BATTERY LOAD UNIT BLU SERIES &

EXTRA LOAD UNIT BXL SERIES

Manual



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1 Introduction

The purpose of this Manual is to provide helpful instructions on how to use the BLU instrument safely, properly and efficiently. It contains information on how to use the BXL Extra Load units as well.

Included instructions will help the user to avoid unsafe situations, reduce maintenance costs and will ensure the reliability and durability of the BLU/BXL instrument.

The BLU must be used in accordance to all existing safety requirements and regulations based on national/local standards for accident prevention and environmental protection.

1.1 Safety Instructions

Safety is the responsibility of the user. Before operating the BLU, please read the following safety instructions carefully.

It is not recommended that the BLU/BXL is used (or even turned on) without a careful observation of the instructions listed in this Manual. The BLU/BXL should only be operated by trained and authorized personnel.

1.1.1 Safety Terms and Symbols

Terms in this Manual. The following terms may appear in this manual:
WARNING: Warning statements identify conditions or practices that could result in injury or loss of life.
CAUTION: Caution statements identify conditions or practices that could result in damage to this product or to other property.

Terms placed on the Device. The following warning terms used in this document may appear on the device:
WARNING: Indicates that potential hazard may occur.
CAUTION: Indicates that potential damage may occur to the instrument or to the test object connected to the instrument.
Symbols on the Device. The following symbols may appear on the device:



Refer to Manual



Protective Earth Terminal



Refer to Manual

1.1.2 Terms of Use

- The BLU/BXL shall be used only if it is in good technical condition. Its use shall be in accordance with local safety and industrial regulations. Adequate precautions must be taken to avoid any risks related to high voltages associated with this equipment and nearby objects.
- The BLU/BXL is intended exclusively for the application purposes specified in the “Intended Use” section. The manufacturer and distributors are not liable for any damage resulting from wrong usage. The user bears responsibility in case of not following the instructions defined in this document.
- Do not remove the protective casing of the BLU/BXL.
- All service and maintenance work must be performed by qualified personnel only.

1.1.3 Orderly Practices and Procedures

- The Manual shall always be available on the site where the BLU/BXL is used.
- Before using the BLU/BXL, all personnel (even personnel who only occasionally, or less frequently, work with the BLU/BXL) assigned to operate the BLU/BXL should read this Manual.
- Do not make any modifications, extensions, or adaptations to the BLU/BXL.
- Use the BLU/BXL only with the original accessories provided by its manufacturer.
- Use the BLU/BXL and its original accessories for the device's intended use only.

1.1.4 Instrument Maintenance

The device should be kept clean in order to prevent excessive cases of dust or other contaminants affecting its operation. It should be cleaned with water/isopropyl alcohol after any dirt/contaminants are noticed on its surfaces.

1.1.5 Operator Qualifications

- Testing with the BLU/BXL should only be carried out by authorized and qualified personnel.
- Personnel receiving training, instruction or education on the BLU/BXL should remain under the constant supervision of an experienced operator while working with the test set and the test object.

1.1.6 Safe Operating Procedures

- Hazardous voltages of up to 480 V can occur inside the BLU/BXL. Therefore, it is not permitted to remove the protective casing of the BLU/BXL.
- Hazardous voltages exist on the terminals of the BLU/BXL. Switch off and unplug the BLU/BXL before touching the connections, especially if a fault is suspected.
- Before putting the BLU/BXL into operation, check the test set for any visible damage.
- Do not operate the BLU/BXL under wet or moist conditions (condensation).
- Before putting the BLU/BXL into operation it is important to assure device is positioned in such a way its cooling is not obstructed by other objects and there is no risk of overheating during its deployment.
- Before running the parallel discharge test with two or more BLU/BXL it is important to provide the hot air from one device is not directed towards another device.
- When setting up the BLU/BXL, make sure the air slots of the test set remain unobstructed. Do not operate the BLU/BXL if explosive gas or vapors are present.
- First connect the cables to the device and then to the tested object, after the test is completed disconnect the cables from the test object first and then from the device.
- Only the external devices which meet the requirements for SELV equipment according to EN 60950 or IEC 60950 should be connected to the BLU/BXL through the serial interface.
- Removing the BLU/BXL protective casing will void the warranty. Any work inside the instrument without prior authorization from DV Power will also void the warranty.
- If the BLU/BXL seems to be malfunctioning, please contact the DV Power Support Team (refer to the "Manufacturer Contact Information" section) after previously checking the "Error Messages" section.
- Every terminal should be checked and verified before connecting the BLU/BXL. Ground connections may be left in place.
- Do not use the BLU/BXL without the extra protective ground cables supplied with the BLU/BXL. It must never be operated in a non-grounded configuration as this may result in an electric shock to the user or damage to the device. Always establish this connection first before establishing any other connections and remove this connection as the very last one.

Note: Never open the measuring circuit while the test is in progress as dangerous high voltage may occur.

Never disconnect cables from the battery while the test is in progress. This can cause excessive DC arc flash on external terminals.



Be aware of the heat created during the discharge test.

1.2 Power Supply

- Supply the BLU/BXL only from a power outlet equipped with protective ground.
- Besides supplying the BLU/BXL from phase-neutral (L1-N, A-N), it may also be supplied from phase to phase (e.g., L1-L2; A-B). However, the voltage must not exceed 264 V AC. Please refer to the "Technical Data" section.
- The BLU/BXL should be positioned in such a way that it is possible to safely disconnect it from the power supply at any moment.

WARNING / AVERTISSEMENT

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Il s'agit d'un produit de classe A. Dans un environnement domestique, ce produit peut provoquer des interférences radio, auquel cas l'utilisateur peut être amené à prendre des mesures adéquates.

1.3 Intended Use

The Battery Load Units - BLU series are stand-alone or PC-controlled battery capacity test sets, based on a state-of-the-art technology, using the most advanced power electronics solutions with coolers and fans integrated into device. The Battery Extra Load Units - BXL Series can be used as an additional load to be used in combination with BLU series if required discharge current or power exceeds the capacity of single / available BLU devices.

The BLU / BXL series devices are the lightweight solution developed to meet customer's wide ranging test procedures (standardized as well as customized). Using a BLU device, the capacity test is performed in an accurate, user-friendly way in accordance with battery testing standards (IEEE 450-2010 / 1188-2005 / 1106-2015, IEC 60896-11/22 and other relevant standards).

The capacity test / discharging can be performed at constant current, constant power, constant resistance or in accordance with a pre-selected load profile. The discharge test can be conducted even in case a battery remains connected to the load – by measuring and compensating the load current during the process.

The BLU devices are used for measuring the capacity and full voltage of the batteries that serve as backup power supply in (but not limited to):

- Power plants
- Telecommunication systems
- Generator excitation systems
- Substations
- Protection and control systems

The BLU devices provide the discharge current of up to 340 A and are applicable to battery strings of up to 480 V DC battery levels.

1.4 BLU & BXL Series - Models

BLU100A



- weight – 12,8 kg (28.2 lbs.)
- discharge power – up to 14,2 kW
- discharge current – up to 160 A
- designed for 6 V – 300 V DC battery systems

BLU200A



- weight – 14,5 kg (32 lbs.)
- discharge power – up to 19,7 kW
- discharge current – up to 240 A
- designed for 6 V – 300 V DC battery systems

BLU340A



- weight – 20,6 kg (45.4 lbs.)
- discharge power – up to 28,4 kW
- discharge current – up to 160 A
- designed for 6 V – 300 V DC battery systems

BLU110T

	• weight – 12,8 kg (28.2 lbs.) • discharge power – up to 8,5 kW • discharge current – up to 150 A • designed for 6 V – 60 V DC battery systems

BLU220T

	• weight – 15,1 kg (33 lbs.) • discharge power – up to 19,2 kW • discharge current – up to 350 A • designed for 6 V – 60 V DC battery systems

BLU360V

	• weight – 20,6 kg (45.4 lbs.) • discharge power – up to 28,4 kW • discharge current – up to 160 A • designed for 6 V – 480 V DC battery systems

BXL-A

	• designed for parallel operation with BLU-A models • applicable to 6 V – 300 V DC battery systems • weight – 12,5 kg (28 lbs.) • discharge power – up to 25,4 kW • discharge current – up to 250 A

BXL-T

	• designed for parallel operation with BLU220T device • applicable to 6 V – 60 V DC battery systems • weight – 12,5 kg (28 lbs.) • discharge power – up to 17,9 kW • discharge current – up to 310 A

BXL-V

	• designed for parallel operation with BLU360V device • applicable to 6 V – 480 V DC battery systems • weight – 16,0 kg (35 lbs.) • discharge power – up to 35 kW • discharge current – up to 190 A

2 Description

2.1 Front Panel Components

2.1.1 BLU SERIES



1. **4,3'' color touch screen display**
   - Displays settings during device test mode selection, as well as the measured values during and after test operation.

2. **Keyboard**

   To control the device please use:
   - ***UP/DOWN*** buttons to set test parameters and to navigate through the **MEMORY** menu.
   - ***RIGHT*** buttons to navigate through active numerical field.
   - ***ENTER*** button to confirm defined test parameters, language, time and date, as well as to go to the next numerical field and screen if nothing needs to be modified on the active one.
   - ***STOP*** button to stop a test, to acknowledge alarm buzzer and to return to the previous numerical field or screen.
   - ***START*** button to start the test.
   - ***SET*** button to go to **SETTINGS** menu (Limit type language, time & date, help update), and **LOAD** menu while the test is in process.
   - ***TEST*** button to define test type and test mode
   - ***LIMITS*** button used to enter in the limits menu
   - ***MEM*** button to go to **MEMORY** menu.

3. **Flash drive**
   To transfer data from device's internal memory onto an external memory stick.
4. **External input (EXT IN) and external output (EXT OUT)**
   External input and output are Ethernet ports used to connect two or more BLU devices when parallel discharge test is applied. Connection is established using a network cable and RS485 communication. BLU100A does not provide parallel operation feature.
5. **Current probe**
   Current probe channel serves to connect the current probe, in order to measure current value that is being pulled (drained) from a battery by BXL or any other load.
6. **Emergency STOP button**
   If an unexpected or unwanted action occurs during a test, emergency **STOP** button can be used to terminate this action by stopping the test and preventing risks that may occur. Besides emergency button and overcurrent protection BLU is equipped with additional fuse as the last level of protection.
7. **Interface**
   USB serial interface is provided to connect to an external computer, if required.
8. **Alarm**
   This channel is used for connecting the BLU with an external ALARM buzzer. The external ALARM buzzer will be controlled and activated according to received commands from the BLU.
9. **Current and Voltage terminals**
   The instrument is equipped with current and voltage test cable terminals.
10. **External Load trigger**
    Used for triggering external load if a BXL device is connected.
11. **Protective Earth Connector**



For protection against parasitic currents or voltages, always connect the BLU protective earth connector to the protective ground (PE). Use only the manufacturer supplied cable.
For safety reasons, always establish this connection before establishing any other connections, and remove this connection as the very last step.

12. **Mains Power Connector and Power Switch**



- **I** In this position, the BLU is connected to the main power supply.
- **0** In this position, the BLU is separated from the main power supply.

** Mains power connector and power switch are placed on the front panel of the BLU100A & BLU110T models*



Note: Do not disconnect the measuring cables from the battery when the test is in process!

2.1.2 BXL SERIES



1. **Display**
   LCD screen 16 characters by 2 lines with backlight, visible at bright sunlight.

2. **Keyboard**
   To control the device please use:
   - ***UP/DOWN*** buttons to set test parameters.
   - ***ENTER*** button to confirm selected test parameters and language settings.
   - ***STOP*** button to stop the test.
   - ***START*** button to start the test.
   - ***SET*** button to go to **SETTINGS** menu.

3. **Mains Power Connector and Power Switch**
   - **I** In this position, the BLU is connected to the main power supply.
   - **0** In this position, the BLU is separated from the main power supply.

4. **Control input (CONTROL IN)**
   Enables connecting and controlling BXL (triggering discharge process) from a BLU device. It is also used for a BXL-BXL connection if multiple BXL devices are used. Connection is established using a set of cables with banana plugs.

5. **Control output (CONTROL OUT)**
   Used to establish connection between two BXL devices, enabling simultaneous triggering of the discharge process on all BXL units. Connection is established using a set of cables with banana plugs.

6. **Emergency STOP button**
   If an unexpected or unwanted action occurs during a test, Emergency Stop button can be used to terminate the test and prevent risks that may occur. Besides emergency button and overcurrent protection BLU is equipped with additional fuse as the last level of protection.

7. **Current and Voltage terminals**
   The instrument is equipped with current and voltage test cable terminals.

8. **Protective Earth Connector**

For protection against parasitic currents or voltages, always connect the BLU protective earth connector to the protective ground (PE). Use only the manufacturer supplied cable.
For safety reasons, always establish this connection before establishing any other connections, and remove this connection as the very last step.

3 Getting Started

3.1 Connecting BLU & BXL to Test Object

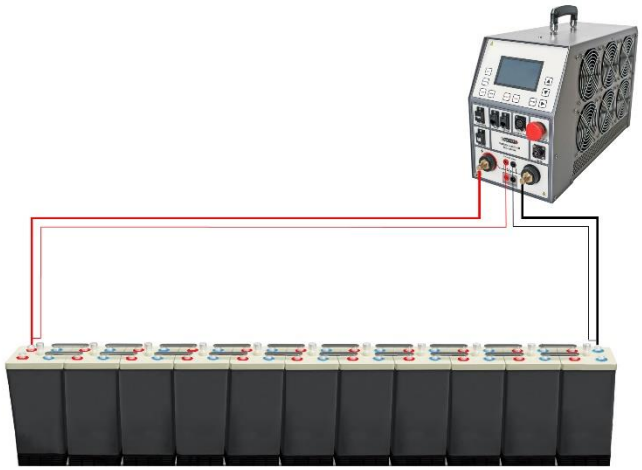
Before the BLU/BXL gets connected to a test object (e.g. a battery), the following steps must be performed:

- Disconnect the battery from its charger in accordance with the national safety regulations.
- The battery should be examined in case of any visual damages or liquid leakage.
- The BLU/BXL itself should be properly grounded. The grounding screw, placed on the front panel of the BLU/BXL, needs to be connected to the PE using the grounding cable.

Note: Always connect measuring cables to the instrument (BLU/BXL) first and then to the test object. When disconnecting, always disconnect the cables from the test object first and then from the instrument(s).
The grounding wire PE should be connected first and disconnected last.
Not following these instructions may cause life-threatening situations.

The BLU can be connected to any battery test object by using a set of the current cables. To maximize the accuracy and measurement repeatability, all clamps must have a good connection to the battery terminals while any crossing between the cables should be avoided. The BLU displays an appropriate message if the connection between a cable clamp and the corresponding battery terminal is not established. The red device terminal should be connected to the plus (+) terminal of the first battery cell in a string (beginning of the string), and the black terminal to the minus (-) terminal of the last battery cell in a string (end of the string). Current cables are represented as red and black thick lines in the Figure 3-1. To establish a smoother regulation of the discharge process, the set of voltage sense cables can be used (thin red and black lines in the Figure 3-1). When using voltage sense cables, the voltage drop on the current cables will not affect a measurement of the battery voltage during the test.

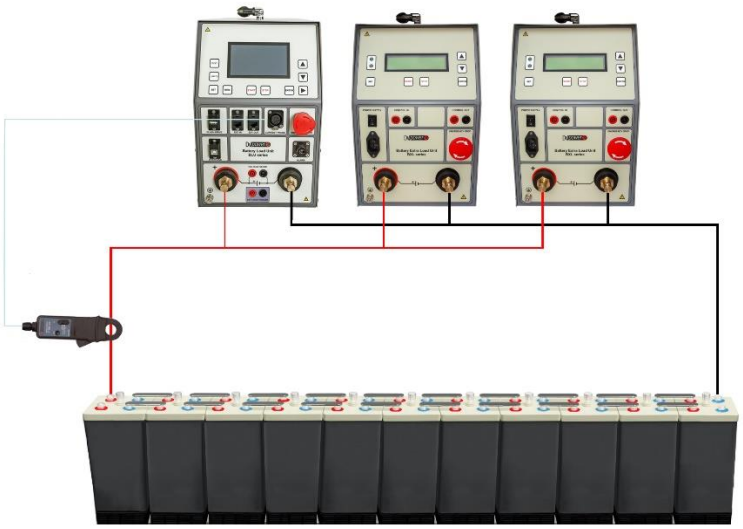
Figure 3-1:
Connecting BLU to test object



If the required discharge current or power exceeds the capacity of a single BLU device, the BXL series external load units can be used. To connect the BXL device the user should follow the same approach as when connecting the BLU device.

Connection diagram for BLU + 2 x BXL units is presented in the Figure 3-2.

Figure 3-2:
Connecting BLU and
2 x BXL to test object



In a BLU & BXL connection, it is necessary to use a current clamp (probe) to be able to regulate a discharge process according to the preset discharge values. The current probe can be connected either to measure a total discharge current (as presented in the Figure 3-2) or a total current conducted by all BXL's units (and additional loads, if any). Depending on the current probe connection point, the appropriate discharge mode (*battery* or *load current* mode) should be selected on the BLU device.

Alternative approach to increase the load capacity is to use several BLU devices in paralleled connection. Up to 10 BLU devices can be connected in parallel. Connection between BLU devices is established using Ethernet ports and RS485 communication. The communication is based on a MASTER-SLAVE principle – an arbitrarily selected device is set as the MASTER while all the other BLU devices should be set as SLAVE units. In the parallel connection the discharge current (power) is distributed in such a way that MASTER unit operates on its capacity limits, while SLAVE units dissipate rest of the preset discharge current (power).

