



# BATTERY VOLTAGE SUPERVISOR **BVS**

## Manual



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## 1. Introduction

The instructions in this manual should help the user to avoid unsafe situations, reduce maintenance costs and ensure reliability and durability of the BVS.

The BVS must be used in accordance with all existing safety requirements and regulations based on national/local standards for accident prevention and environmental protection. In addition, the relevant international standards are listed in the Paragraph 8 of the “Technical data” section of this document.

### 1.1. Safety Instructions

#### 1.1.1. Safety Terms and Symbols

##### Terms in this Manual

These terms may appear in the Manual:

**WARNING:** Warning statements identify conditions or practices that could result in an 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 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 Device

The following symbols may appear on the device:



Refer to Manual



Insulation class II

#### 1.1.2. Terms of Use

The BVS 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 BVS 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. 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 BVS is being used. Before using the BVS, all personnel (even the personnel who only occasionally, or less frequently, work with the BVS) assigned to operate the BVS should read this Manual. Do not make any modifications, extensions, or adaptations to the BVS. Use the BVS only with the original accessories provided by its manufacturer. Use the BVS 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 (e.g. battery electrolyte, corroded battery terminals etc.) affecting its operation.

### **1.1.5. Operator qualifications**

- The BVS is a system to be used by personnel who are trained and qualified to recognize the associated hazards when working with such systems and are familiar with the safety precautions required to avoid a possible injury.
- Proper installation and testing are essential to the correct functioning of the system. In case of any questions concerning installing and operation of BVS system, contact DV Power Support and/or request monitoring assistance. Except as explained in this manual, do not attempt to service the BVS equipment.
- Any adjustment, maintenance, or repair of this product must be performed by qualified personnel or contact a customer engineer through DV Power support. Never allow unauthorized personnel to operate the equipment. Only qualified and trained personnel are to perform the operations described in this manual.
- Calibration of the BVS must be performed by technically qualified trained personnel.

### **1.1.6. Safe operating procedures**

Batteries are potentially dangerous, and proper precautions must be observed in handling and maintenance of batteries and its monitoring system. Maintenance shall be done only by personnel knowledgeable of batteries and trained in the safety precautions involved. Properly insulated tools and adequate personal protective equipment shall be used when working with batteries and the monitoring system.

The following personal protective equipment shall be available to personnel who perform battery maintenance work: glasses and face shields, acid-resistant gloves, protective aprons, portable or stationary water facilities for rinsing eye and skin in case of contact with electrolyte, class C fire extinguisher, acid or alkaline neutralizer, and adequately insulated tools.

Observe the following precautions:

- Prohibit smoking and open flames, and avoid arcing in the immediate vicinity of the battery.
- Avoid wearing metallic objects, such as jewelry.
- Keep the top of a battery clear of tools and other foreign objects.
- Ensure unobstructed egress from the battery area.
- Ensure that battery area and/or cabinet ventilation is operable.
- Neutralize static buildup just before working on the battery by having personnel contact the nearest effectively grounded surface.
- Do not remove battery vents.



**Safety is the responsibility of the user. Before operating the BVS, please read the following safety instructions carefully.**  
**It is not recommended the BVS is used (or even turned on) without careful observation of the instructions listed in this Manual.**

- Do not install the BVS under wet or moist conditions (condensation).
- Before putting the BVS into operation, check the entire device for any visible damage.
- Use of the BVS in a manner not specified in this Manual could compromise designed-in safety.



**CAUTION: During installation of BVS system, all connections between BVS-CU and cell modules CVM, SVM and SCM should be performed with BVS-CU disconnected from power supply. Not following these instructions can cause damage to the BVS system.**



**WARNING: Connecting the CVM to a battery**  
**Never connect provided VS cables to the battery prior to connecting to the CVM. The voltage sense cables should firstly be connected to the CVM, and subsequently to the battery.**

- Remove the BVS in case of presence of explosive gas or vapors.
- Work inside the instrument without prior authorization from DV Power will void the instrument's warranty and it can be extremely risky, prone to serious injury.
- If the BVS seems to be malfunctioning, please contact the DV Power Support Team (refer to the "Manufacturer Contact Information" section).
- When performing any work related to batteries, it is recommended to follow all safety procedures and safe working practices in IEEE recommended standards for battery maintenance and testing procedures.

- Never work on any system that threatens life or injury through hazardous voltages, even when safety precautions have been taken.
- Any unauthorized changes or modifications to the equipment that may create unsafe or even hazardous situations are forbidden.
- In case of disconnecting battery inter-cell connections, it is recommended first to disconnect all CVM units from the battery string.
- Do not disconnect/connect the communication cables during the work of the system.
- After servicing of the battery, any removed links must be fitted and reconnected **before** the CVM modules are reinstalled.



**WARNING:** Before performing any work on batteries that can produce hazardous conditions, e.g. sulfuric acid and water spillage while adding water into battery electrolyte, it is recommended to disconnect the CVM module from the battery in case of potential spillages of water and/or sulfuric acid.

## 1.2. Before applying power supply

Check described configuration and provided drawings in this Manual. Refer to the Chapter 3 for Installation instructions of the BVS. Double-check all connections and verify that the system is set to match a necessary voltage level and all the safety precautions are taken.

Assume the high voltage or current may be present inside the equipment to be tested and on the equipment terminals. Observe system's external markings and all electrical safety precautions when removing and installing equipment covers, when connecting leads, and when making adjustments. Never energize the cabinet or any component with 115VAC (or 230VAC if applicable) or battery voltage until after the installation is complete.

**Never exceed equipment voltage, power ratings, or capabilities.**

Note: *Refer to system's external markings described under the Safety Symbols.*

## 1.3. Measurement category

The BVS is intended to be used for measurements in Overvoltage Category I (CAT I) for battery systems up to 500 V.

### **WARNING / AVERTISSEMENT**

This equipment is classified as measurement category I and must not be used within measurement category II, III and IV.

Cet équipement est classé dans la catégorie de mesure I, et ne doit pas être utilisé pour des catégories de mesure II, III et IV.

## **1.4. Intended use**

The Battery Voltage Supervisor Capacity Model (BVS) is an integrated system used for monitoring large battery banks during capacity testing. These batteries serve as a backup power supply in:

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

The primary use of the Battery Voltage Supervisor (BVS) is for real-time measurement of a cell voltage, inter-cell connection voltage and ambient temperature during battery capacity testing. In addition it can measure string voltage and string current using optional string voltage module SVM and string current module SCM. These two modules enables the BVS to monitor discharge test performed with all load banks on the market. By continuously measuring cell and inter-cell voltage values, the BVS provides an extended analysis of individual cell conditions in a battery string. In case a particular cell demonstrates critical voltage values during discharge, the BVS detects it and the user can bypass that cell within a string. In this way, all other remaining cells in the string can continue a discharge process.

## 2. Description

### 2.1. System overview

The BVS is an integrated system consisting of the following elements:

1. **Control Unit BVS-CU**: the main unit that serves as data acquisition and transfer of measured data from CVMs to PC. The BVS-CU also serves as a power supply to all connected CVM modules.
2. **Cell voltage module CVM**: single unit (module) connected to individual batteries, measuring voltage and inter-cell voltage of each battery in a string.
3. **String Voltage module SVM** (optimal accessory): single unit (module) connected to a string, measuring voltage of the entire string.
4. **String current module SCM** (optimal accessory): single unit (module) connected with a current clamps to a string, measuring string current.

**Note:** Current clamps are battery supplied. It is important to emphasize that the battery needs to be fully charged before the test, in order to avoid any loss of the results.

The BVS-CU unit, besides being a data collector and forwarding all measured data to an external PC, can also provide ambient temperature measurements. Up to 4 temperatures measurement channels can be used for obtaining battery average ambient temperature.

### 2.2. BVS connection diagram

Proper operation between BVS-CU and CVMs is provided by connecting the units in a bus topology, as shown in the figure 2-1. In this way, a fault in one CVM will not affect data transfer to the rest of CVM units. The BVS-CU uses RS485 serial communication for data transfer to a CVM. By using a differential data transfer protocol, high noise immunity is also provided. Up to 128 CVM modules can be connected to one BVS-CU.

