Infratek 23DC-Source Tester

User’s Manual

Infratek

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1. SAFETY, WORKING WITH BATTERIES CAN BE DANGEROUS

Before using the Infratek 23 DC-Source Tester carefully read and understand the following safety information. This information is meant to be in addition to the safety practices required by your employer.

- Wear safety glasses.
- Wear protective gloves; batteries can produce high electrical potential.
- Do not place metallic parts on top of batteries; a battery is a powerful DC-Source that delivers very large short circuit currents.
- For battery testing use safety clamps or safety probes only.
- The Infratek 23 DC-Source Tester is reverse voltage protected up to 200V.

The Infratek 23 DC-Source Tester is designed for maximum user safety. It is safe to measure batteries on high potential with the printer or a notebook connected to the RS-232 interface of the tester. The interface isolates the high battery potential to protect users from hazardous shock.

To comply with EN50081-1 the test leads must form 3 windings through ferrite Siemens B642290-L674-X830. The interface cable must be shielded.

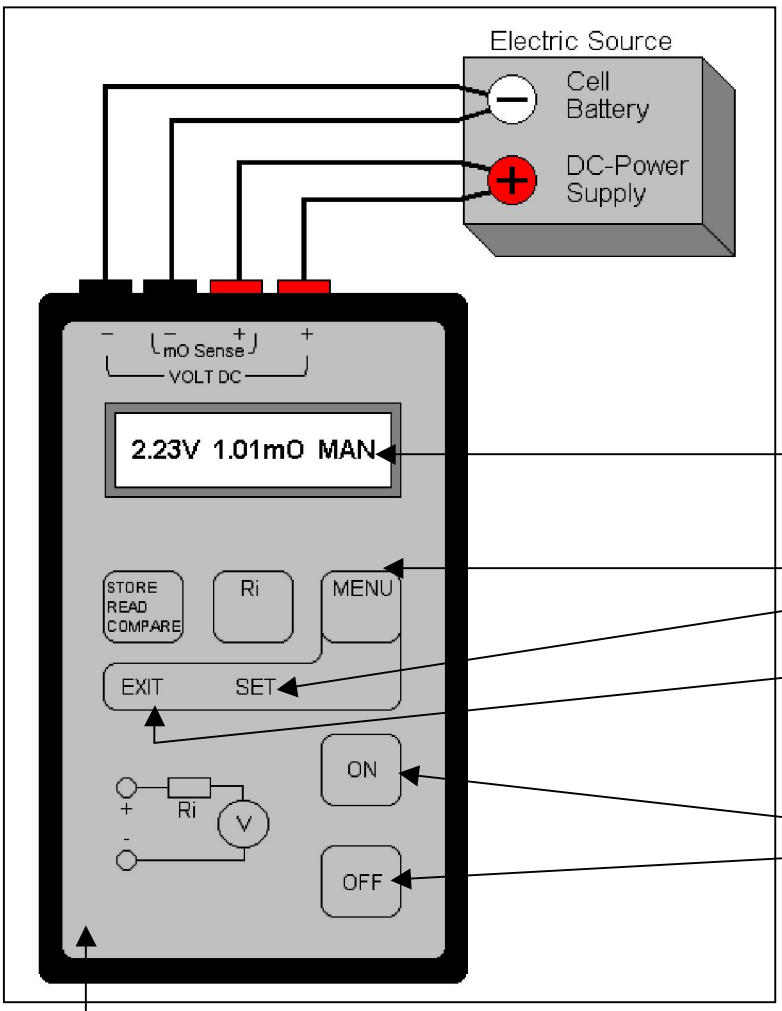
Important: Limits on Ri battery resistance measurements.

Please be aware of overheating the DC23 input circuitry when measuring battery resistance Ri at high voltages in short time intervals (see also 3.1. Specifications).

Battery voltage 70 – 100 V:	**Maximum 1 Ri measurement per minute**
Battery voltage 40 – 69 V:	**Maximum 2 Ri measurements per minute**
Battery voltage 20 – 39 V:	**Maximum 3 Ri measurements per minute**

2. INTRODUCING THE INFRATEK 23 DC-SOURCE TESTER

4 wire connection to battery or DC power supply



Indicates Operating Mode
MAN: Manual measurement
AUT: Automatic measurement
RD: Read Memory
CMP: Compare Reference
LDT: Load Test

Operating Mode
MAN is the operating mode at start up.
Starts Ri measurement.
Select **MENU**
Use **SET** to increment, decrement, and select.
Use **EXIT** to leave menu selection.