A connection of the two BLU devices for a parallel discharge test is presented in the Figure 3-3. Thick line connections represent the current cables. The red current cables are to be connected to the plus terminal at the beginning of the battery string. Black current cables are to be connected to the minus terminal at the end of the string. The RS485 connection cable needs to be connected between EXT OUT on the MASTER and EXT IN on the SLAVE unit; otherwise the MASTER-SLAVE communication will not work properly.

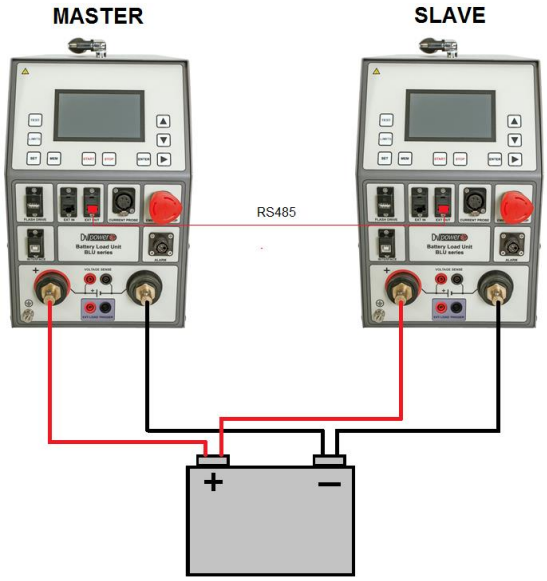


Figure 3-3:
Connecting two BLU devices to test object for parallel discharge

Note:

- **For safety reasons, a connection between the BLU/BXL and a test object should be always established as described in this Manual.**
- **The measuring cables should not be connected after the start of the test.**
- **No connections between BLU/BXL to battery should be established while the charger is connected to the battery string.**
- **The measuring cables should not be disconnected before the test is over.**
- **It is important to organize working area in order to avoid damaging cables. It may cause life threatening situations.**

3.2 Setting Test Parameters

The BLU instrument can perform the following tests:

- Discharge test
- Parallel discharge test (all models except the BLU100A & BLU110T)
- Discharge test using the current probe

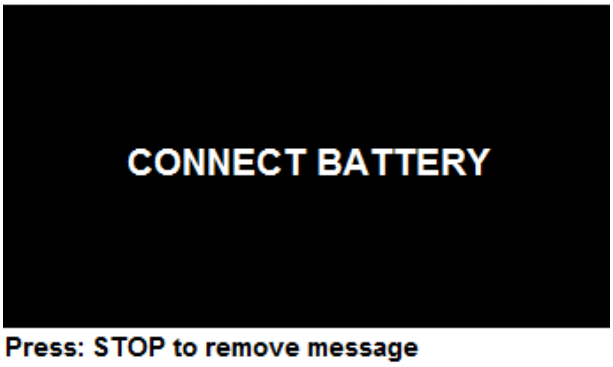
After the BLU device is switched on, the initial message informing the user about a name of the device and the installed firmware as well as the SBC version is displayed, Figure 3-4.



Figure 3-4:
The initial screen for the BLU200A model

After displaying the initial screen for a several seconds, the BLU automatically changes the display to the **CONNECT BATTERY** screen. The message will be displayed until the BLU is connected to a battery or the STOP button is pressed.

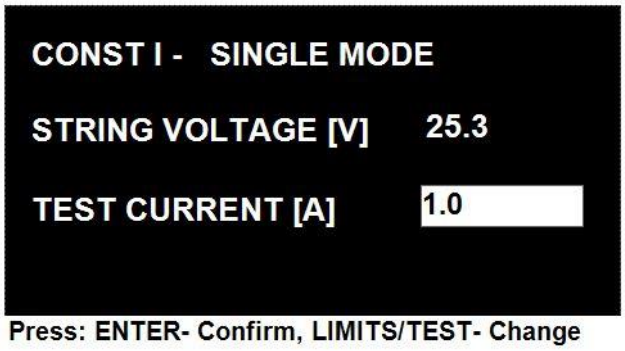
Figure 3-5:
„CONNECT BATTERY“ screen



3.2.1 Selecting Discharge Mode

After connecting the BLU to a battery, the Test settings menu automatically appears on the display. The default display is the *Constant current test type* (*CONST I*).

Figure 3-6:
Test settings menu



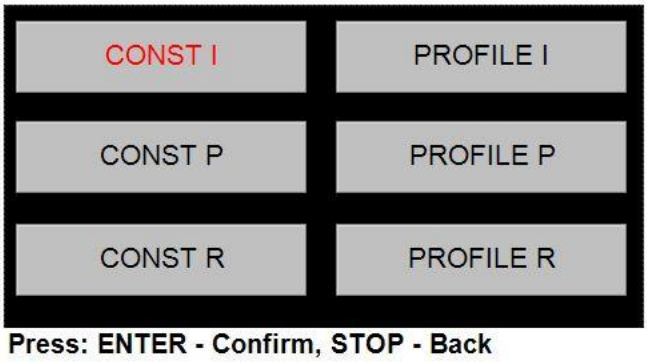
String voltage value presents a voltage measured by the current or voltage sense cables. The voltage value is displayed automatically as soon as the current or voltage cables are connected to the test object.

Test current value represents a discharge current set to be constant throughout the discharge test. This parameter is user-selectable.

If the user requires a discharge test to be conducted on the basis of the constant power or constant resistance, the test type needs to be changed.

Pressing the ***TEST*** button (located on the front panel of the instrument) the following screen appears on the display:

Figure 3-7:
The **Test type** settings

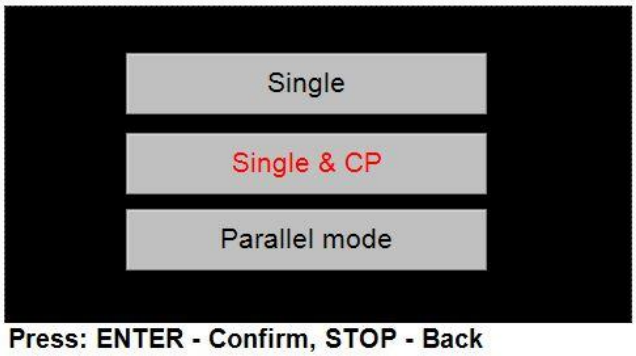


The BLU device supports performing the discharge test of several types and in several modes.

The available discharge types are: Constant current (*CONST I*), Constant power (*CONST P*), Constant resistance (*CONST R*), *PROFILE I*, *PROFILE P*, and *PROFILE R*.

After selecting the discharge type (by pressing the ***ENTER*** button after navigating using the ***UP/DOWN*** buttons through the menu), the user needs to select one of the three available discharge modes: *SINGLE*, *PARALLEL* and *SINGLE & CP MODE* (Figure 3-8).

Figure 3-8:
The **Test mode** settings



In the **TEST SETTINGS** menu, the following parameters need to be set:

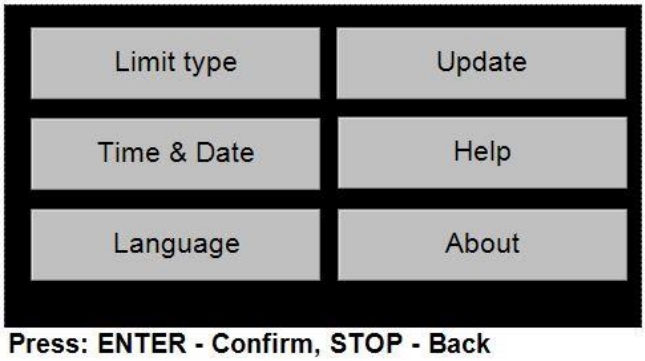
- **String voltage**. It is detected automatically when the test cables are connected to the test object.
- **Test Type**. The following discharge types can be selected: Constant current (CONST I), Constant power (CONST P), Constant resistance (CONST R), PROFILE I, PROFILE P, and PROFILE R.
- **Test Mode**. The following test modes can be chosen: SINGLE, PARALLEL and SINGLE & CP MODE.
- **Test current/power/resistance**. This selection depends on the BLU model being used.

To change among the single current/ power/ resistance value press the ***UP/DOWN*** buttons shortly. The ***RIGHT*** button is used to navigate through the numerical field, to change values of each digit separately. For faster value change, please hold the ***UP/DOWN*** buttons longer.

3.2.2 Settings Menu

The **SET** menu enables the user to change the Limit type, Time & Date, Language, to update or only to check the firmware / software version, and to copy Log file to a USB. The ***SET*** button should be pressed to enter this settings menu (Fig 3-9):

Figure 3-9:
The **Settings** menu

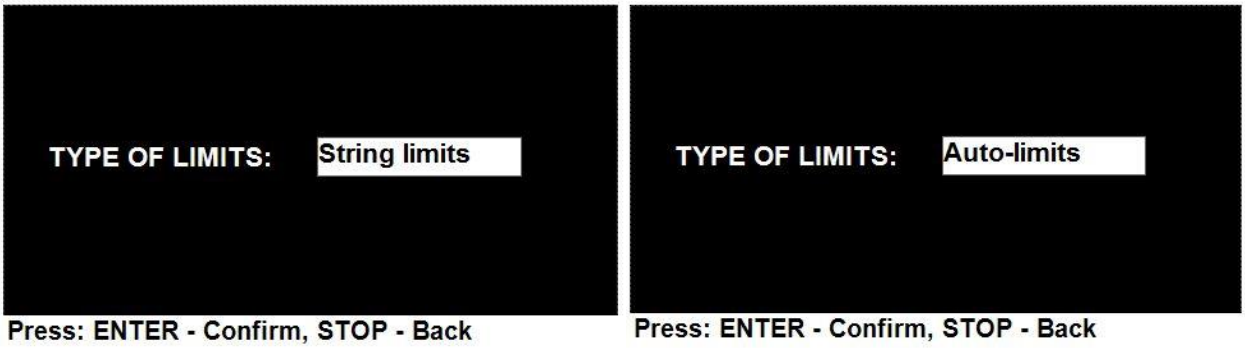


The ***UP*** and ***DOWN*** buttons are used for navigation and ***ENTER*** for entering the chosen submenu. Alternatively, any submenu can be entered by finger-pressing the corresponding box on the touch screen display.

3.2.2.1 Setting Limit Type

The Limit type is the first parameter to be set. After entering the **Limit type** submenu one of the following screens appear (Figure 3-10).

Figure 3-10:
The **Limits type**

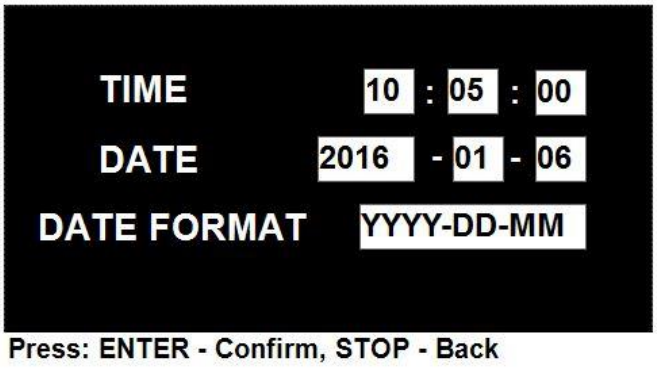


There are two types of limits that can be selected using the ***UP/DOWN*** buttons: **String limits** and **Auto limits**. What Limit type (*String* or *Auto*) will be displayed depends on customer's limit settings in a previous test. **"**String limits" refers to limits of the entire string, while "Auto limits" enables entering limits of single cells.
After pressing the ***ENTER*** button, selected limits type is loaded and the Settings screen is displayed. Depending on a selection, different parameters needs to be set in the **Limits** menu (please refer to the section 3.2.3. for more information).

3.2.2.2 Setting Time & Date

After entering the **Time & Date** submenu the following screen will be displayed (Figure 3-11).

Figure 3-11:
The **Time & date** menu



The user can change time, date or to modify date format. Available date formats are: "YYYY-DD-MM", "YYYY-MM-DD" and "DD-MM-YYYY". The selected date format will be used as a part of the name of saved test results (more details can be found in the section 3.4 -"The Memory menu"). The changes are confirmed by pressing the ***ENTER*** button, while the ***STOP*** button enables exiting the submenu without saving the changes.

3.2.2.3 Setting Language

The **Language** submenu enables the user to change the language of the user interface. Available languages can be observed by pressing the ***UP / DOWN*** buttons.

Figure 3-12:
The **Language** menu



After a language other than the currently active language is selected by pressing ***ENTER***, the user would be required to restart the device. After restarting the device, the selected language becomes active.

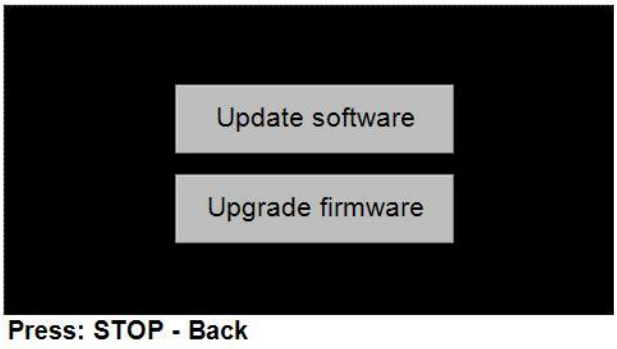
3.2.2.4 Firmware / Software Update

The **Update** submenu (Figure 3-13) needs to be approached if the firmware or software (SBC application) needs to be updated. It is needed to save firmware / software on a USB (in the main folder, not subfolders), plug in the USB, and to select option you want to update on the display. The uploading process does not take more than 10 s. It would be required to restart the device after the update is completed.

Note:

After pressing the *Update* button the device will start downloading the corresponding file. If for any reason BLU cannot download firmware / software from the USB, the message: "*USB not connected*" will be displayed. The message could be caused by USB - BLU bad connection. Alternatively, it should be confirmed that firmware / software is placed in the main USB folder and that firmware / software file name is the same as declared by the manufacturer. If any of the reasons stated above are not source of the problem, the BLU should be restarted before trying the update again. If the problem remains present after the restart, the DV Power Customer Support Service (support@dv-power.com) should be contacted for further instructions.

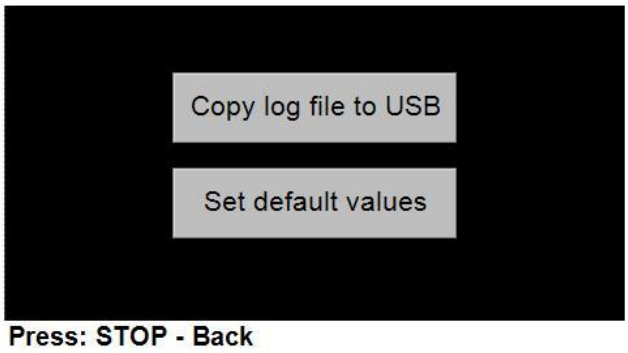
Figure 3-13:
The **Update** menu



3.2.2.5 Help & About submenus

After entering the **Help** submenu the following screen will be displayed.

Figure 3-14:
The **Help** screen



During the discharge test, any unexpected behavior of the BLU device will be recorded in its internal memory as a Log file. The file is encrypted and its content can only be analyzed by the DV Power Support team. Providing the log file will speed up the process on clarifying operational or other issues.
To extract the log file, a USB should be plug in and *Copy log file to USB* button should be pressed. The USB can be removed as the message “File is copied” is displayed on the screen.

The “Set default values” button will set all parameters to their basic values (manufacturer defined values).

The “About” submenu provides information about firmware / software (SBC) version installed in the device. The same versions are displayed on the screen for several seconds after switching on the BLU device.

3.2.3 Limits Menu

The BLU provides 4 adjustable stop points: battery string voltage, discharge time, discharge capacity, and the cell voltage. In order to set the values of the stop points, the ***Limits*** menu should be entered by pressing the **Limits** button on the BLU front panel.
Depending on the limit type selected in the ***SET*** menu (*Auto limits* or *String limits*), different parameters can be set in the ***Limits*** *menu*.

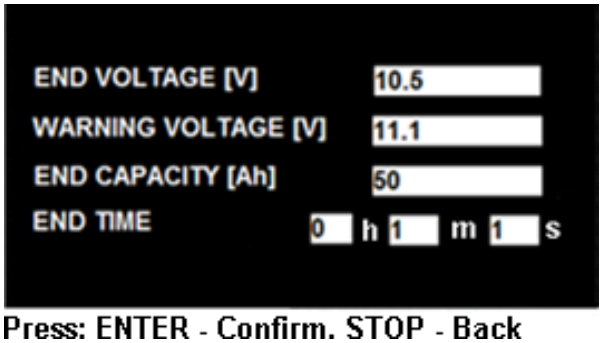
3.2.3.1 String Limits

The String limits offer the user to define 3 stop points:

- End Voltage [V] – final voltage of the entire battery string under a test;
- End Capacity [Ah] – total discharged capacity;
- End Time [h/min/sec] – total test time.

Additionally, a *Warning voltage [V]* parameter which notifies (but does not stop the test) the user the string voltage is low and approaching the final voltage value, can be set.

Figure 3-15:
String limits settings



For a single value change to press the ***UP/DOWN*** buttons shortly. The ***RIGHT*** button is used to navigate through the numerical field to change values for each digit separately. For faster value change, please hold the ***UP/DOWN*** buttons longer. The ***ENTER*** button is used to confirm the value and to move to the next field. In case the value in the previously confirmed fields needs to be changed, the ***STOP*** button is used to go one line back.
After pressing the ***ENTER*** button while the cursor is in the last box (END Time -→ sec), the new limit settings will be loaded and the Test settings menu will be displayed.

