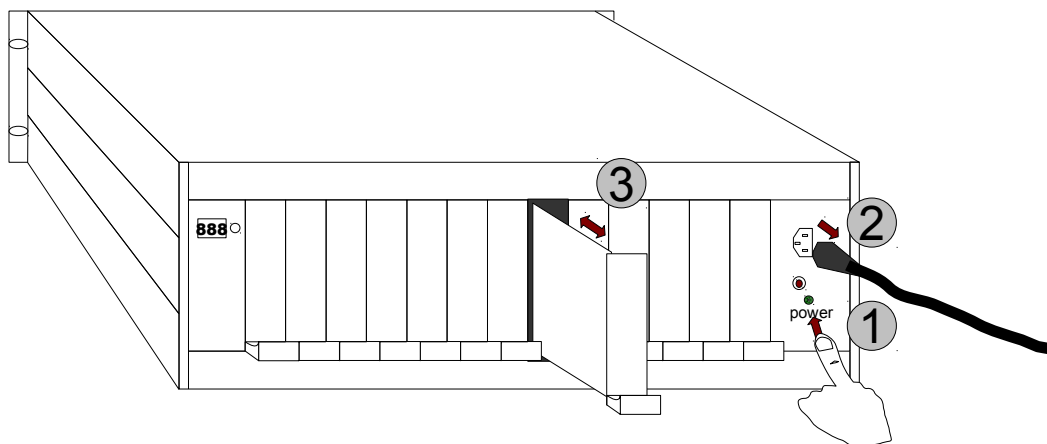
**Make sure to read the entire manual before using Bilt system!**

- Bilt system is designed for use solely in industrial and laboratory environment by skilled staff. It is your responsibility to use the product in an appropriate manner. When using Bilt, make sure to comply with the following safety guidelines in order to avoid the risk of : fire, electric shock, injuries or equipment damages. ITest disclaims any responsibility or liability for any harm or damage resulting from the misuse of Bilt, its modules and its derivative products according to all safety information, precautions and installation procedure listed in all this document and in module's datasheets. Any lack of compliance may damage the system. The manufacturer's guarantee will be null and void if any of these clauses has not been respected. Please read the entire document before using Bilt.

Symbols :

		
Danger, read documentation	Danger of electric shock	Earth

- Bilt must be earthed and powered by a 110V 60Hz or a 220V 50Hz network, depending on the mains input board of the Bilt Sytem. The lack of earth connection can lead to injuries or death in case of electric shock.
- Some high voltage modules involve a risk of potential death. These modules can be identified by the “electric shock” sign above, which is marked on their front panel. The operator must take all necessary safety measures and make sure that no conductive part is exposed.
- Modules may only be installed or removed when the mainframe is switched off. If this clause is not respected the module, the mainframe and all other modules may be damaged. We recommend that you always screw down the modules correctly in order to avoid accidental live ejection of the modules particularly during disconnection of the 4mm jacks.



- For measurements/supply of circuits with voltages  $V_{rms} > 30V$  or  $V_{dc} > 70V$ , suitable measures should be taken to avoid any hazards.
- Modules which do not have over-voltage protection system or whose system have been deactivated may be damaged if they receive a permanent voltage greater than the active range or greater than a few hundreds of mV in reverse.
- No internal maintenance operation may be performed by the operator without iTest agreement, particularly because of dangerous internal voltage even when Bilt is switched off. Dismantling of the upper or lower lids of the mainframe is forbidden and will void the warranty.
- **Do not insert hand in the rear of the mainframe if modular positions are empty whether Bilt is switched on or off (risk of electric shock). Fill all module's empty slot with a stainless-steel panel screwed on the mainframe as a module (contact us to order such a panel).**
- Make sure that ventilation openings are clear and that the room is adequately ventilated.
- In case of internal capacitor failure, a small amount of toxic gas can be released. Take all necessary measures to ventilate the room and contact iTest's after-sales service.
- The product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnection device. It must be ensured that the power cable is easily reachable and accessible at all times. If Bilt is integrated in racks or systems, a disconnecting device must be provided at the system level.
- The product may be operated only from TT supply network fused with max. 16A.
- Never use the Bilt system under conditions in which condensation has formed or can form in or on the product; e.g. if the system was moved from a cold to a warm environment.
- Do not place Bilt near heat-generating devices.
- Don't use any device or equipment near a liquid.
- Do not stack anything on the mains cable.
- Do not insert any object or liquid in the mainframe's openings to avoid electric shock.
- Try not to use Bilt during a storm or use surge arrester devices.
- Prior to cleaning, disconnect Bilt from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents.
- Unplug immediately the mains cable if the mainframe has fallen or has been damaged.

## 2. EC Declaration of Conformity

according to ISO/IEC 17050-1:2004, DoC #02-2009

**Manufacturer's name :** iTest S.A.R.L.

**Manufacturer's Address :** 119, rue de la Providence  
31500 Toulouse - France

**declares under its sole responsibility that :**

**Product name :** Bilt / Tiny Bilt

**Product Configuration :** ALL1)

**Product Options :** BE715, BE717

**Accessories :** ALL2)

**conforms to the following Product Specifications:**

**Safety :** CEI 61010-1:2001 2nd edition: Safety requirements for electrical equipment for measurement, control, and laboratory use

**EMC :** CEI 61326-1 (July 1997 +A1 1998 +A2 2001 +A3 2004): electrical equipment for measurement, control, and laboratory use - EMC requirement - Part 1: general requirements

EN61000-4-2: Electrostatic discharge (ESD)

EN61000-4-3: Radio-frequency electromagnetic field

EN61000-4-4: Electrical fast transients/burst immunity

EN61000-4-5: Surge immunity

EN61000-4-6: Conducted high frequency disturbances

EN61000-4-8: Power-frequency magnetic fields

EN61000-4-11: Voltage variations, dips and interruptions

EN55022 Class A: conducted and radiated emissions

CEI 61000-3-2: mains harmonics (only for mains input board ref. BN603)

### Supplementary Information :

- The products herewith comply with the requirements of the Low Voltage directive 2006/95/EC, the EMC directive 2004/108/EC and carry the CE marking accordingly.
- This Device complies with Part 15 of the FCC Rules. Operation is subject to the following two Conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- This declaration is valid as far as the product is used according to the user manual.
- In a residential environment, the equipment may cause radio frequency interference. In this case the user may be required to take appropriate measures.

1) The product was tested in two typical configurations. List of tested parts: BN101, BN721, BN606, BN603, BN602, BN613, BN614, BE718, BE584, BE841, BE842, BE515, BE516, BE517, BE427, BE437, BE534, BE549, BE715.

The modules or sub-assemblies not tested are of the same design rules as the ones above. They accordingly give the product the conformity to the same standards. List of concerned elements at the date of issue of the DoC: module's family BE52X, BE53X and BN61X, BE580, BE582, BE585, BE586, BE587, BE561, BE426, BE547, BE548, BE572, BE832, BE810, BE470, BE471, BE474, BE481, BE482, BE483, BE433, BE435, BE436, BE592, BN609, BN105, BN723, BN722, BN607, BE717.

2) The accessories are cables, printed boards, heating or cooling systems.

Place of issue: 119, rue de la Providence 31500 Toulouse - France

Date of issue: July, 10th 2009

Hervé CONSTANS  
General manager



**For regulatory compliance information contact :**

Worldwide Contact : iTest, 119 rue de la Providence, 31500 Toulouse, France, +33 (0)561548130

### 3. Technical characteristics

Mains input		
Topology	Active PFC (BN603)	Rectifier (BN602)
Voltage range	100-240Vac	220-240Vac
Input Power	600W-1200W	900W
Current	6A	4A
Frequency range	47-63Hz	47-63Hz
Phase	Single	Single
Inrush current	13A max.	4A max.
Efficiency	> 80% @ 230Vac	98%
Power factor	0,99 typ @ 110Vac 0,97 typ @ 230Vac	-
Start-up time*	< 3s	< 3s
Hold-up time*	700ms (no load) – 100ms (500W)	700ms (no load) – 100ms (500W)
Leakage current*	6mA max.	3mA max.
Internal Protection	overload, over-heating, over-voltage, short-circuit	-
Connectors		
Mains input unit	Standard IEC receptacle Ø4mm Socket (earth) MicroFit® ("Safety Stop")	
Bilt's front panel	SUBD-9 female (RS232) USB Type B female PS/2 (keyboard, if front display option)	
CPU unit	SUBD-9 male (RS422) USB Type B female RJ45 (Ethernet) IEEE-488 female (GPIB) BNC female (trigger)	
Miscellaneous		
Dimension	19" 4U mainframe 482x178x405mm	
Operating temperature	5°C à 40°C ambient Power derating over 25°C	
Storage temperature	0°C to 70°C	
Humidity	0 to 80% RH, non condensing	
Installation category	CAT II	
Environment	Indoor use, pollution degree 2	

\* Depends on the number/model of primary power converters used. Characterized here with 2 BE613 (300W).

## II Bilt Presentation

### 1. Bilt unit overview

Bilt is a modular system designed to both generate and monitor high quality signals for test benches and laboratory applications.

The standard modules are high performances DC sources supply. A range of extra modules includes functions as varied as temperature controller, pulses and pattern generation, multi channel measurement, relay driver and, last but no least, specific application modules.

The Bilt mainframe supplies hardware and software requirements for any set and combination of modules: powering, air cooling, synchronizing, dedicated data setting and logging.

The system is well suited for systems requiring both remote controller and network connection for overall control. A large choice of connections is available whatever the mainframe type: RS232, RS422, GPIB, USB and Ethernet.



#### 1.1. Mainframe items description

The Bilt mainframe is available according to 4 different sizes and formats:

Front view:



Ref	BN100	BN101	BN103	BN105
nickname	standard	"with display"	micro-Bilt	Tiny-Bilt
Slot Number	13	13	5	8
module position	back	back	front	front
Display	--	B&W LCD 120x70mm	--	B&W LCD 120x70mm
maximum output power	Configurable, up to 780W+	Configurable, up to 780W+	260W+	210W+
rack size ( W, H, D)	19" x 4U x 360mm	19" x 4U x 360mm	half 19" x 4U x 260mm	19" x 4U x 260mm
fixing and handling	rack brackets +handles	rack brackets +handles	handles(bracket in option)	rack brackets +handles

Rear view:

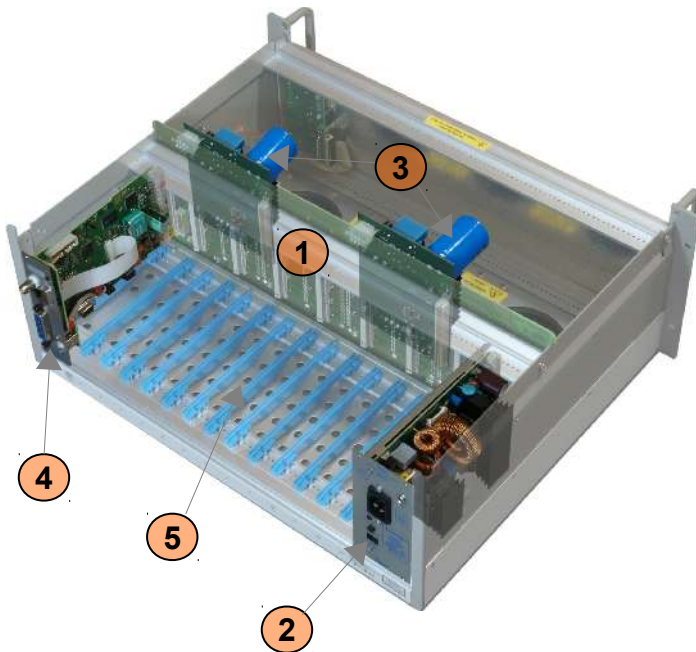


note:

- The standard Bilt unit has 13 slots for the modules located at the rear, well suited for a cabling integrated in a rack. The smallest versions have the modules located at the front, well suited for desktop or standalone use.
- The optional LCD display is useful for measurement and setting read-back or for easing development steps.
- The Bilt mainframes are fitted with different primary power supplies according to the user application requirements and the mains specification.
- The front panel is fitted both for rack stacking and fixing or for handling as a standalone equipment.
- In any case, the cooling air flow needs both front and rear clearance, but complies with stacking.

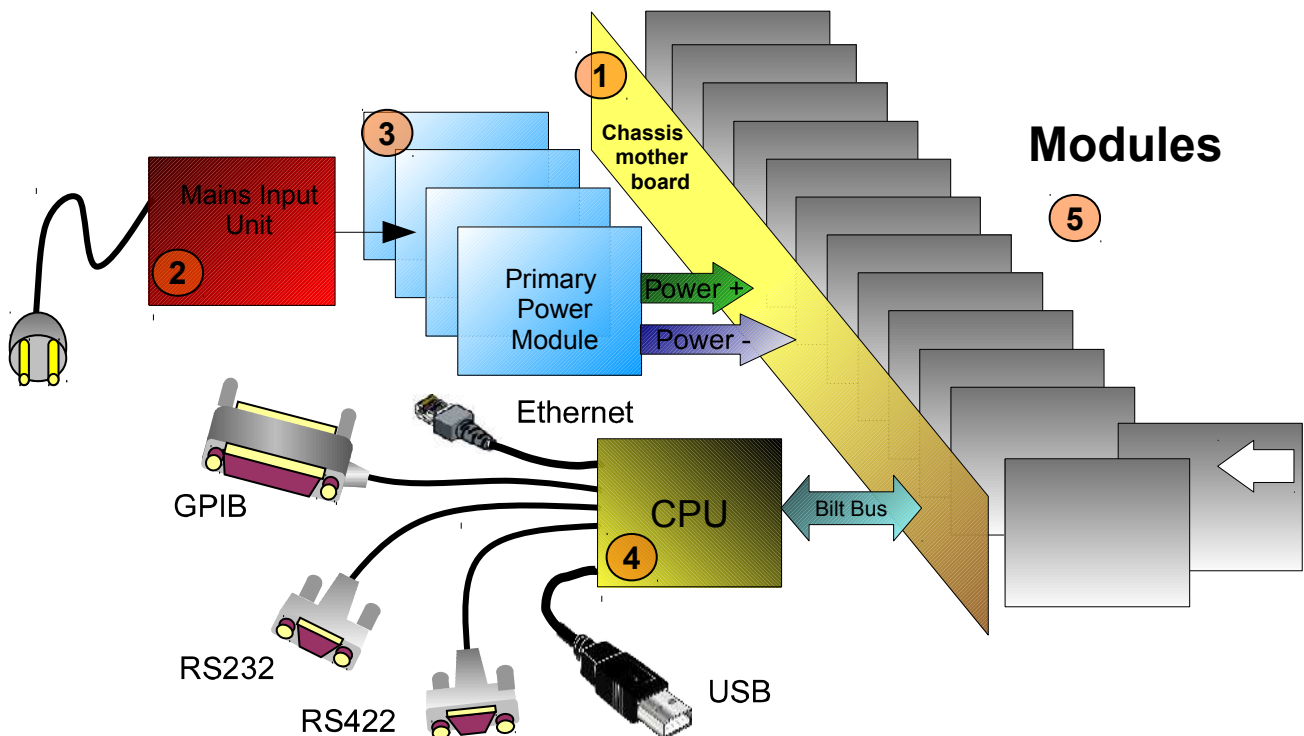


## 1.2. Radiography of a Bilt unit



a standard Bilt unit is made of:

- ① A mother board
- ② A mains input board for AC/DC conversion.
- ③ one to four primary power converters
- ④ A main controller board
- ⑤ location for up to 13 modules





## 2. Power management of the Bilt units

### 2.1. Power conversion principle

The power conversion from the mains voltage to the DC source output is always proceeded through two steps:

- First, the AC input voltage is converted into a common rail DC low voltage using a set of internal power boards. The common rail along the backplane is made of two different voltages, +25V and -25V, whose maximum available current/power is to be set according to the application.
- Then, each DC source module sinks power from the common rail to supply its output regulator providing high performances signal for the application. In addition, the common rail is used to supply all the internal circuitry of the system, thus adding an offset on the required power.

The Bilt system can be either 110-220V AC voltage compliant using PFC input stage, or only 220V AC voltage compliant using simple rectifier, which is more efficient for large power.

As the Bilt mainframe comes with a large choice of size and power equipment, the challenge for the user is to forecast how much power will need the application:

- The simplest but wrong way to proceed is to add all the maximum power values that each plugged module is able to deliver according to its own specification. This will lead to waste expensive power boards and, anyway, the Bilt main-frames are not designed to withstand the sum of all its modules crest power: 120W is the standard maximum output power for one module, but the maximum average output power for 13 modules within a standard Bilt unit is only half, ie  $60W \times 13 = 780W$ .
- The advisable way to proceed is to add the maximum power values that each load is going to sink, then to ensure that the available primary power is larger. For this purpose, the specification of the primary power is always given in term of "equivalent output power", including the common efficiency of the Bilt modules themselves. Most of the output modules suck significant power only from the +25V common rail. The -25V common rail is used to supplying both low power applications and internal circuitry.

As power consumption forecasting is difficult, the measurement of the actual primary power consumption is included in the Bilt monitoring parameters, for both common rails +25V and -25V. Therefore, at any time, the user can display the maximum available power value and the ratio between the used power and the available power. Furthermore, if the ratio rises well above the maximum 100% value, the Bilt unit will disable all the outputs while proceeding a proper backup and sending a warning message.

When using tough loads, as switching, capacitive, reactive, high voltage, the user should be aware that transient current can occurs back to the common rail, and therefore a larger power margin can be required.

## 2.2. Power supply setups

The smallest versions of BILT mainframes BN103 & BN105 are fitted with a fixed and embedded primary power supply.

The standard BILT mainframes BN100 & BN101 are powered by a configurable primary power system, ranging from a minimum of 130W up to a maximum of 780W. For general purpose application, they are proposed with a choice of standard power packages defined in the following table.

Mainframe	option description	Mains specification		power board package	equivalent output power issued from:	
		AC voltage range	maximum input power		-25V common rail	+25V common rail
<b>BE103 Micro-Bilt</b>		110V - 220V	480W	embedded / fixed power	80W	260W
<b>BE105 Tiny-Bilt</b>		220V	450W	BN602 / fixed power	130W	210W
	PFC	110V - 220V	500W	BN603 / fixed power	130W	210W
<b>BE100 / BE101 standard mainframe</b>	light power	220V	260W	BN081 = BN602+BN614+BN611	65W	130W
	standard power	220V	450W	BN082 = BN602+BN614+BN613	65W	260W
	medium power	220V	800W	BN083 = BN602+BN614+2*BN613	65W	520W
	maximum power	220V	1100W	BN084 = BN602+BN614+3*BN613	65W	780W
	light power & PFC	110V - 220V	275W	BN071 = BN603+BN614+BN611	65W	130W
	standard power & PFC	110V - 220V	475W	BN072 = BN603+BN614+BN613	65W	260W

For special purpose application, the BILT mainframes BN100 & BN101 can be delivered with any set of primary power converters. This can be done either before delivery or later on, just by plugging or unplugging power DC/DC converters, within the 4 internal slots hidden behind the front panel of the unit.

ref	specification of the primary power converters	equivalent output power	polarity, ie supply +25V or -25V common rail
<b>BN611</b>	DC/DC 400V to 25V 6A	130W	either, set by straps
<b>BN613</b>	DC/DC 400V to 25V 12A	260W	either, set by straps
<b>BN614</b>	DC/DC 400V to 25V 3A	65W	only for negative -25V rail
<b>BN612</b>	DC/DC 400V to both +25V 3A & -25V 3A	2 x 65W	both common rail, +25V & -25V

The system requires both positive and negative primary power, at least for internal circuitry supplying. The table here-above specifies how the primary converter can supply the positive rail, or the negative, or both.