The BVS connection is illustrated below.

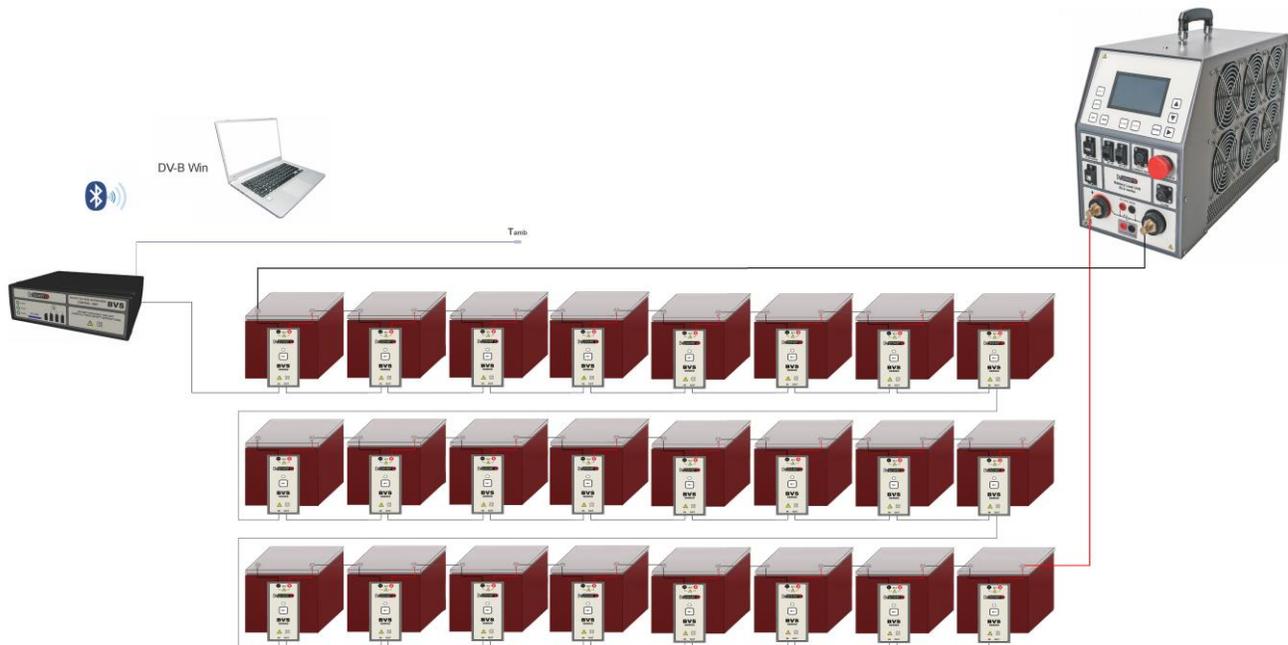


Figure 2-1. BVS (BVS-CU<sup>1</sup> and CVM) connection to battery system with Battery Load Unit (BLU) device

The system is designed as the battery supervision system that can easily be configured for different battery sizes and configurations. The BVS components also have a useful life beyond that of the battery and can be mounted in different configurations due to their lightweight, small size and simple design.

## 2.3. BVS panel components

### 2.3.1. Control Unit BVS-CU

Main functions of the BVS Control Unit (BVS-CU) are:

- Providing 66 V power supply to all connected CVM modules
- Data transfer to DV-B Win application software system
- Data storage in the BVS-CU's internal memory (2 GB SD card)
- Ambient temperature measurement (up to 4 measurement channels are available)

#### 2.3.1.1. BVS-CU front panel

The front view of the BVS Control Unit BVS-CU is presented in the figure below.

<sup>1</sup> The BVS operates with the Battery Load Unit (BLU) series using DV-B Win software. This operational diagram is to illustrate only the connection between the CVM modules and the BVS-CU device.



Figure 2-2 – BVS Control Unit BVS-CU: Front view

**1. LED indication:**

- a. *Power:* During the BVS normal operation and while powered on, the red Power LED is continuously turned on.
- b. *Status:* The green Status LED is turned on while the BVS is turned on and not in test. The LED is blinking during the test.
- c. *Alarm:* In case of one single cell or the whole battery system reaches predefined critical voltage values during a capacity test, the red Alarm LED will start blinking.

**2. SD Card**

The BVS-CU has a 2 GB SD card that serves as internal storage for downloading all measured data from the CVM units to BVS-CU. In case of an external PC is not available, results can be moved to the PC and analyzed using DV-B Win software at a later time.

**3. Temperature measurement connectors**

The BVS-CU has 4 channels for measuring ambient temperatures in different locations, so that the average ambient temperature can be obtained during capacity testing.

**2.3.1.2. BVS-CU back panel**

The back panel of the BVS-CU contains the following components:

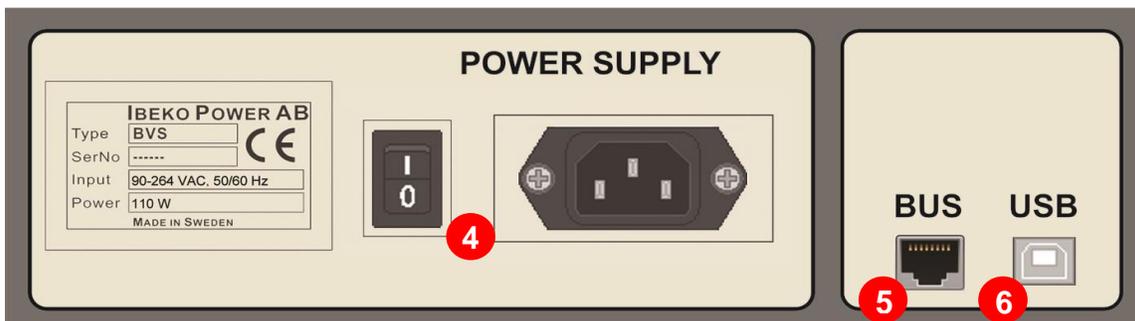


Figure 2-3 – BVS Control Unit BVS-CU: Rear panel view

4. **Mains power connector and power switch**

Connects the device to mains power supply with a grounded power cord. Input voltage of the BVS-CU is 90 – 264 V AC, 50/60 Hz.

5. **RJ45 connector**

Connects the BVS-CU to the last or first CVM in the string.

6. **USB port**

The USB port connector serves to connect the BVS to an external PC via a USB communication cable.

### 2.3.2. Cell Voltage Module CVM



Figure 2-4. Cell Voltage Module (CVM) front View

The CVM components marked on the figure above represent:

1. **LED indication**

Red LED:

- Flashes during the CVM initialization
- Turns on in case of reaching the alarm voltage values

2. **SET**

Before entering in the BVS Monitoring screen, an ID number (address) needs to be assigned to each CVM, which is done by pressing on button SET on each module, after pressing the button *Reset* in DV-B Win software. It is recommended to start setting from the first cell in the battery string to the last in the proper order, for an easier analysis of test results & detection of bad cells.

### 3. Communication ports

RJ45 connectors for communication cables between CVM (IN – input, OUT output). The CVM connection procedure should be performed according to instructions described in the Chapter 3.

### 4. VS cable connectors

Voltage sense connections are used to connect the CVM directly to individual cells.

For the string voltage module SVM, VS connectors are connected to the measured string

For the string current module SCM, this connectors are connected to current probes, for battery current measurement.

## 3. Getting started

Prior to starting installation of BVS, check if all system components are in a proper condition, correctly assembled and clean of any dust or elements that can cause dysfunction of the system or hazardous conditions. In case of any suspicion of BVS proper operation, please contact the manufacturer for further instructions.



**CAUTION:** During installation of BVS system, all connections between BVS-CU and cell modules CVM, SVM and SCM should be performed with the BVS-CU disconnected from power supply! Not following these instructions can cause damage to the system.



**CAUTION:** During connection of CVM to the battery, voltage sense cables should always be connected firstly to CVMs, and then to battery cells. During disconnection, the connection to battery terminals should be removed the first.