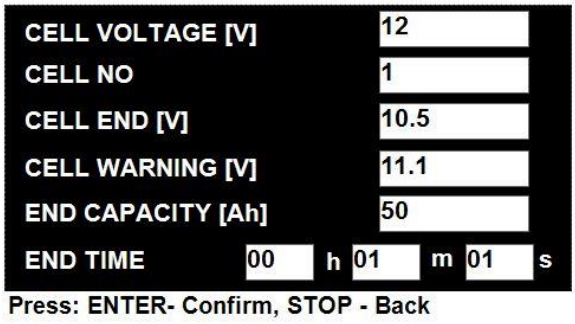
3.2.3.2 Auto Limits

The **Auto limits** (or cell limits) enables the user to define cell limits.
The following parameters can be set:

- Cell Voltage [V] – nominal cell voltage. Selectable values are 1,2; 2,0; 6,0; 12.0 and 24,0 V;
- Cell No – Total number of cells;
- Cell End [V] – final cell voltage;
- Cell Warning [V] – alarms the user about the warning voltage is reached;
- End Capacity [Ah] - total discharged capacity;
- End Time [h/min/sec] – total test time.

Based on the entered values, the BLU calculates the final voltage limit for the entire string.

Figure 3-16:
Auto limits settings



Note:
The maximum number of cells that can be selected depends on the nominal cell voltage. The total voltage, which equals to a number of cells multiplied by the cell voltage, should not exceed:

- **300 V for a single BLU100A, BLU200A or BLU340A unit;**
- **70,5 V for BLU110T and BLU220T models;**
- **500 V for a BLU360 V.**

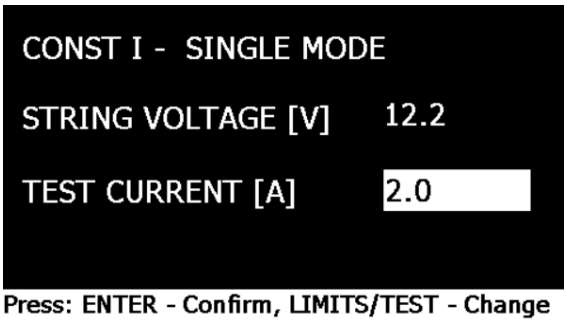
After pressing the ***ENTER*** button, while the cursor is in the last box (END Time → sec), the new limit settings will be loaded and the Test settings menu will be displayed.

3.3 Discharge Modes

3.3.1 Single Mode

After all the discharge parameters are set, including the limits and the discharge current / power / resistance, the user can start the test. To confirm the settings, the ***ENTER*** button on the front panel of the instrument should be pressed while the Test settings menu is displayed (Figure 3-17).

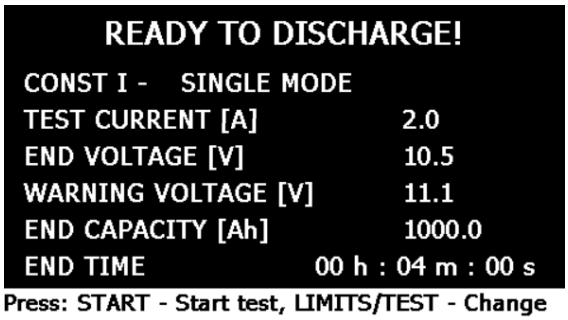
Figure 3-17:
The **Test settings** menu for the constant current discharge mode



If the constant power (*Const P*) or the constant resistance (*Const R*) mode is selected, the value of power or resistance will be displayed, respectively, and could be changed in the menu.

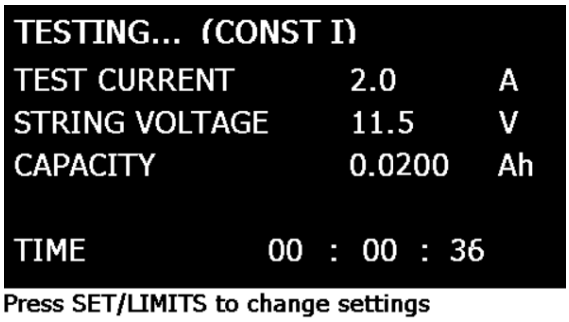
Pressing the ***ENTER*** button the **Ready** screen appears (Figure 3-18). The **Ready** screen presents the selected test parameters to be verified prior to the test. If no changes are required, the test can start by pressing the ***START*** button. However, if any of the parameters need to be modified, the user needs to exit the ***Ready*** menu by pressing ***STOP***, and then to enter *Limits, SET* or *TEST* menu, depending on the modification required.

Figure 3-18:
The **Ready** screen



The following parameters can be verified: the discharge mode, test Current/ Power/ Resistance (depending on a selected mode), end voltage, warning voltage, end capacity and discharge end time.
Pressing the ***START*** button, the discharge process starts and the **Discharge** screen will be displayed (Figure 3-19).

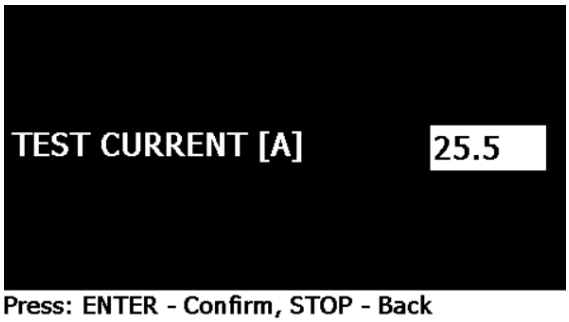
Figure 3-19:
The **Discharge** screen



The **Discharge** screen enables monitoring the test Current/ Power/ Resistance (depending on a selected mode), total string voltage, measured capacity as well as elapsed time since the start of the test.

The BLU enables the user to modify the test parameters during the test. If needed, press the ***SET*** button to change the test mode among the Current/ Power/ Resistance options.

Figure 3-20:
Load settings



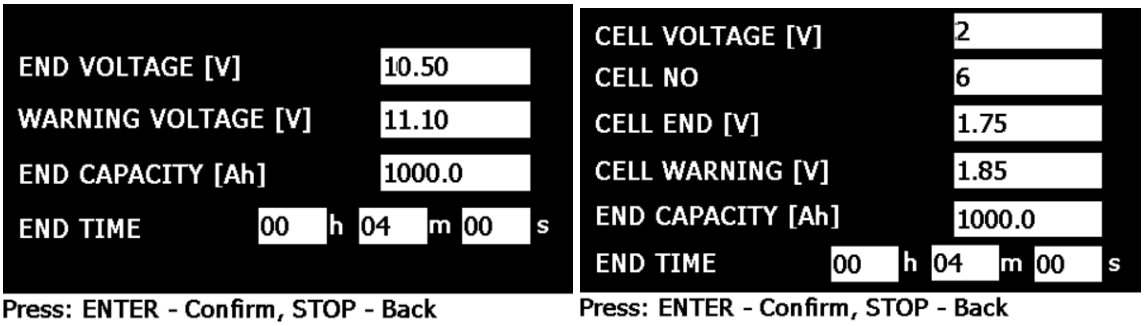
The ***RIGHT*** button is used to navigate through the numerical field, from one digit to another and ***UP/DOWN*** to change the current value. After the value has been changed the **ENTER** button is pressed and the test continues running with the new selected current/ power/ resistance.

The BLU will limit maximum values of current or power / minimum values of resistance that can be set during the test. The limits depend on battery voltage the BLU is connected to.

If the user enters changes in the SET menu without confirming them by pressing ENTER, after 45 seconds the test settings screen will be displayed again but no changes will be introduced.

If the user requires changing the limits settings during the test, it can be done by pressing the ***Limits*** button placed on the front panel. Depending on the selected limit type prior to the test (*Auto limits* or *String limits*), different parameters could be reset in the **Limits** *menu*.

Figure 3-21:
The Limits screen if String limits (left) or Auto limits (right) were selected



Any of the displayed parameters can be modified during the test.

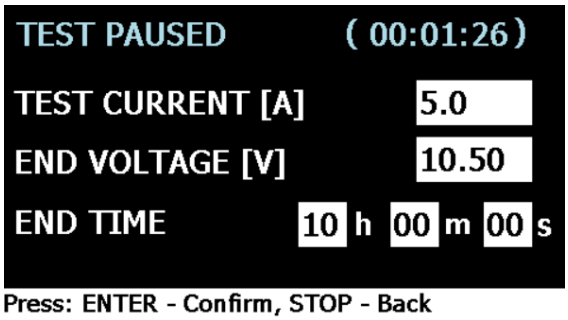
The ***ENTER*** button is used to confirm the value and to move to the next field. If the value in the previously confirmed fields needs to be changed, the ***STOP*** button is used to go a line back.

After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new limit settings will be loaded and the test will continue with the new parameters.

Additionally, if the user needs to pause the test (in order to replace a bad cell) it can be done by pressing the ***STOP*** button only once. Double-pressing the ***STOP*** button will terminate the test.

Pressing the ***STOP*** button during the test will display the **Pause** screen (Figure 3-22).

Figure 3-22:
The **Pause** menu for constant current modes



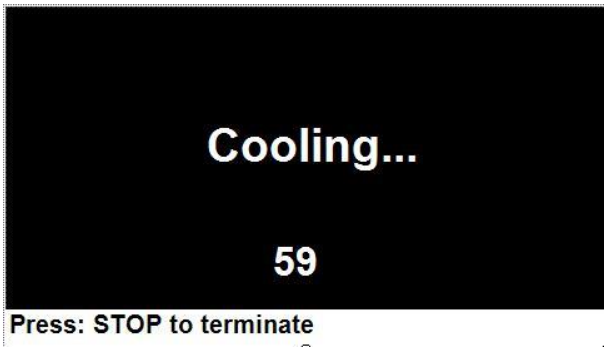
The user can change the test current (or power, or resistance, depending on the selected mode), final battery voltage and test time while the test is paused. Changes are confirmed by pressing the ***ENTER*** button.

After pressing the ***ENTER*** button with the cursor being located in the last box (END Time → sec), the new test settings will be loaded and the test will continue with these new parameters.

When the test is paused, fans will continue operating for 60 seconds. The cooling process cannot be interrupted.

After the test has been completed, the BLU will display an appropriate message and the buzzer will sound for 0,5 sec. The cooling process will continue for 60 seconds to cool down the internal dissipating structure.

Figure 3-23:
The **Cooling** message



Note:

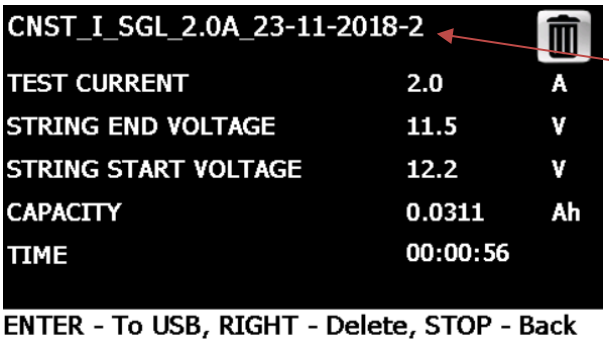
The 1-minute cooling process after the end of test can be aborted by pressing the *STOP* button. However, after a several hours long discharge test it is strongly recommended not to interrupt the post-test cooling process.

Pay attention to never remove the leads during the testing process!

As the cooling process ends, the **Results** screen is displayed (Figure 3-24).

The results screen displays: test current, cell voltage (only if *Auto Limits* are selected), start voltage, end voltage, capacity and discharge time. The test ID (consisting of a date and a test number) is presented on the top of the screen. The ID number will be automatically offered; however, the user can modify it. Press the ***ENTER*** button to save the results to the BLU device internal memory. The result can be opened / displayed in the Memory menu and downloaded to a USB memory media for further analysis. Pressing the The opened result can be deleted from the instruments memory by pressing the ***DELETE*** button. User will be requested to confirm that wants to delete the results before the result is irreversibly deleted from instrument's memory.

Figure 3-24:
The **Results** screen



3.3.2 Current Probe (CP) Mode

3.3.2.1 Setting BLU Parameters

In case the battery needs to remain connected to the load or the BXL device (or other device) is used as an additional load, the test needs to be performed in the CP MODE. In this mode the measurement will be based either on the total battery current or a load current being measured by the DC current probe. The Current probe measurement function enables the BLU to measure the total current in an external path and regulate the process based on this measurement.

Several connection diagrams, presenting connections "*BLU to battery"* or "*BLU & BXL to battery",* are presented in the Figure 3-25 and Figure 3-26.

Figure 3-25:
Connecting BLU & load in **CP MODE –** battery current (left) and load current (right) mode

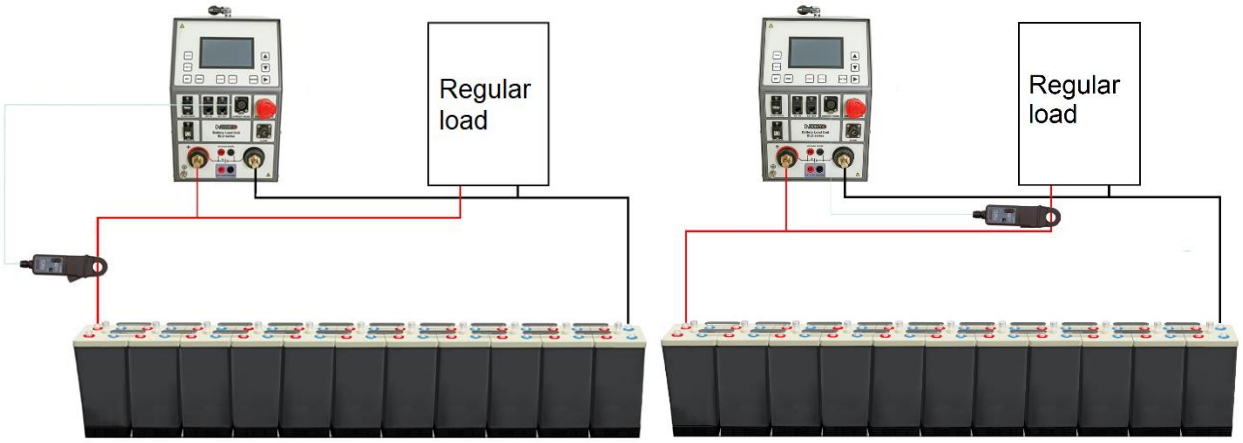
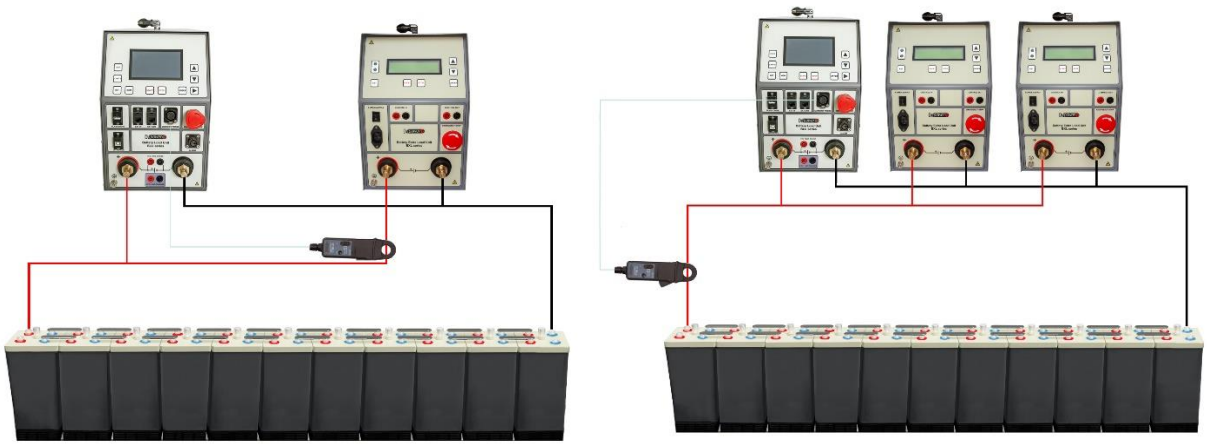
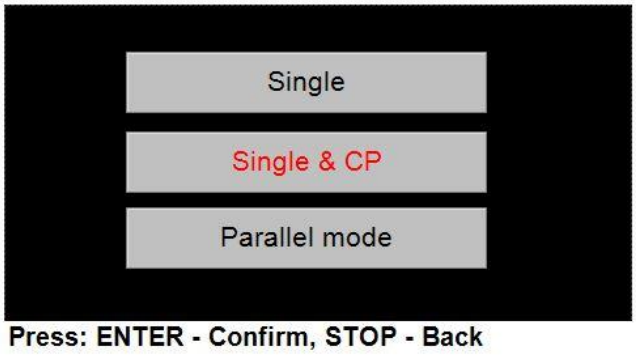


Figure 3-26:
Connecting BLU & BXL(s) in **CP MODE –** load current (left) and battery current mode (right)



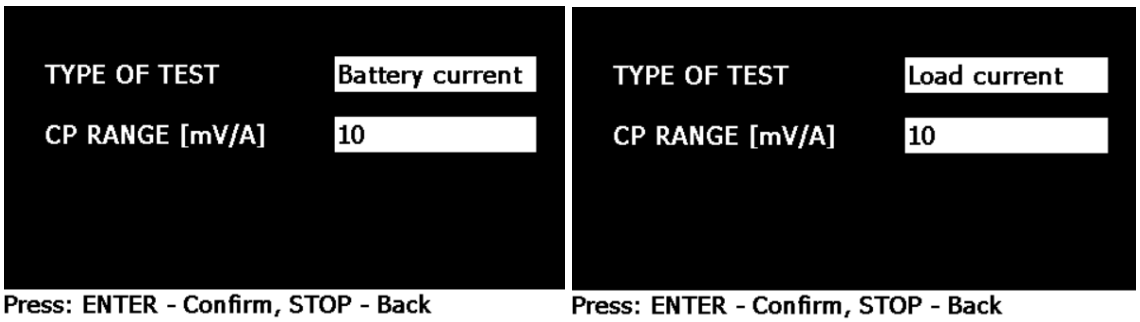
To select the Current probe (CP) mode, the user needs to select *SINGLE & CP MODE* discharge mode in the Test mode settings screen (Figure 3-27).