Turn tester on
Turn tester off

Battery door at bottom of tester. Remove two M2 screws with screwdriver. RS-232 Interface connector DB9.

Isolation voltage between tester inputs and RS-232 output is 1500V.
Connect to label printer or computer.

- Store and print measurement
- Read memory
- Compare against reference value

3. FEATURES OF THE INFRATEK 23 DC-SOURCE TESTER

The Infratek 23 DC-Source Tester characterizes electrical sources (batteries or DC-power supplies) by their unloaded DC-voltage, and their internal source resistance **Ri**.

- Simple to use, hand held, and lightweight.
- Designed for battery testing 0.5Ah to 2000Ah.
- Designed for DC power supply testing up to 100V.
- Designed for maximum user safety.
- Designed for efficient handling of maintenance data.
- Tester comes with isolated RS-232, printer, and Windows software.
- Tester for stationary batteries, traction batteries, and car batteries.
- Four test methods for stationary batteries.
- One test method for traction batteries.
- One test method for car batteries.
- Stores up to 500 individual reference values. Uses compare mode.
- Tests single cells (min. 1.65V), battery blocks, and battery strings up to 100V.
- Wide **Ri**-range 050μΩ (2000Ah) to 8Ω.
- Wide voltage measurement range 0-30V / 0-200V.
- Turn on and measure, no zeroing, no adjusting, no range setting.
- Simple menu programmable functions.
- Stores up to 500 battery measurements (voltage and **Ri**).
- Operation with 3 keys only.
- Reverse voltage protected up to 200V.
- Five different tester versions are available:
  FULL: Tester with RS-232 interface, label printer, Windows software, Carrying case.
  MED: Tester with RS-232 and Windows software
  GEN: Tester only, no RS-232.
  CAR: Tester with 30A battery load.
  CAR FULL: Tester with 30A battery load, RS-232 interface, and label printer.

- Low cost battery monitors on request.

3.1. SPECIFICATIONS

Size of Batteries	Tests batteries 0.5Ah-2000Ah and voltages up to 120V	sealed, non-sealed; lead acid and other
Voltage UB	Ranges 2; 0-30V, 0-200V Resolution; 10mV, 0.1V Accuracy; 1 % ±1 digit	200Vdc maximum Display; 3 digits 23° ±3°C
Source Resistance Ri	Ranges 3; 0-20, 0-400mΩ, 0-8Ω Resolution; 1μΩ, 10μΩ, 0.1mΩ Measurement repetition; ±1 digit Accuracy: 1 % ±2 digit; Ri>1mΩ	U_B: 1.6V-120V Display 3 digits S/N >20dB; Ri>2mΩ S/N >20dB
Display	6.5mm, 16 character LCD	V, mΩ, Mode
Interface	RS-232, isolated from batteries	300V CAT II
Operation / Time	Via menu, 3 controls	0.6s measurement time
Data Storage	500 complete sets U_B, R_i	N=1 to N=500
Supply	9V battery or accumulator	for 6-8h operation
Size / Weight	155 x 90 x 35mm; 400 gr.	
Temperature	Operating: 0-30°C; storage: -10 -40°C	
Limits on Ri measurement	*1 measurement / minute 2 measurement / minute 3 measurement / minute **Please be aware of overheating the DC23 input circuitry when measuring battery resistance Ri at high voltages in short time invervals.**	UB = 70-100V UB = 40-69V UB = 20-39V

***Battery voltage 70 – 100 V:** **Maximum 1 Ri measurement per minute**

Battery voltage 40 – 69 V: **Maximum 2 Ri measurements per minute**

Battery voltage 20 – 39 V: **Maximum 3 Ri measurements per minute**

4. AVAILABLE TEST METHODS

This section gives an overview of the test methods available using the Infratek 23 DC-Source Tester. Reference values (voltage, **Ri**) for every battery or cell are established at date x when you start your battery maintenance program or when you have a new battery system in operation for 2 to 6 months. Maintenance measurements are taken once or twice a year. All later measurements are compared to the individual reference values of every battery and when, for example, **Ri** has increased by 40 % the battery must be serviced or replaced. Individual reference values are used because every battery has its own reference values. **Ri** may vary ±50 % even on batteries from the same type and production batch.

Test Method 1:

The tester is used together with the label printer. First time measurements are printed. This label is stuck to the battery and is used as reference label.
Labels from later measurements are put on a label stack next to the reference label and may be visually compared to the reference values.