Voltage sense cables provided with BVS have an additional insulation layer on banana connectors, to prevent short-circuiting the battery during BVS connection. An additional protection of battery short-circuit is provided by fuses that are installed in VS cables (covered with yellow outer casing). The side of voltage sense cables with yellow marking should be connected to the battery, and the other side of the cable to CVM.

### 3.1. Installation

Each CVM is designed to be installed on a single battery cell. One CVM can also be connected to multiple cells connected in series, if the total voltage does not exceed 30 V. The procedure for configuration and installation of the BVS on a battery string (for the case when cell Nb. 1 is connected to main (-) terminal of the battery) is given below.

1. The CVM module is placed on the battery with a Velcro tape attached to the back side of the module. Clean the area on the battery where Velcro tape is to be placed.
2. Peel the protective paper from the back of the CVM and place the CVM firmly on a battery surface. Install the first CVM in the battery string, as shown in the figure 3-1 (step 1 in figure 3-1).

3. The **IN** RJ45 port of the first CVM in the battery string should be connected to Control unit BVS-CU (the connection to BVS-CU can also be established by connecting the last CVM in the string to BVS-CU through the **OUT** port of the last CVM).
4. Each **OUT** RJ45 port of each CVM in the battery string should be connected to the next CVM **IN** communication port (step 2).
5. Connect the red and black voltage leads to the positive (+) and negative (-) CVM terminals (step 3).
6. Connect the alligator clamps provided with the BVS to the tested battery (step 4).
7. Repeat the steps 1-5 for all batteries in the systems that have BVS installed.

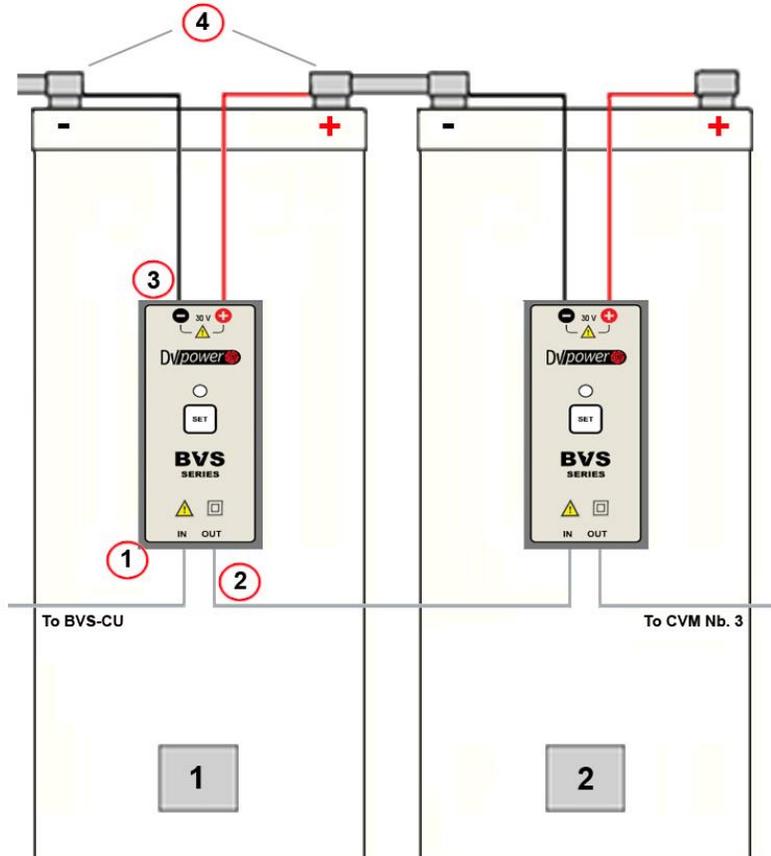


Figure 3-1. Installation procedure for connecting CVM to battery



**CAUTION:** During installation of BVS system, all connections between BVS-CU and cell modules CVM, SVM and SCM should be performed with BVS-CU disconnected from power supply. Not following these instructions can cause damage to the BVS system.

A connection of cell voltage modules with the IN communication port of the first CVM in the string connected to the BVS-CU is shown in figure 3-2.



Figure 3-2. Connection of CVM to BVS-CU

### 3.2. Measurement parameters

#### 3.2.1. Control Unit BVS-CU

##### Ambient temperature measurement

During battery capacity testing, it is recommended to measure the ambient temperature around tested batteries. For these purposes, 4 temperature measurement channels<sup>2</sup> are provided on the BVS-CU to enable ambient temperature measurements at multiple locations. This value can be used for temperature capacity compensation of the discharge test.

#### 3.2.2. Cell Voltage Module CVM

Each CVM has two measurement channels:

- Measurement channel with 30 V DC measurement range, intended for cell voltage measurement
- Measurement channel with 50 mV DC measurement range, whose main purpose is inter-cell voltage measurement

##### Cell voltage measurement

Each cell voltage module CVM is connected directly to cells and measures cell individual voltages of up to 30 V DC, enabling connections to cells of up to 30 V.

##### Inter-cell connection voltage

The basic approach to measuring inter-cell connection voltage is presented in figures 2-5 and 2-6. The connection of the CVM has to be configured in such a way that the **OUT** port of the cell no. **N** is connected to the **IN** port of the cell no. **N+1**.

<sup>2</sup>Different types of temperature probes are available upon request.

The type of connection of CVM to a battery is available in two cases of battery configuration:

1. *The first cell in the battery string is connected to the main (-) terminal of the string*

The connection scheme for this case is presented in figure 2-5. Through the communication link (**OUT** port on cell no. **N**), the voltage on the + terminal of the cell no. **N** is forwarded to the mV measurement channel of the cell no. **N+1**. In this way, the cell no. **N+1** directly measures the inter-cell connection voltage between the cells no. **N** and **N+1** ( $V_{int2}$ , as shown in figure below).

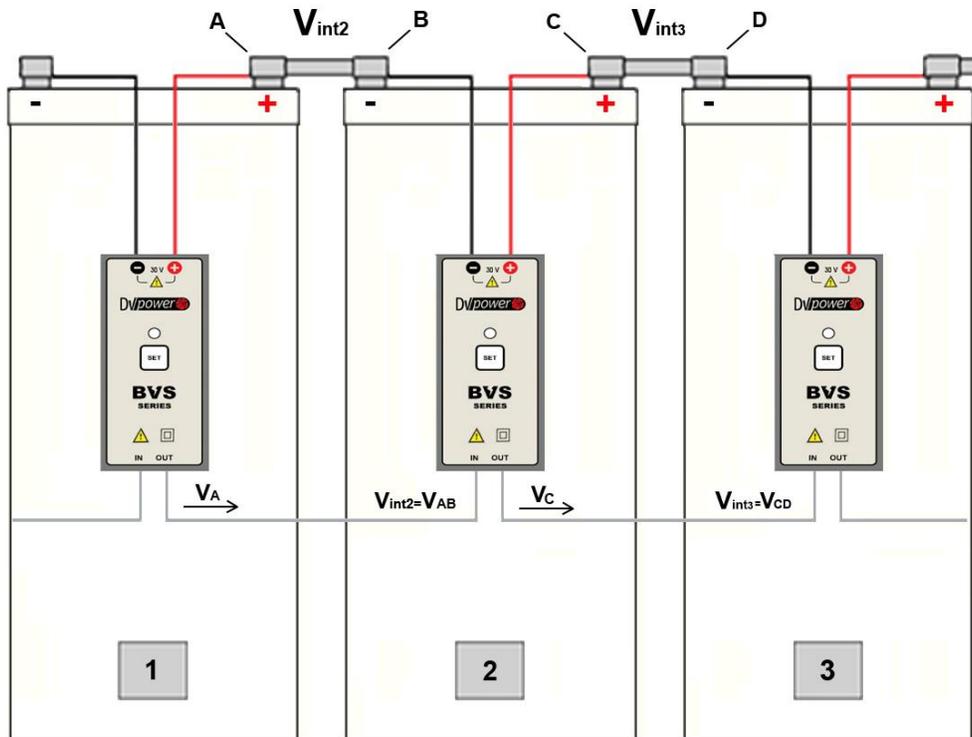


Figure 2-5. CVM Inter-cell connection voltage measurement procedure 1

In this case, the intercell voltage measured by CVM Nb. 2 is  $V_{AB}$ , and the voltage measured by CVM Nb. 3 is  $V_{CD}$ .