When several primary converters are plugged and set to supply the same common rail, they work well in parallel and when the system is not operating at full power it distributes the consumed power between them. The monitoring of the actual primary power consumption for both common rails +25V and -25V will indicate the total value of available power and the total value of ratio between the used power and the available power. See EasyStress software user manual or SCPI commands section for access to primary power monitoring.

Caution: The modification of the available power within a Bilt mainframe needs to unscrew the front panel and therefore to access to the high voltage area. The mains should have been previously disconnected. A dedicated maintenance sheet is available, allowing to proceed safely to this modification.

## 2.3. Power management facts

### 2.3.1. input power switch

The input power is switched ON and OFF by a power transistors and a control circuitry which performs:

- soft start with limited inrush current.
- ON/OFF command on both front panel and rear panel using a remote single push button.
- memory of the state after mains interruption: if previously ON, the unit will restart without press 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 one of the 25V common rail voltage
  - an internal thermal alarm or an overrun of the maximum input power (only BN603 PFC )

### 2.3.2. AC/DC input converter

The BE103 Micro-Bilt mainframe is fitted with an PFC input converter which sustains its maximum power whatever the mains voltage within the 110V to 220V range.

The standard mainframe BE100/BE101 performs its maximum power level when connected to 220V AC voltage. The maximum power is limited to half when connected to 110V AC mains, using the BE603 - PFC board.

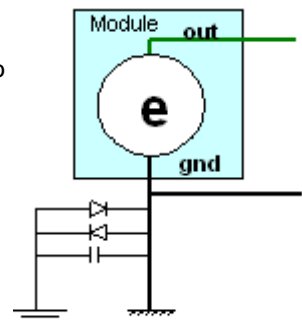
Mainframe	Mains input board	AC voltage range	maximum input power	total equivalent output power
<b>BE103 Micro-Bilt</b>	<i>integrated PFC</i>	110V - 220V	480W	340W
<b>BE100 / BE101 standard mainframe</b>	<b>BN 602</b>	220V	1,1KW	850W
	<b>BN603 - PFC</b>	220V	1,2KW	850W
		110V	600W	450W

### 2.3.3. common output ground

The mainframe's electrical ground is referenced to the mains ground.

- In DC to within  $\diamond$  1V by means of adjoining power diodes in opposite directions. This maximum offset is sufficient to ensure that the power return current does indeed return to each rack through the (GND) cables and not via the mains ground.
- In AC by means of several ceramic capacitors distributed on each Bilt modular board as well as in the rack (on the motherboard). This makes it possible to ensure quality and referencing of filtering and also EMC protection for the whole system.

**Warning :** using Bilt thanks to RS232 interface and a PC makes that Bilt's ground and earth are shorted.. Use the insulated RS422 interface if necessary (BE717 option : external case interfacing USB to RS422).



#### 2.3.4. temporary power backup when the mains stops

- **System reaction to mains cutoff**

Bilt has an integrated "emergency mains cutoff system" which guarantees to the control system a sufficient power autonomy to ensure a clean break. Hence the DC sources continue to control the set values until the short circuit relay is shut off which guaranties that there are no transients on the output. In addition, when the rack is used with EasyStress for stress tests, the date and time of the mains cut-off are recorded in each group's trace memory.

**Warning :** The autonomy only concerns control and low power signals. If, for example, you are using a BE510 with a range of a few mA to send commands to a MOS gate and if you have programmed a stopping time of 50ms in relation to the module providing the drain voltage, the sequencing will be respected. but if you want to set a stop time for a signal of several watts, the signal will collapse before execution of the stop time due to lack of primary power. What the system guarantees even in this case is the lack of transients or undesirable random effects on the output.

Communication with BE718 anticipates mains input disappearance by stopping Bilt's module before lack of power.

## 3. Bilt unit connections and panels features

### 3.1. CPU board

**Processor :** STR912FA, core ARM 966-E at 96MHz, 512ko Flash, 96Ko SRAM + 2Mo SRAM (external memory, backed-up thanks to a battery), internal clock and calendar.

**Memory :** 2Mo external Flash

**Clock :** 100MHz oscillator for mainframe clock generation and GPIB clock.

**Battery :** Ni/Mh 3,6V at least 3 months retaining capability without powering Bilt.

**Interfaces :**

- RS232, EIA/TIA-232E and CCITT V28 compliant ( $\pm 10V$ )
- RS422 56k/207k, insulated ( $\pm 5V$ )
- GPIB (IEEE488.2), National Instrument TNT4882 at 40MHz
- Ethernet 10/100M on insulated RJ45 (LVDS)
- USB 2.0 slave (5V)
- Trigger : open collector (5V)



BE718 CPU board (on the left)

### 3.2. Front panel

A « SAFETY STOP » connector on the front panel of the mains input board is part of a safety system which stops the DC source modules if the electrical loop between two of its contacts is opened (example : for a door contact when using high voltage modules).

## 4. Modules

### 4.1. Generalities

- **Module identification**

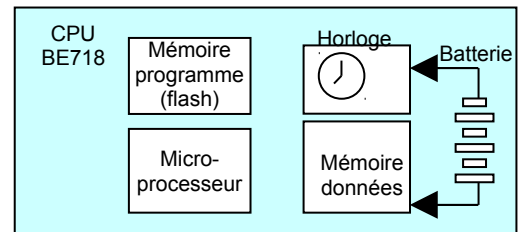
Each Bilt module has an E<sup>2</sup>PROM memory containing its complete identification. On initialization, the system reads the identification of each module from this memory and loads the relevant software structure. Thus, the selection of a module slot activates the set of SCPI commands related to the instrument installed.

For instance, if slot 4 has a BE427 temperature module the command «meas :temp ? » will return the temperature measurement. The same command to the same slot with a DC BE516 source installed will return the SCPI error message « undefined header ».

An SCPI command can be used to identify the type of module installed in the slot in question as well as its serial number, its software version and the date on which it was last checked or calibrated.

- **Permanent memory**

The system memory and clock are saved by battery power. Thus if you have programmed a module's parameters and you switch off and then switch on the system without changing the module's place in the rack, the parameters will remain unchanged. This system feature was designed for stress test requirements using EasyStress software but can have undesirable effects when directly used in SCPI mode. In particular if a rack has been used in the EasyStress environment then the command « \*rst » should be used to reset the rack before using it in SCPI mode. Indeed EasyStress activates operation of modules in groups with group level alarms which can prevent the module from operating correctly with its own commands.



- **Software changes**

The CPU board's firmware is memorized in a flash memory. This firmware may evolve to improve Bilt's performances. A PC software (« TeleBilt ») is provided to update the firmware of the rack very easily. The latest CPU software file can be obtained on a CD ROM, E-mail or by direct download on iTest website ([www.itest.fr](http://www.itest.fr)). It should be noted that the firmware update can be done simultaneously for several networked racks.

The module's firmwares should not change. But, in particular cases and under iTest advice, they also can be updated thanks to another PC software (« TeleModule »). In such a case, TeleModule software and the firmware file will be provided on a CD-ROM.

→ Full list of modules and accessories on [www.itest.fr](http://www.itest.fr)



## 4.2. DC sources

Bilt DC sources are characterized by very accurate setting and measurement. These performances are achieved thanks to a wide choice of ranges (e.g.: 9 current ranges for the BE516, from 5 $\mu$ A to 6A full scale). It is important to correctly choose the range to be used. By default, modules come in automatic range selection mode, i.e. when stopped they automatically select the suitable range according to the past setting (current or voltage). You may change the setting in operation but only within the same range. Remember there will be a loss of accuracy if the setting (or measurement) becomes too small in relation to the actual resolution.



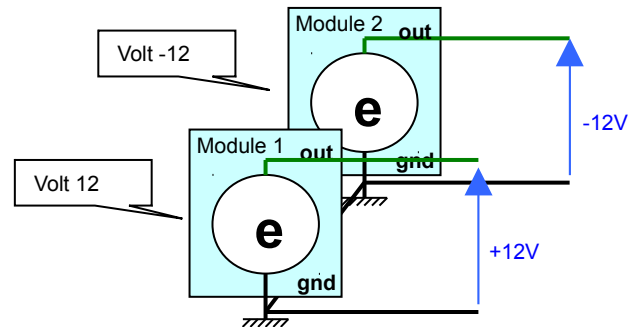
Most of these power supplies are not floating but referenced to a common ground : it is impossible to connect them backwards to obtain negative tension, or to cascade them to double the voltage. On the other hand most of them are bipolar and may be programmed in negative.

DC sources for the Bilt system are referenced to the common electrical ground of the rack.

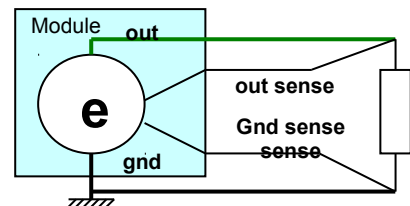
This enables to :

- Substantially reduce the cost.
- Enable simple and efficient filtering without capacitors on output (no problem of common mode noise).
- Avoid electrostatic discharge due to isolated systems.
- Clearly references ground layouts.

To deliver a negative signal, the sources are bipolar and power outlets are marked "GND" "OUT" (and not "-" and "+" as for a floating power output).



Since the ground for each source is also common at the test equipment level the system uses 4 wire remote sensing which enables: An identical cross section for all power (OUT) and return (GND) leads. A stable and accurate voltage regulation while compensating losses on individual lines (OUT SENSE) and especially common lines (GND SENSE).



In order to protect the linked components under all circumstances (in particular during mains powering up or powering down of the mainframe), most of Bilt DC source modules have short circuit relays : when these are off they have null impedance in output.

Most of Bilt DC sources features an Over-Voltage Protection system. See each module's datasheet to see the availability of this fonction.

Unlike what may be available on other SCPI power supplies, the over-voltage-protection of Bilt modules is a stand-alone hardware system whose response time is short enough to efficiently protect the module against an accidental short-circuit with a voltage greater than its acceptable range (or even much greater) or a reverse voltage (>500mV in the opposite direction to the current range). Let us take the example of the polarization of a power MOS at 250V on the Drain with a BE537 and at 15 Volts on the gate with a BE516 on a very low current range for monitoring the leak. Following a failure of the MOS or a handling error, the 250V voltage is applied on the output of the BE516 module. This one will protect itself in three stages :

1. A power transil will limit the voltage to about 120% of the maximum voltage range of the DC source (within a few pico-seconds).
2. Detection of over-voltage (if the pulse is longer than 1 $\mu$ s), triggering of a power short-circuit system (within 10 $\mu$ s).
3. Normal stopping of power supply (software) setting at 0V and 0A then activation of the short-circuit relay (stage duration: 60ms).

Note that this very efficient system is operational even for low current ranges, without deterioration of performance in terms of accuracy and leakage current.

Important note : in the case of a group stop through over-voltage protection this stops with respect to the programmed inter module sequences except for the module which triggered the alarm. As indicated above in order to protect against over-voltage the module short-circuits its output with a very short response time.

→ Full list of modules and accessories on [www.itest.fr](http://www.itest.fr)

### III Hardware installation

## 1. Main frame installation

Each Bilt mainframe is delivered in an individual parcell containing also a mains cable. All ordered modules are already installed in the mainframe and screwed down. Bilt is thus immediately fully operational without any installation procedure. Simply connect the supplied mains cable between the mainframe and an earthed plug and choose a communication interface to start using Bilt. The mains voltage must match the Bilt system installed mains input board voltage range (BN602 or BN603).

Make sure that ventilation openings are clear and that the room is adequately ventilated.

#### *Starting/stopping Bilt :*

Press the push-button « POWER » on the front panel of the mains input board or on the mainframe's front panel. The start-up time may vary from 1 to 4 seconds depending on the number of primary converters installed.

In case of mains cut-off, Bilt will restart as soon as the mains returns.

The « SAFETY STOP » connector on the front panel of the mains input board is part of a safety system which stops the DC source modules if the electrical loop between two of its contacts is opened. This enables, for instance connecting this loop to the access door of a room, to stop high voltage modules in case of intrusion.



#### *Using the front panel programmable keys :*

Two keys marked « F1 » and « F2 » can be freely programmed thanks to SCPI commands. They can simply switch the modules on or do much complex functions.

#### *Control LEDs :*

- « Listen » LED : incoming communication in progress
- « Talk » LED : outgoing communication in progress
- « Error » LED : communication error
- « Alarm » LED : at least one module sent an alarm
- « Output » LED : at least one module is on



## 2. Modules installation

All Bilt are delivered fully assembled. However, you may need to change your configuration by removing or replacing modules.



**These operations must imperatively be done when Bilt is switched off.  
Otherwise, modules may be damaged.**

To remove a module, after unscrewing it, pull its handle retaining the module with your other hand on top of its front panel. Once the module has disengaged from the mainframe connector, pull it gently away from the chassis maintaining a proper alignment between the brackets and the module.

Insert without forcing the new module into its slot, ensuring proper alignment between the brackets and the module so as not to tear the module components out because of the neighbouring module. Pressure is needed at the end of the race to set the module connector in the mainframe connector. After full integration of a module in its slot, screw it down to the mainframe at least at one of the two locations.

Unused modules must be stored in an electrostatic bag.

### Connection to the modules

Read each module's documentation to get input or output connector information.

The supplying of loads over long distances (>3m) needs possibly additional RF rejection hardware to get in conformity to the EMC requirements.

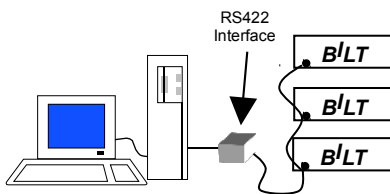
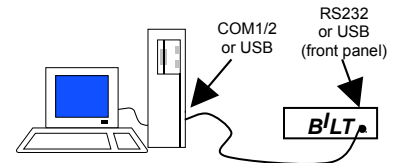
### *Using modules :*

All modules are automatically detected and identified at Bilt's start-up. No driver installation is necessary if CPU's firmware is up to date. Modules are then ready to be controlled by SCPI commands.

### 3. Communication interfaces : connection to a computer

The standard version of the system comes with five interfaces : RS232, RS422, GPIB, TCP/IP and USB.

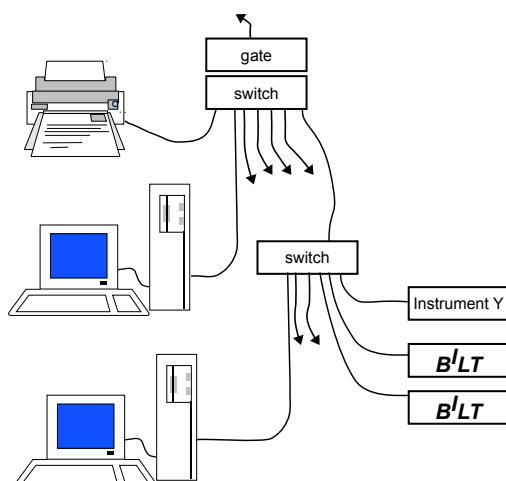
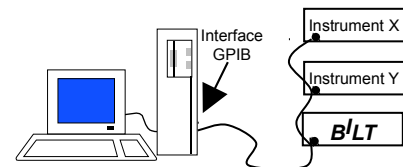
The **RS232 and USB interfaces**, which are accessible on the front panel, enables very easy control of one rack through a computer's serial interface (COM or USB on a PC for instance). It is generally used for maintenance operations or for local operation using a terminal emulator such as the Windows Hyper Terminal. (Serial configuration : 8 data bits, no parity bit, 1 stop bit, no flow control)



Several Bilt racks can be connected in a network via the **RS422 interface** (up to 99). The advantage is that it enables simple, cheap wiring and can handle long distances.

Note : Optional BE717 accessory, which provides a self-powered isolated USB/RS422 interface, is available separately.

The **GPIB interface** is a rapid parallel network with standard electrical and mechanical specifications. This is the easiest way of integrating Bilt into a heterogeneous test bench. Bilt is entirely compatible with the IEEE488.2 standard for GPIB operation.



**TCP/IP Ethernet interface** is fully standard (100Mbps, RJ45, full duplex, port 5025). It may be used on a specific network (just as RS422 and GPIB) or on a company network.

Default addresses :

RS422 : last two digits of the serial number

GPIB : 05

Ethernet : 192.168.150.1xx, xx are the last two digits of the serial number. Port 5025 is not configurable.

## IV Bilt Programming

### 1. General presentation

#### 1.1. Requirements

For development of programs, a terminal interface is required.

- If Bilt rack is equipped with a display (BE740 option), this display can be used as terminal by plugging a PS2 keyboard on the front panel.
- In all cases, a PC computer can be used thanks to the iTest “BiltTerminal” software provided.

Note : Under Microsoft Windows OS, “HyperTerminal” software can also be used.

#### 1.2. SCPI commands overview

No matter what type of interface is used, the BILT system only accepts and returns ASCII character chains in an SCPI format.

**SCPI** stands for “Standard Commands for Programmable Instruments”. The purpose of this norm is to standardize the instruments commands between programmable test and measurement devices from different manufacturers.

The syntax is based on the use of the most explicit keywords possible with a long and a short form (e.g. : the SCPI command **VOLTage** can be written **volt** or **voltage**) possibly preceded by a « root command » (e.g. **meas:volt**). If the command has an argument, it is placed after the keyword, separated by a space (**volt 12**). If the command must return data, the key word is followed by « ? » (**meas:volt ? ↵** → answer : 1.002 ). Whether on input or output, lines are ended by the LF end-of-line character (ASCII 10, represented by ↵ ).

The character « ; » allows to remain at the same level of “routing” : for instance, commands **limit:upper 3.2** and **limit:lower 2.8** can be chained this way : **limit:upp 3.2; low 2.8↵**.

The characters « :: » allows to return to the root : **volt:range 12** and **curr:range 1e-3** can be chained on the same line : **volt:range 12 :: curr:range 1e-3↵**

If a command needs several parameters (as input or output), they are separated with commas (',').

Bilt generally respects recommendations made by the SCPI consortium. However some syntax has been simplified or adapted to better match our product specifications.

Note : SCPI commands are case insensitive.