Figure 3-27:
The **Test mode** settings



The mode can be selected by pressing the *SINGLE & CP MODE* box on the display or by pressing the **ENTER** button while the field is on (letters marked as red). Afterwards, the following screen will be displayed (Figure 3-28):

Figure 3-28:
Test Settings menu for **CP MODE**



- **Type of the test -** There are two types of the tests that can be selected using the **UP / DOWN** buttons:
  - **Battery current -** the total current drawn from the battery is measured by using the current probe. The BLU regulates its own discharge current / power to match the preselected battery current/power value. During the discharge test the real-time values of the total current / power discharged from the battery and the current/power dissipated in the BLU will be displayed.

- **Load current** – this approach is based on measuring the load current. The BLU regulates its own discharge current / power so the sum of measured load current / power and the BLU current / power is equal to the user preselected discharge current / power. During the discharge test the real-time values of the total current / power discharged from the battery and the current / power measured by the current probe will be displayed.

Note:

If available current clamp is battery-operated (supplied from internal battery), it should be paid attention that battery is capable to supply the clamp throughout the test. Battery-operated clamps are provided with non-rechargeable 9 V battery. Provided battery will be capable to supply the clamp during one 8h or 10h test. Before starting new test of long duration (such as 8 h / 10 h discharge tests), brand-new battery should be used. Minimum capacity of the battery should be 300 mAh.

Rechargeable batteries, capacity of 300 mAh or more, can also be used to supply the clamp. Rechargeable battery should be used in fully charged condition (it should be charged within last 12h before discharge test is started). Rechargeable battery should be replaced by new battery according to battery manufacturer suggestions on battery life stated in the manual.

In case the used battery is fully discharged before the end of the test, the clamp will switch off. There is no hazard to device or battery string if the clamp switches off. There are 2 possible outcomes if the clamp switches off: BLU will terminate the discharge test (if selected test was *CP Battery current*) or BLU will continue the test with maximum current that can be achieved (*CP Load current*).

Note:

The current probe readings / BLU readings will be inaccurate if the current measured by current probe during the test is less or equal to the zeroed offset value.

Note:

Green LED diode should be ON on the clamp when clamp is ready for (longterm) test. If red diode is ON, clamp will switch off in 10-15 min.

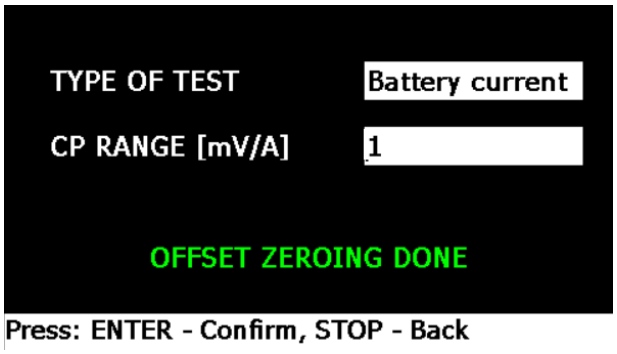
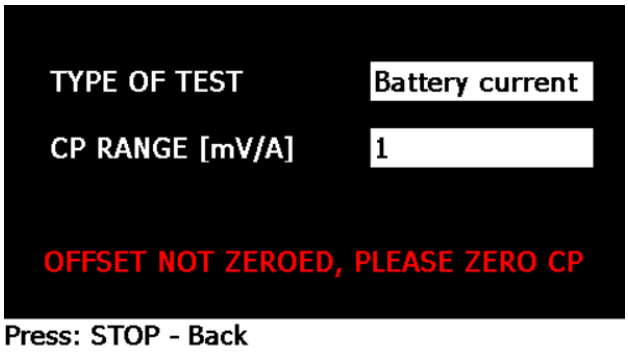


Figure 3-29:
Test settings menu when **offset zeroing is done**

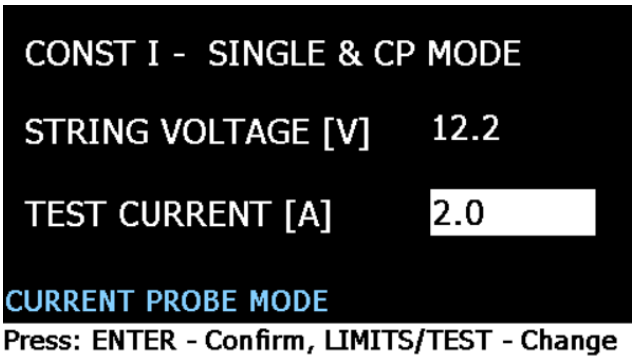
If zeroing offset in not performed well, the message "**OFFSET NOT ZEROED, PLEASE ZERO CP**" appears on the display.

Figure 3-30:
Warning message
offset not zeroed



After all the selections have been confirmed and offset zeroing done, by pressing ***ENTER*** the device switches to CP Test Settings menu, where the test current needs to be selected.

Figure 3-31:
Test settings menu
for **CP MODE** discharge



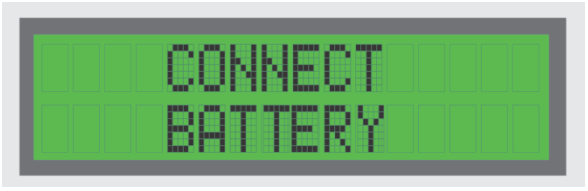
After entering the READY screen, and if the user is satisfied with the selected parameter values, the test can be started by pressing **START**. In case a BXL is used, it is necessary to set the BXL parameters before starting the test.

3.3.2.2 Setting BXL parameters

When the BXL device is switched on, the initial message informing the user about name of the device and installed firmware version is displayed.

After displaying the initial screen for several seconds, the BXL displays the **CONNECT BATTERY** message. The message will be displayed until the BXL gets connected to a battery.

Figure 3-32:
The CONNECT BATTERY
message



When the BXL connection with the battery is established the Test setting menu appears on the display (Figure 3-33).

Figure 3-33:
Test settings menu



The displayed parameters are:

- U [V] – battery voltage (not user-changeable),
- R [Ω] – BXL internal resistance,
- I [A] – current that will be discharged by the BXL at the selected resistance value.

Depending on the battery voltage level, the BXL enables selecting several resistance values up to the value of 3,2 Ω (for BXL-A), 0,133 Ω (for BXL-T) or 8,480 Ω (for the BXL-V model).

The maximum current that can be achieved by the BXL is a function of the BXL internal resistance. Relation between the maximum current of the BXL and the maximum (initial) voltage of the battery is presented in the Table 3-1. The resistance of the recommended set of the current cables is included in the listed resistance values. Listed resistances are the lowest resistance values that can be selected at the corresponding voltage.

Table 3-1: Maximum discharge currents at various maximum battery voltages

Umax (V)	BXL-A		BXL-T		BXL-V	
	Resistance (Ω)	Imax (A)	Resistance (Ω)	Imax (A)	Resistance (Ω)	Imax (A)
7,05	0,088	80	0,067	100	0,373	15
14,1	0,088	160	0,067	210	0,373	35
28,2	0,112	250	0,067	310	0,373	75
56,4	0,230	250	0,148	310	0,373	155
70,5	0,642	110	0,277	250	0,373	190
129,3	0,802	160	-	-	0,960	130
141	0,802	180	-	-	0,960	145
258,5	2,500	90	-	-	2,135	115
282,0	3,200	90	-	-	2,135	125
480	-	-	-	-	8,480	55

Note:

Selected resistance on the BXL should be high enough so that BXL current is lower than the total discharge current. Otherwise, BLU will not be able to regulate the discharge current and will stop the test.

After the resistance is selected, the discharge test can be started. By pressing the **ENTER** button, the BXL displays the **Ready** screen.

Figure 3-34:
The **Ready** screen menu



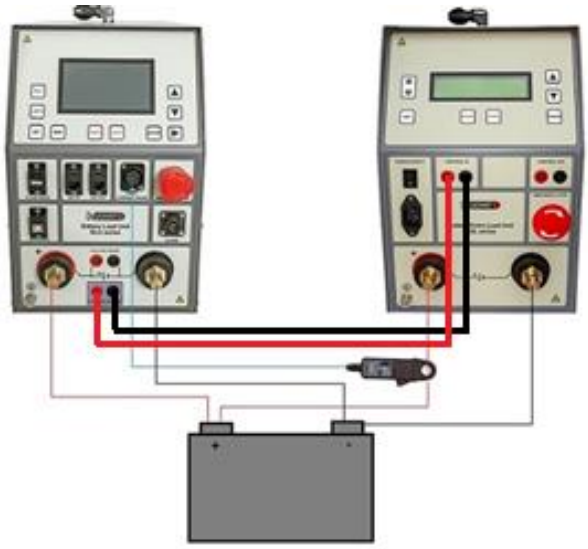
The discharge test using a combination of the BLU and the BXL can be started by using two different ways:

- Pressing the ***START*** buttons: first on the BXL, and then on the BLU.
- Pressing the ***START*** button on the BLU only – if the external trigger cables are used (Figure 3-35). The external trigger cables enable triggering the BXL by the BLU when the test is initiated on the BLU. It is important to emphasize that in this case the connection between these two units needs to be established by using the cables for parallel operation. Also BXL needs to be in the **Ready** menu.

Note:

- **The user-defined discharge current determines the number of BXL units that needs to be used. The BXL(s) need(s) to compensate difference between required load capacities and BLU load capacities.**
- **The BXL is a resistive and non-regulative load. The current conducted by the BXL at the beginning of the test will be different (higher) than the BXL current at the end of the test (due to change in the battery voltage). The BLU needs to have capacity in reserve to compensate the difference at lower battery voltages.**

Figure 3-35:
The BLU-BXL connection – trigger cables emphasized

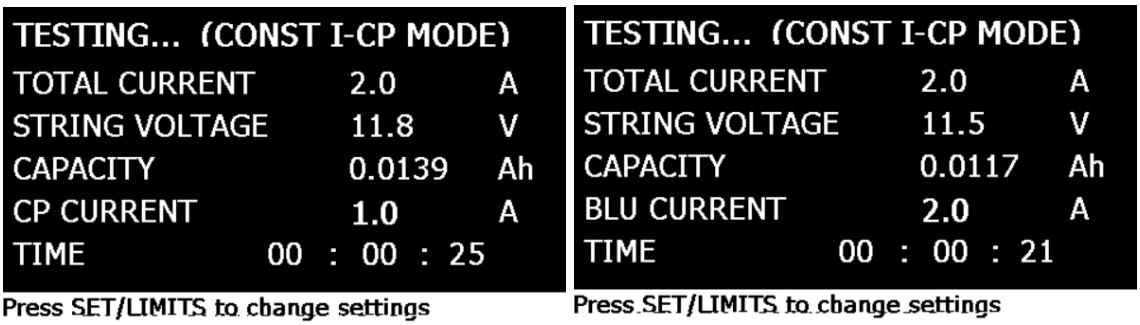


3.3.2.3 During the test

After the test is initiated by pressing ***START***, the **Discharge** screen on the BLU will be displayed. Depending on the selected test type (*load current* or *battery current*) the **Discharge** screen will present slightly different parameters (Figure 3-36):

- Total current [A] – total battery current;
- String Voltage [V] – battery string voltage;
- Capacity [Ah] – total discharged capacity;
- CP Current [A] – current measured by the current probe in the *Load current* mode;
- BLU Current [A] – BLU discharge current in the *Battery current* mode;
- Time [h/min/s] – Total test time

Figure 3-36:
The discharge screen – Load current mode (left) and battery current mode (right)



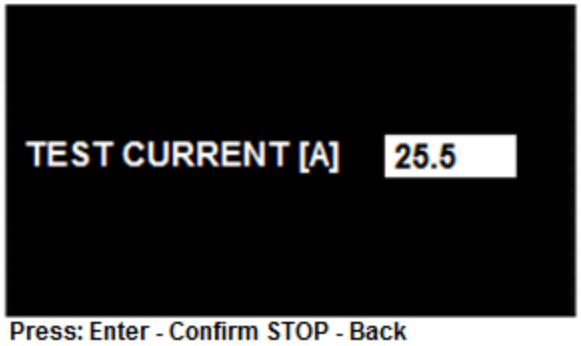
If the BXL is used, after test is started, the following screen will be displayed on the BXL (Figure 3-37). The current discharged by the BXL will be reduced as the battery voltage starts to decrease.

Figure 3-37:
The BXL **Test Running** screen



The BLU enables the user to modify the test parameters during the test (this option is not implemented on the BXL's). The ***SET*** button needs to be pressed in order to be able to change the test Current/ Power/ Resistance.

Figure 3-38:
Load settings



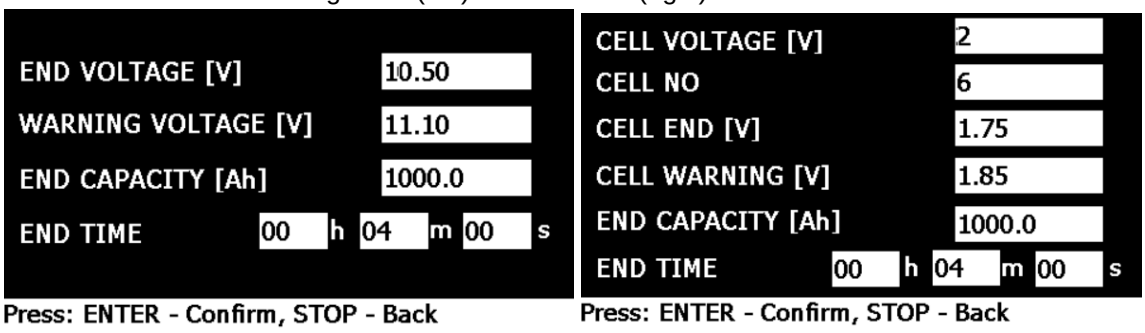
The ***RIGHT*** button is used to navigate through numerical field, from one digit to another and ***UP/DOWN*** to change the current value. After the value has been changed the **ENTER** button is pressed and the test continues running with the new selected current/power/resistance.

The BLU will limit maximum values of current or power / minimum values of resistance that can be set during the test in the *Load current mode*. The limits depend on battery voltage the BLU is connected to. The user needs to pay attention not to exceed the BLU capacities when changing parameters in the *Battery mode* – since the BLU will stop the test.

If the user enters changes in the SET menu without confirming them by pressing ENTER, after 45 seconds the test settings screen will be displayed again but no changes will be introduced.

If the user requires changing limits settings during the test, it can be done by pressing the Limits button on the front panel. Depending on the selected limit type prior to the test start (*Auto limits* or *String limits*), different parameters can be reset in the **Limits** *menu*.

Figure 3-39:
The Limits screen if String limits (left) or Auto limits (right) were selected

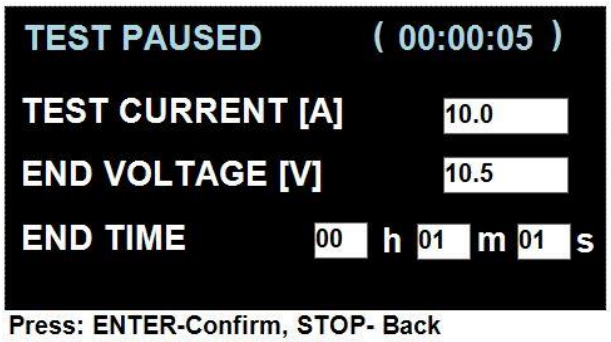


Any of the listed parameters can be modified, as it can be done prior the test.

The ***ENTER*** button is used to confirm the value and to move to the next field. In case the value in previously confirmed fields needs to be changed, the ***STOP*** button is used to go to a line back.
After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new limit settings will be loaded and the test will continue with the new parameters.

Additionally, if the user needs to pause the test (in order to replace a bad cell) it can be done by pressing the ***STOP*** button only once. Double-pressing the ***STOP*** button will terminate the test.
Pressing the ***STOP*** button during the test will display the Pause screen (Figure 3-40).

Figure 3-40:
The **Pause** menu for constant current modes



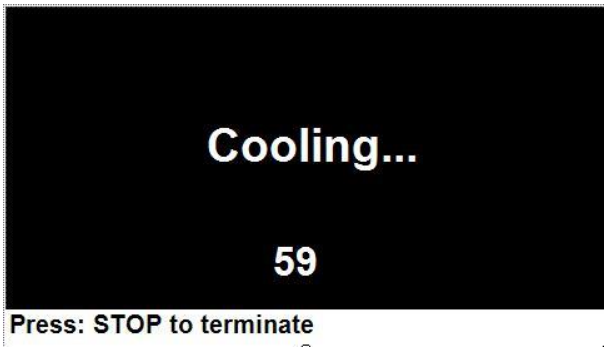
During the pause, the user can change the test current (or power or resistance, depending on the selected mode), final battery voltage and test time. Changes will be confirmed by pressing the ***ENTER*** button.

After pressing the ***ENTER*** button with the cursor being located in the last box (END Time → sec), the new test settings will be loaded and the test will continue with these new parameters.

When the test is paused, fans will continue operating for 60 seconds. The cooling process cannot be interrupted.

After the test has been completed, the BLU will display an appropriate message and the buzzer will sound for 0,5 sec. The cooling process will continue for additional 60 seconds to cool down the internal dissipating structure.