Test Method 2:

Number all batteries (cells/blocks) from N=1 ... 500 in the sequence you would make the measurements. The maintenance measurements are made off-line (not connected to the notebook) and are stored in memory corresponding to the battery number N. When you have taken all the measurements load the data to your notebook using the **BatHandler** program. Compare the data with the reference values using the **BatAnalyze** program. First time measurements can be used as reference values.

Test Method 3:

Test method 3 is similar to test method 2 except that testing is on-line with your notebook, using the **BatAlarm** program. Measurement by measurement is transferred to the notebook and directly compared to the reference values. Large warning signs are flashed when limits are exceeded.

Test Method 4:

Test method 4 uses the DC-Source Tester only, no printer nor software are required.
Number all batteries N=1, 2, 3 .... 500. First time measurements are stored at memory location corresponding to the battery number N.
Later maintenance measurements are taken using the **CMP** (compare) operating mode. The measurements can instantly be compared with the individual reference values stored in your tester.

5. GETTING STARTED, INSTRUMENT BATTERY REPLACEMENT

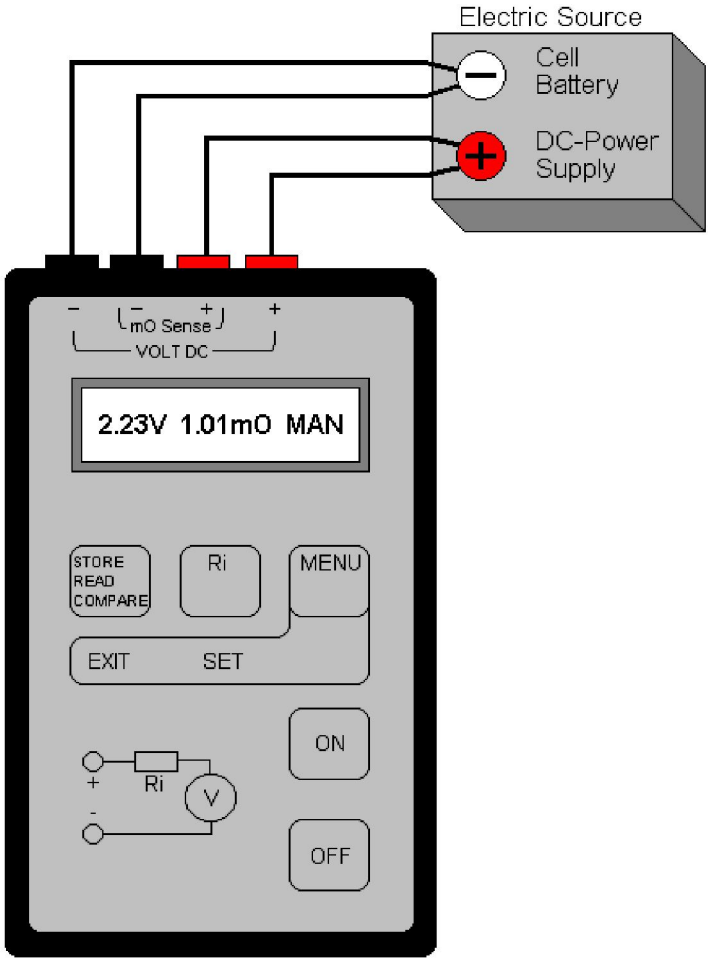
Connect the **BLACK** two-pole measuring clip to the **BLACK** input terminals of the tester and the **RED** two-pole measuring clip to the **RED** input terminals. Press the **ON-**key to turn the tester on. At start -up the internal instrument battery is checked and its condition is displayed with the following sequence:

BATTERY TEST → 8.82V BAT O.K or 5.40V BAT LOW

If the battery voltage is below 5.2V the above sequence will not be executed. A new 9V battery must be installed as follows: remove battery door at bottom of tester. (See also Section 2). Use an M2 flat tip screw driver to loosen the two M2 screws. Replace the old battery with a new one and reinstall the battery door.

6. TAKING BASIC MEASUREMENTS

Connect the **BLACK** Kelvin measuring clip to the negative pole on your source and the **RED** Kelvin clip to the positive pole. The poles can be of any metal including stainless steel. The source can be a 2.2V cell, a block, or a battery string of up to 100V, or a power supply of up to 100V.
As soon as the clips are connected to the source the source's DC voltage is displayed (DC average reading). Press the **Ri** key to start a measurement of the source resistance.
The source voltage must be in the range 1.6V to 100V, and the source resistance range 0.05mΩ to 8Ω. Also, the source must be able to deliver a 1A peak current. **The DC-Source Tester is protected against reverse polarity of up to 200V.**



7. MENU SELECTION

Press the **MENU** key to view the available menus. Once you select a menu mode, the center key becomes the **SET** key (to alter settings) and the left key becomes the **EXIT** key to leave the menu mode.