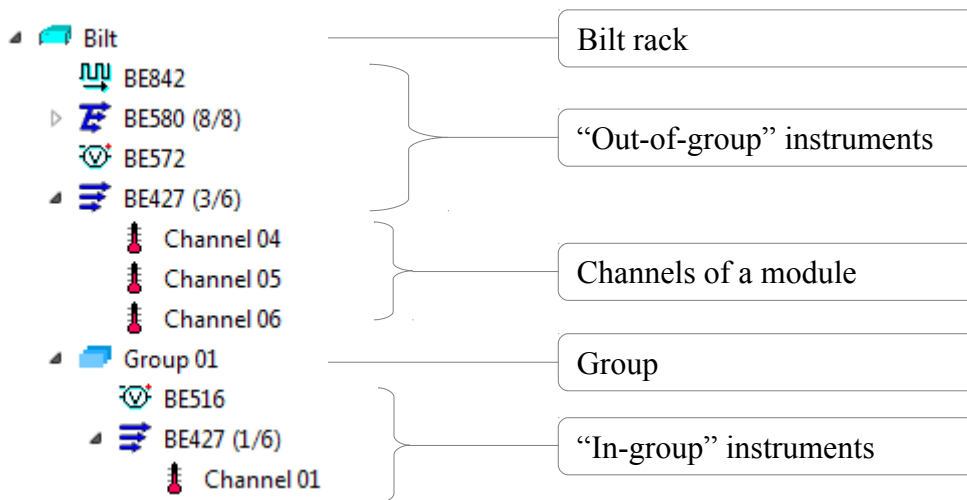
## 2. BILT operating principle

Bilt is a modular system which can contain up to 13 instruments with various features. Each instrument has its own set of SCPI commands which can be retrieved in corresponding datasheet.

A widely used feature of the Bilt system is to use groups of instruments :

Several instruments can be affected to a group. It allows to create a set of instruments whose start/stops are coordinated. A start and stop sequence can be defined using delays between the main group start or stop and each module start or stop, and, moreover, it offers many functionalities like parameter memorization, cycling conditions, setting thresholds on measured parameters to automatically stop a test, triggering features, ...

As a consequence, a structure is created inside the Bilt unit, which can be represented like a tree :



Accordingly, each group, module and channel must be accessible independently :

- Modules are addressed thanks to the command “iX”, where X stands for the position of the module inside Bilt rack :  
typing “i3” will cause the addressing of the following commands to the module plugged in the third position inside Bilt rack.
- Channels are addresses thanks to the command “cX”, where X stands for the channel number X of current selected module :  
typing “i3” and then “c2” will cause the addressing of the following commands to the channel number 2 of the module plugged in the third position inside Bilt rack.
- Groups are addressed thanks to the command “pX”, where X stands for the group number :  
typing “p1” will cause the addressing of the following commands to the group number 1.

Note : currently selected items can be retrieved thanks to the commands “i?”, “c?” and “p?”.

For example, imagine a case where a DC source module is plugged in position 4, a multichannel temperature controller is plugged in position 6 which channel number 3 is used. Both DC source module and the third channel of the temperature controller are affected in group number 1. The following command sequence could be used :

i4↵	→ selects the module in position 4 (the DC source)
VOLTage 1,5↵	→ the module in position 4 receives this command.
i6↵	→ selects the module in position 6 (the multichannel temperature controller)
c3↵	→ selects the channel 3 of currently selected module (i6 here)
MEASure:TEMPerature ?↵	→ The channel 3 of the module 6 receives this command and answers : “20,6↵”
p1↵	→ selects the group number 1
P:STATE:ON↵	→ The group number 1 receives this command and then starts. (i4 and i6;c3 starts synchronously)

Notes :

- commands could have been chained like : “i6;c3;meas:temp ?↵”
- group commands can be compacted like : “p1:stat:on↵”

## 3. BILT SCPI commands

### 3.1. General rack commands

Command	Comments	By default.
<b>*RST</b>	Completely resets the rack: Stops all groups and modules Deletes groups and declared memories. It is best to wait 3 to 4 seconds before re-communicating with the rack.	
<b>INST [val][?] or I [val][?]</b>	Selects a module or reads the last selection	<b>1</b>
<b>INST : LIST ? or I : L ?</b>	Returns the list of instruments fitted to the rack: 1,Id ;2,Id...	
<b>SYSTem : VERSion ?</b>	Software version	
<b>SYSTem : ERRor ?</b>	Reads last error not yet read (fifo).	
<b>SYSTem : VERBoSe [ ?][1/0/on/off]</b>	(TCP/USB/RS232/RS422 only : in GPIB verbose is always OFF). In « verbose » mode : - Returns token type data in the form « 0, OFF » - Automatically returns error messages. - Replaces the argument separator « ; » in output by a line return. - The [LF] on output is replaced by [CR][LF].	<b>RS232 : on RS422 : off USB : off GPIB : off TCP : off</b>
<b>SYSTem : TIMe [?][jj,mm,aa,h,mm,ss]</b>	System date & time. Precision clock saved (operating on battery).	
<b>SYSTem : POWer ?</b>	Returns: Measurement +25 in Volts, Power +25 used in %, Measurement -25 in Volts, Power -25 used in %. Example : 25.3,72,-25.2,21	
<b>SYSTem : POWER : MAX ?</b>	Returns available power in watts on +25, on -25 (e.g. : 900,150)	
<b>SYSTem : SERial : BAUD [val]</b>	Programming of baud rate (bit par second).Valid immediately !. Possible value : 19200, 38400, 56000, 125 (=125k), 208 . The baud-rate is not altered by upgraded µC software.	<b>56000<sup>(EP)</sup></b>
<b>SYSTem : SERial :ID [ ?][Val]</b>	Programs or reads one 422 network address (two digits in hexa). The 00 and FF addresses are illegal.	2 last digits of serial number <sup>(EP)</sup>
<b>SYSTem : GPIB :ADDRess [ ?][Val]</b>	Programs or reads one GPIB address. The GPIB address is not altered by µC software.	<b>5<sup>(EP)</sup></b>
<b>SYSTem:ETHernet:ADDRess [?] [a,a,a,a]</b> <b>SYSTem:ETHernet:ROUte [?][a,a,a,a]</b> <b>SYSTem:ETHernet:MASK [?][a,a,a,a]</b> <b>SYSTem:ETHernet:MAC [?]</b>	Programs or reads the TCP/IP address, gateway and mask. Reads the physical address (MAC). Example : SYST:ETH:ADDR 192,168,0,1;ROUT 192,168,0,255;MASK 255,255,255,0	192,168,0,1xx 255,255,255,255 255,255,255,0 <sup>(EP)</sup> xx=Serial No
<b>SYSTem : NAME [ ?][String]</b>	Assigns or returns the rack name (Max : 20 characters).	<b>"Bilt xx"<sup>(SV)</sup></b> xx=Adr 422
<b>SYSTem : OVERPROT off</b>	Removes over-voltage-protection for all modules which are equipped with it (Warning : An applied over-voltage on output of a module whose over-voltage protection is disabled may be destructive.)	
<b>SYST :SET ?/SYST :SET :NEXT ?</b>	Returns the complete set-up of the rack in the form of a series of commands which can be re-emitted as they are. In mode « syst :verbose :off », returns the first line by <b>SYST :SET ?</b> then the following lines one by one at each <b>SYST :SET :NEXT ?</b> . The last line returns «END ».	
<b>Syst:key:def 1,[string][?]</b>	Programs or reads the SCPI string executed by pushing the « F1 » button (new racks) or « ON » button (old racks). 80 c max.	<b>""<sup>(sv)</sup></b>
<b>Syst:key:def 2,[string][?]</b>	Programs or reads the SCPI string executed by pushing the « F2 » button (new racks) or « OFF » button (old racks). 80 c max.	<b>""<sup>(sv)</sup></b>

- \* (EP) = Saved in Eeprom, not affected by \*RST command / (SV) = Saved in non-volatile RAM. Default value is restored by \*RST.
- \* Unlike certain GPIB modular devices, BILT does not use the secondary GPIB address system to point a module.
- \* The parameters for each module are in saved RAM, and hence are not lost during powering down. They are only reinitialized when there is a physical change of the type of module or by the command « \*rst ».
- \* Programming of GPIB 21 and 00 addresses is prohibited because they correspond to default addresses of the GPIB HP (21) and National Instrument (00) board.
- \* A rack which has been used with the iTest **EasyStress**® software should be completely reinitialized by « \*rst » before being used for instrumentation to avoid any surprises intrinsic to the programming of the groups of modules.
- \* A command allows to record a default programming for the F1 and F2 keys after the execution of a the \*rst command. Please contact us.

## 3.2. Common commands for all the instruments

Command	Comments	By deflt.
<b>INST [val][?] or I [val][?]</b>	Selects a module, or reads the last selection.	<b>1</b>
<b>*idn ?</b>	Identifies the module in the form <i>num</i> , « <i>str</i> » (e.g. : 510, « ITEST BE510GS... »). Apart from the type of module, contains the module's serial No; the date of the last calibration (LC) or the manufacturer's date-code (DC), as well as the software version (VL). For modules consisting of a mother-board and a daughter, the two are identified. Refer to the module technical sheet.	
<b>DEFine [str][?] or NAME [str][?]</b>	Module name (20 characters max)	Ref module <sup>(SV)</sup>
<b>STATe ?</b>	Reads the internal state of the module1 : . ),0,OFF ;1 ON ; 2 WARNING ; 3,ALARM On certain modules State may be the switching on/ switching off command ( «state on/off»).	
<b>SET [:FIRST] ? / SET :NEXT?</b>	Returns the complete instrument set-up in the form of a series of commands which may be re-emitted as they are . In mode « syst :verbose :on » -conventional use as a terminal - « SET ? » returns in one go all commands separated by « ↵ ». In mode « syst :verbose :off », returns the first line by « SET ? » then the following lines one by one at each « set :next ? ». The last line returns « END ».	
<b>START :TYPE [OR/AND][?]</b>	Type of behavior for the module when it is declared in several groups. If start is of the type « OR », the module will be switched « On » as soon as one of the group in which it has been declared is switched « On » Otherwise (« AND » case) it will be switched « On » when all groups including are « On ».	<b>OR<sup>(SV)</sup></b>
<b>STOP :TYPE [OR/AND][?]</b>	Type of behavior for the module when it is declared in several groups. If Stop is the type « OR », the module is left On » as long as at least one of the groups in which it is declared is « On ».	<b>OR<sup>(SV)</sup></b>
<b>IMC ?</b>	Returns the type of module for multichannel module : <ul style="list-style-type: none"> <li>1 → IMC = "Independent Module Channel". The On/Off operations are asynchronous for each channel. Each channel can be moved in separate group.</li> <li>0 → non-IMC = Mono or multichannel module which all channels are synchronous for On/Off operation (le: BE580).</li> </ul>	
<b>IDATa ? / IDATa :NEXT ?</b>	Short-cut returning "Mx,State,Fail,Meas :Param 0 ,Meas :Param 1" where : <ul style="list-style-type: none"> <li>x is the instrument position</li> <li>State : 0,OFF ;1,ON ;2,WARNING ;3,ALARM</li> <li>Fail : token with maximum of four letters, giving the alarm status of the instrument, NO if nothing to declare .e.g. : NO, LOW, HIGH, TEMP...</li> </ul> The multichannel boards return a line per channel and x takes the form instrument/No / channel N° (example for the module 6 channel 2 : 6/2). If the commands exceeds 100 characters, it returns NEXT after the current line. The rest may be obtained by the command IDATA :NEXT ?	
<b>PARAM ?</b>	Returns the list of parameters which can be memorised (see MEMory :...) and expected in the commands IDATa et MDATa. Syntax : No, « name », unit, Type of mem1, type of mém2... ; ...	

<sup>SV</sup> : Parameter in permanent memory

### 3.3. Groups commands

The definition of groups of instruments is used :

- To start/stop an x number of modules in a consistent way (**PROG**ram/**STAT**e **ON/OFF**), with pre-programmed delays between each module. (**STAR**t/**STOP** :**DEL**ay).
- To manage a test time counter (**PROG**ram :**TIME**).
- To stop a consistent set of instruments when a measuring threshold is exceeded, by external triggering or by a delay command.
- To create memories in order to trace module measurements (**MEM**ory :...)
- To get a test log (**HIST**ory :...) : time-tagged text file tracing powering up, stops, exceeding of program thresholds, mains cut-off....
- ...

#### 3.3.1. Main group commands

Command	Comment	By default.
<b>PROG</b> ram [val][ ?] ou <b>P</b> [val][ ?]	Selects a group The group remains selected as long as no other one has been selected. Max 12 groups.	<b>1</b>
<b>P</b> : <b>DEF</b> ine / <b>P</b> : <b>CLEAR</b> : <b>DEF</b>	Creates or deletes the definition of the group. The definition can only be deleted if no other module is linked to the group.	
<b>P</b> : <b>NAME</b> [str][ ?]	Group name (20 characters max)	<b>PROGRAM xx</b> <sup>SV</sup>
<b>P</b> : <b>INST</b> [ : <b>LIST</b> ] ?	Returns the list of modules attached to the current group	
<b>P</b> : <b>INST</b> : <b>LIST</b> <b>VERBO</b> se ?	Returns the list of modules and channels attached to the current group under the form : Inst, Inst, Inst-channel,Inst-channel,Inst, ... Example : 2,3,4-2,4-3,6 = modules 2,3,6 + channels 2 and 3 of module 4	
<b>P</b> : <b>INST</b> : <b>ADD/DEL</b>	Adds/Removes the current instruments of the current group.	
<b>P</b> : <b>INST</b> : <b>LIST</b> No, No, No	Replaces the composition of the current group with the previous list.	
<b>P</b> : <b>CHAN</b> : <b>ADD/DEL</b>	Adds/Removes the current channel (chan x) of the current IMC instrument (I x) from the current group (p x). Example : <b>p2::i4::chan6::p:chan:add</b> : Attach channel 6 of instrument 4 to group 2.	
<b>P</b> : <b>CHAN</b> : <b>LIST</b> No, No, No	Chooses the active channel in the current group (p x) of the current IMC instrument (I x). Example : <b>i4::p2:chan:list 2,5</b> : Attach channel 2 and 5 of instrument 4 to the group 2. All other channels are deselected for this group.	
<b>P</b> : <b>STAT</b> e [on/off][ ?]	Switches the common group with synchronisation of modules between them according to their <b>STAR</b> t/ <b>STOP</b> : <b>DEL</b> ay. It is possible to switch on the group only if its state is <b>Off</b> . To switch state form <b>alarm</b> or <b>time-stop</b> to <b>Off</b> , send <b>P:STATE :CLEAR</b> . The query form return : <b>0,ND ;1,OFF ;2,ON ;3,WARNING ;4,ALARM ;5,TSTOP</b>	<b>off</b>
<b>P</b> : <b>STAT</b> e : <b>CLEAR</b>	Used to switch the <b>ALARM</b> state to <b>OFF</b> , or <b>WARNING</b> to <b>ON</b> . Indispensable for restarting a group after an alarm . (note : To leave the <b>TSTOP</b> state time stop must be increased or the memory dumped)	
<b>P</b> : <b>LIM</b> it [0/1/on/off][ ?]	Activates threshold monitoring for this group.	<b>Off</b> (SV)
<b>P</b> : <b>TIME</b> : <b>STAT</b> e [0/1/on/off] [ ?]	Activates the time counter and memorisation for the current group . The time and memorisation will be valid if the group is, moreover, On ( <b>P</b> : <b>STAT</b> e <b>ON</b> )	<b>off</b> <sup>SV</sup>
<b>P</b> : <b>TIME</b> [hh,mm ,ss][ ?]	Reinitialises/Reads the group test time Max 9999 hours.	<b>0,0,0</b> <sup>SV</sup>
<b>P</b> : <b>TIME</b> : <b>STOP</b> [hh,mm,ss][ ?]	Programs the code marking end of test . Max 9999 hours.	<b>1000,0,0</b> <sup>SV</sup>
<b>P</b> : <b>NTES</b> t [val][ ?]	RUN number.	<b>1</b> <sup>SV</sup>
<b>P</b> : <b>HIST</b> ory [: <b>NEW</b> ] ?	Returns a new log line since the last query (if any). If there are several lines then several queries should be made.	
<b>P</b> : <b>HIST</b> ory : <b>ALL</b> [?][ : <b>NEXT</b> ] ?	Returns all log lines. If the log is longer than four lines, <b>NEXT</b> is passed on the last line. The following lines are available by <b>P :HIST :ALL :NEXT</b> ?	
<b>P</b> : <b>HIST</b> ory : <b>ADD</b> string	Used to enter a « user » line in the log file.	
<b>P</b> : <b>MEM</b> ory : <b>CLE</b> ar	Reinitialises memories, log and time counter for this group.	
<b>PDATA</b> [val] ?	Short-cut returning the following data : G(group n° ),(new),(groupe state),(groupe time) Example : « G1,0,2,0010h20m45s »	
<b>MDATA</b> [val] ?/ <b>MDATA</b> : <b>NEXT</b> ?	Short-cut returning data for « pdata ? » for the group pointed at according to the data in « idata ? » for each group module.	
<b>P:LIST</b> ?	Returns the list of defined groups (ex : 1,3,4).	

<sup>SV</sup> : Parameter in permanent memory

### 3.3.2. Memorization features

The memories described here are measurement tables. Each measure point is separated by a time interval. Memories are defined in relation to the current group (**PRO**gram), the current module (**INST**) and eventually the channel (**CHAN**nel) for multichannel modules.

#### Usual types of memory :

- **Infinite memories :**

These memories will store measured values from the beginning of the test till the end with a constant number of points. To do this, when all points had been stored, the system will remove one measure over two and set the period twice longer. These memories are used to view parameters evolution throughout the entire test.

**INFS** memories : “Self Compress Memory Sample” - memorizes a point. For re-dimensioning only the second point of each pair is kept.

**INFX** : “Self Compress Memory Envelope” - simultaneous memorizing of two points separately (Min/Max). For each re-dimensioning only the extreme point of each pair is kept. (the smallest of the min, the largest of the Max). Thus the envelope remains consistent even after 1000h of testing.

- **Roll memories :**

These memories will store a moving, fixed time width memory. The number of points and the period are constant, so, each new measure will erase the latest one. These memories are used to view the end of the test.

**ROLS** memories : “Roll memory Sample” - memorizing of a point.

**ROLX** memories : “Rol memory Envelope” - simultaneous memorizing of Min and Max separately.

Command	Comment	By default.
<b>MEMory</b> [<name>][?]	Selects the <name> memory or returns the currently selected memory corresponding to the current Instrument/Program context.	
<b>MEM :DE</b> fine <name> , type , points , période , paramètre	Name : String 8 characters max. Type : A type supported by the module INFS/INFX/ROLS/ROLX... Points : 64,128,256,512,1024,2048 for envelope (INFX/ROLX) 128,256,512,1024,2048,4096 for sample (INFS/ROLS) Parameter : Parameter of the module to be memorised (see PARAM ?)	(SV)
<b>MEM :DE</b> fine ?	Returns definition parameters for the current memory.	
<b>MEM :LI</b> st ?	Returns the list of memories defined for the currently selected group/modules	
<b>MEM</b> [name] : <b>CL</b> ear : <b>DE</b> F	Frees memory linked to a name and to a currently selected pair.(I/P) (opposite command to define)	
<b>MEM</b> [name] : <b>DA</b> TA [: <b>FI</b> rst] ? <b>MEM</b> [name] : <b>DA</b> TA : <b>NE</b> xt ?	Returns the first block of memory available . Returns the following data block. Format for memories ROLS,ROLX,INFS,INFX,IOL : <ul style="list-style-type: none"> <li>• Header : Period in ms (first block only )</li> <li>• For single point memories (ROLS,INFS,IOLS) : val ;val ;val...</li> <li>• For two-point memories (ROLX,INFX) : min,max ;min,max ; min...</li> </ul> END as last argument (last block) The blocks contain at most 40 measurements (20 pairs for two-point memories).	