## 4. BVS testing with DV-B Win software

Once the system is installed on a battery string and the Battery Load Unit BLU is connected or any other load bank the monitoring procedure can be started. To control the BVS and to set its parameters, DV-B Win software needs to be installed, the instrument needs to be connected to a PC using a USB cable or a Bluetooth module if included. If the BVS is connected to a PC for the first time, it may be necessary to wait until the USB drivers are installed.

The DV-B Win software can be started either by clicking Start –Programs – DV-B Win or by double clicking the DV-B Win icon on the desktop. The starting screen shown in the figure below will appear:

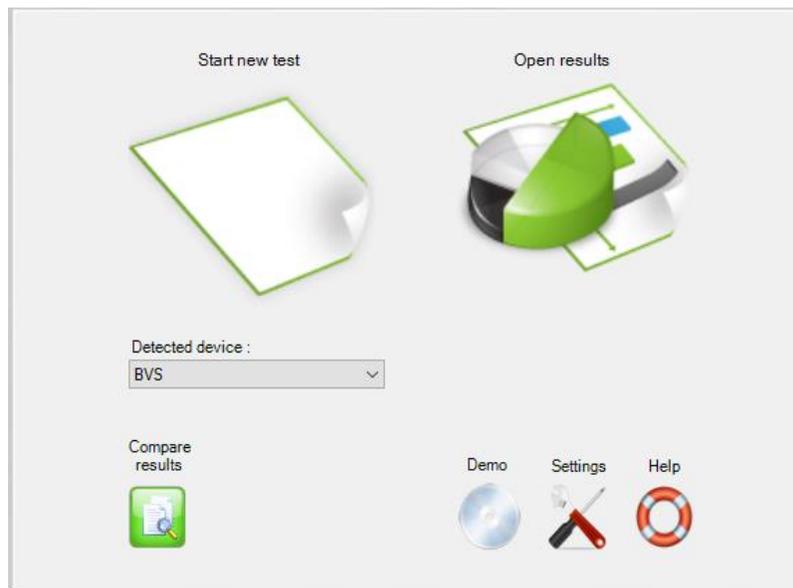


Figure 4-1. The DV-B Win introduction screen

In case the device is not recognized in the detected device field, the new button shown in the upper left corner of the DV-B Win should be pressed.

### 4.1. Test settings

#### 4.1.1 Test Object Information

After the BVS or (BLU & BVS combination) is recognized in the detected devices field and a new test is started, the following user interface display will appear.

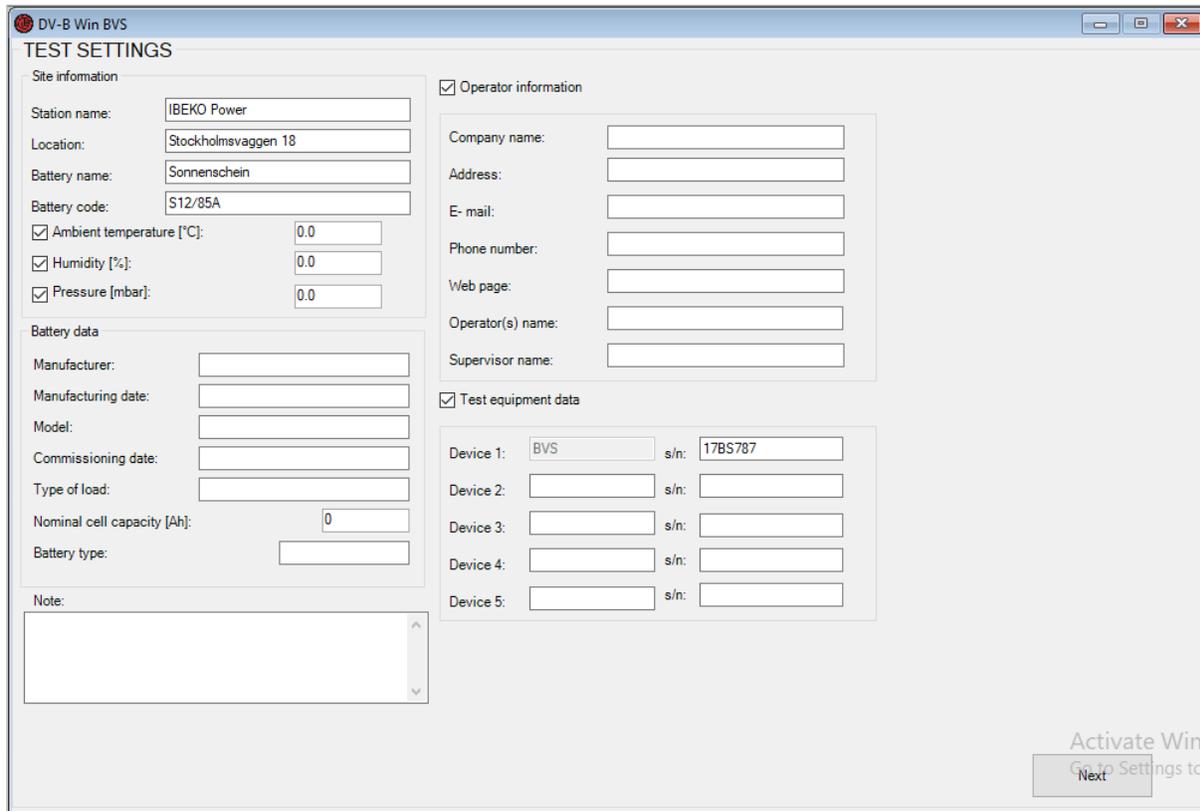


Figure 4-2. Information about the test object

The *Test Settings* window provides an optional way of adding information about location, test object, and the test conditions that may be useful for later analysis. Any data entered in the test info tab will be shown in the automatically generated test report at the end of the test.

After clicking “Next”, the tab info with the test parameters will be displayed (Figure 4-3).

### 4.1.2 Test settings form

#### TEST SETTINGS

**Battery**

Battery string voltage [V]:

Nominal cell voltage [V]:

Number of strings:

Number of cells:

**Limits**

String limits  Auto Limits

END  Warning

Min (End) Warning Max

String voltage [V]

Cell voltage [V]

Cell temperature [°C]

Intercell connection voltage [mV]

**Cell measurement**

Cell measurement mode:

Sample rate:  h  m  s

Number of modules:

Module address:

Cell Temperature

String current

StringVoltage

Device: **BVS** FW version: **0.08** Status: ---

Figure 4-3. Tab of the General test settings menu

Before the start of the monitoring process it is necessary to assign addresses to all modules. The purpose of addressing modules is, to give certain addresses (numbers) to the modules which will link it with the cell number that it monitors. In order to address modules the button **Reset** on DV-B Win form needs to be pressed first. After that, it is necessary to press the **SET** button on each module. By pressing the SET button, the red LED on the module will flash once. That means the module has been addressed properly. BVS has optional string voltage module (**SVM**) and string current module (**SCM**) for string current and voltage measurements. In case these two modules are connected, it is necessary to check the options *String current* and *String voltage* in the test settings screen, as shown on the figure 4-3.

**Note:** *These two check boxes will not appear on the test settings screen in case BVS is connected along with BLU Unit, since the BLU already measures string voltage and string (discharge) current.*

After setting all modules and setting the limits and parameters for a discharge test, the user can move to the next form. By pressing the **Next** button, the following screen appears.

## 4.2. Testing form

The test form can have two different layouts. The layout depends whether BVS works with or without BLU. In case the BVS works without BLU, screen shown on the figure 4-4 appears.