Figure 3-41:
The **Cooling** message



Note:

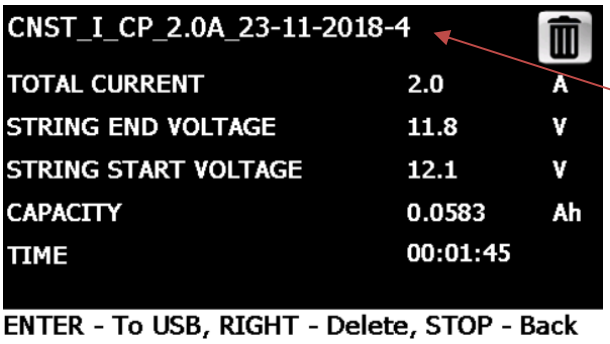
The 1-minute cooling process after the end of test can be aborted by pressing the *STOP* button. However, after a several hours long discharge test it is strongly recommended not to interrupt the post-test cooling process.

Pay attention to never remove the leads during the testing process!

As the cooling process ends, the **Results** screen is displayed (Figure 3-42).

The results screen displays: test current, cell voltage (only if *Auto Limits* are selected), start voltage, end voltage, capacity and discharge time. The test ID (consisting of a date and a test number) is presented on the top of the screen. The ID number will be automatically offered; however, the user can modify it. Press the ***ENTER*** button to save the results to the BLU device internal memory. The result can be opened/displayed in the Memory menu and downloaded to a USB memory media for further analysis. The opened result can be deleted from the instruments memory by pressing the ***DELETE*** button. User will be requested to confirm that wants to delete the results before the result is irreversibly deleted from instrument's memory.

Figure 3-42:
The **Results** screen



3.3.3 Parallel Mode

3.3.3.1 Setting MASTER - SLAVE Parameters

In case the required discharge current or power exceeds the capacity of a single BLU device, several (up to ten) BLU devices can be connected in parallel. The connection between BLU devices is established using Ethernet ports, network cable and RS485 communication. The communication is based on a MASTER-SLAVE principle: One device is always selected to be the MASTER and all the others are the SLAVE units.

Note:

The parallel connection discharge mode is not implemented in the BLU100A device. However, multiple BLU100A devices can operate simultaneously during the discharge test. It is required one BLU100A to operate in the CP mode and measure a total battery current (*battery mode*) or a total current of all other connected BLU100A devices (*load current mode*).

The BLU-BLU device connection in the parallel mode is presented in the Figure 3-43. The red connections are to be connected to the plus terminal at the beginning of the battery string. The black connections are to be connected to the minus terminal at the end of the battery row. It is necessary to connect the RS485 connection cable between EXT OUT on the master and EXT IN on the SLAVE unit.

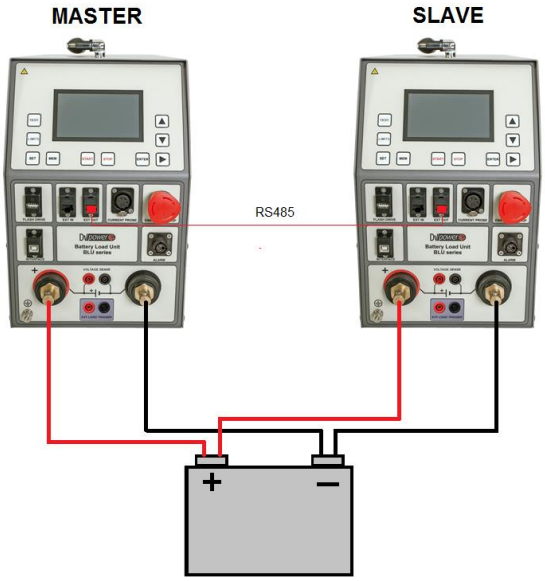


Figure 3-43: Connecting two BLU devices to test object for **Parallel discharge**

Selecting the required number of BLU device depends on the battery voltage and a required discharge current/power. Maximum currents for up to 4 BLU devices are presented in the Table 3-2.

Table 3.2: Maximum currents for up to four BLU devices connected

Battery Nominal voltage (V)	No. of units	Maximum discharge current (A)					
		BLU100A*	BLU200A	BLU340A	BLU110T*	BLU220T	BLU360V
6	1	40	60	50	100	100	50
	2	80	120	100	200	200	100
	3	120	180	150	300	300	150
	4	160	240	200	400	400	200
12	1	80	120	100	150	200	100
	2	160	240	200	300	400	200
	3	240	360	300	450	600	300
	4	320	480	400	600	800	400
24	1	160	240	160	150	350	160
	2	320	480	320	300	700	320
	3	480	720	480	450	1 050	480
	4	640	960	640	600	1 400	640
48	1	160	240	160	150	350	160
	2	320	480	320	300	700	320
	3	480	720	480	450	1 050	480
	4	640	960	640	600	1 400	640
60	1	120	210	160	120	270	160
	2	240	420	320	240	540	320
	3	360	630	480	360	810	480
	4	480	840	640	480	1080	640
110	1	110	140	160	-	-	160
	2	220	280	320			320
	3	330	420	480			480
	4	440	560	640			640

120	1	100	140	150	-	-	150
	2	200	280	300			300
	3	300	420	450			450
	4	400	560	600			600
220	1	55	75	110	-	-	110
	2	110	150	220			220
	3	165	225	330			330
	4	220	300	440			440
240	1	50	70	100	-	-	100
	2	100	140	200			200
	3	150	210	300			300
	4	200	280	400			400
480	1	-	-	-	-	-	55
	2						110
	3						165
	4						220

*BLU100A & BLU110T do not provide parallel operation feature. Multiple BLU units can be used only if one BLU operates in CP mode.

When selecting the Parallel Mode in the Test mode settings (Figure 3-8), the BLU changes the display to the Test Settings menu for a parallel discharge test. In the **Parallel Discharge** menu, the following parameters need to be set:

- **Configuration** – Available configurations are MASTER and SLAVE. Switching between different configurations is achieved by pressing the **UP / DOWN** buttons. Note that all test parameters are set on the MASTER unit.
- **SLAVE NUMBER** – Total number of slave units. The value is set on the Master unit only.
- **ADDRESS** - defines the slave address that identifies the slave device. It is an integer number, starting with 1, that is set on the Slave units only.

Figure 3-44: **Parallel discharge** screen on Master (left) and Slave units (right)

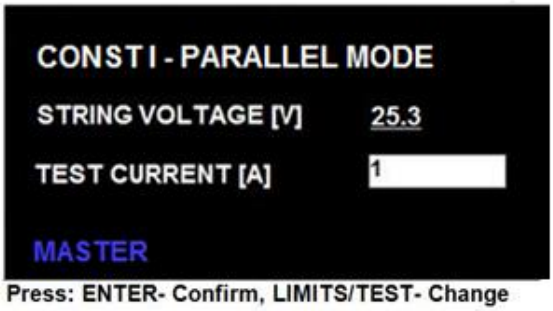


After all the selections have been confirmed, press the ***ENTER*** button on all SLAVE units first and at the end on the MASTER unit. The MASTER device switches to the next screen (Fig. 3-45).

Note:

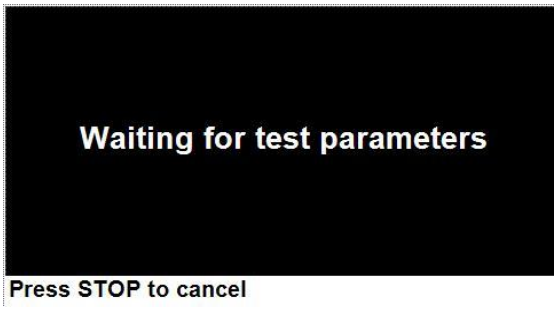
In the parallel connection the MASTER unit will discharge as much energy as possible; the remaining energy (discharge current / discharge power) is distributed evenly among all connected SLAVE units. Minimum discharge current of connected Slave units is 1 A.

Figure 3-45:
Test Master unit settings menu



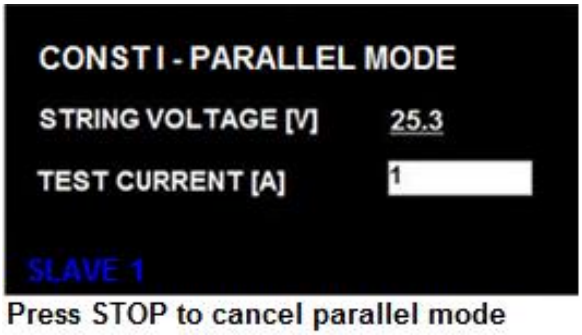
The SLAVE device(s) display(s) the following message (Figure 3-46):

Figure 3-46:
Message on slave



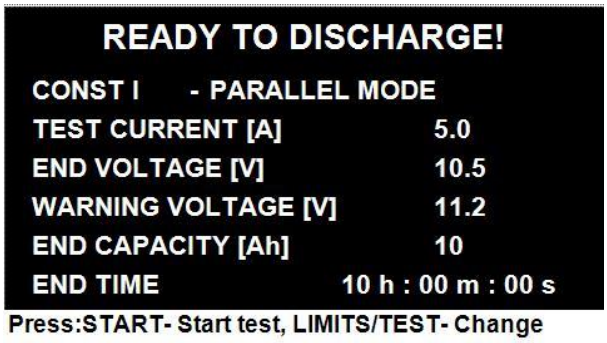
As the Master unit is set as *Master*, the Slave unit(s) will display the following screen (Figure 3-47):

Figure 3-47:
Test settings menu on **SLAVE 1** device



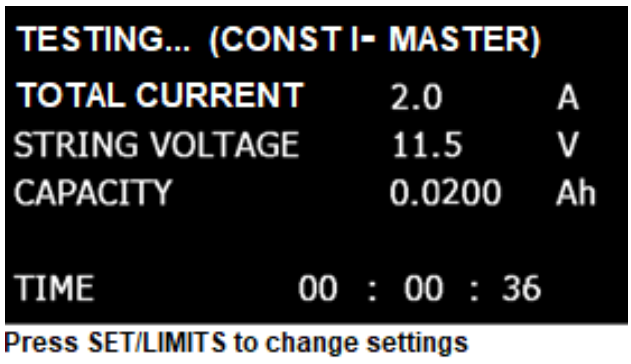
After all the selections have been confirmed by pressing ***ENTER*****,** the MASTER device switches to the **Ready** screen (Fig. 3-48):

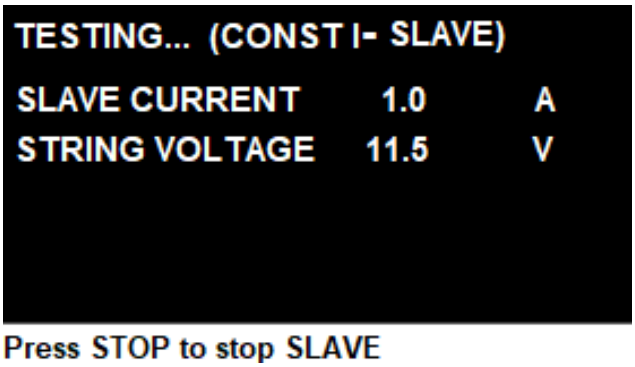
Figure 3-48:
Test **Ready** screen for Parallel discharge



If the user is satisfied with the parameter values, the test can be started by pressing ***START*****.** When the test starts the parallel discharge testing screen is displayed on both/all devices:

Figure 3-49: Testing screen for **Parallel discharge:** Master (left) and Slave (right)

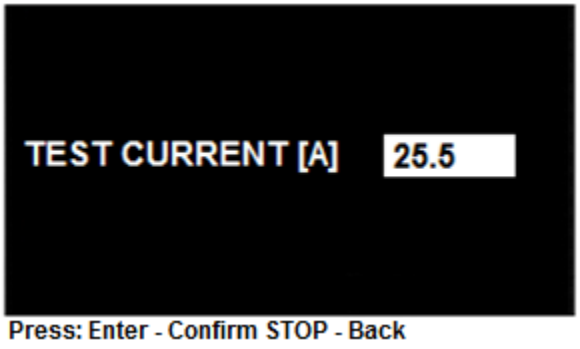




If the user decides to change discharge current during the parallel discharge test it can be done by pressing the ***SET*** button on the MASTER unit.

The BLU enables the user to modify the test parameters during the test. The **SET** button needs to be pressed in order to be able to change the test Current / Power / Resistance.

Figure 3-50:
Load settings



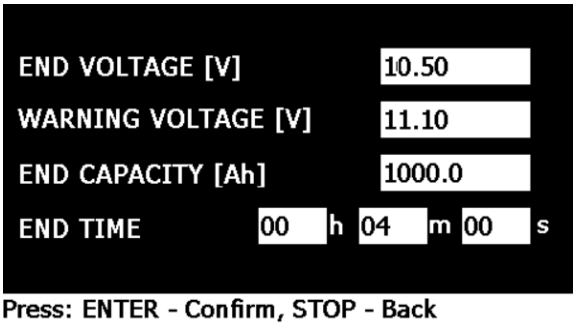
The ***RIGHT*** button is used to navigate through numerical field, from one digit to another and ***UP/DOWN*** to change the current value. After the value has been changed the **ENTER** button is pressed and the test continues running with the new selected current / power / resistance.

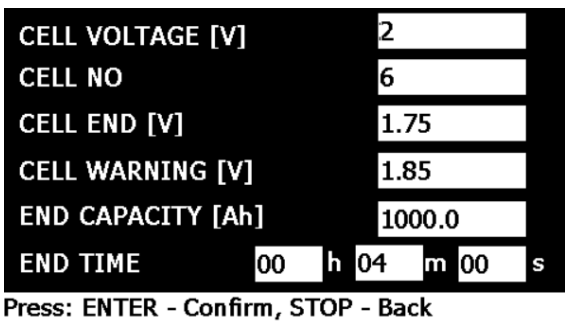
The BLU will limit maximum values of current or power / minimum values of resistance that can be set during the test. The limits depend on battery voltage the BLU is connected to.

If the user enters changes in the SET menu without confirming them by pressing ENTER, after 45 seconds the test settings screen will be displayed again but no changes will be introduced.

If the user requires changing limits' settings during the test, it can be done by pressing the Limits button on the front panel. Depending on the selected limit type prior the test (*Auto limits* or *String limits*), different parameters could be reset in the ***Limits*** *menu*.

Figure 3-51:
The Limits screen if String limits (left) or Auto limits (right) were selected



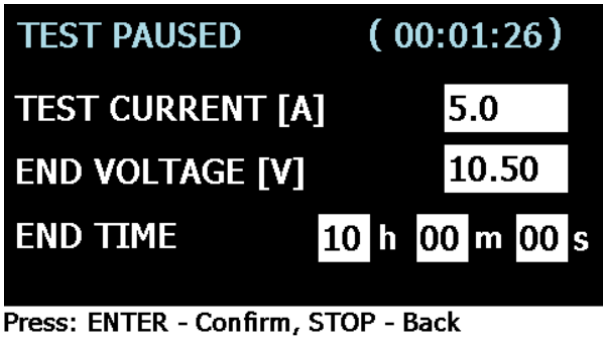


Any of the listed parameters can be modified, as it can be done prior the test.

The ***ENTER*** button is used to confirm the value and to move to the next field. In case the value in previously confirmed fields needs to be changed, the ***STOP*** button is used to go to a line back.
After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new limit settings will be loaded and the test will continue with the new parameters.

Additionally, if the user needs to pause the test (in order to replace a bad cell) it can be done by pressing the ***STOP*** button only once. Double-pressing the ***STOP*** button will terminate the test.
Pressing the ***STOP*** button during the test will display the Pause screen (Figure 3-52).

Figure 3-52:
The **Pause** menu for constant current modes



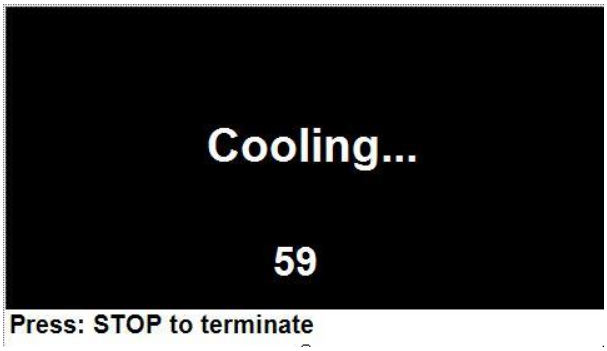
The user can change the test current (or power or resistance, depending on the selected mode), final battery voltage and test time. Changes are confirmed by pressing the ***ENTER*** button.

After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new test settings will be loaded and the test will continue with the new parameters.

When the test is paused, fans will continue operating for 60 seconds. The cooling process cannot be interrupted.

After the test has been completed, the BLU will display an appropriate message and the buzzer will sound for 0,5 sec. The cooling process will continue for additional 60 seconds to cool down the internal dissipating structure.

Figure 3-53:
The **Cooling** message



Note:

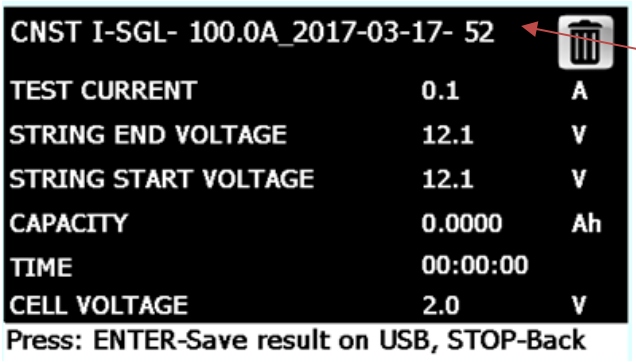
The 1-minute cooling process after the end of test can be aborted by pressing the STOP button. However, after a several hours long discharge test it is strongly recommended not to interrupt the post-test cooling process.