<sup>SV</sup> : Parameter in permanent memory

#### Advanced types of memories :

- When using group's cycling features, another type of memory is available : IOL memories. Please see ch. #3.3.4.Cycling features for further details.
- In conjunction with macros, yet another type of memory is available : TRIG memories. Please see ch. #3.3.5.Macro features for further details.

#### Notes :

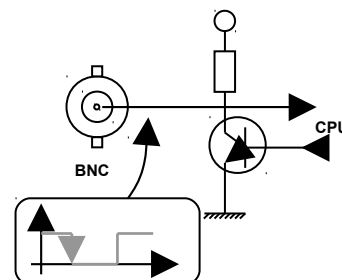
- There is no command for reinitializing memories. This is done by the group command.« **P :MEM :CL**EAR ». (which also clears the group time counter and the test history).
- More specific memories can be available on some modules. Their explanation must be found on the module datasheet.

### 3.3.3. Triggering features

The Bilt CPU board has a trigger BNC connector. This is an input/output using an open collector with pull-up of about 10 kΩ at +5Volts.

The trigger is sensitive to the falling edge on input and generates negative output pulses of 100 ms, also active on the falling edge.

The trigger can also be activated by the Trig signal of the GPIB. It is possible to simulate a GPIB trigger by the command IEEE « \*TRG ».



Trigger In :

Command	Comment	By default.
TRIG:STATE [action] [?]	Programs trigger action for the module pointed at.	Off <sup>(SV)</sup>
TRIG:SOURCE [EXTernal/BUS] [?]	Detects Trigger on BNC jack (EXT) or on Gpib bus(BUS)	Ext <sup>(SV)</sup>
P :TRIG:STATE [action] [?]	Programs trigger action for the group pointed at	Off <sup>(SV)</sup>
P :TRIG:SOURCE [EXTernal/BUS] [?]	Detects Trigger on BNC jack (EXT) or on Gpib bus (BUS)	Ext <sup>(SV)</sup>

Note :

- « \*TRG » simulates GPIB reception on the rack during communication.
- « syst : trig on » and « syst :trig off» simulate BNC trigger reception for the whole network from a rack including the emitting rack.

Trigger Out :

Command	Comment	By default
OUTP :TRIG:STATE [source] [?]	Programs type of trigger emitted for the module pointed at.	Off <sup>(SV)</sup>
P :OUTP :TRIG:STATE [source] [?]	Programs type of trigger emitted for the group pointed at.	Off <sup>(SV)</sup>

<sup>SV</sup> : Paramètre en mémoire permanente

« Action » & « sources » parameters for Trig commands :

	In (action)	Out (source)
OFF		Does nothing (by default).
START	Switches the group selected to On	Generates when the group selected is switched on.
STOP	Switches the group selected to Off.	Generates when the group selected is switched off
STARTSTOP	Switches the group selected to On if it is Off or vice-versa.	Generates when the group selected changes its state..

Note : Whether in reception or emission it is highly recommended to interpret the whole configuration of a rack trigger either only at the level of the modules (TRIG :...), or only at the level of groups (P :TRIG :...) in order to avoid any operating anomaly.



### 3.3.4. Cycling features

The principle is to alternatively switch the modules of a group On and Off according to program times (in seconds, between 1 and 250s). The ON state corresponds completely to normal operation of the group. However the Off state raises some difficulties in relation to the completely powered down state :

- The output short circuit relays on DC sources are not activated.
- The zero voltage may be slightly effective (offset), specified for each module.

The program sequences for each module (start/stop delay) are expected for each switching on and off. Monitoring of threshold during the On phase after the program stabilization delay is also covered

For modules featuring memorization possibilities, a new type of memory is available : the IOL\_SAMPLE memory. It operates as an infinite compression memory but the period of initial memorization is the cycle, then, after compression, every two cycles, then, every four cycles, etc. The user can adjust the moment of the cycle that he wants to memorize. This moment can be programmed in seconds starting from the beginning of the On phase. As for the other types of memory, one must use the number of graph points between 128 and 4096. The system does not offer any envelope memory possibilities for this type of memorization.

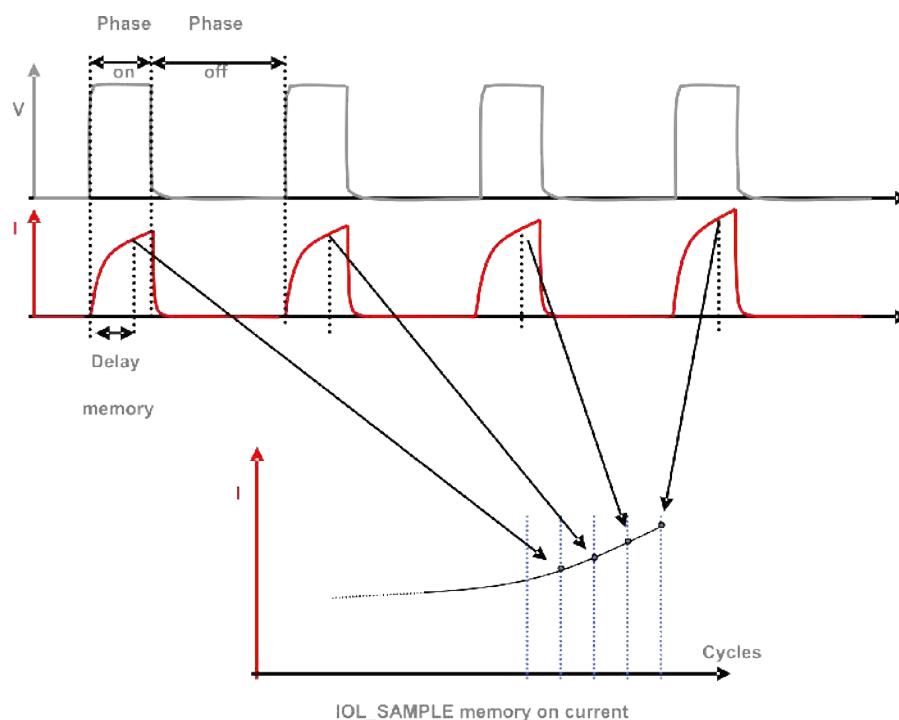
The initial state of the cycling may be programmed. The test can start by the On or the Off phase. This possibility used together with starting of all the groups of a rack (using trigger feature), is used to test two groups in phase opposition

The stopping is asynchronous for cycling in all cases (operator stop threshold or time delays).

IOL commands :

Command	Comment	Par déf.
P :IOL :STATE [0/1/on/off][?]	On/Off cycling state for selected group	0
P :IOL :TON / P :IOL :TOFF [val][?]	On/Off cycling phases duration in seconds (max 250)	60 <sup>(SV)</sup>
P :IOL :FIRST [0/1/off/on][?]	Initial state	on <sup>(SV)</sup>
P :IOL :SET ? [:NEXT? (until END, verbose off only)]	Returns the complete cycling configuration of current group.	

Example of On/Off cycling with memorizing of a cycle moment :



### 3.3.5. Macro features

- Standard Macros :

A macro is an SCPI instructions line saved and executed by Bilt's CPU card on specified instant(s) of the test.

→ A macro belongs to a group, there's 3 macros available per group.

→ Macros are started when both "p:state on" and "p:time:state on" conditions are met.

Command	Comment	Par déf.
<b>P :MACro</b> <b>[No, Exist, DelayTime, LoopTime, "SCPI cmd"]</b> <b>[?]</b>	No = macro number (0, 1 or 2). Exist = 1 if active, 0 if inactive, DelayTime = delay before first execution (in hundreds of ms). LoopTime = duration between each execution (in hundreds of ms). (0 → no loop) SPCI cmd = SCPI instructions line to execute.	<b>-,0,0,0,""</b> (SV)
<b>P:MACro:ATRestart Type</b>	Behavior on group restart without time reset : Type = 0 → continue. Type = 1 → reset. Type = 2 → restart last macro executed, then, continue. (common command for each macros).	<b>0</b> (SV)
<b>P:MACro:REINIT</b>	Resets the time counters of each macro. (common command for each macros).	
<b>P:MAC :SET ?</b> <b>[NEXT? (until END, verbose off only)]</b>	Returns complete macro configuration of current group.	

Example :

```
p:mac:set ?↵
p:mac0,1,10,36000,"i13::temp 20"↵
p:mac1,1,18010,36000,"i13::temp 125"↵
p:mac2,0,0,0,""↵
p:mac:atrestart reinit↵
END↵
```

→In the example above, a temperature controller (i13)  
→will cycle the temperature every hours between  
→20 and 125 °C.

→ On macro execution, a dated event is recorded in group history (See p:hist command). When macros are looped, a single record is produced on the first execution (after applying specified delay).

→ Macros can be programmed with a recurrence that can go down to 100ms. However, no guarantee is given on the accuracy, and, in some cases, you can saturate Bilt's CPU and make the system unstable.

- Advanced macros :

The macros also allows to modify the setup of one or several modules at run-time using computed or predefined values, stored in variables.

The system offers an area of 100 locations to store variables, using floating format, and 10 locations to store indexes, using integer format.

Variables can be accessed by their absolute address (range from 00 up to 99) or thanks to indexes. (which themselves are accessed by their number, from 0 up to 9).

Variables and indexes are in permanent memory, they are set by "\*rst" command to 0.

**WARNING :** the data area is shared by all groups, and therefore all macros inside Bilt rack. Special attention must be given on the data accessed for each macro defined !

Command	Comments	Def.
<b>VAR[<i>val1</i>],[<i>val2</i>]</b>	update data located @ <i>[val1]</i> with value[ <i>val2</i> ], <i>[val1]</i> address ranges from 00 up to 99 <i>[val2]</i> data format uses standard floating values	
<b>VAR[<i>val1</i>]?</b>	read data located @ <i>[val1]</i> <i>[val1]</i> address ranges from 00 up to 99	
<b>VAR:IND[<i>val1</i>],[<i>val2</i>]</b>	update index N° <i>[val1]</i> with value[ <i>val2</i> ] <i>[val1]</i> index number ranges from 0 up to 9 <i>[val2]</i> data format uses integer values from 00 to 99	
<b>VAR:IND[<i>val1</i>]?</b>	read index N° <i>[val1]</i> <i>[val1]</i> index number ranges from 0 up to 9	
<b>VAR:IDM[<i>val1</i>]</b>	setting maximum index value <i>[val1]</i> data format uses integer values from 00 to 99 (useful when running increment function )	
<b>VAR[<i>val1</i>]:ADD[<i>val2</i>]</b>	add the data located @ <i>[val1]</i> with [ <i>val2</i> ] <i>[val1]</i> address ranges from 00 up to 99 <i>[val2]</i> data format uses standard floating values	
<b>VAR[<i>val1</i>]:MUL[<i>val2</i>]</b>	multiply the data located @ <i>[val1]</i> with [ <i>val2</i> ] <i>[val1]</i> address ranges from 00 up to 99 <i>[val2]</i> data format uses standard floating values	
<b>VAR[<i>val1</i>]:DIV[<i>val2</i>]</b>	divide the data located @ <i>[val1]</i> with [ <i>val2</i> ] <i>[val1]</i> address ranges from 00 up to 99 <i>[val2]</i> data format uses standard floating values	
<b>VAR 00:FILL[<i>val1</i>],[<i>val2</i>],...</b>	update data table starting at address 00 with the list of values separated by a comma (data format uses standard floating values)	
<b>VAR[<i>val1</i>]:IFEQ[<i>val2</i>],...</b> <b>VAR[<i>val1</i>]:IFLE[<i>val2</i>],...</b> <b>VAR[<i>val1</i>]:IFGE[<i>val2</i>],...</b>	Stops the SCPI parser if @ <i>val1</i> don't respects the condition. (IFEQ = if equal, IFLE = if lower or equal, IFGE = if greater or equal) Example : <i>var8:ifle 4,9;add 0,1</i> → if (@8 <= 4,9) then (@8 += 0,1).	
<b>VOLT#[<i>val1</i>]#</b> <b>or CURR#[<i>val1</i>]#</b> <b>or LIM:UPP#[<i>val1</i>]#</b> <b>etc...</b>	any standard module commands can be used using indirect data values instead of absolute data : at run time, #[ <i>val1</i> ]# will be replaced by the value of the data located @ <i>[val1]</i> . [ <i>val1</i> ] address ranges from 00 up to 99	
<b>VOLT#i[<i>val1</i>]#</b> <b>or CURR#i[<i>val1</i>]#</b> <b>or LIM:UPP#i[<i>val1</i>]#</b> <b>etc...</b>	any standard module commands can be used using indirect indexed data values instead of absolute data: at run time, #[ <i>val1</i> ]# will be replaced by the value of the data located at the address indicated by the index N° <i>[val1]</i> . after completion, the index N° <i>[val1]</i> will be incremented : +1. If the maximum value specified by the VAR:IDM command is reached, then the index will be reset to 00. <i>[val1]</i> index number ranges from 0 up to 9. This syntax allows reading a table from 00 to MAX then cycling.	
<b>VOLT#d[<i>val1</i>]#</b>	same thing, but, after completion, the index N° <i>[val1]</i> will be decremented. If the minimum value 00 is reached, then the index will be set to the value specified by the VAR:IDM command This syntax allows reading a table from MAX to 00 then cycling.	
<b>VOLT#x[<i>val1</i>]#</b>	same thing, but, after completion, the index N° <i>[val1]</i> will be incremented until the maximum value is reached, then decremented until the minimum value is reached. This syntax allows reading a table from 00 to MAX and MAX to 00 then cycling.	
<b>VAR:AutoReset</b>	Sets or reads the state of index autoreset system. For auto-increment/decrement commands of indexes, if var:ar is programmed to Off, the decrement/increment will stop at the last value. Otherwise, index will be reset to the initial value and decrement/increment will continue.	

- Triggered Infinite Memories

This function allows the user to define the sample position of a memory while a macro is running.

*Principle of memory "TRG" :*

For each group, there are three infinite memories with external trigger (TRG1/TRG2/TRG3) which corresponds to three different instants of memorization.

As all other memories (INF, ROL ...), the TRG(x) ones are defined in reference to a module (a channel) and a parameter (eg : Module3, channel3, TEMPerature).

It's possible to define several memories of the same type (TRG1 for example) in the same group : for instance, one for the module 1 on current and another for the module 2 on voltage.

The "triggered measurement" will be updated at the same time for both of them : at the execution of the SCPI instruction "*mem:trig 1*". This instruction can be included in a macro.

Memories TRG(x) are infinite sample memories which operate exactly as standard INFS memories. They are synchronous of the group, with an initial storage period of 28.125 seconds, multiplied by two at each compression. The difference is the memory point value : it is not the current value of measurement but the last "triggered measurement" of the module, triggered by the command line "*mem:trig (x)*".

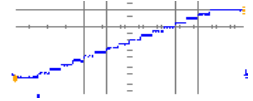
*Notes :*

At each start of the group, the "triggered measurement" of memory is reset to the value 0,00. Accordingly, as long as no update is made by the command *mem:trig x*, it is the value 0,00 which is memorized.

The SCPI command "*mem:trig (x)*" is referenced to the group. The normal usage is "*p(GroupNo);mem:trig (TrigNo)*", however, this selection of the group is unnecessary in macros because the group is pre-selected by the system.

- Examples :

- **10 voltage steps starting from 2V up to 20V, 2s step duration, stop when completed**



**method 1 : using constant increment value** ( allows unlimited slew rate & time values )

MACRO1 / DELAY=0 / no loop : **var 01,2**  
operation : initialize data located @01 = 2

MACRO2 / DELAY=0s / LOOP=2s : **i1;:volt #01#;:var01:add2**  
operation : set module 1 voltage with the data located @01  
then, add 2 to the data located @01

MACRO3 / DELAY=20s / no loop : **p1;:p:stat off**  
operation : stop group

note:

as data located @01 is used with this group, it is requested to use different addresses for other groups.  
macro 3 can be replaced by the time stop function (parameter "step duration" in group properties)

**method 2 : using predefined data values** ( allows arbitrary waveform )

MACRO1 / DELAY=0 / no loop : **var:ind 1,0;idm10;:var 00:fill 2,4,6,8,10,12,14,16,18,20**  
operation : initialize index 1 = 0  
set maximum index value = 10  
initialize data area starting at location 00 with values 2,4,6,8,10,12,14,16,18,20

MACRO2 / DELAY=0s / LOOP=2s : **i1;:volt #i1#**  
operation: set module 1 voltage with the data value located at the address given by index 1  
then, post increment index 1 = +1  
if index 1 = maximum value = 10, then reset index 1 = 0

MACRO3 / DELAY=20s / no loop : **p1;:p:stat off**  
operation : stop group

note : as index 1 is used with this group, it is requested to use different index for other groups.  
The data table always starts at address 00 and all the group use the same table.

- **10 step voltage saw tooth, up to 20V and down to 2V then cycling, 2s step duration**



MACRO1 / DELAY=0 / no loop : **var:ind 1,0;idm10;:var 00:fill 2,4,6,8,10,12,14,16,18,20**

operation : initialize index 1 = 0  
set maximum index value = 10  
initialize data area starting at location 00 with values 2,4,6,8,10,12,14,16,18,20

MACRO2 / DELAY=0s / LOOP=2s : **i1;:volt #x1#**  
operation: set module 1 voltage with the data value located at the address given by index 1  
then, post increment or decrement index 1 = +/- 1  
when index 1 = maximum value = 10, then change slope direction : decrement  
when index 1 = minimum value = 0, then change slope direction : increment

note:

as index 1 is used with this group, it is requested to use different index for other groups.  
The data table always starts at address 00 and all the group use the same table.

The macro1 is identical with the previous example.

The only difference is the command x inside macro2.

Using d command instead of x, gives a constant decreasing slope 20,18,16... 4,2,20,18,16 etc...

### 3.4. Managing alarms and threshold monitoring between groups and instruments

All the modules capable of measurements have programmable thresholds which can stop either the module or the group(s) in which they have been declared.

For “Out of group” modules, if the threshold monitoring is activated, they will stop on any threshold cross : module is in alarm state

“In group” modules, if the threshold monitoring is enabled, will just create a warning on threshold cross. If the group in which they are affected has the threshold monitoring disabled, the group (and therefore corresponding instruments) will continue the test. Otherwise, if the group has the threshold monitoring enabled, the group will stop.

Notes :

- the warning message of the module which generated the warning or alarm will ascend to the group in which its affected.
- If no modules inside group has any threshold activated, the group threshold monitoring command is useless.
- On DC sources the parameter should first of all be chosen (current or voltage) : The monitored parameter will be the one which is not regulated. To do this, you must program the expected mode : voltage regulation / voltage or current (FUNC CV/CC). On most sources this command has no physical effect : the modules have independent voltage and current settings (and measurements), and are regulated in one or the other of the modes according to the load.