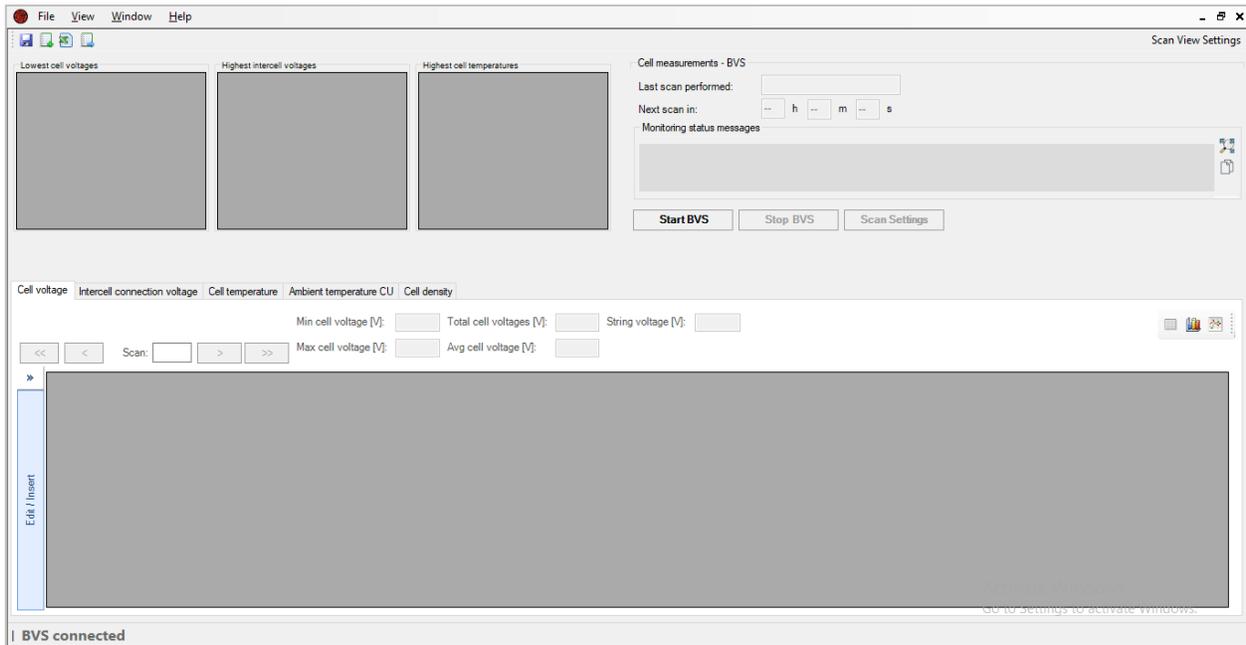


Figure 4-4. Test starting tab BLU and BVS

In case BLU is connected along with the BVS, screen shown on the figure 4-5 appears.

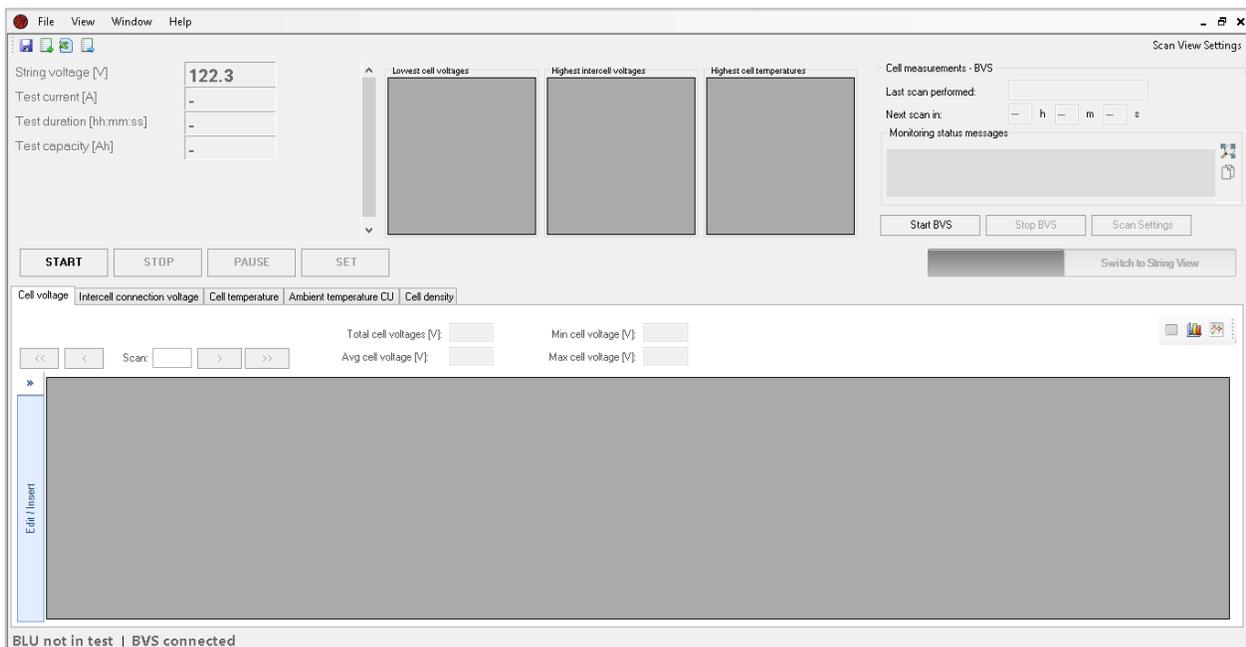


Figure 4-5. Test starting tab BLU and BVS

This window contains two tool sections: one is reserved for a discharge test and another one for the cell voltage-monitoring mode. Both of these sections contain command tools.

#### 4.2.1. Starting the discharge test

For controlling the BLU device during the discharge test, following buttons can be used.

- **START** – start the discharge test
- **STOP** – stop the discharge test
- **PAUSE** – used in case a pause of the test is needed
- **SET** – Pressing the button “SET”, the SET Menu dialog will be displayed without stopping the test. It provides the user the ability to change the test current value and test duration.

#### 4.2.2. Voltage monitoring section

DV-B Win options provided for control of BVS are:

- **Start BVS** – to start the monitoring process.
- **Stop BVS** – to stop the monitoring process.
- **Scan settings** – the Scan settings dialog will be displayed without stopping the monitoring process. It provides the user with ability to change the sampling rate, and uncheck measurement of Intercell voltage or temperature.

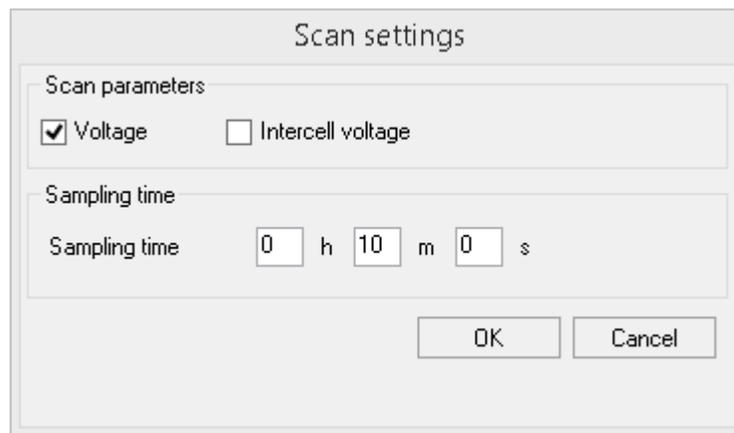


Figure 4-6. Scan settings screen available during the monitoring procedure

Note: The maximum selectable sample rate depends on the number of CVMs connected.

#### 4.2.3. Saving test results

Results obtained from the devices (BLU or/and BVS) can be saved to a file with .dvvb extension. In the Save menu, select Save → Save as file, where a Save dialog box will appear.