Pay attention to never remove the leads during the testing process!

As the cooling process ends, the **Results** screen is displayed (Figure 3-54).

The results screen displays: test current, cell voltage (only if *Auto Limits* are selected), start voltage, end voltage, capacity and discharge time. The test ID (consisting of a date and a test number) is presented on the top of the screen. The ID number will be automatically offered; however, the user can modify it. To save results in the BLU device memory the ***ENTER*** button should be pressed***.*** The result can be opened in the Memory menu and download on a USB from the memory menu for further analysis.

Figure 3-54:
The **Results** screen

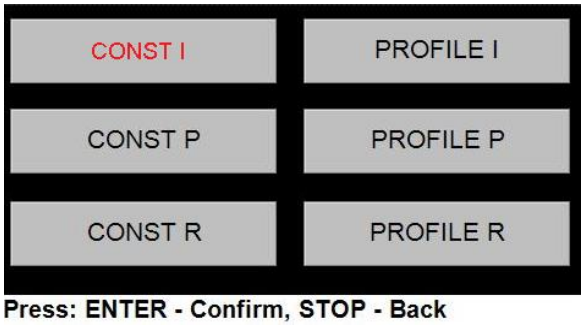


The opened result can be deleted from the instruments memory by pressing the ***DELETE*** button. User will be requested to confirm that wants to delete the results before the result is irreversibly deleted from instrument's memory.

3.3.4 Profile Modes

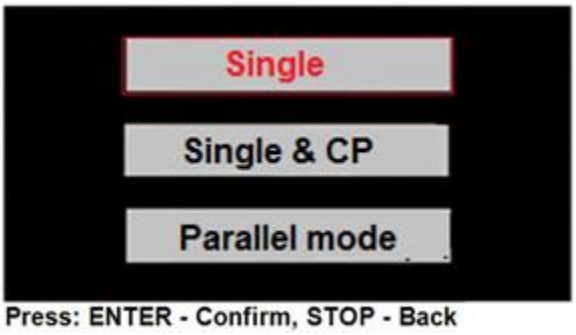
PROFILE modes provide selection of time intervals in which the discharge current, power or resistance will be changed in order to perform modified performance tests. Profile modes (PROFILE I, PROFILE P and PROFILE R) can be selected on the Test type settings screen (Figure 3-55).

Figure 3-55:
The **Test type** settings



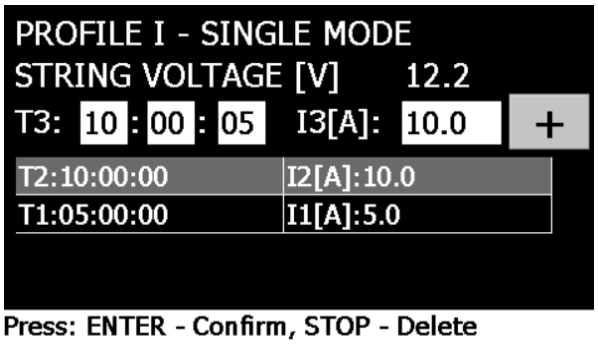
The ***UP*** / ***DOWN*** buttons are used for navigation and ***ENTER*** is used for selecting the test type. After the test type has been confirmed by pressing ***ENTER,*** the following screen will be displayed:

Figure 3-56:
Test mode settings



The ***UP*** / ***DOWN*** buttons are used for navigation and ***ENTER*** button is used to confirm the test mode. After the test mode has been confirmed by pressing ***ENTER,*** the instrument switches to the Profile test settings screen (Fig 3-57).

Figure 3-57:
Profile test settings

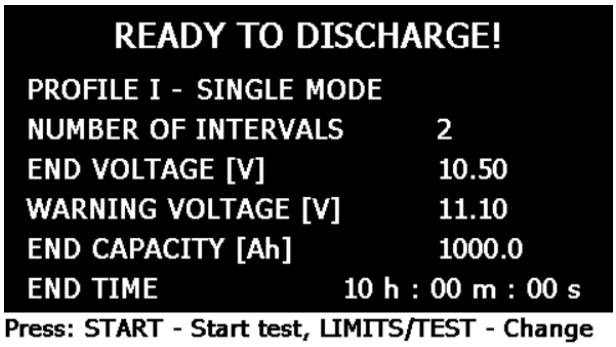


The ***RIGHT*** button is used to navigate through numerical fields (from one digit to another) in order to set desired values for each digit separately. ***UP/DOWN*** buttons are used to set desired values. The ***ENTER*** button is used to confirm the value for selected numerical field and to move to the next field. In case the value in the previously confirmed field needs to be changed, the ***STOP*** button is used to go back. The interval can be added by clicking the button "**+**". To add the next interval, it is necessary to use the touch screen on the display and position the cursor on the desired field. To delete one of the previously set intervals, or all intervals, press the ***STOP*** button and select the wanted solution: *Clear last profile* or *Clear all profiles.*

Pressing the ***TEST*** button device exits the current PROFILE test type and switches to the Test type settings screen.

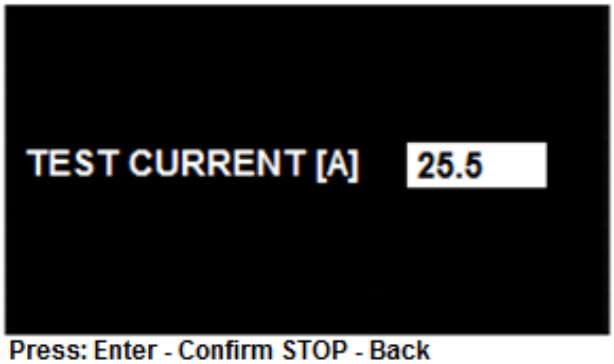
After all the intervals have been confirmed, the instrument switches to the **Ready** screen (Figure 3-58) by pressing the ***ENTER*** button.

Figure 3-58:
The **Ready** screen for the Profile I mode



The BLU enables the user to modify the test parameters during the test. The **SET** button needs to be pressed to change the test current/power/resistance.

Figure 3-59:
Load settings



Use the ***RIGHT*** button to navigate through the numerical field, from one digit to another and ***UP/DOWN*** to change the current value. After the value has been changed the ***ENTER*** button is pressed and the test continues running with the new selected current/ power/resistance.

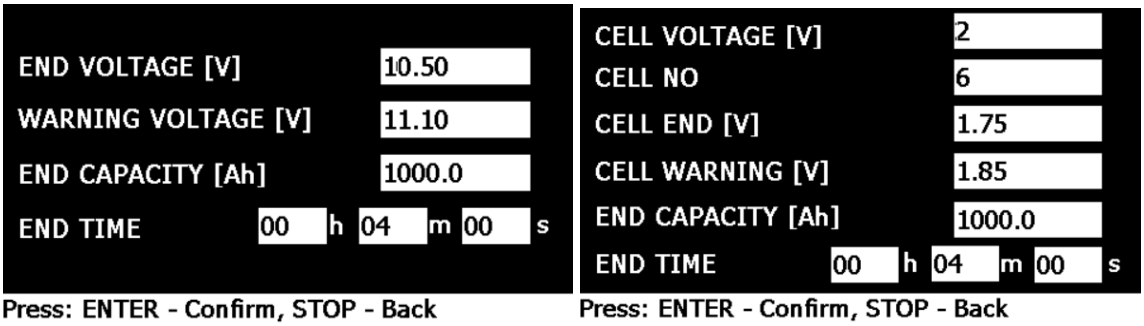
The BLU will limit values of current/power/resistance that can be set during the test. The limits depend on a battery voltage the BLU is connected to.

BLU enables setting 0 A in Profile I mode in any interval. This option enables battery resistance measurement which is based on high load / no load sequence.

If the user enters changes in the SET menu without confirming them by pressing *ENTER*, after 45 seconds the test settings screen will be displayed again but no changes will be introduced.

If the user requires changing limits settings during the test, it can be done by pressing the ***Limits*** button on the front panel. Depending on the selected limit type prior the test (*Auto limits* or *String limits*), different parameters could be reset in the ***Limits*** *menu*.

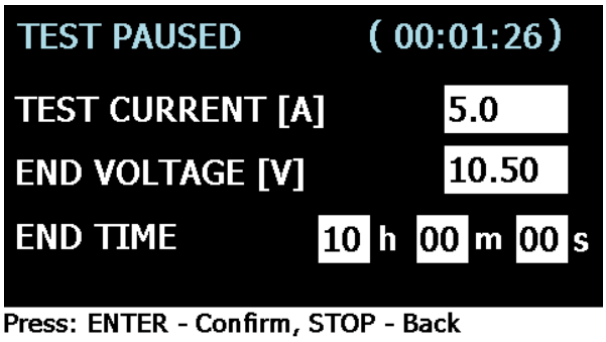
Figure 3-60:
The Limits screen if String limits (left) or Auto limits (right) were selected



Any of the listed parameters can be modified, as it can be done prior the test.
The ***ENTER*** button is used to confirm the value and to move to the next field. In case the value in previously confirmed fields needs to be changed, the ***STOP*** button is used to go to a line back.
After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new limit settings will be loaded and the test will continue with the new parameters.

Additionally, if the user needs to pause the test (in order to replace a bad cell) it can be done by pressing the ***STOP*** button only once. Double-pressing the ***STOP*** button will terminate the test.
Pressing the ***STOP*** button during the test will display the Pause screen (Figure 3-61).

Figure 3-61:
The **Pause** menu for constant current modes



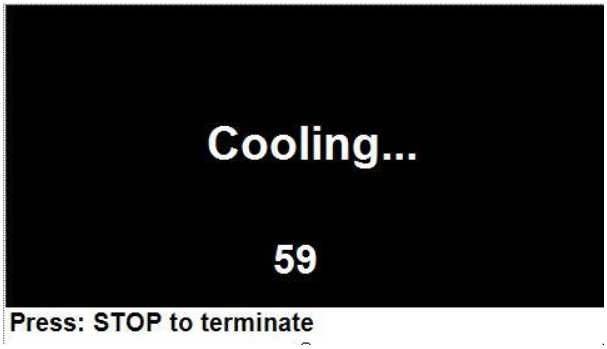
The user can change the test current (or power or resistance, depending on the selected mode), final battery voltage and test time. Changes are confirmed by pressing the ***ENTER*** button.

After pressing the ***ENTER*** button while the cursor is in the last box (END Time → sec), the new test settings will be loaded and the test will continue with the new parameters.

When the test is paused, fans will continue operating for 60 seconds. The cooling process cannot be interrupted.

After the test has been completed, the BLU will display an appropriate message and the buzzer will sound for 0,5 sec. The cooling process will continue for additional 60 seconds to cool down the internal dissipating structure.

Figure 3-62:
The **Cooling** message



Note:

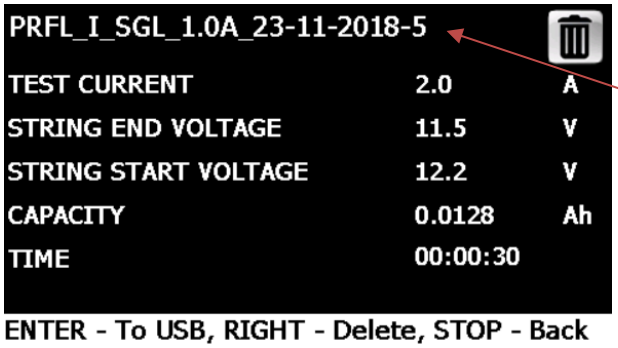
The 1-minute cooling process after the end of test can be aborted by pressing the STOP button. However, after a several hours long discharge test it is strongly recommended not to interrupt the post-test cooling process.

Pay attention to never remove the leads during the testing process!

As the cooling process ends, the **Results** screen is displayed (Figure 3-63).

The results screen displays: test current, cell voltage (only if *Auto Limits* are selected), start voltage, end voltage, capacity and discharge time. The test ID (consisting of a date and a test number) is shown on the top of the screen. The ID number will be automatically offered; however, the user can modify it. To save results in the BLU device memory the ***ENTER*** button should be pressed**.** The result can be opened in the Memory menu and download on a USB from the memory menu for further analysis.

Figure 3-63:
The **Results** screen



The opened result can be deleted from the instruments memory by pressing the ***DELETE*** button. User will be requested to confirm that wants to delete the results before the result is irreversibly deleted from instrument's memory.

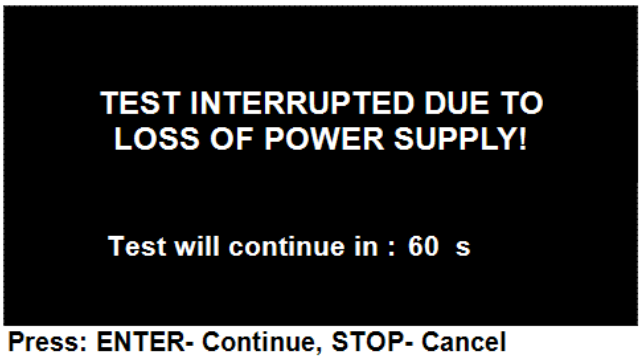
3.4 Mains Power Interruption – Automatic Test Resume

The BLU Series instruments provide a special feature: automatic test resume in case of mains power supply interruption, short-term or long-term. The instrument will pause the discharge tests if mains power supply is interrupted, while all parameters of the discharge test (measured capacity, elapsed time, battery

voltage with 1 sec sampling resolution, discharge current / power / resistance with 1 sec sampling resolution) are recorded in the device's memory.

After mains power supply is restored, the BLU instrument automatically switches on and displays an appropriate message (Figure 3-64).

Figure 3-64:
Automatic Test Resume



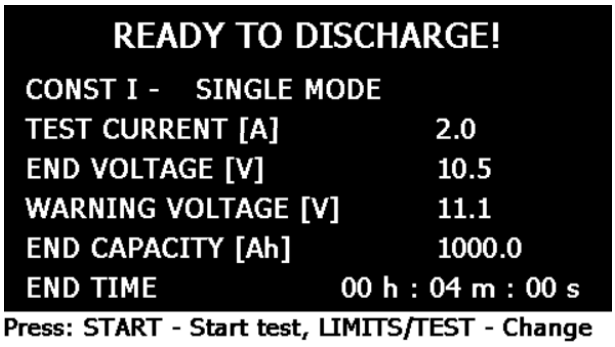
After 60 sec, the discharge test will be continued without need for human interaction (the exception are test in *Current probe (CP)* mode which requires current probe zeroing before test can be continued*).* The buzzer will be on until 60 sec time counts down to zero. As the zero is reached, the test continues and all pre-test test settings remain unchanged (end voltage, test time, end capacity, warning limits).

The operator can continue the test manually. The steps to continue with the test depend on the selected test mode (*Single, Current probe-CP, or parallel*).

3.4.1 Single mode

After the power supply is restored, the following screen is displayed (Figure 3-65) by pressing the ***ENTER*** button.

Figure 3-65:
„Ready to discharge" screen

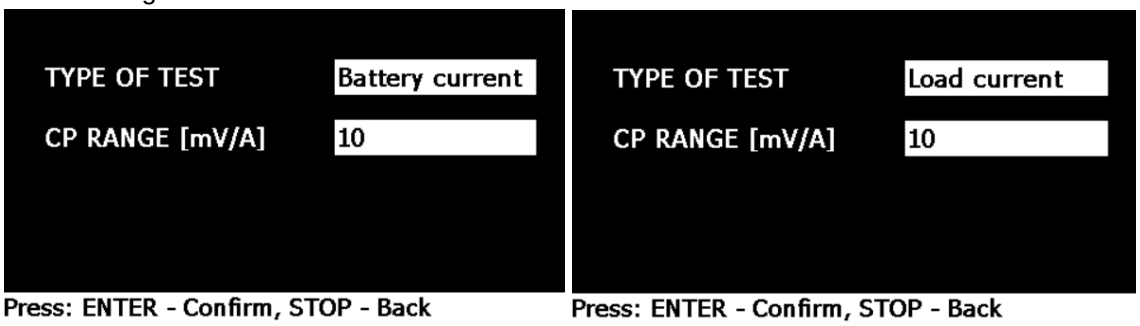


Pressing the ***START*** button, the test will be continued and all pre-test test settings remain unchanged (end voltage, test time, end capacity, warning limits). During the test, the test settings can be changed (test current / power / resistance and limits) as in case of non-interrupted tests.

3.4.2 Current probe (CP) mode

After the power supply is restored, one of 2 following screens is displayed (Figure 3-66).

Figure 3-66:
Test Settings menu for **CP MODE**

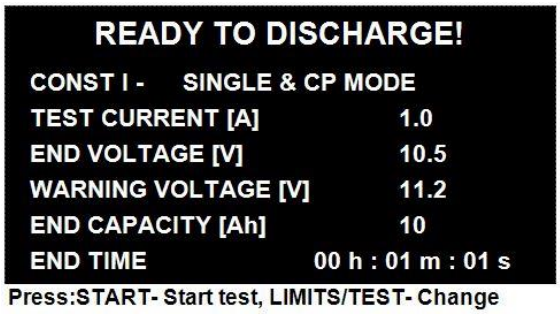


After confirming that **Type of test** and **CP range** correspond to pre-test selected options (and range selected on the current probe), the operator should zero the current probe. The ***ZERO*** button on the current probe should be pressed in order to change the offset value. The offset should be below 5 A for the probe to be zeroed. When the CP offset reaches the value below 5 A, "**OFFSET ZEROING DONE**" message appears on the display.
After all the selections have been confirmed and offset zeroing done, by pressing ***ENTER*** the device switches to CP Ready menu, where test settings can be rechecked before continuing the test by pressing the ***Start*** button.