Commands at module level :

Command	Comments	By default.
STAt ?	Returns the status: 0 or OFF → Off. Nothing to report . 1 or ON → On. Nothing to report . 2 or WARNING → Threshold exceeded but module is in a group whose threshold alarm is not validated. (p :limit off), and it is not stopped. 3 or ALARM → Threshold exceeded, module stopped.	
LIMit :STAt [0/1/on/off][ ?]	Activates threshold monitoring for this module.	Off <sup>(SV)</sup>
LIMit :FAIL ?	Returns the type of alarm which caused the stop. (LOW, HIGH...)	
LIMit :CLEAr	Deletes and re-arms the thresholds/alarms.	
LIMit :UPPer [val][ ?] LIMit :LOWer[val][ ?]	Programs the upper and lower thresholds. If you wish to monitor only one of the two, enter a value which is out of range for the other.	
LIMit :DELay[val][ ?]	Programs the delay after which the thresholds must be monitored (= measurement stabilization time ). Generally in ms from 1 to 65000. In seconds on temperature modules.	

Group level commands :

Command	Comment	By default.
P :STAt ?	Returns status : 0 or ND → Not defined. 1 or OFF → Off. Nothing to report. 2 or ON → On. Nothing to report. 3 or WARNING → one or several thresholds exceeded in a group but the threshold alarm has not been validated (p :limit off), and the group has not stopped. 4 or ALARM → Threshold exceeded, module stopped. 5 or TSTOP → Stop on end of test. Stop code.	
P :LIMit [0/1/on/off][ ?]	Activates threshold monitoring for this group.	Off <sup>(SV)</sup>
P :STAt :CLEAr	Deletes and re-arms threshold for all modules and the group.	



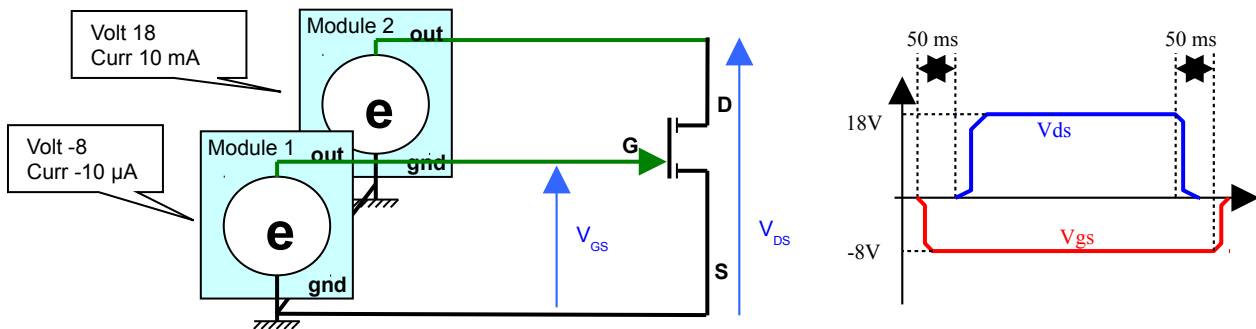
TO RESTART A GROUP STOPPED FOLLOWING AN ALARM YOU MUST FIRST ACKNOWLEDGE AND RE-ARM THE ALARMS. (P :STATE :CLEAR)



## 4. SCPI program samples

### 4.1. Creating group and programming start/stop delays between modules

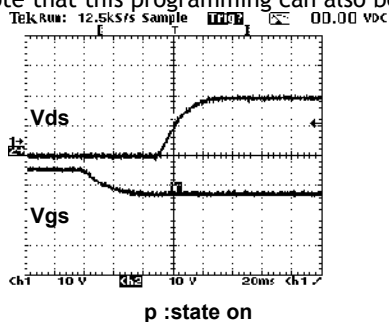
The programmer has to polarize a FET transistor. The transistor must be blocked with -8 Volts. The expected leakage currents are about one  $\mu\text{A}$  on the gate and of one mA on the drain. Not to stress the component, the gate voltage must imperatively be present before, and disappear after, the drain voltage.



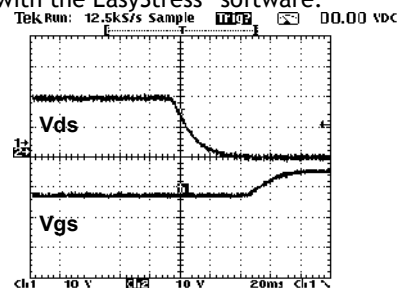
Two BE510 are used, in position 1 and 2 in the rack.

*RST	Rack reset, wait at least 4 seconds before starting again to communicate with the rack.
P1	Group 1 selection
P:DEF	Group creation
P:INST:LIST 1,2	Assignment of modules 1 and 2 at the group 1
I1	Module 1 selection
VOLT -8;CURR -10E-6	Voltage and current setting programming
START:DELAY 100; :STOP:DELAY 50	Start-delay of 100 ms (min value for BE510) and stop delay of 50 ms.
I2	Module 2 selection
VOLT 20;CURR 10E-3	Voltage and current setting programming
START:DELAY 150; :STOP:DELAY 0	Start-delay of 150 ms (50 more than module 1) and stop delay of 0 ms (50 less than module 1).
...	
P1:STATE ON / OFF	Power On/Off of the group of module.
I1;MEAS:CURR?;I2;MEAS:CURR? → -2.2356E-7;8.456E-4	Current readback.

Please note that this programming can also be made very simply with the EasyStress<sup>®</sup> software.



p :state on



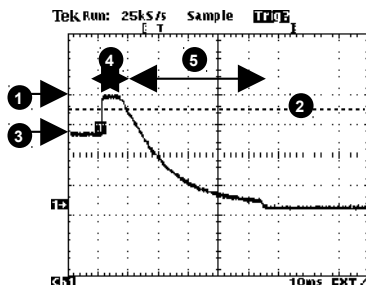
p :state off or main power defect or threshold

## 4.2. Activation of a safe stop on threshold breach

### “Out-of-group” module :

A BE510 module, inserted into the position 10 of a Bilt unit, is used to powered a 5V system with nominal consumption of 2.5A. The module is programmed to stop if consumption exceeds 3A. Nevertheless, the system can consume up to 3.2A during the launching phase, and the threshold should be supervised only 1 second after starting.

*RST	Rack reset - wait at least 4 seconds before starting again to communicate with the rack.
I10	Module 10 selection
VOLT 5 ; CURR 3.5A	Voltage and current setting programming.
FUNC CV	FUNC CV/CC The function is used to choose which is the supervised parameter: - CC regulation awaited on current → threshold on voltage - CV regulation awaited on voltage → threshold on current
LIMIT :LOWER -5 ;UPPER 3	Threshold programming. The lower threshold is not used: an out of range value is entered. The upper threshold is programmed with 3A.
LIMIT :DELAY 1000 ;STATE ON	Threshold delay programming with 1000 ms. Threshold activation.
OUTPUT ON / OFF	Module power on/off
STATE ?	State control: 0 → Off, 1 → On, 2 → Alarm.



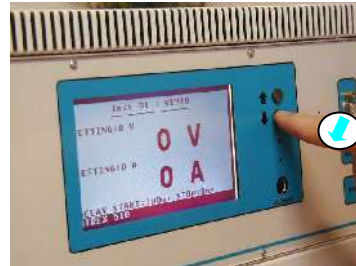
The oscillogram visualizes the current.: 1 → current limitation (3.5A), 2 → threshold (3A), 3 → system nominal consumption (2.5A), 4 → reaction time (hard limitation to programmed setting), 5 → hold time. After a stop on threshold, you can directly re-start with **output on** command, or clear the threshold before with **lim:clear**. If several thresholds are programmed, it is possible to know which one was crossed by using the **lim:fail?** command.

### “In-group” module :

Continuing the example of group program (previous page), a monitoring of high threshold on the drain current of the transistor fixed to 2mA is added:

I2	Module 2 selection
FUNC CV;;LIM:LOW -5;UPP 2E-3	The high threshold of current is programmed with 2 mA. The low threshold is entered with a unreachable value.
LIMIT:STATE ON	Threshold activation - module level.
P:LIMIT ON	Threshold activation - group level.
To retrieve the group state: P:STATE ?	1 → Off, 2 → On, 3 → On and Warning (Threshold active and crossed on module level, but not active on group level), 4 → Off and Alarm (Stop on threshold)
After a stop on threshold, and before starting again: P:STATE:CLEAR	If not, the system refuses to start and out the error “Command incompatible with the current state”...

## V Front panel display usage (BE740 option)



### « GENERAL » SCREEN :

Lists all modules, their On/Off status (video high-lighting of N°), their name (by default the type of module), the essential measurement(s) and finally the group to which they belong (if defined) .

01	BE510	12.001 V	102.12µA
02	BE580	C2 17.23 V	**** A
03	SOURCE	5.223 V	102.2nA
04	DRAIN	6.042 V	249.9mA
05	SOURCE	5.750 V	1.234µA
06	RELAY	01000	100100
07	BE430	450.1 V	223.1µA
08	BE510	-16.999 V	-45.235nA
09	PULSE	11 100ns	5.5µs
10	-	-	-
11	BE510	0 V	0 A
12	-	-	-
13	Etuve	124.2°C	-

### « GROUPS » SCREEN :

Only present if module groups have been defined, it gives for each of them the name, status (on/off warning alarm or time stop) and the test time.

REAL TIME : 28/05/99 14:52:36			
01	LOT 21-02	ON	1026h42
02	LOT 21-03	WARNING	1026h41
03	MOS-256	ON	00:23:42
04	-	-	-
05	-	-	-
06	-	-	-



Inst 13 : Etuve	
TEMPERATURE	
122.5 °C	
K SENS	

Inst 08 : BE528	
SETTING : 450 V	
449.6 V	
SETTING : 1mA	
228.1µA	
DELAY START:150ms STOP:0ms	
500 V 120mA DC-SOURCE	

Inst 01 : BE510	
SETTING : 12 V	
12.001 V	
SETTING : 200µA	
102.15µA	
CH1 1	
CH2 2	
CH3 2 20 V 4 A DC-SOURCE	
CH4 200mA CV -11 V -18mA	
CH5 200mA CC -2.335 V -50mA	
CH6 2mA CV *** V 2.23mA	
CH7 2mA CV 12 V 1.02mA	
CH8 200mA Cc 14.2 V 55mA	
PP 4	
DELAY START:100ms STOP:0ms	
8 CHAN 15V 200mA DC-SOURCE	



00000	
6 7 8 9 10	
00000	
10 CHANNELS ISOLATED SWITCH	

### « MODULE » SCREENS :

One screen per module, different for each type, for very clear display of most module parameters.

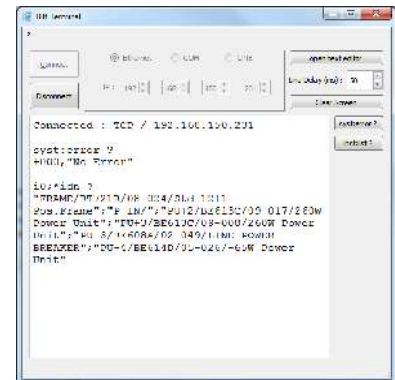
## VI Software tools

## 1. Overview

All Bilt racks are provided along with a free software suite composed of :

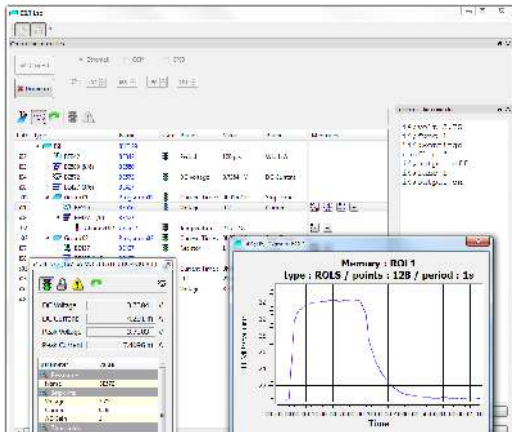
**“BiltTerminal” :**

The minimal interface to communicate with Bilt in a command-line way.



**“BiltLab” :**

An advanced terminal which allows to communicate with Bilt thanks to a graphical interface.



**“TeleBilt” :**

An utility software which allows to update Bilt's firmware.  
(for maintenance purpose).



For Burn'in and Life-test applications, "EasyStress" software can be purchased separately. It allows to control up to 19 Bilt racks networked in the aim of electronic components stress, defining all test conditions, measurements, memorizations and providing real-time monitoring on all running tests in a single display.

Notes :

- All iTest software allows to communicate through any of RS232, RS422, USB, GPIB and Ethernet ports.
- Bilt racks are software independent : As all Bilt's settings are saved in local CPU memory, any PC software interruption has no consequence on Bilt activity, configuration memorization, ...

## 2. Installation

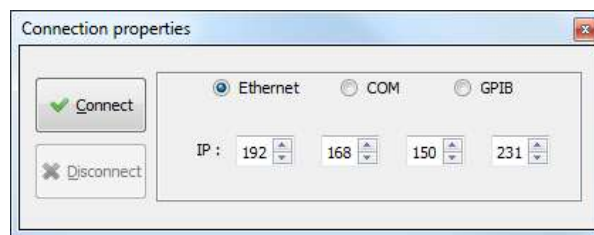
Under windows : run "BiltUtilsSetup.exe" to start installing then follow the instructions.  
(Supported OS : Windows XP SP2, Vista and Seven)

## 3. Setting up communication

"BiltTerminal", "BiltLab" and "TeleBilt" shares the same interface to specify which communication type has to be used to access to Bilt. Note that TeleBilt also has networking feature.

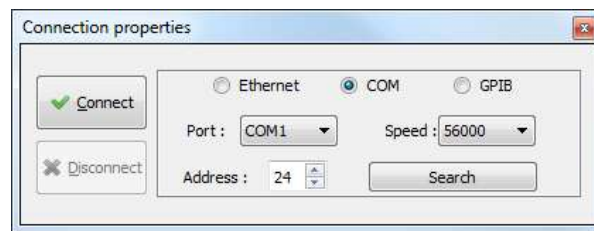
- **TCP port**

Click on « Ethernet » and specify the IP address of the BILT unit :



- **Serial ports (USB / RS232 / RS422)**

Click on « COM », specify the port number ("Port"), the address of the BILT unit ("Address") and the appropriate baud rate of the port ("Speed") :

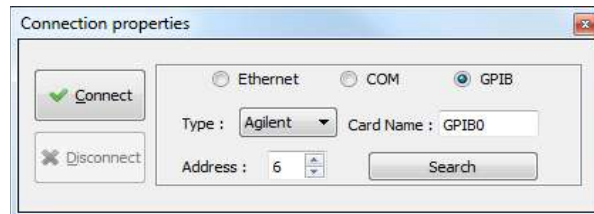


Notes :

- Click on "Search" button to find connected units on selected serial port.
- If desired port number doesn't appear in the list (in case of virtual ports usage), right-click on the connection box and then click on « update available ports ».
- Recommended speed are 56k for RS232 and 208k for RS422 (speed is useless with USB ports)

- **GPIB port**

Click on « GPIB » :



Select the GPIB interface : « NI » for National Instruments (NI488.2) or « Agilent » (Visa)  
Type the GPIB card name(GPIB0 in the example above)  
Specify the GPIB address of the BILT unit (6 in the example above)

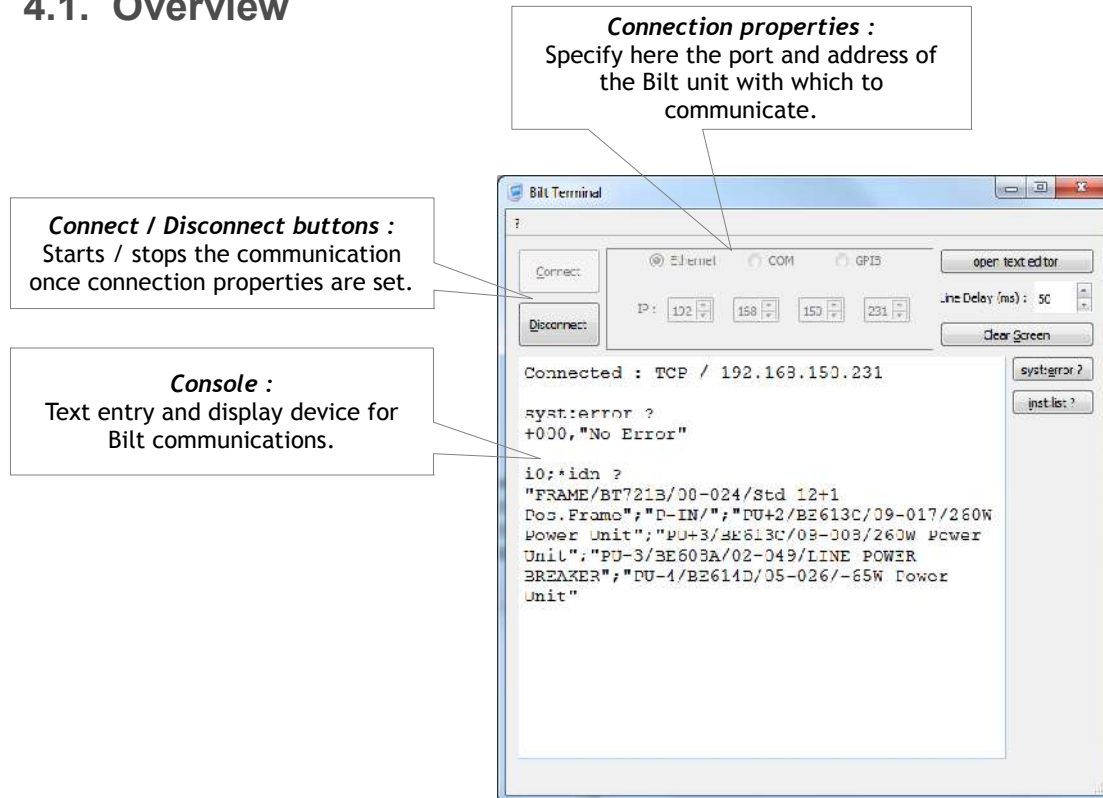
Notes :

- Click on "Search" button to find connected units on selected GPIB port.
- On Agilent interfaces, the name required is the « Visa Id » name (not the « SICL » one).
- The GPIB card name is case sensitive

→ Click on "Connect" button

## 4. Using Bilt with BiltTerminal

### 4.1. Overview



- Specify the way of communicating with Bilt unit (See chapter “1.3.Setting up communication” for details)
- Click on “Connect” button
- If connection is successful, start communicating with Bilt unit. (See chapter TODO “Bilt Programming” to get a reference of Bilt’s SCPI commands)

#### → Special Keys :

- the « Tab » key changes the verbose mode. (not available in GPIB)
- the « Esc » key erases the current line.
- the « Del », « Suppr » and « left arrow » keys erases one character on the current line.
- the « up arrow » and « down arrow » repeats previously sent commands.