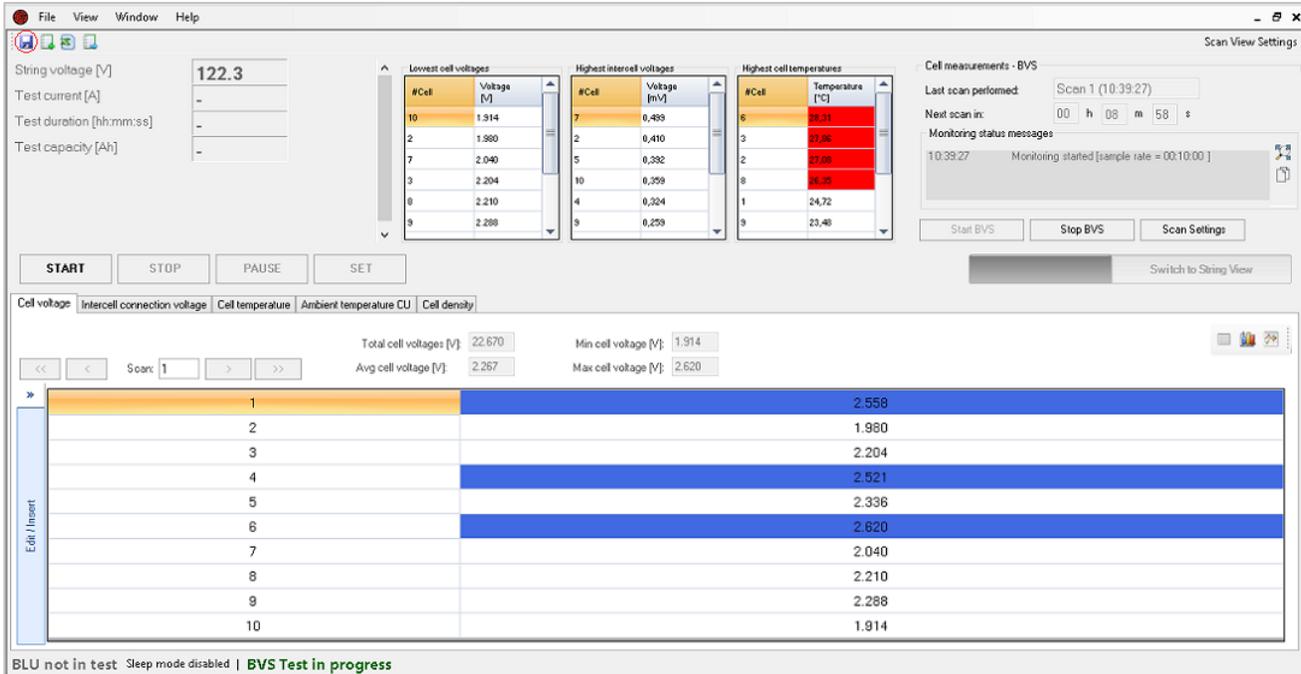


Figure 4-7. Saving test results

#### 4.2.4. Test report creation

A Test report can be generated by pressing the icon “Report” on the toolbar (marked with a red circle in the figure below).

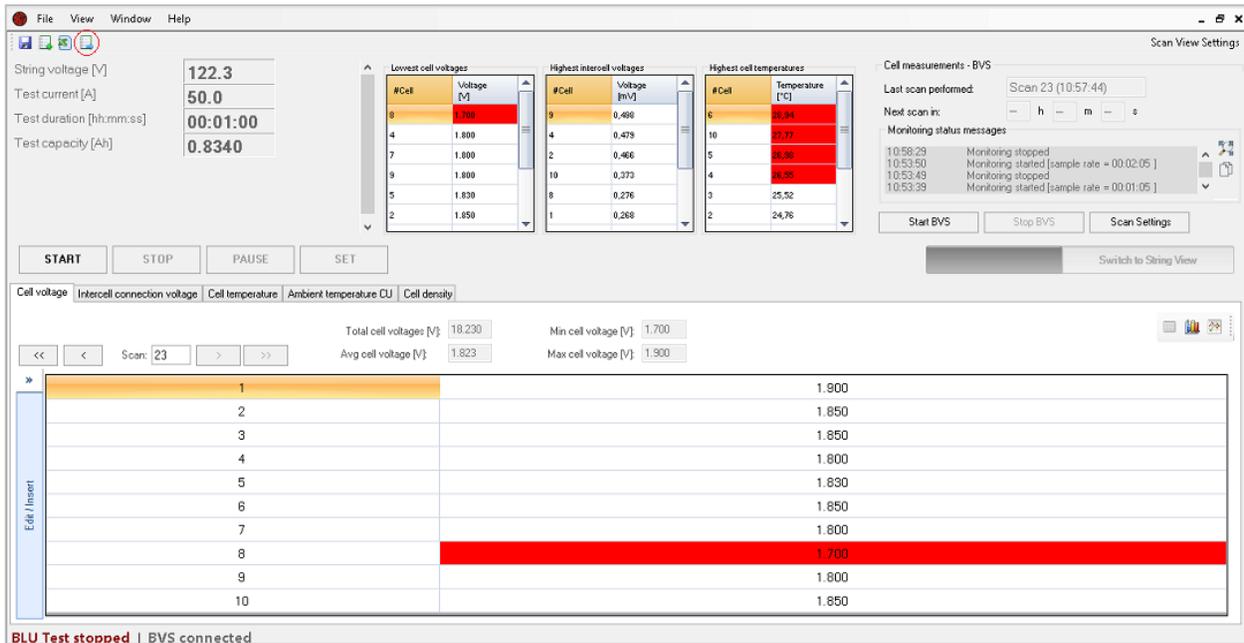


Figure 4-8. Saving test results

After clicking the report button on the toolbar, the report viewer opens:

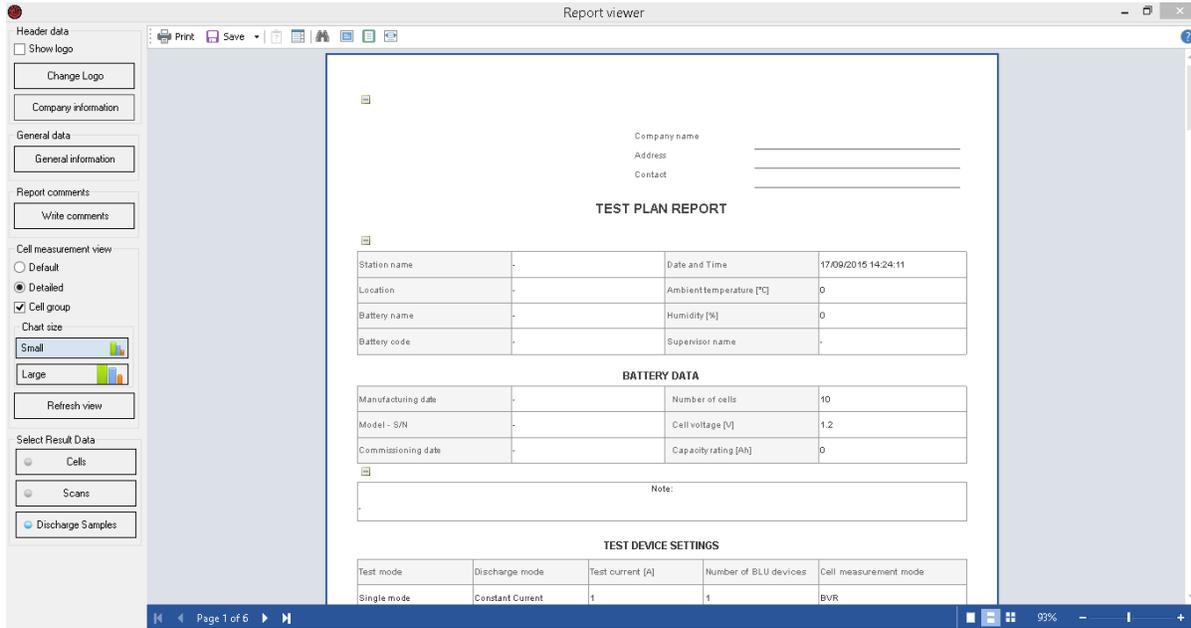


Figure 4-9. Report view tool

The Report viewer tool has several sections, allowing the user to modify the test report.