Note:
The current probe readings / BLU readings will be inaccurate if the current measured by current probe during the test is less or equal to the zeroed offset value.

In case a BXL is used, it is necessary to set the BXL parameters before starting the test.

Figure 3-67:
„Ready to discharge“ screen

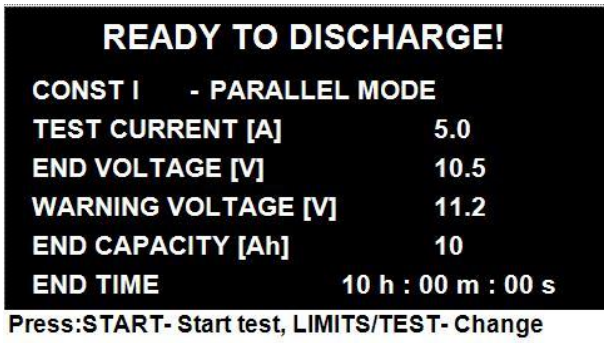


Pressing the ***START*** button, the test will be continued and all pre-test test settings remain unchanged (end voltage, test time, end capacity, warning limits). During the test, the test settings can be changed (test current / power / resistance and limits) as in case of non-interrupted tests.

3.4.3 Parallel mode

After the power supply is restored, the following screen is displayed (Figure 3-68) by pressing the ***ENTER*** button.

Figure 3-68:
„Ready to discharge“ screen



Pressing the ***START*** button, the test will be continued and all pre-test test settings remain unchanged (end voltage, test time, end capacity, warning limits). During the test, the test settings can be changed (test current / power / resistance and limits) as in case of non-interrupted tests.

3.5 The Memory Menu

To preview the saved test results press the ***MEM*** button on the front panel. The results are listed by a test ID and a date of the test as shown in the Figure 3-69.

Figure 3-69:
The **Memory** screen



Using ***UP*** and ***DOWN*** buttons, a specific test results can be selected. Press the ***ENTER*** button to display it.

The ***ENTER*** button should be pressed to save the displayed result to a plugged-in USB. The USB can be removed as the message “Result is saved” is displayed on the screen. Pressing the ***DELETE*** button, the opened result will be deleted from the instruments memory.

3.6 Measurement Parameters

Overview of the maximum currents for various battery voltage ranges with the minimum achievable cell voltage of 1,75 V is presented in the table 3.3. Maximum currents available by using BXL series devices are also presented in the table. The highest resolution of the reading is always displayed.

Table 3.3: Maximum currents for various battery voltage ranges

		Maximum discharge current (A)								
Battery voltage (V)		BLU100A	BLU200A	BLU340A	BXL-A	BLU110T	BLU220T	BXL-T	BLU360V	BXL-V
Nom.	Min/Max									
6	5,25	40	60	50	59	100	100	74	50	11
	7,05				80			100		15
12	10,5	80	120	100	119	150	200	156	100	26
	14,1				160			210		35
24	21,0	160	240	160	186	150	350	230	160	55
	28,2				250			310		75
48	42,0	160	240	160	186	150	350	230	160	115
	56,4				250			310		155
60	52,5	120	210	160	81	120	270	185	160	141
	70,5				110			250		190
110	96,3	110	140	160	119	-	-	-	160	96
	129,3				160					130
120	105,0	100	140	150	134	-	-	-	150	107
	141,0				180					145
220	192,5	55	75	110	67	-	-	-	110	85
	258,5				90					115
240	210,0	50	70	100	67	-	-	-	100	93
	282,0				90					125
480	300,0	-	-	-	-	-	-	-	65	34
	410,0									46
	410,0								55	46
	500,0									55
Weight (kg / lbs)		12,8 / 28.2	14,5 / 32	20,6 / 45.4	12,5 / 28	12,8 / 28.2	15,1 / 33	12,5 / 28	20,6 / 45.4	16 / 35
Max Power (kW)		14,2	19,7	28,4	25,4	8,5	19,2	17,9	28,4	35

Typical accuracy of the BLU instrument is:

- ± (0,5 % of reading + 0,2 A) for the current measurement, and
- ± (0,5 % of reading + 0,1 V) for the voltage measurement, with the full scale values shown in the Table 3.3.

Guaranteed accuracy for the BLU instrument is:

- ± (1 % of reading + 0,5 A) for the current measurement, and
- ± (1 % of reading + 1 V) for the voltage measurement.



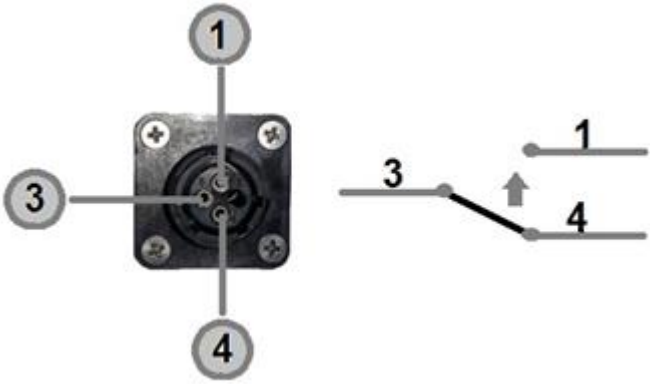
Note: It is important to provide a good connection between the clamps and the connecting point on the test object to achieve stable and accurate test results.

4 External Alarm Function

This function is provided and controlled by a relay connected to a connector called “ALARM” from the figure below. This connector and the adequate cable are used for connecting to the external alarm. The relay specifications are the following: 6 A, 250 V.

The external alarm connector is shown on the figure bellow. The pins 1, 3 and 4 of the connector are in use, where pin 2 is not used. Pin 3 corresponds to common branch of the relay. Pin 1 corresponds to steady state of the relay and pin 4 corresponds to active mode. When relay closes the circuit between pins 3 and 1 the alarm is not activated, i.e. the alarm is in steady mode. However, when relay closes the circuit between pins 3 and 4 the alarm is activated.

Figure 4-1:
The external alarm connector



The cable which is usually plugged in the above connector and connected to the external alarm is shown on the figure below:

Figure 4-2:
The external alarm cable



Green cable corresponds to pin 4, which is connected to the active mode of the relay.
Brown cable corresponds to pin 1, which is connected to the steady state of the relay.
Yellow cable corresponds to pin 3, which is connected to the common branch of the relay.

The alarm is activated in the following scenarios:

- Alarm value of string voltage or discharge time is reached.
- The test is stopped because string voltage limit value or end discharge time are reached
- Power supply suddenly interrupted and the device is turned off.
- Thermal protection is activated due to overheating.
- Fan failure.
- Sudden connection failure between the device and the battery set.

The alarm is acknowledged and reactivated by pressing any of the arrow buttons or by pressing STOP button, depending on a different scenario.

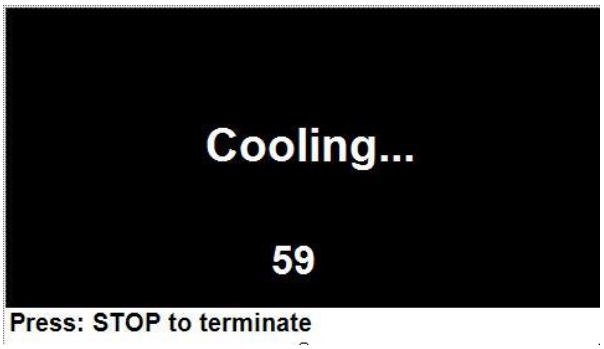
5 Warning Messages

Any operational situation requiring additional attention is indicated by an external alarm or by an alarm buzzer sound. Furthermore, the display indicates a status message. To stop the external alarm or the alarm buzzer, the status message should be removed from the display. To stop the test and to return to the **TEST SETTINGS** menu press ***STOP***.

5.1 Warning Message "Cooling"

The ***STOP*** button needs to be pressed 2 times to stop the test. Double-pressing the ***STOP*** button, the BLU enters a cooling stage that lasts 60 seconds while the *Cooling* message is displayed. After several hours long discharge test, it is recommended not to interrupt the 1-minute cooling. However, the cooling process can be terminated sooner by pressing the ***STOP*** button once again.

Figure 5-1:
Warning message "**Cooling**"



5.2 Warning Message "STRING ALARM VOLTAGE REACHED"

This message is displayed when the preset warning level of the string voltage value is reached. The audio alarm sounds with one short and sharp tone.

Figure 5-2:
Warning message "**String alarm voltage reached**"



Note: If the external alarm is not used, the internal BLU alarm buzzer will be activated the same way in all the above scenarios instead.

5.3 Warning Message "DISCHARGE TIME OVER"

This message is displayed when the value of discharge test time is reached. The test will be stopped and the alarm is activated with the continuous sound lasting 15 seconds. There is a half-minute pause and then again the continuous sound is present for 15 seconds, unless the alarm has been acknowledged by pressing the ***STOP*** button.

Figure 5-3:
Error message
"**Discharge time**



5.4 Warning Message "MEMORY FULL"

This message indicates that BLU internal memory capacity is reached and new results cannot be saved. It is necessary to delete some results from the memory to save the just-obtaining results.

Figure 5-4:
Warning message
"**Memory full**"



5.5 Warning Message "STRING END VOLTAGE REACHED"

This message indicates that the preset end voltage value is reached. The test is stopped and the alarm is activated with the continuous sound lasting 15 seconds. There is a half-minute pause and then again the continuous sound is present for 15 seconds, unless the alarm has been acknowledged by pressing the ***STOP*** button.

Figure 5-5:
Error message
"**String end voltage reached**"



6 Error Messages

Any operational error is signaled by an external alarm or by an internal device buzzer alarm plus the display indicates a status message. To stop the external alarm or the alarm buzzer, the status message should be removed/acknowledged from the display. To stop the test and to return to the **TEST SETTINGS** menu press ***STOP***.
If abnormal operating conditions occur during the battery testing, the following error messages will appear on the display.

6.1 Error Message "FANS FAILURE"

This message appears if there is a failure of more than one upper fan or any other fan in the device. The alarm is activated and continuous sound is present for 15 seconds followed by a half minute pause and then again the continuous sound is present for 15 second, unless the alarm has been acknowledged.

Figure 6-1:
Error message
"**Fan failure**"



6.2 Error Message "OVERCURRENT"

This message is shown if the hardware protection (current exceeds BLU maximum current) or the firmware protection (current is 10% over the allowed value) is activated. The test will be stopped and the alarm is activated with the continuous sound for 15 seconds, a half minute pause and the continuous sound again for 15 second, unless the alarm was acknowledged. In this case the suggestion is to restart the device, reset the test parameters and restart the test.

Figure 6-2:
Error message
"**Overcurrent**"



6.3 Error Message "OVERHEATING"

If the BLU operating temperature rises too high this warning will appear. The test will be stopped and the alarm is activated with the continuous sound present for 15 seconds a half a minute pause and again 15 seconds of continuous alarm sound until the alarm is acknowledged.
In the case of overheat, it is necessary to wait for the test set to cool down and repeat the test.

Figure 6-3:
Error message
"**Overheating**"



6.4 Error Message "OVERVOLTAGE"

The error message “OVERVOLTAGE” will be displayed if the voltage measured by the BLU instrument is higher than its maximum voltage. The BLU will instantaneously stop the test if voltage measured on its current or voltage terminals is higher than:

- 300 V for BLU100A, BLU200A and BLU340A unit;
- 70,5 V for a BLU220T model;
- 500 V for a BLU360 V.

Figure 6-4:
Error message
"**Overvoltage**"



The test can be restarted if the voltage is within the defined range for a specific model.

7. Installing Foldable Platform Truck

If ordered, foldable platform truck will not be attached to the transport case. However, the steps to attach the platform to the transport case is simple and not time-consumable.

Step 1. Prepare transport case, the platform track and belt with hooks (Figure 1).
Step 2. Unfold the Platform Track. Move back side of transport case to the Platform Track (Figure 2).
Step 3. Place the hooks around handle at the top (Figure 3).
Step 4. Follow steps marked by 1, 2 and 3 on Figure 4.
Step 5. Pull the belt strongly forward, and press down to fix it (Figure 5). Transport case is ready for moving.




Figure 7-1 and 7-2

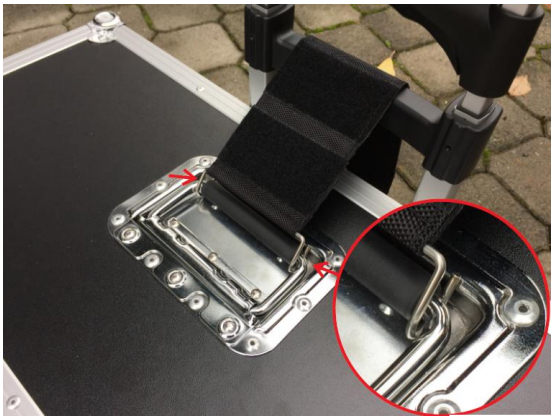
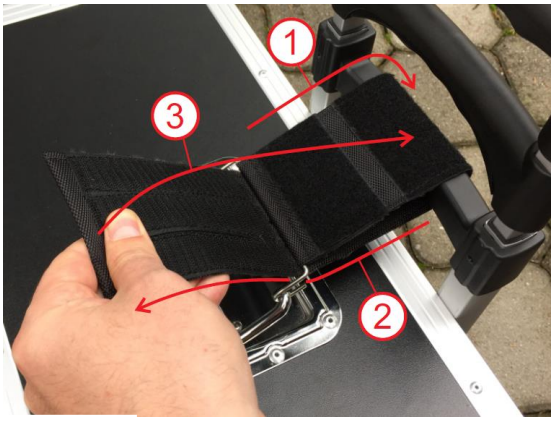



Figure 7-3 and 7-4

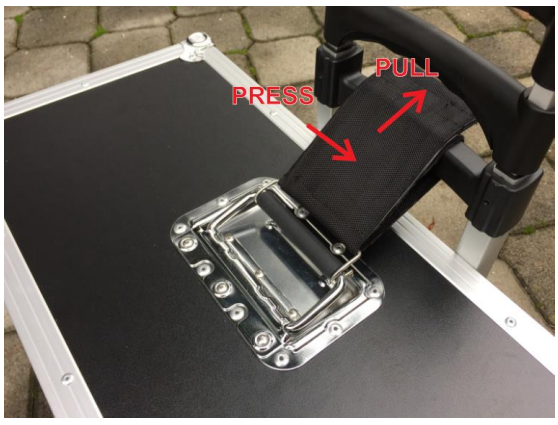




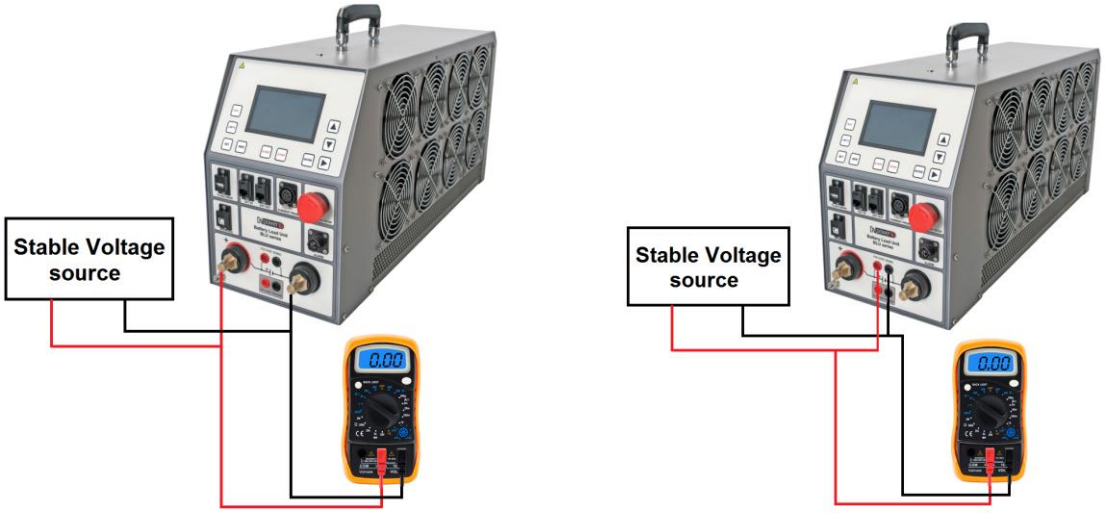
Figure 7-5 and 7-6

8. Troubleshooting guide

8.1. Voltage measurement check

If it is suspected that the device is not measuring DC voltage accurately, please perform the voltage measurement check described below.

1. Connect a DC voltmeter to BLU device for voltage measurement check of current terminals channel, as shown in the Figure 8-1.a.
2. Use a stable DC voltage source, to generate required values of test voltages, as stated in Table 8-1.
3. Compare each generated voltage value with the expected value on BLU device from Table 8-1.
4. Repeat the same procedure from points 1-3 for measurement check of VS channel (Figure 8-1.b)



1.1.a. 1.1.b

Figure 8-1: *Connection of BLU device for DC voltage measurement check.*
8-1.a. Voltage measurement check of current terminal channel
8-1.b. Voltage measurement check of VS channel

Test voltage [V]	Expected voltage on BLU device [V]
12	*11,8 - 12,2*
24	*23,8 - 24,2*
48	*47,7 - 48,3*
60	*59,6 - 60,4*
120*	*109,4 – 110,7*

Test voltage [V]	Expected voltage on BLU device [V]
240*	*218,8-221,2*
320**	*318,3-321,7*
380**	*378,0-382,0*
420**	*417,8-422,2*
480**	*477,5-482,5*

Table 8-1 - *DC voltage measurement check*

**applicable for models BLU100A, BLU200A, BLU340A, and BLU360V*
***applicable for model BLU360A*

8.2. Current measurement check

If it is suspected that the device is not measuring DC current accurately, please perform the current measurement check described below.