## 4.2. Additional features

- **Editable buttons :**

Buttons can be added on the right side of the BiltTerminal under the « syst:error ? » one. To add an editable button, right-click on the right-side of BiltTerminal and click on « Add button ». The following window appears :



Enter the command in the editable line then select « yes » to send the command directly or « no » to add arguments to the command before sending it. (It can be usefull not to send the command for commands that need to be completed like voltage setpoints).

Click « OK », the button function is shown on the button :

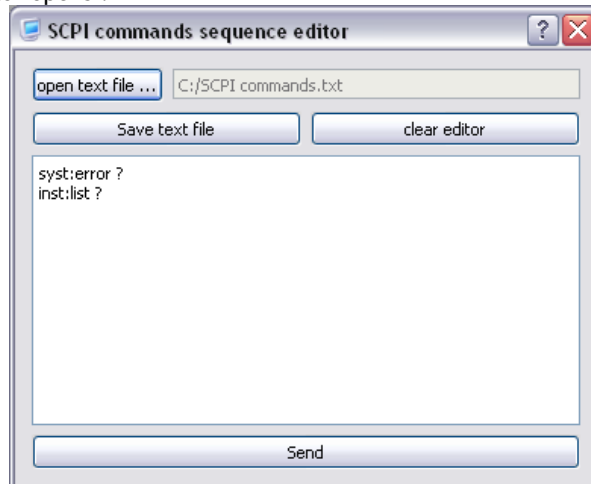


Special tip : add the character « & » in front of a letter to create a keyboard shortcut to the button. For example, typing « &inst:list ? », makes the button accessible thanks to « Alt + i » shortcut.

- **Text editor :**

To send long or frequently used SCPI commands sequence, it can be needed to store them in a text file. There are two ways to send them on Bilt chassis :

- Copy the SCPI commands from any text editor and, then, paste them in the text box of Bilt Terminal.
- Use the text editor included in BiltTerminal : click « open text editor » on the main window, the following editor opens :



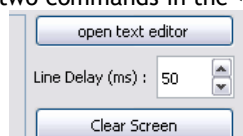
Click « open text file ... » to open an existing text file.

Click « Save text file » to save the contents of the editor.

Click « clear editor » to clear the contents of the editor.

Click « Send » to send the contents of the editor to the connected chassis.

Note : set the time interval to elapse between two commands in the « Line Delay » box on the main window :





### 4.3. Serial port special case

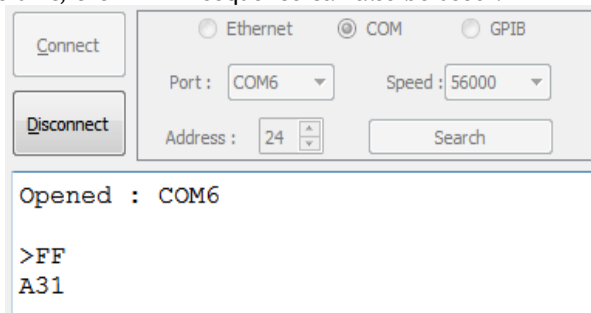
- **RS232 / USB**

When connected in RS 232 or USB, specifying the address is not necessary. To open the port without specifying address, right-click on the connection box and check « Just open port (don't use address) ». When clicking the « connect » button, BiltTerminal will just open the port without any control. The communication will be enabled even if no units are connected.

- **RS 422**

If « Just open port (don't use address) » is checked on RS 422 port, the chassis must be turned in listener mode to communicate with it. To do this, type the sequence « >XX » where XX stands for the address of the unit. For example, if the address of the unit is 47, type « >47 », if connection is successful, the BILT unit should answer « A47 ».

To determine the address of the unit, the « >FF » sequence can also be used :



Connect

Disconnect

☐ Ethernet ☒ COM ☐ GPIB

Port : COM6 Speed : 56000

Address : 24 Search

Opened : COM6

>FF

A31

**WARNING :** Don't type the « >FF » sequence if several chassis are networked on RS 422 port !

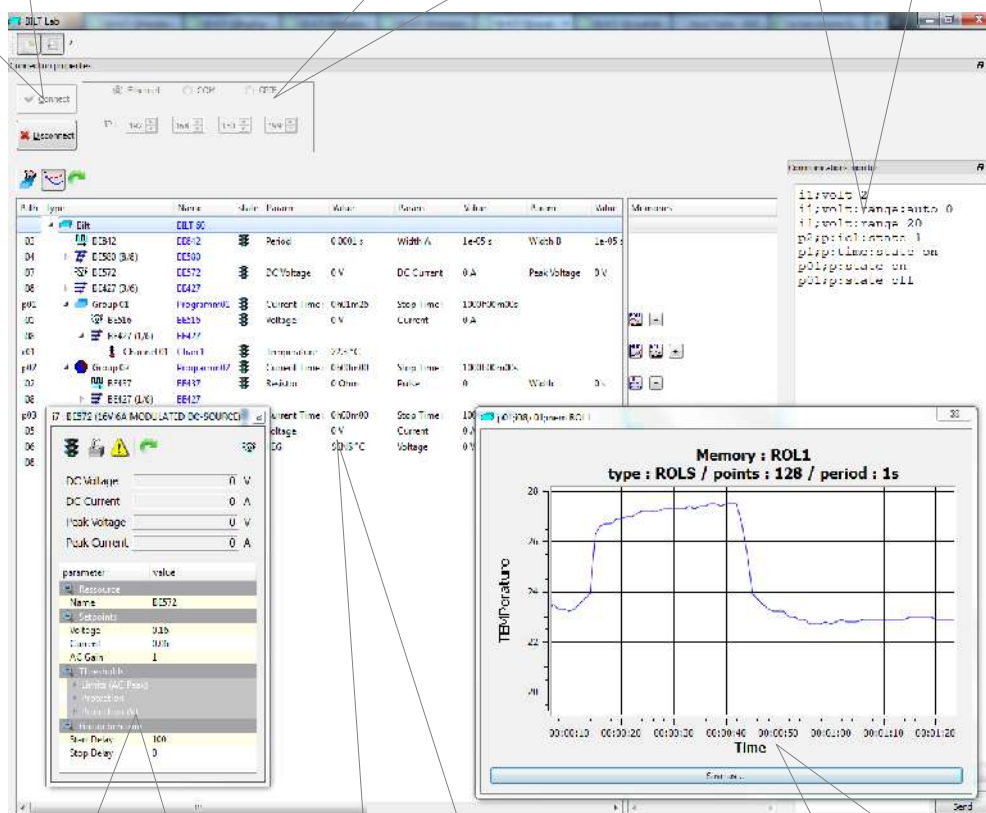
## 5. Using Bilt with BiltLab

### 5.1. Overview

**Connect / Disconnect buttons :**  
Starts / stops the communication once connection properties are set.

**Connection properties :**  
Specify here the port and address of the Bilt unit with which to communicate.

**Communications monitor :**  
Shows all communications with Bilt. Can send SCPI commands as an inline terminal



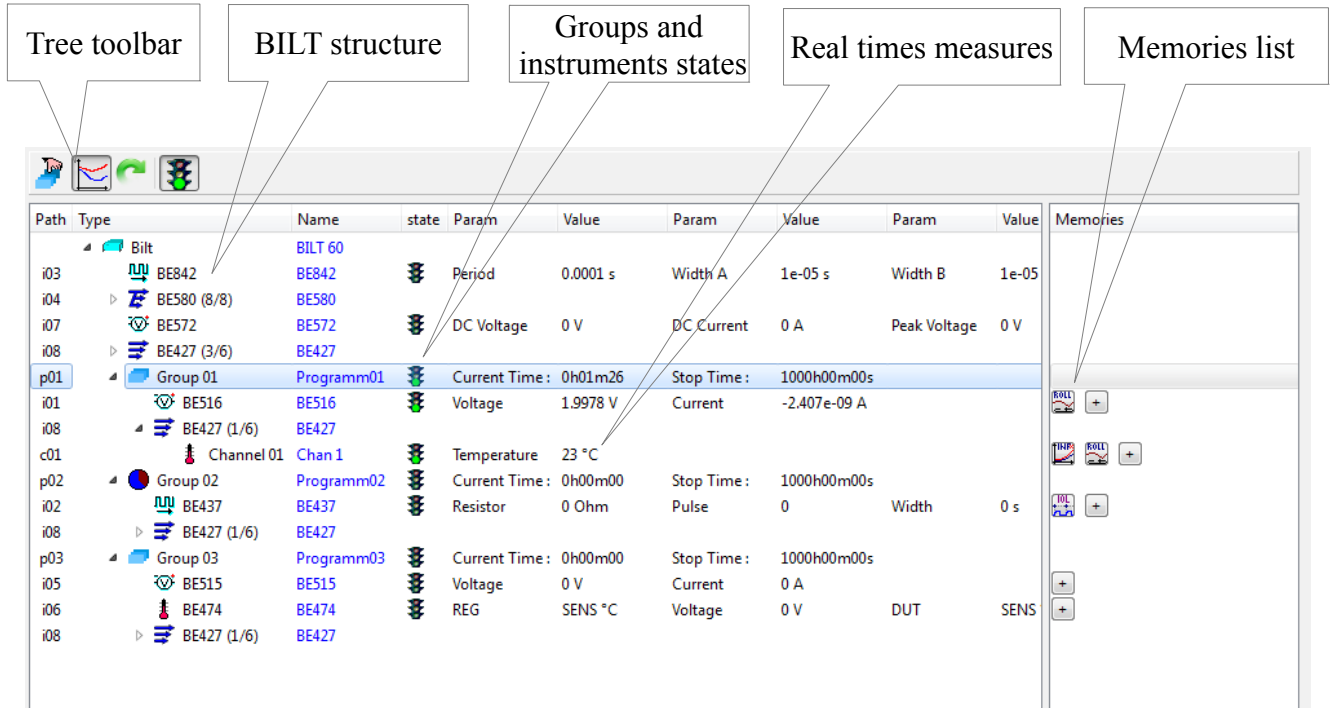
**Control window :**  
All instruments settings are available thanks to dedicated control windows.  
→ double-click on a node in the tree to open corresponding control window

**Bilt tree :**  
The main tool to access to Bilt properties :  
Shows Bilt structure, instruments/groups states, real-time measures and memories

**Memories :**  
Plot defined memories, visualize parameter evolution refreshed in real-time.  
Export memories data in CSV format.

## 5.2. Main tool : the Bilt tree

Once connected to a BILT unit, the BILT tree will show an image of current BILT structure including real time measures and memories :



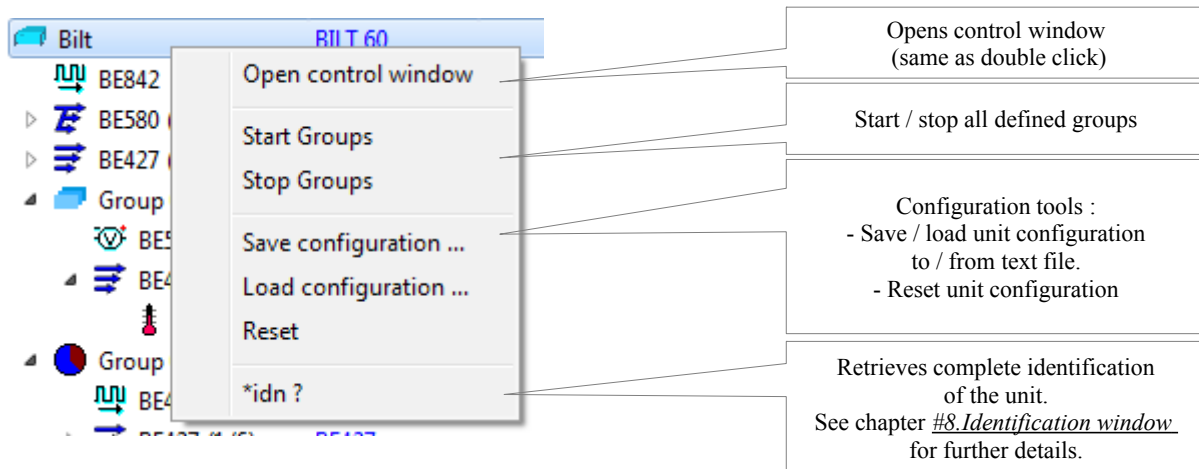
The screenshot shows the Bilt tree interface with the following components labeled:

- Tree toolbar:** Located at the top left, containing icons for file operations and tree management.
- BILT structure:** The main tree view showing the hierarchy of BILT components.
- Groups and instruments states:** A section showing the status of various groups and instruments.
- Real times measures:** A section displaying real-time measurement data.
- Memories list:** A section listing saved memory configurations.

Path	Type	Name	state	Param	Value	Param	Value	Param	Value	Memories
Bilt		BILT 60								
i03		BE842		Period	0.0001 s	Width A	1e-05 s	Width B	1e-05	
i04		BE580 (8/8)								
i07		BE572		DC Voltage	0 V	DC Current	0 A	Peak Voltage	0 V	
i08		BE427 (3/6)								
p01		Group 01								
i01		BE516		Current Time	0h01m26	Stop Time	1000h00m00s			
i08		BE516		Voltage	1.9978 V	Current	-2.407e-09 A			
c01		Channel 01		Temperature	23 °C					
p02		Group 02								
i02		BE437		Current Time	0h00m00	Stop Time	1000h00m00s			
i08		BE437		Resistor	0 Ohm	Pulse	0	Width	0 s	
p03		Group 03								
i05		BE515		Current Time	0h00m00	Stop Time	1000h00m00s			
i06		BE515		Voltage	0 V	Current	0 A			
i08		BE474		REG	SENS °C	Voltage	0 V	DUT	SENS	

This element is the main tool to access to most BILT Lab's features. It's behavior is modeled on the Windows Explorer's tree except that it has columns. These columns are intended to show parameter / measures couples which are refreshed in real-time.

For each node in the Bilt tree, all corresponding features are available thanks to contextual menus : (Contextual menus are shown by right-clicking on the nodes)



The screenshot shows the Bilt tree with a right-click context menu open. The menu options are:

- Open control window
- Start Groups
- Stop Groups
- Save configuration ...
- Load configuration ...
- Reset
- \*idn ?

Callouts explain the functions of these options:

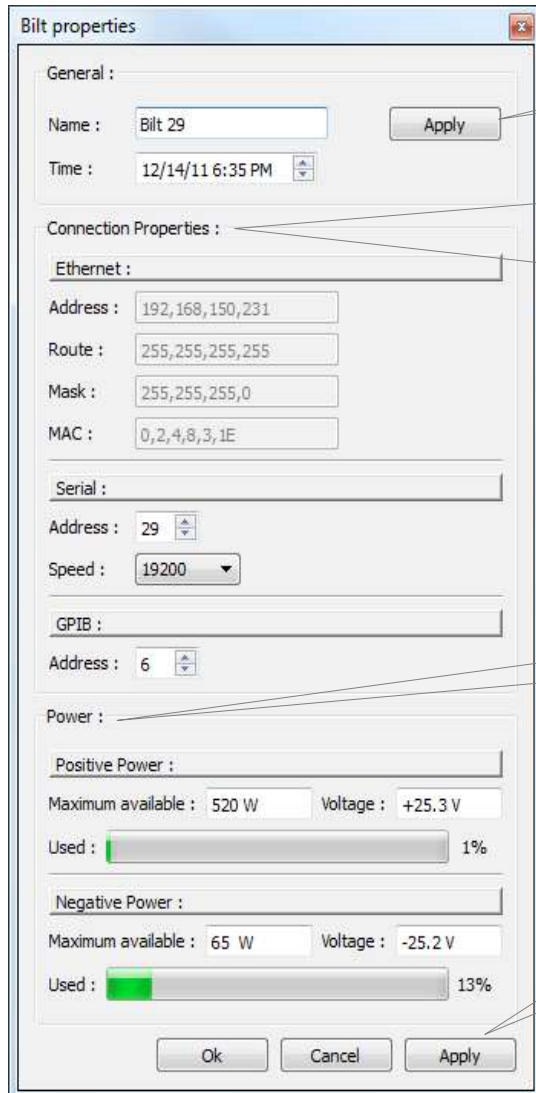
- Open control window:** Opens control window (same as double click)
- Start Groups / Stop Groups:** Start / stop all defined groups
- Save configuration ... / Load configuration ...:** Configuration tools :
  - Save / load unit configuration to / from text file.
  - Reset unit configuration
- \*idn ?:** Retrieves complete identification of the unit. See chapter #8. *Identification window* for further details.

## 5.3. Control windows

To open a control windows, double-click on corresponding node in the tree.

### 5.3.1. BILT control window

The BILT control windows provides access to all system properties :



The screenshot shows the 'Bilt properties' dialog box with the following sections:

- General :**
  - Name : Bilt 29
  - Time : 12/14/11 6:35 PM
- Connection Properties :**
  - Ethernet :**
    - Address : 192,168,150,231
    - Route : 255,255,255,255
    - Mask : 255,255,255,0
    - MAC : 0,2,4,8,3,1E
  - Serial :**
    - Address : 29
    - Speed : 19200
  - GPIOB :**
    - Address : 6
- Power :**
  - Positive Power :**
    - Maximum available : 520 W
    - Voltage : +25.3 V
    - Used : 1%
  - Negative Power :**
    - Maximum available : 65 W
    - Voltage : -25.2 V
    - Used : 13%

Buttons: Ok, Cancel, Apply

On property change, an "Apply" button will appear, click on it to apply the change

Connection Properties :

Be careful when changing connection properties !

To avoid impossible later reconnection, the properties of current connection are unavailable.

In case of serial port usage, we strongly advise to use speeds of 56000 bauds on RS232 port and 208000 on RS422 ports (speed setup is useless on USB port).

Power information :

These informations are read-only

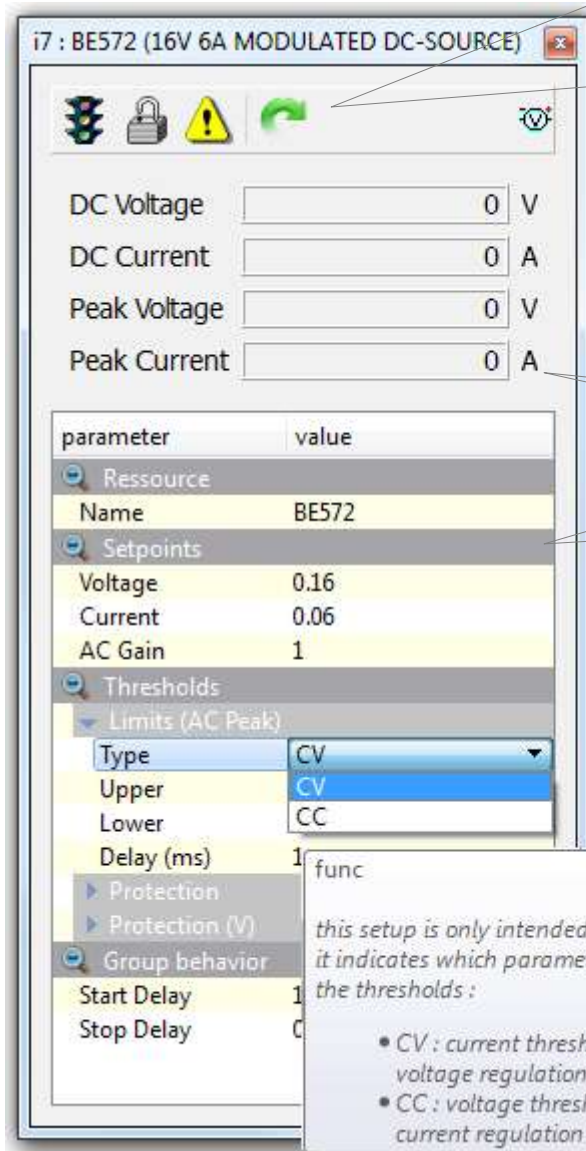
Clicking on the "Apply" button will apply all changed properties of the window,

Clicking on "Ok" will apply all properties changes and then close the window.