**Change logo** – enables the user to change a company logo in the test report.

**Company information** – This button includes basic company information. By clicking on the *Company information* button the following window appears:

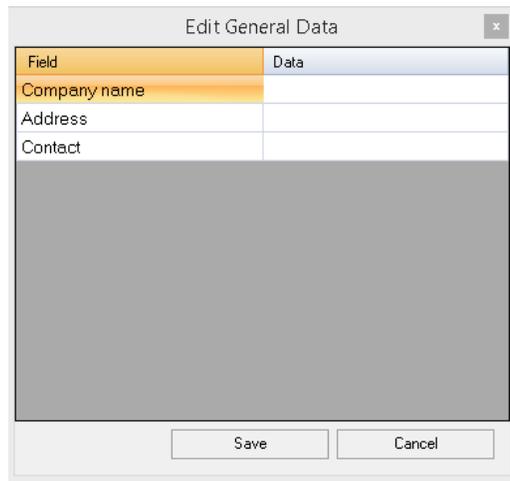


Figure 4-10. Company information data editing

**General information** – This section includes *General information* button allowing the user to change the previously entered information about location data and test object. By clicking on the *General information* button the following window appears:

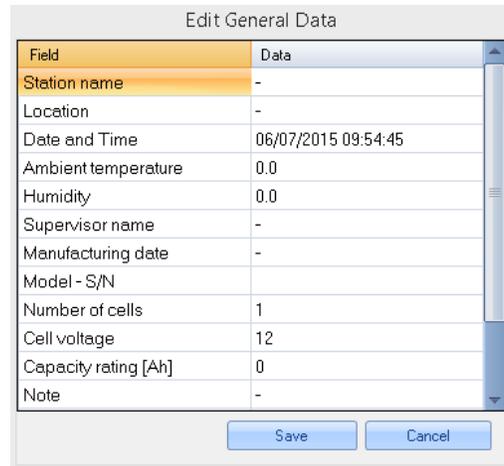


Figure 4-11. General data editing

The **Write comments** subsection enables writing notes and comments in the report document. By clicking on the *Write comment* button the following window appears:

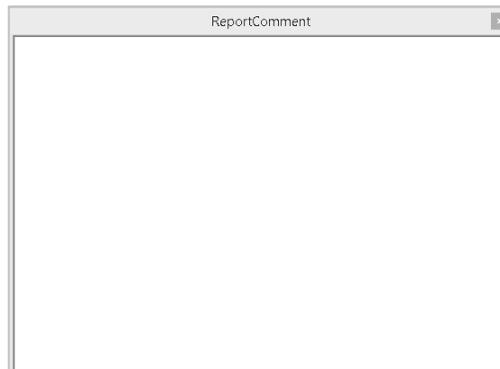


Figure 4-12. Report comments

**Cell measurement view** - enables the user to exclude or include cell grouping from the test report, and to choose whether to use a detailed or default cell results view in the test report. After every change it is necessary to click the *Refresh Report* button in order to confirm all changes.

The **Discharge samples** button allows the selection of samples that will be shown in the test report. Clicking on the *Discharge samples* button the following window appears:

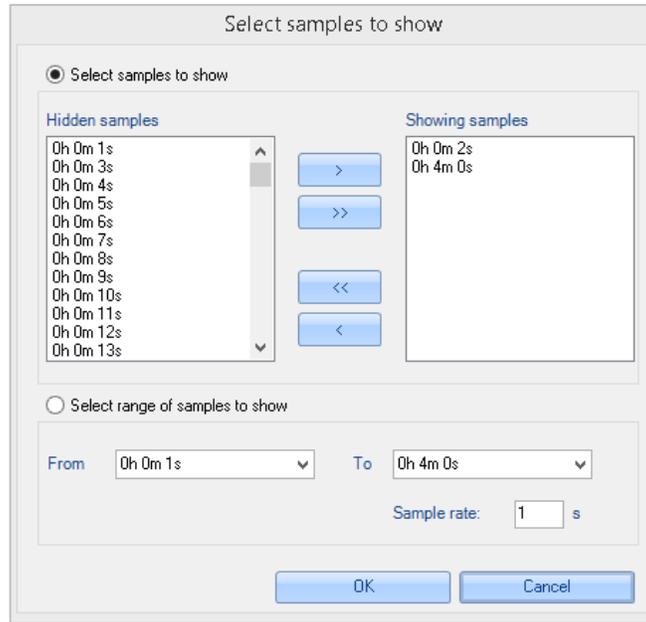


Figure 4-13. Discharge samples

Graphs subsection enables the user to exclude or include different types of graphs from the test report.

## 5. Troubleshooting

If suspected the device is presenting inaccurate results, the following tests should be performed.

### 5.1. CVM voltage measurement check

To perform a test of the  $\pm 30$  V measurement channel, please perform the following steps.

1. Connect a stable voltage source and a reference voltmeter to CVM, as shown in figure 5-1.
2. Open DV-B Win software, SET the CVM module in DV-B Win (as described in Section 4), and start the test by pressing *Start BVS* in DV-B Win software.
3. Generate the voltage values from table 5-1.
4. Read the voltage value measured with the voltmeter. Compare voltage values measured by the voltmeter to the value from the CVM, shown in DV-B Win software.
5. If the voltage values measured by the BVS compared to the voltmeter do not exceed BVS specified typical accuracy, the device is measuring correctly.

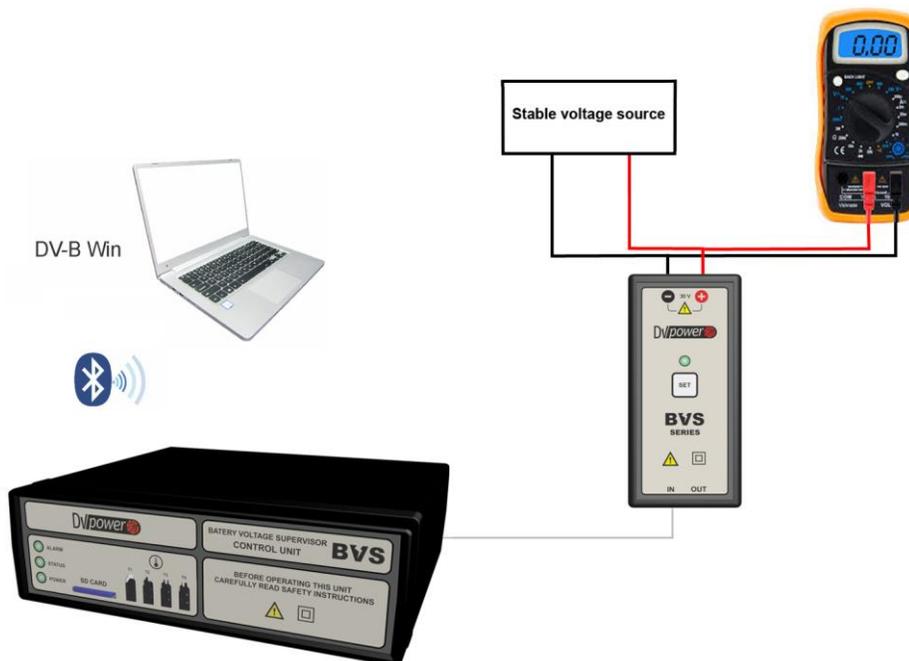


Figure 5-1. Measurement check of CVM V channel

Voltage U [V]	Voltage measured by CVM U [V]	Voltage measured by voltmeter U [V]	Voltage U [V]	Voltage measured by CVM U [V]	Voltage measured by voltmeter U [V]
1,2			12		
2			24		
6					

Table 5-1 – Measurement check of CVM V channel

The procedure for measurement check of the mV channel of CVM is shown in figure 5-2.

To check the mV measurement channel of one module, it is necessary to use an additional CVM to pass the (+) test voltage to the mV channel of the tested CVM.

1. Connect a stable mV source and a reference voltmeter to modules, as shown in figure 5-2
2. Open DV-B Win software, SET the CVM modules in DV-B Win (as described in Section 4), and start the test by pressing *Start BVS* in DV-B Win software.
3. Generate the voltage values from table 5-2, and read mV measurements for the tested CVM (the module set as Nb. 2, on the right in figure 5-2).