1. Connect BLU device, a battery, a DC voltmeter and a 1 mΩ/100 mΩ test shunt (depending on the test current), as shown in Figure 8.2.
2. Select the test current values on BLU, as shown in Table 8.2, by entering the TEST menu on the device, and selecting a test in CONST I mode.
3. To start the test, click on button ENTER to enter the *Ready menu,* and press START.
4. Measure the voltage drop on the test shunt R_{shunt} using the digital voltmeter.
5. Compare voltage drop values on the test shunts measured with the digital multimeter, with the expected voltage drop values, given in Table 8.2.

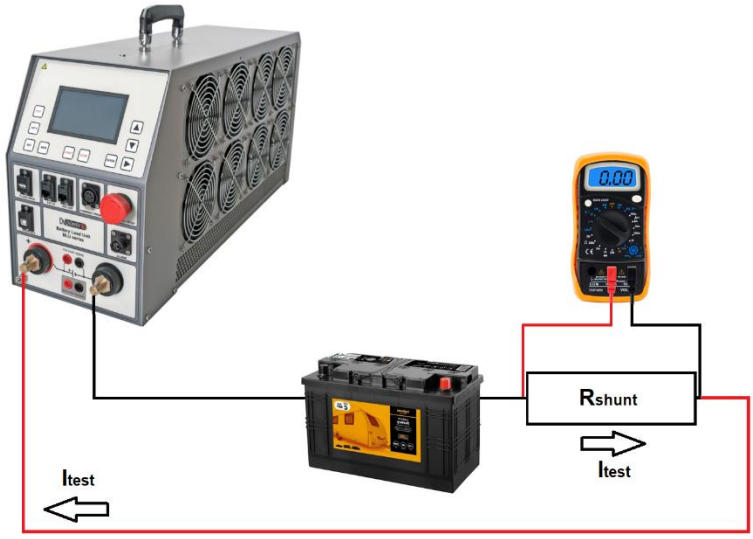


Figure 8-2: *Connection of BLU device for DC curent measurement check.*

BLU test current [A]	R_{shunt} [mΩ]	Measured voltage drop V_{shunt} [mV]
5	**100**	477,5 – 522,5
10	**100**	*975,0 – 1025,0*
15	**100**	*1 472,5 – 1 527,5*
20	**100**	*1 970,0 – 2 030,0*
25	**100**	*2 467,5 – 2 532,5*
50	**100**	4 955,0 – 5 045,0

BLU test current [A]	R_{shunt} [mΩ]	Measured voltage drop V_{shunt} [mV]
100	**1**	99,3 – 100,7
150	**1**	149,0 – 151,0
*200**	**1**	198,8 – 201,2
*240**	**1**	248,5 – 251,5
*300***	**1**	298,3 – 301,7
*350***	**1**	348,0 – 352,0

Table 8-2 - *DC current measurement check*

**applicable for models BLU220T and BLU200A*
***applicable for model BLU220T*

NOTE: Since the maximum current available on the BLU device depends on the measured voltage, please choose the rated voltage of the battery, according to table 3.3, for choosing the appropriate test current values.

9. Customer Service

Before calling or sending an e-mail to Customer Service for assistance, please take the following steps:

- Check all cable connections.
- Try the test on another instrument, if available.
- Perform the troubleshoot procedure.
- Have the following information available: instrument serial numbers, hardware configuration, and software revision.
- Exact description of the problem, including DUT (Device Under Test), error messages and the sequence of events before it appeared.
- List of solutions that have been tried.

The Customer Support Department can be reached at:

Local support (Sweden): + 46 8 731 78 24
International support: + 46 70 0925 000
E-mail: support@dv-power.com



Note: **Email communication is preferred for support issues, since the case is then documented and traceable. Also, the time zone problems and issues with occupied telephones do not occur.**

10. Packing the Instrument for Shipment

If you need to send the instrument to DV Power for servicing, please contact the DV Power Customer Service for return instructions at:

Local support (Sweden): +46 8 731 78 24
International support: +46 70 0925 000
E-mail: support@dv-power.com



Note: **DV Power is not responsible for any damage during shipping. Please carefully protect each instrument from shipping and handling hazards. Ensure the protective covers are securely in place. Instrument has to be sent to DV Power as freight pre-paid, unless other arrangements have been authorized in advance by the DV Power Customer Service.**

To prepare an instrument for shipment, please follow these instructions:

1. Disconnect and remove all external cables. Do not include manuals, cables, and transducer connecting rods unless recommended by DV Power Customer Service.

2. Reuse the original packing material if it is available. If it is not available, pack the instrument for shipment according to the instructions for fragile electronic equipment. It is recommended use two-wall minimum

corrugated cardboard box with a minimum 5 cm (2 inch) thick poly foam padding, or a wooden crate with minimum of 5 cm (2 inch) thick poly foam padding all around.

11 Technical Data

11.1 Mains Power Supply

- Connection — according to IEC/EN60320-1; C320
- Voltage — 90 V – 264 V AC, 50 / 60 Hz, single-phase
- Power consumption — 100 VA for BLU100A model
  150 VA for BLU200A, BLU220T, BXL-A and BXL-T models
  200 VA for BLU340A, BLU360V and BXL-V models
- Fuse — 2 A / 230 V, type F

11.2 Dimensions and Weights

- BLU Series

Model	Dimensions	Weight
BLU100A	440 x 221 x 355 mm 17.3 x 8.7 x 14 in	12,8 kg 28 lbs.
BLU110T	440 x 221 x 355 mm 17.3 x 8.7 x 14 in	12,8 kg 28 lbs.
BLU200A	560 x 221 x 355 mm 22 x 8.7 x 14 in	14,5 kg 32 lbs.
BLU220T	560 x 221 x 355 mm 22 x 8.7 x 14 in	15,1 kg 33 lbs.
BLU340A	730 x 221 x 355 mm 28.7 x 8.7 x 14 in	20,6 kg 45.4 lbs.
BLU360V	730 x 221 x 355 mm 28.7 x 8.7 x 14 in	20,6 kg 45.4 lbs.

- BXL Series

Model	Dimensions	Weight
BXL-A	560 x 221 x 355 mm 22 x 8.7 x 14 in	12,5 kg 28 lbs.
BXL-T	560 x 221 x 355 mm 22 x 8.7 x 14 in	12,5 kg 28 lbs.
BXL-V	730 x 221 x 355 mm 28.7 x 8.7 x 14 in	16 kg 35 lbs.

11.3 Maximum Discharge Current & Power

- BLU Series

Model	Current	Power
BLU100A	160 A	14,2 kW
BLU110T	150 A	8,5 kW
BLU200A**	240 A	19,7 kW
BLU340A	160 A	28,4 kW
BLU360V*	160 A	28,4 kW
BLU220T	350 A	19,4 kW

- BXL Series

Model	Current	Power
BXL-A	250 A	25,4 kW
BXL-T	310 A	17,9 kW
BXL-V	190 A	35,0 kW

* For the BLU360V model only, maximum power derates at temperatures over +35˚C (+95˚F).

Current / voltage diagram for the BLU360V model at +35˚C (+95˚F) and +50˚C (+122˚F) is presented the Figure 11-1

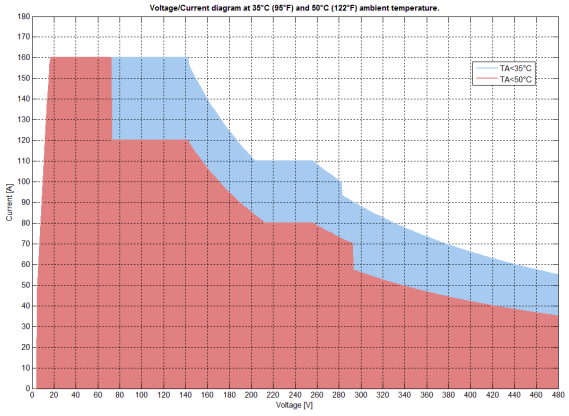


Figure 11-1:
Current / voltage diagram for the BLU360V model

** For the BLU200A model only, maximum power derates at temperatures over +35˚C (+95˚F).

Current / voltage diagram for the BLU200A model at +35˚C (+95˚F) and +50˚C (+122˚F) is presented the Figure 11-2.

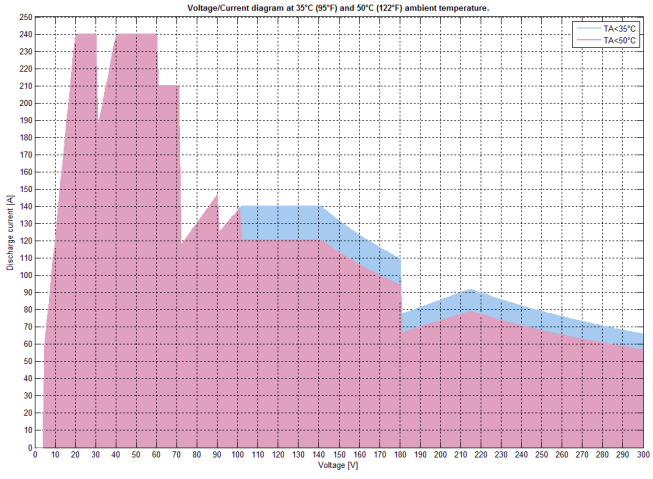


Figure 11-2:
Current / voltage diagram for the BLU200A model

11.4 Measurement

Internal Voltage Measurement

Model	Range	Resolution
BLU100A	0 – 300 V DC	0,1 V
BLU200A	0 – 300 V DC	0,1 V
BLU340A	0 – 300 V DC	0,1 V
BLU110T	0 – 75 V DC	0,1 V
BLU220T	0 – 75 V DC	0,1 V
BLU360V	0 – 500 V DC	0,1 V

- Typical accuracy: ± 0,5% of reading ± 0,1 V

Model	Range	Resolution
BXL-A	0 – 300 V DC	1 V
BXL-T	0 – 75 V DC	1 V
BXL-V	0 – 500 V DC	1 V

- Typical accuracy: ± 0,5% of reading ± 1 V

Internal Current Measurement

Model	Range	Resolution
BLU110T	0 – 200 A DC	0,1 A
BLU100A	0 – 300 A DC	0,1 A
BLU200A	0 – 300 A DC	0,1 A
BLU340A	0 – 300 A DC	0,1 A
BLU360V	0 – 300 A DC	0,1 A
BLU220T	0 – 400 A DC	0,1 A

- Typical accuracy: ± 0,5 % of reading ± 0,2 A

Model	Range	Resolution
BXL-A	0 – 300 A DC	1 A
BXL-T	0 – 450 A DC	1 A
BXL-V	0 – 250 A DC	1 A

- Typical accuracy: ± 0,5% of reading ± 1 A

Current probe range and resolution (for BLU Series)

- Range 0 – 300 / 1 000 A DC
- Resolution 0,1 A DC

Time measurement (for BLU Series)

- Typical accuracy ± 0,01 % of reading ± 1 digit

11.5 Display

- For BLU Series 4,3 inch touch screen color display
- For BXL Series LCD screen 16 characters by 2 lines with backlight, visible in bright sunlight

11.6 Warranty

- 3 years

11.7 Environment conditions & Standards

Environment conditions

- Operating temperature:
  -10 °C to +50 °C / 14 °F to +122 °F
- Storage & Transportation temperature:
  -40 °C to +70 °C / -40 °F to +158 °F
- Humidity: 90%, non-condensing

Applicable standards

- Low Voltage Directive:

  Directive 2014/35/EU (CE conform)
  Applicable standards, for a class I instrument, pollution degree 2
  Installation category II: IEC EN 61010-1
- Electromagnetic Compatibility (EMC):

  Directive 2014/30/EU (CE conform).
  Applicable standard: EN 61326-1
- CAN/CSA-C22.2 No. 61010-1

All specifications herein are valid at ambient temperature of + 25 °C /+ 77°F and recommended accessories. Specifications are subject to change without notice.

12 Accessories



Current cables



Extension cables



Sense cables with dolphin clips



Transport case for BLU



Current probe 30/300 A



Cable bag



Cable set for BLU-BXL simultaneous triggering



Cable for BLU-BLU parallel operation



Cable for external alarm

Order Info

Instrument	Article No
Battery Load Unit BLU100A	BLU100A-N-00
Battery Load Unit BLU200A	BLU200A-N-00
Battery Load Unit BLU110T	BLU110T-N-00
Battery Load Unit BLU220T	BLU220T-N-00
Battery Load Unit BLU340A	BLU340A-N-00
Battery Load Unit BLU360V	BLU360V-N-00
Battery External Load Unit BXL-A	BXL400X-A-00
Battery External Load Unit BXL-T	BXL400X-T-00
Battery External Load Unit BXL-V	BXL400X-V-00

Included Accessories	Article No
Windows based DV-B Win PC software including USB cable (*for BLU models*)	
Mains Power cable	MPCXXA-XX-00
Ground (PE) cable	CABLE-GND-00
Transport case for BLU – small size (*for BLU100A and BLU110T models*)	HARD-CASE-B0
Transport case for BLU – medium size (*for BLU200A, BLU220T, BXL-A and BXL-T models*)	HARD-CASE-BL

Transport case for BLU – large size (*for BLU340A, BLU360V and BXL-V models*)	HARD-CASE-B1

Recommended	**Article No**
Current cables 2 x 3 m 25 mm^2 (9.84 ft., 4 AWG) with alligator clamps (A4) isolated (*for BLU110T*)	C2-03-25FA4I
Current cables 2 x 3 m 35 mm^2 (9.84 ft., 2 AWG) with alligator clamps (A4) isolated (*for BLU100A, BLU340A, BLU360V, BXL-A and BXL-V models*)	C2-03-35VA4I
Current cables 2 x 3 m 50 mm^2 (9.84 ft., 0 AWG) with alligator clamps (A4) isolated (*for BLU200A*)	C2-03-50VA4I
Current cables 2 x 3 m 70 mm^2 (9.84 ft., 00 AWG) with alligator clamps (A4) isolated (*for BLU220T*)	C2-03-70FA4I
Cable bag	CABLE-BAG-00

Optional	**Article No**
Current cables 2 x 3 m 50 mm^2 (9.84 ft., 0 AWG) with alligator clamps (A4) isolated (*for BLU100A, BLU340A, BLU360V, BXL-A and BXL-V models*)	C2-03-50VA4I
Current cables 2 x 5 m 35 mm^2 (16.4 ft., 2 AWG) with alligator clamps (A4) isolated (*for BLU100A, BLU340A, BLU360V, BXL-A and BXL-V models*)	C2-05-35VA4I
Current cables 2 x 5 m 50 mm^2 (16.4 ft., 0 AWG) with alligator clamps (A4) isolated (*for BLU100A, BLU200A, BLU340A, BLU360V, BXL-A and BXL-V models*)	C2-05-50VA4I
Current cables 2 x 5 m 70 mm^2 (16.4 ft., 00 AWG) with alligator clamps (A4) isolated (*for BLU220T and BXL-T models*)	C2-05-70FA4I
Current cables 2 x 10 m 35 mm^2 (32.8 ft., 2 AWG) with alligator clamps (A4) isolated (*for BLU100A, BLU340A, BLU360V and BXL models*)	C2-10-35VA4I
Current cables 2 x 10 m 70 mm^2 (32.8 ft., 00 AWG) with alligator clamps (A4) isolated (*for BLU220T and BXL-T models*)	C2-10-70FA4I
Extension cables 2 x 5 m 35 mm^2 (16.4 ft., 2 AWG) (*for BLU100A, BLU340A, BLU360V, BXL-A and BXL-V models*)	E2-05-35VA3I
Extension cables 2 x 3 m 50 mm^2 (19.84 ft., 0 AWG) (*for BLU100A, BLU200A, BLU340A, BLU360V, BXL-A and BXL-V models*)	E2-03-50VA3I
Extension cables 2 x 5 m 70 mm^2 (16.4 ft., 00 AWG) (*for BLU220T and BXL-T models*)	E2-05-70VFMI
Extension cables 2 x 10 m 35 mm^2 (32.8 ft., 2 AWG) (*for BLU100A, BLU340A, BLU360V and BXL models*)	E2-10-35VA3I
Extension cables 2 x 10 m 50 mm^2 (32.8 ft., 0 AWG) (*for BLU100A, BLU340A, BLU360V and BXL models*)	E2-10-50VA3I
Sense cables 2 x 3 m (9.84 ft.) with banana plugs + dolphin clip (*for BLU models*)	S2-03-00BPDC
Sense cables 2 x 5 m (16.4 ft.) with banana plugs + dolphin clip (*for BLU models*)	S2-05-00BPDC
Sense cables 2 x 10 m (32.8 ft.) with banana plugs + dolphin clip (*for BLU models*)	S2-10-00BPDC
Current clamp 30/300 A power supplied from the instrument with extension 5 m (16.4 ft.) (*for BLU models*)	CACL-0300-06
Cable for external alarm (*for BLU models*)	CABLE-EXA-05
Extension cable for external alarm 5 m (16.4 ft.) (*for BLU models*)	E1-EXABLU-05
Cable for BLU-BLU parallel operation 3 m (9.84 ft.) (*for BLU200A, BLU220T, BLU340A and BLU360V models*)	CP-03RJ45-00
Cable set 2 x 2 m 1 mm^2 (6.56 ft., 17 AWG) for BLU-BXL simultaneous triggering (*for BXL models*)	PO-02-01BPBP
Cable set 2 x 5 m 1 mm^2 (16.4 ft., 17 AWG) for BLU-BXL simultaneous triggering (*for BXL models*)	PO-05-01BPBP

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