Click on "Cancel" to discard changes and close the window.

### 5.3.2. Modules control windows

Each module control window has the same looking :



The toolbar provides three controls of the module (if available for considered module) :

The first push button toggles active / inactive state of the module.

(If an alarm occurs, the reason of the alarm will be shown in the tool tip of this button.)

The second push button toggles active / inactive threshold monitoring of the module (limits).

The third push button clears module alarms.

Then, a fourth button produces a refresh of the control window (useless unless Changes are done thanks to terminal)

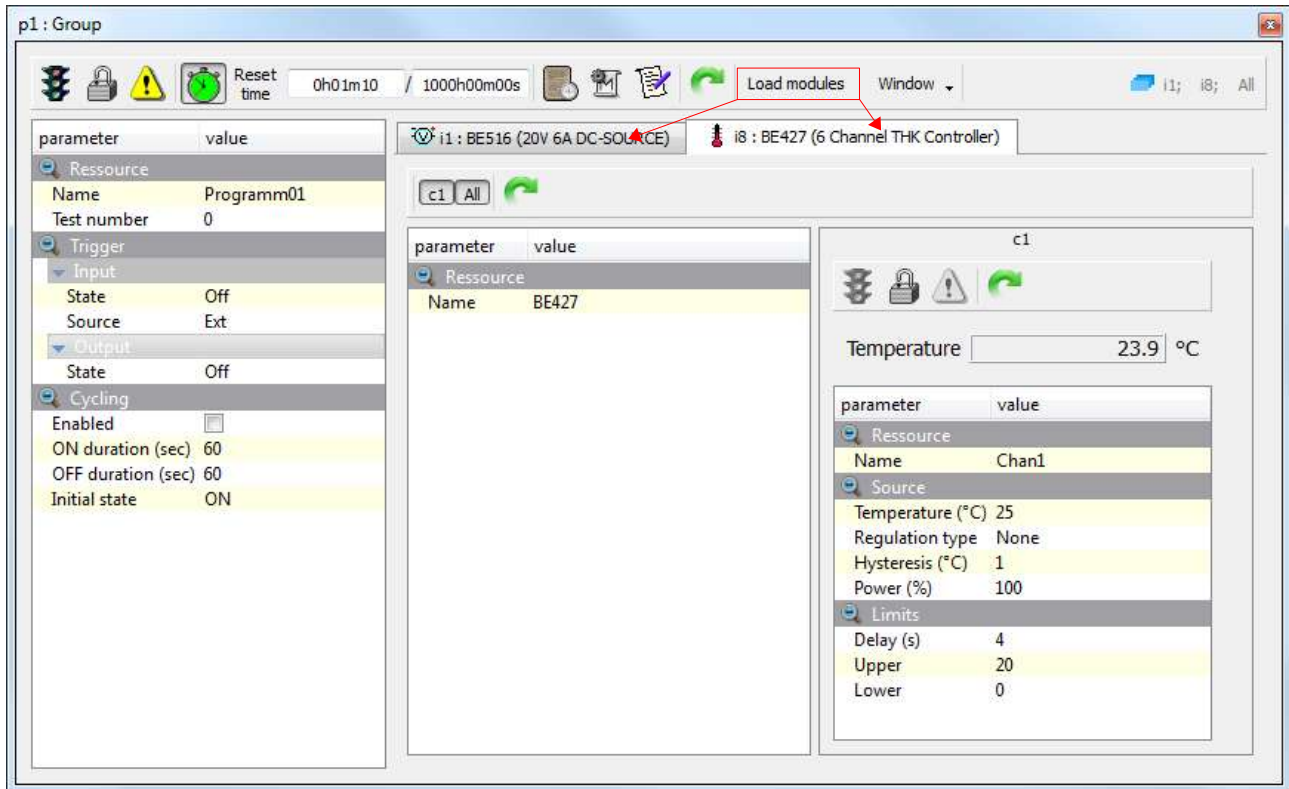
Real time measures

All modules settings are available Through a property tree.

Titles and subtitles can be expanded / collapsed

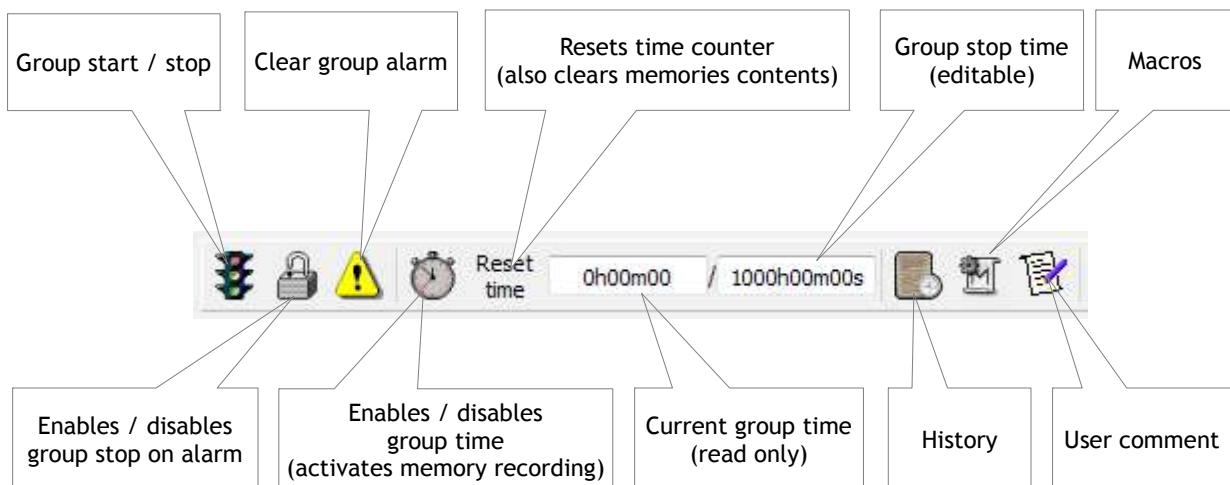
For each setting, corresponding SCPI command And a breve description is available in the property's tooltip

### 5.3.3. Group control windows



\* Group assigned modules can be loaded inside the group control window by clicking on “Load modules”.

All group properties are available in the tree found on the left side of the window and the toolbar. Indeed, the toolbar of group's control windows offers many actions in addition of the traditional tree buttons found in module's control windows toolbar :



**Important note :**

The stop time has to be edited within the toolbar.

To set stop time, two forms can be used : “.,.,.” or with “.h.m.s” :

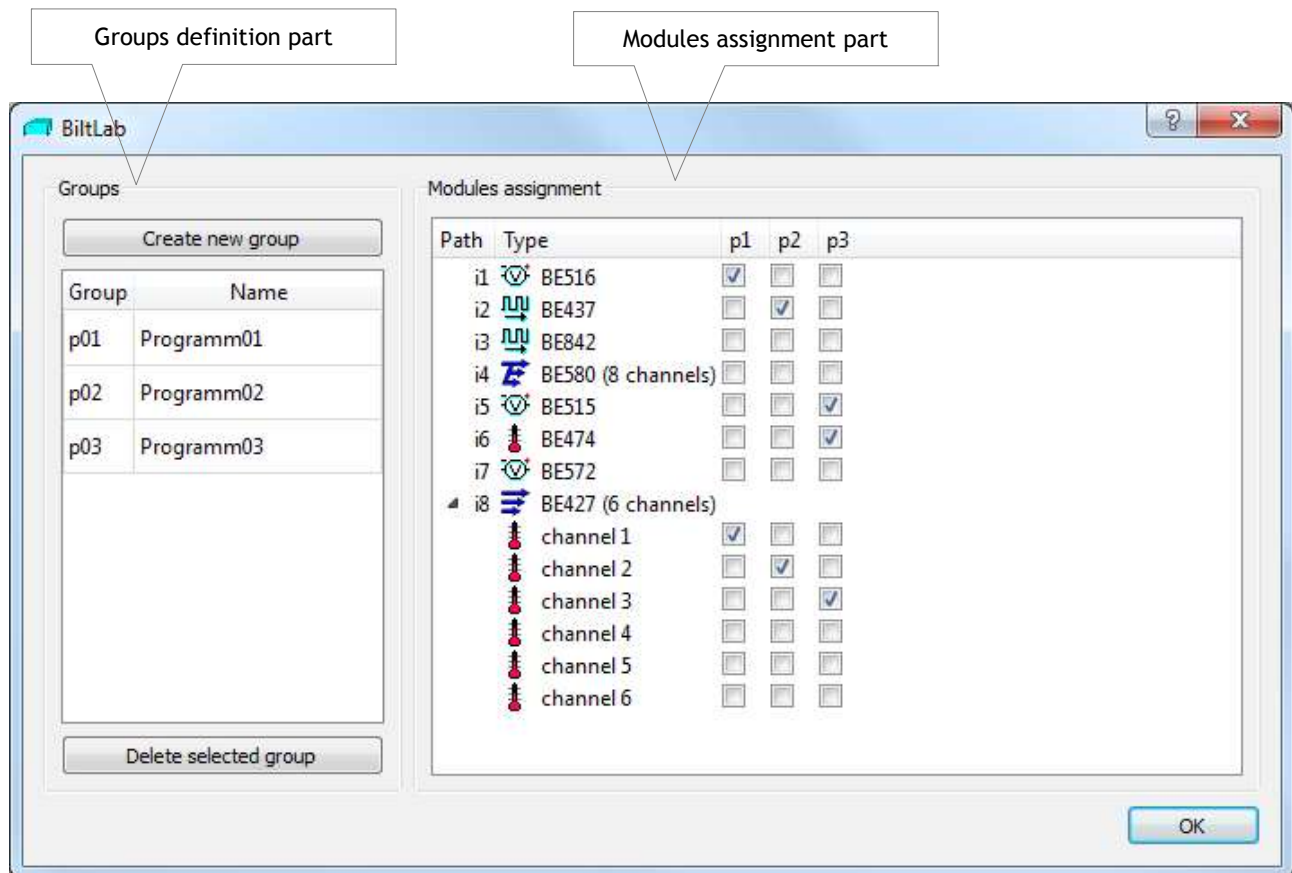
for example : 100 hours can be set thanks to “100,0,0” or “100h0m0s”

## 5.4. Managing Bilt structure

To create / remove groups and assign modules to groups, open the structure editor by clicking on the Bilt tree toolbar button :



The following window opens :





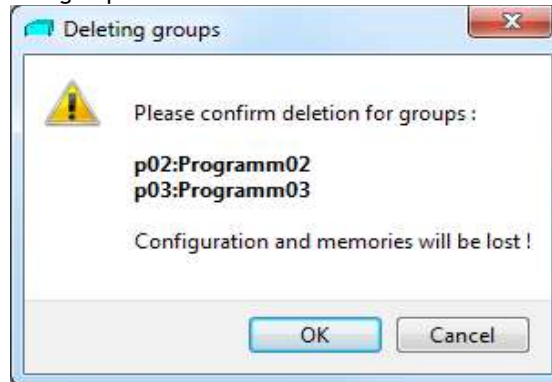
### 5.4.1. Groups definitions

To add groups, use the “Create new group” button :



Note : the defined group name may be changed later in the group control window.

To remove groups, select the groups to remove in the table and use the “Delete selected groups” button :

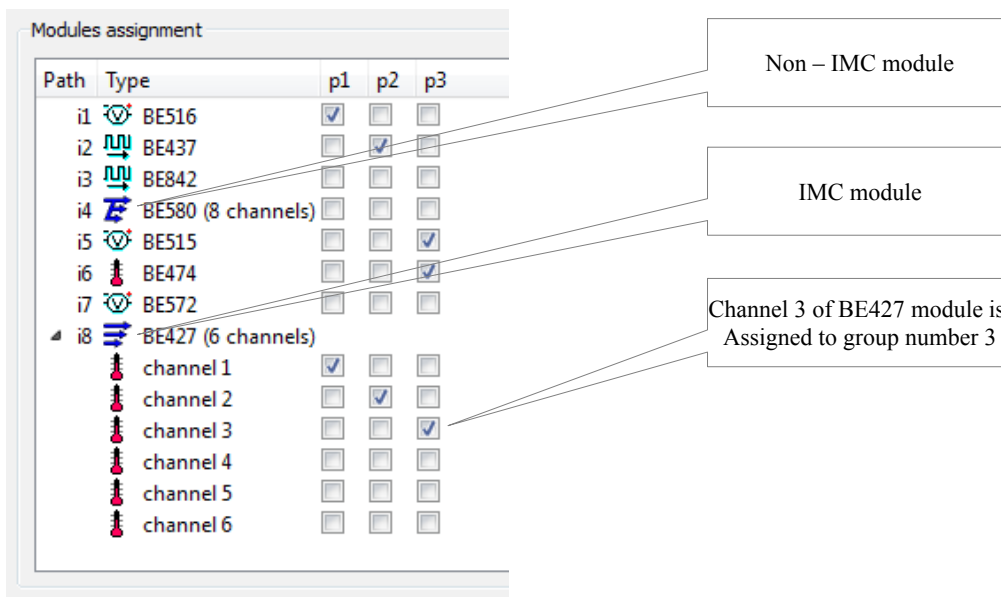


### 5.4.2. Modules assignment

The modules assignment part of the BILT structure editor show all modules plugged in the unit in a tree.

Note : Only IMC modules can be expanded/collapsed, non-IMC modules appears as single channel modules.

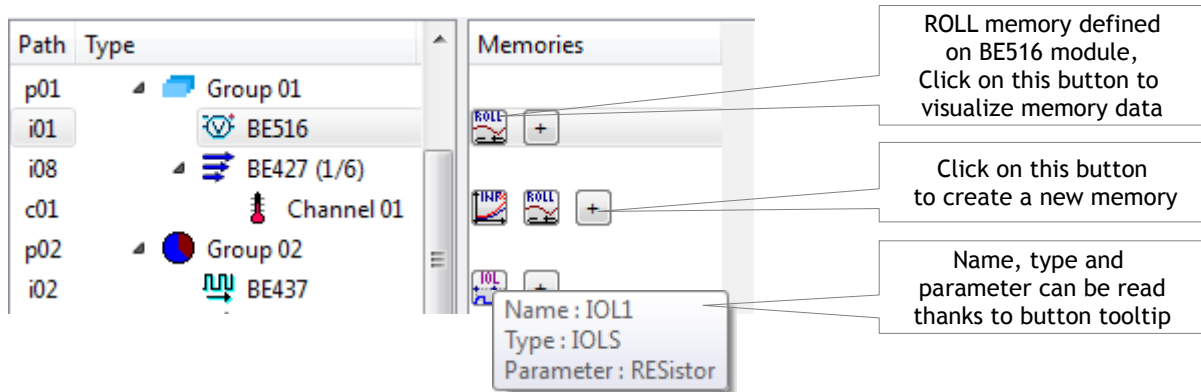
Each column in the tree represents a defined group. To assign a module or channel to a group, check the box in corresponding row / column :



## 5.5. Managing memories

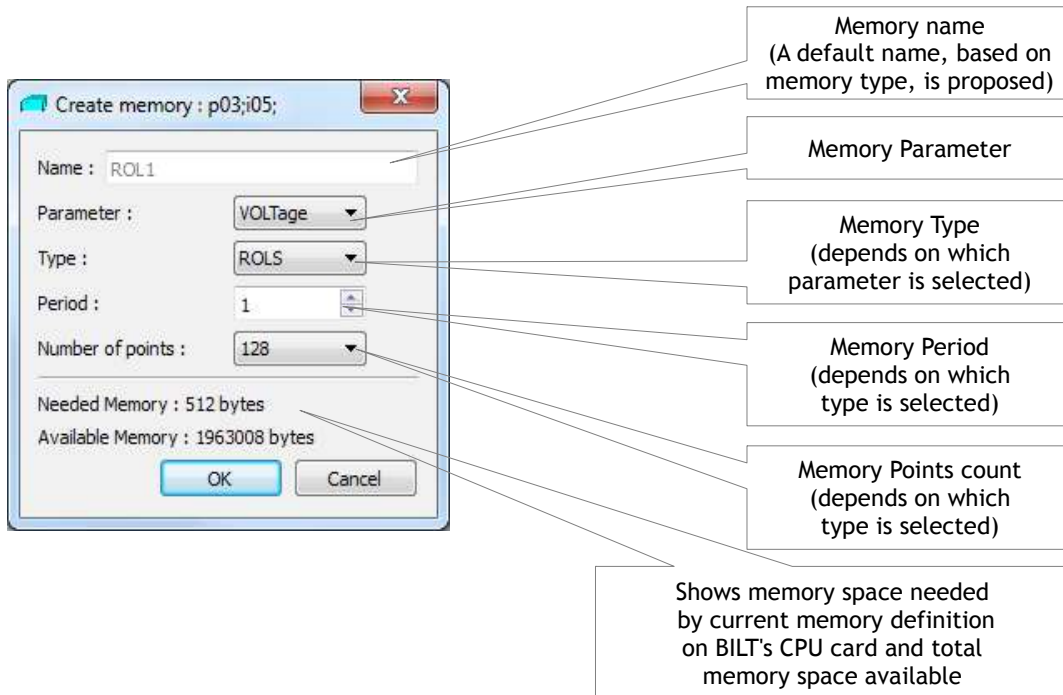
### 5.5.1. Creating / removing / duplicating memories

Defined instrument's memories are displayed side by side with the BILT Tree in a virtual last column :



Note : memories can be deleted or copy / pasted thanks to contextual menus (right-click).

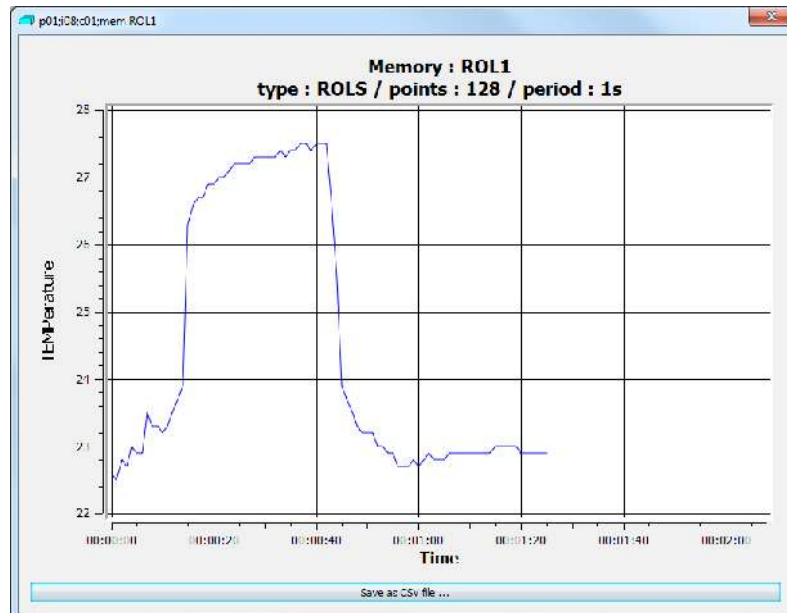
When clicking on memory creation button, the following dialog window opens :



→ Click on "OK" button to create defined memory.