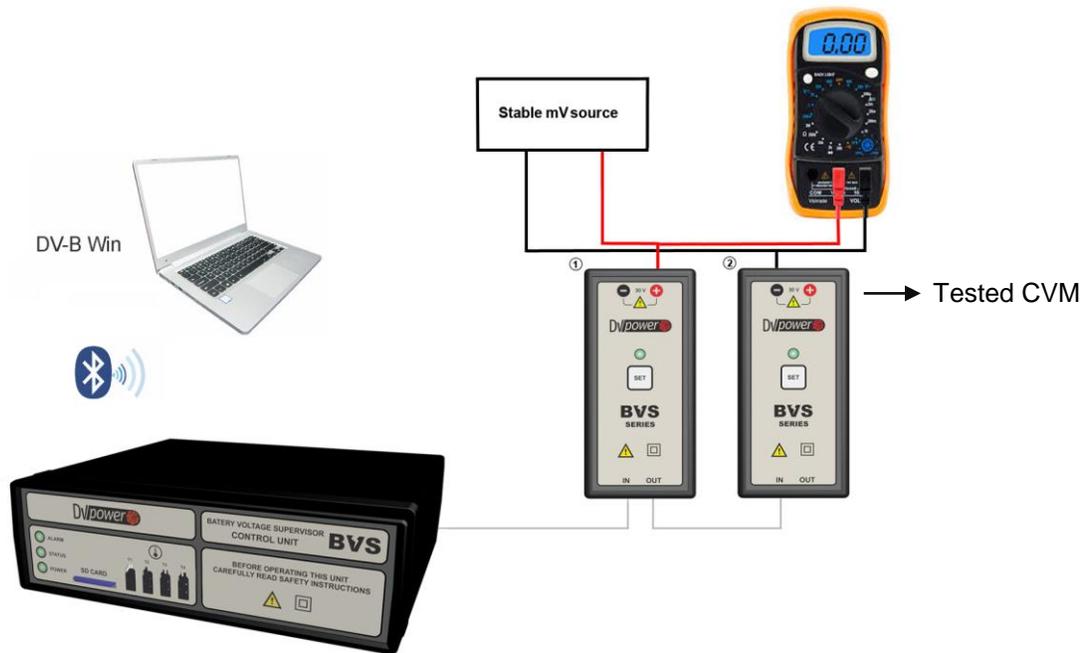


Figure 5-2. Measurement check of CVM mV channel

Voltage U [mV]	Voltage measured by CVM U [mV]	Voltage measured by voltmeter U [mV]
5		
15		
40		

Table 5-2 – Measurement check of CVM mV channel

To maximize the accuracy and measurement repeatability, make sure all clamps have a good connection to the battery and avoid any crossing between the measuring cables.

## 5.2. SVM & SCM measurement check

To check voltage measurement of the string voltage module, voltage values from table 5-2 should be used. The connection of SVM is the same as for 30 V measurement check of CVM, as shown in figure 5-1.

Voltage [V]	Voltage measured by SVM U [V]	Voltage measured by voltmeter U [V]	Voltage [V]	Voltage measured by SVM U [V]	Voltage measured by voltmeter U [V]
1,2			60		
2			120		
6			240		
12			380		
24			480		
48			580		

Table 5-2 – SVM voltage measurement check

To check measurement of the string current module SCM, a stable mV source should be used. The connection to SCM is the same as for CVM, as shown in figure 5-1. Voltage values that should be used are given in table 5-3.

Before starting the test, set the CP ratio of 1 mV/A in the *Test settings* form in DV-B Win software.

Voltage [mV]	Current measured by SCM I [A]	Voltage measured by voltmeter U [mV]
10		
25		
50		
100		
250		
500		
800		
1000		

Table 5-3 – SCM current (mV) measurement check

## 6. Customer service

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

1. Check all cable connections.
2. Try the test on another instrument, if available.
3. Perform the troubleshooting procedure
4. Have the following information available:
  - Instrument serial numbers, hardware configuration, and software revision
  - Exact description of the problem, including the test object information, 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](mailto: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.

## 7. 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](mailto:support@dv-power.com)

**Note:** DV Power is not responsible for shipping damage. Please protect each instrument from shipping and handling hazards carefully. Please ensure protective covers are securely in place. Instruments should be sent to DV Power freight pre-paid, unless other arrangements have been authorized in advance by 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, 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.

## 8. Technical Data

### Power Supply

- Input voltage 90 – 264 V AC, 50/60 Hz
- Input power 110 VA
- BVS CU Output / CVM input voltage: 66 V

### Measurement

Parameter	Measurement range	Resolution
Cell voltage	±30 V CC	1 mV
Intercell voltage	± 50 mV CC	1 μV
String voltage	± 600 V CC	1 mV
String current	± 1 V CC	0,1 μV

- Typical accuracy:  
 ± 50 mV CC: ± (1% rdg + 1% FS)  
 ±1 V CC: ± (0,1% rdg + 0,1% FS)  
 ±30 V CC: ± (0,1% rdg + 0,1% FS)  
 ±500 V CC: ± (0,1% rdg + 0,1% FS)
- Temperature:  
 -20 °C - +80 °C / -4 °F - +176 °F

### Communication

- USB: Device to PC connection

### Memory

- Internal: 2 GB SD Card

### Real time clock

- Precision: ±5 seconds per month
- Calendar: 100 year with leap year detection
- Time retention: 10+ years (battery removed)

### Environment conditions

- Temperature:  
 -10 °C - +45 °C / 14 °F - +113 °F

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

- Maximum relative humidity 95 % for temperatures up to 31 °C, decreasing linearly to 40 % relative humidity at 55 °C

### Dimensions and Weight

- Dimensions (L x W x D):  
 BVS-CU: 206 mm x 180 mm x 64 mm  
 8.11 in x 7.08 in x 2.51 in  
 CVM: 66 mm x 28 mm x 139 mm  
 2.6 in x 1.1 in x 5.5 in  
 SVM, SCM: 66 mm x 28 mm x 139 mm  
 2.6 in x 1.1 in x 5.5 in
- Weight:  
 BVS-CU: 0,78 kg / 1.7 lbs  
 CVM: 0,14 kg / 0.3 lbs  
 SVM, SCM: 0,18 kg / 0.4 lbs

### Warranty

- Three years

### Low Voltage Directive:

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

### Electromagnetic Compatibility:

- Directive 2014/30/EU (CE conform)
- Applicable standard: EN 61326-1

## 9. Accessories

Instrument with included accessories	Article No
Battery Voltage Supervisor Control Unit	BVS-CUNN-000
Cell voltage module*	BVS-CVMCN-00
DV-B Win PC software including USB cable Power supply cable	

Recommended accessories	
Voltage sense cables for connection of CVM to battery 2 x 0,25 m**	S-025-01BPAC
Communication cable for Cell voltage modules 1 x 0,5 m**	C1-0025-RJRJ
Communication cable for CVM-C connection 1 x 2 m	C1-2000-RJRJ
NTC thermistor*** for ambient temperature measurement 1 x 1 m**	TP-2015-NTC0
Plastic transport case	PLST-CAS-BV1
Plastic transport case	PLST-CAS-BV2

Optional accessories	Article No
String Voltage module	BVS-SVM00-00
String Current module	BVS-SCM00-00
Bluetooth module	BLUET-MOD-00
Voltage sense cables 2 x 0,5 m 1mm <sup>2</sup> with banana plugs + alligator clips	S-005-01BPAC
Voltage sense cables 2 x 0,25 m 1mm <sup>2</sup> with banana plugs + dolphin clips	S-025-01BPDC
Voltage sense cables 2 x 0,5 m 1mm <sup>2</sup> with banana plugs + dolphin clips	S-005-01BPDC
Voltage sense cables 2 x 0,25 m 1mm <sup>2</sup> with banana plugs	S-025-01BPBP
Voltage sense cables 2 x 0,5 m 1mm <sup>2</sup> with banana plugs	S-005-01BPBP
Sense cables 2 x 5 m with banana plugs + dolphin clip (for SVM)	S2-05-00BPDC
Current clamp 30/300 A with internal battery supply and extension 5 m (for SCM)	CACL-0300-08
Cable bag	CABLE-BAG-00
Rechargeable NiMH battery 8,4 V 300 mAh for current clamps	RCGB-30084-0
Battery charger 2 x 9 V for NiMH/NiCd batteries	BATCH-2X9V-0
Calibration system for Cell voltage modules	-

\* Number of Cell voltage modules may vary depending on application

\*\* Different cable lengths available upon request

\*\*\*Different types of temperature sensors available upon request

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In case of a disagreement between the translation and the original English version of this Manual, the original English version will prevail.

## Manufacturer Contact Information



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