## 5.5.2. Viewing and exporting memories

Click on desired memory button to open corresponding memory window, the following window opens :



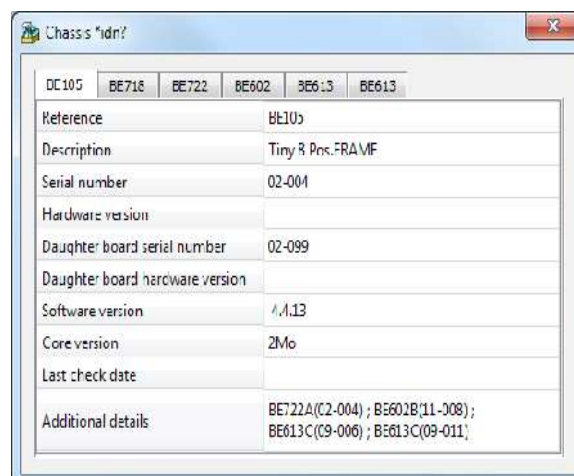
Click on save button to export the memory as text file (CSV format).

### IMPORTANT NOTE :

Retrieving memories data costs a lot of communication time. As a consequence, when many memory windows are open, the overall software performance are slowed.

## 5.6. Identification windows

To retrieve hardware properties of the BILT unit or modules, use the contextual menu (right-click) of corresponding node in the tree and click on “\*idn?”. The following window opens :

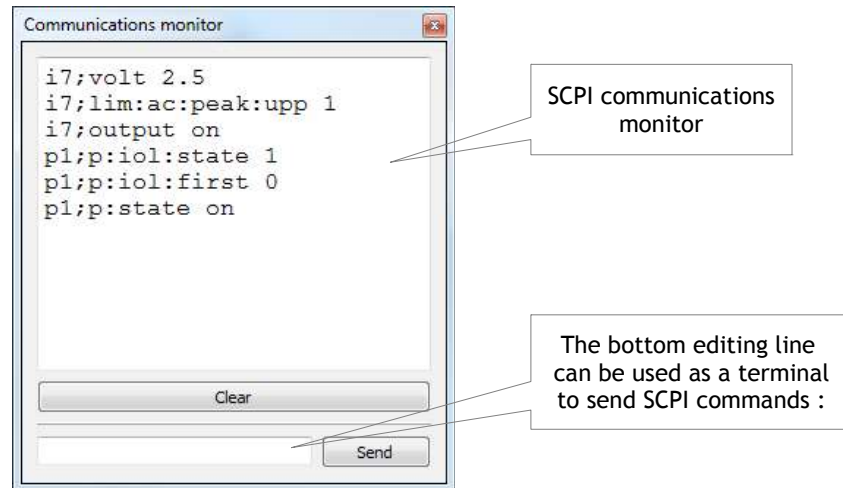


Chassis Identification

DC105	BE718	BE722	BE602	BE613	BE613
Reference	BE103				
Description	Tiny R Proc-FRAMF				
Serial number	02-004				
Hardware version					
Daughter board serial number	02-099				
Daughter board hardware version					
Software version	V.1.13				
Core version	2Mo				
Last check date					
Additional details	BE722A(02-004) ; BE602B(11-008) ; BE613C(09-006) ; BE613C(09-011)				

## 5.7. Communications monitor

All user's communications with the BILT unit appears on the Communications monitor :



### IMPORTANT NOTE :

As a background task sends continuously SCPI commands to the unit (to refresh measures and memories), all SCPI commands must be done with full instruments path addressing :

For example, to send a voltage setpoint command to the module at position 7, the command must be "i7;volt 3". If "i3" is sent first, BiltLab's background tasks will then silently change current module addressing. As a consequence, when sending "volt 7", the module which will receive the command is unknown.

## 6. Updating Bilt's CPU board firmware with TeleBilt

TeleBilt software is a tool that allows users to load firmwares on the CPU card of BILT chassis : BE712 cards (previous generation) or BE718 cards (last generation).

Updating the firmware of the CPU card is a maintenance operation which must only be done under iTest advice.

### 6.1. Preliminary notes on Bilt CPU card firmware update (IMPORTANT)

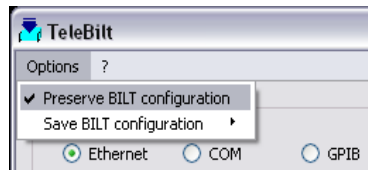
#### 6.1.1. Chassis configuration.

Updating the firmware on CPU card erases chassis configuration and memories contents.

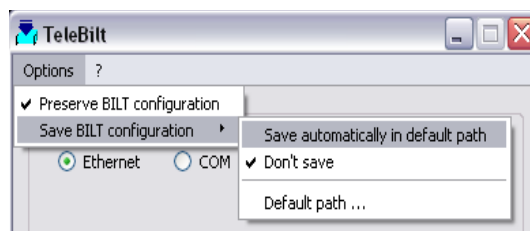
As memories contents can't be restored, it's highly recommended to save them thanks to « EasyStress » or « BiltLab » software.

In order to preserve chassis configuration, by default, « TeleBilt » will save the configuration in a text file before loading the new firmware, and will then restore it.

This behavior can be disabled from the « Options » menu by unchecking « Preserve BILT configuration »:



Once the configuration has been restored, by default, « TeleBilt » will erase the text file that contains the configuration. These text files can be kept by checking « Options » >> « Save BILT configuration » >> « Save Automatically in default path » :



In this case, it's recommended to specify a folder to store configuration text files by clicking on « Default path ... ». (Otherwise, the default path is a folder called « temp » in the installation directory)

### 6.1.2. CPU card types and BILT chassis types

- CPU cards :

There are two kinds of CPU cards : the BE712 one (the previous generation) and the BE718 one (latest generation). Their respective firmwares are not compatibles ! (a BE718 firmware can't be loaded on a BE712 card and vice-versa).

To determine the compatibility between a CPU card and a firmware, TeleBilt analyses the extension of the Intel-Hex file that contains the firmware (\*.H86 for BE712, \*.hex for BE718). Accordingly, don't modify the extension of the Intel-Hex files. This error could only be fixed by the iTest repair service.

- BILT chassis :

There are two kinds of chassis : the « BILT » chassis which contains 13 slots to insert modules and the « Tiny-BILT » which contains only 8 slots. Their firmwares are specific for each of them.

As TeleBilt doesn't control the correspondence between the firmware and the chassis type, it belongs to the operator to make sure of that correspondence.

Note : Loading a « Tiny-BILT » firmware on the CPU card of a « BILT » chassis or inversely is totally reversible and has no « harmful » effect on the material. However, the chassis will have unwanted behaviors and its configuration could not be restored. This will require to reload a suitable firmware.

### 6.1.3. Stop on errors

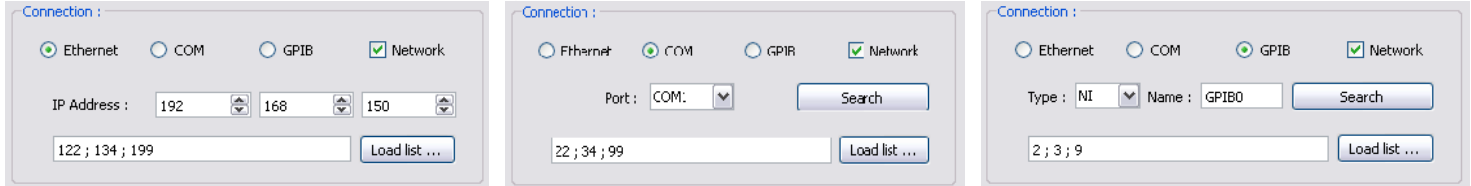
If an error occurs during the upload, TeleBilt will reset the chassis, what will allow the CPU card to reload the previous firmware, and will then restore the configuration of the chassis (if the option "Preserve BILT configuration "is checked). Thus, the chassis will recover its initial state.

At worst, if indeed an unexpected problem occurs, simply turn off and on the chassis so that the CPU card reloads its previous firmware. Then, the configuration could be restored manually as described below.

The loading of firmware into the CPU card is not critical, however, if the operation fails several times consecutively, please contact iTest.

## 6.2. Specifying connection on a network

To connect to several networked chassis, check « Network » on the connection box :

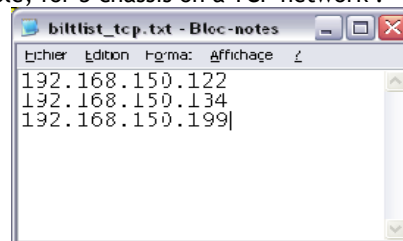


The first screenshot shows the Ethernet connection type with IP addresses 192, 168, and 150 entered. The second screenshot shows the COM connection type with port COM1 and addresses 22, 34, and 99 entered. The third screenshot shows the GPIB connection type with Type NI and Name GPIB0 entered, and addresses 2, 3, and 9 entered.

An editable line appears at the bottom of the connection box. Enter the addresses separated by a « ; ».

Notes :

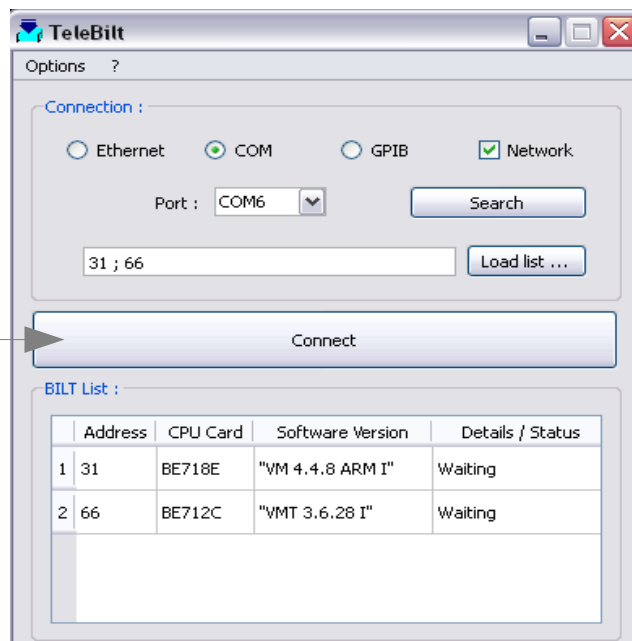
- Desired chassis addresses can be loaded from a text file by clicking on the « Load list ... » button. The text file must contain one address per line. For example, for 3 chassis on a TCP network :



```
biltlist_tcp.txt - Bloc-notes
Fichier Edition Format Affichage
192.168.150.122
192.168.150.134
192.168.150.199
```

- For GPIB and RS422 network, addresses can be found and selected by clicking on the « Search » button.

Once the connection box set, click on the « Connect » button :



The screenshot shows the TeleBilt main window with the connection box set to Network. The 'Connect' button is highlighted with a red arrow. Below the connection box is the BILT List table, which contains two rows of data.

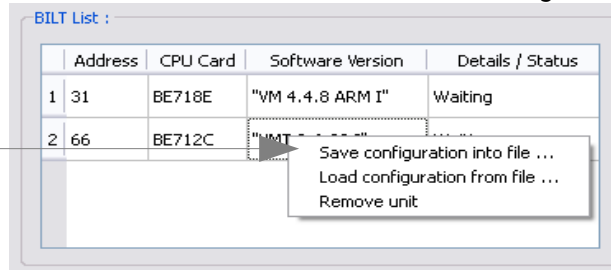
	Address	CPU Card	Software Version	Details / Status
1	31	BE718E	"VM 4.4.8 ARM I"	Waiting
2	66	BE712C	"VMT 3.6.28 I"	Waiting

The CPU cards of the connected chassis appears in the table of the « BILT List » box.



## 6.3. Saving / Loading manually the configuration

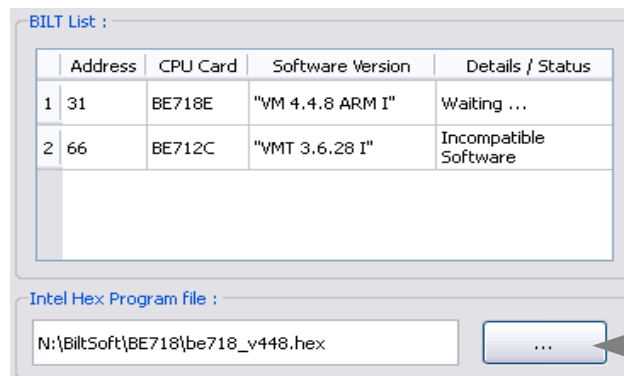
Once connected, it is possible, regardless of the firmware loading, to save or restore the configuration of a chassis by right-clicking in the table on the row that refers to desired chassis. The following contextual menu opens :



- Click on « Save configuration into file ... » to save the chassis configuration. (TeleBilt will then ask the user to specify a text file to write the configuration)
- Click on « Load configuration from file ... » to restore a configuration. (TeleBilt will then ask the user to specify a text file which contains the configuration)

## 6.4. The Intel-Hex files that contains the firmwares

To specify the Intel-Hex file that contains the firmware to load, click on the « ... » button in the « Intel Hex Program file » box :



The file path appears in the editable line.

## 6.5. Loading the firmware on the CPU card

### 6.5.1. Last checkings before launching the update

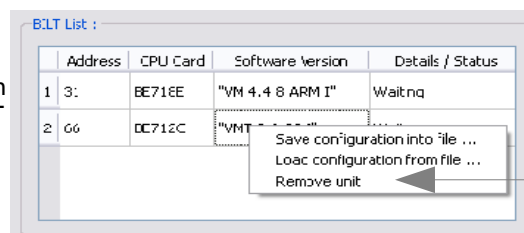
- CPU card types:

If different CPU card types are connected, verify that the « Detail / Status » cell contains « Incompatible Software » on the lines that refers to CPU card incompatibles with selected firmware (BE712 CPU card and BE718 firmware in the example above)

- Chassis types :

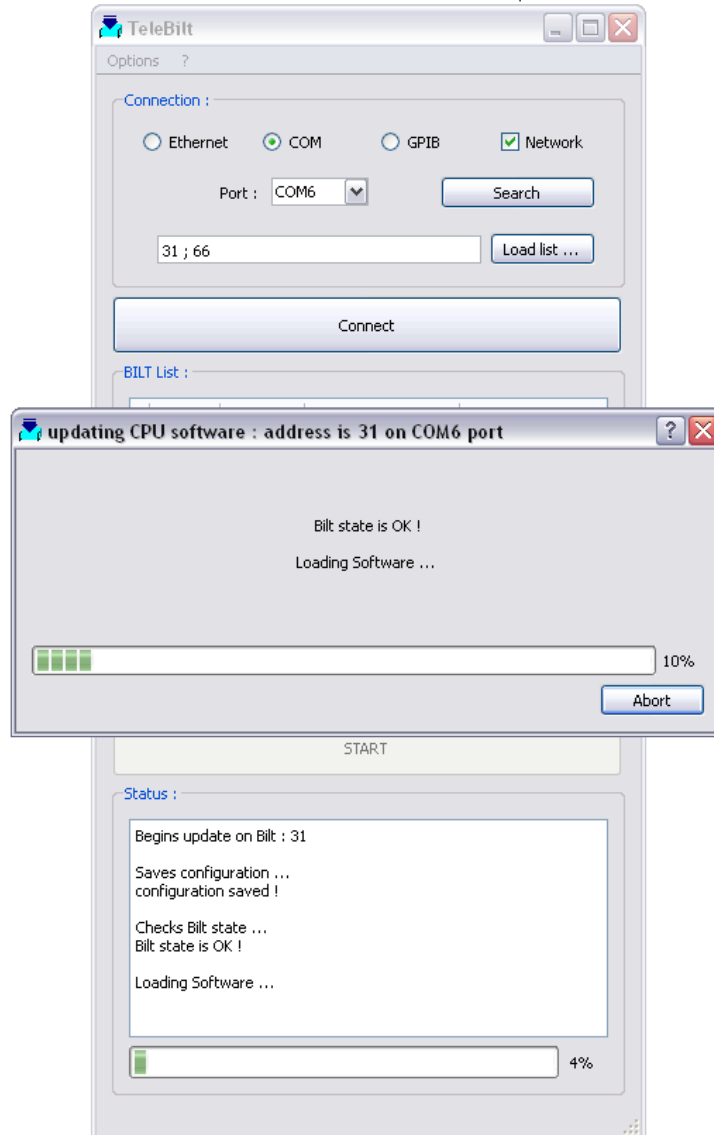
Verify that the firmware suits chassis type.

In both cases, it is recommended to disconnect the chassis that mustn't load the firmware by removing their addresses in the connection box or by clicking on « Remove chassis » in the contextual menu of the BILT List (right-click on the table) :



### 6.5.2. Launching the update

Once connected to desired chassis and the Intel-Hex file specified, click on the « START » button !



A progress window appears.

The process can be aborted at any time by clicking on the « Abort » button.

## VII Calibration

For each module DC or AC source, Itest develops an automatic calibration program using highly accurate laboratory instruments which are regularly calibrated by certified companies. Their type, serial number and calibration date are included in the test reports.

DC and AC source module's accuracy specifications are guaranteed for two years following a calibration.

iTest offers a two-year metrological inspection contract for the Bilt modules. Some of our major customers have successfully implemented their own metrological inspection benches using Bilt DC source modules. However, these programs risk being rather cumbersome, due to the large number of ranges of certain modules.

## VIII Maintenance

- Hardware maintenance

No repair or hardware maintenance operation may be performed by the customer without the agreement of iTest. iTest disclaims all responsibility for any damage or injury caused by a maintenance operation not made in its workshop.

In case of breakdown, contact iTest first (“warranty” section).

- Software maintenance

## IX Warranty and customer support

All the Bilt products in the catalog come with a 2 year parts and labour warranty, when returned to our workshops. A telephone support service is also available for the same period.

In addition, iTest offers a contract to extend the warranty and support service for periods of 2 years.

Products no longer covered by our warranty can be returned to be fixed after a phone agreement, in the limit of ten years after their purchase date.

***Technical and commercial support, after-sales service :***

From monday to friday (except French public holidays), 10:00AM-5:00PM (Central European Time)

Phone : (+33) (0) 651 548 130

Fax : (+33) (0) 651 548 139

E-mail : [itest@itest.fr](mailto:itest@itest.fr)



**i T E S T – Bilt Systems**

**☎ 05 61 54 81 30 - ☒ 05 61 54 81 39**

**119, Rue de la Providence – 31500 TOULOUSE**

**Ltd with a capital of 150 000 €**

**APE 742C - RCS B405 318 577 - Code TVA FR21 405 318 577**

***itest@itest.fr***

***WWW.ITEST.FR***