• **MODE SELECT>SET**	Select operating modes (**MAN**, **AUT**, **RD**, **CMP**, **LDT**)
• **INCR 10** • **INCR 1** • **DECR 10** • **DECR 1**	Increment memory location by 10 Increment memory location by 1 Decrement memory location by 10 Decrement memory location by 1
• **SET MONTH *** • **SET YEAR ***	Set month in non-volatile memory to be printed Set year in non-volatile memory to be printed.

*The tester does not use a real time clock. When you are using the printer update month and year as required with the **SET MONTH** and **SET YEAR** menus.

7.1. OPERATING MODE SELECTION

In the menu "**MODE SELECT>SET**", five different operating modes can be chosen.

•**MAN** manual	Voltage is continuously measured. Press the **Ri** key to start **Ri** measurement. Press the **STORE** key to store or print the displayed data. N is incremented by 1.
•**AUT** automatic	Connect measuring clips to battery. **Ri** measurement is started automatically. Data are stored, printed, and displayed. N is incremented by 1. Measurement is displayed.
•**RD** read memory	Press the **READ** key to read stored measurements from memory. N is decremented by 1.
•**CMP** compare to reference	The displayed measurement can be compared to the individual reference values stored in your tester. Each new measurement increases the reference location N by 1.
•**LDT** load test	For car battery testing there is a 30A load available. Press the **LOADTEST** key to start the load test sequence. After six seconds the results are displayed and printed.

7.2. SAVING INSTRUMENT SETTINGS

Before turning off the tester you can save the settings and have the tester start up in the same configuration as you left it. The operating mode and the memory storage location N are saved.

To save the setting:

Press MENU key. Now press the EXIT key twice quickly. Turn tester off.

8. OPERATING MODE “MAN”

The Infratek 23 DC-Source Tester starts up in the Manual operating mode - MAN (unless you had saved the instrument setting). The source voltage is continuously measured and displayed. Pressing the Ri key initiates an Ri measurement.

The measurement can be stored by pressing the STORE key. When a printer is connected to the tester the measurement data are stored and printed.

When the tester is connected to a notebook computer and you are using the BatAlarm software, the data are stored in the tester and are transferred to the computer and there they are instantly compared to the reference file. If voltage and/or Ri limits are exceeded a warning is displayed on the screen.

9. OPERATING MODE “AUT”

AUT is the Automatic measuring mode for Ri, data storage, and data hold. When a valid voltage of >1.7V appears at the measuring clips the Ri measurement starts automatically, measurement data are stored and either are printed when a printer is connected, or are transmitted to a notebook computer. The memory location N is incremented by 1. The display goes into Hold and displays the voltage and Ri reading until you connect the measuring clips to the next cell or battery.

10. OPERATING MODE “RD”

RD is the Read memory. RD is used to display stored measurements at memory location N=1 up to N=500. Press the READ key to display the stored values and the associated memory location. N is decremented by 1.

11. OPERATING MODE “CMP”

CMP is the **Compare** displayed measurement to your individual voltage- and $\mathbf{R_i}$-reference values. Illustrative Example: It is your job to service 50 traction batteries. You want to detect long-term capacity deterioration. This is how you can make use of the **COMPARE MODE**:

Step 1: Start your maintenance plan by numbering the batteries N=400 to 449 (these are also the memory locations in your tester).

Step 2: Establish reference values for every battery by first fully charging it. Wait 1 hour before taking the measurement for the reference value. Read the number on the battery, e.g. N=410. Store the measured reference value in the tester memory at memory location equal to the battery number.

Step 3: For battery servicing use the reference values to make your decisions. For example: the battery needs to be charged, or the battery needs to be replaced when in charged condition Ri has increased more than 40 % to 60 %.

12. OPERATING MODE “LDT”

LDT is the **Load** test for car batteries. This operating mode is designed for car battery testing. Car battery testers are equipped with a 30A battery load.
Firmly connect the two black measuring clips to the minus pole of the battery and the two red clips to the plus pole. The clips may not touch each other, otherwise the high current flow will falsify the measurement. For this test the battery does not have to be disconnected from car electronics. Press the **LOADTEST** key to start the following sequence:

1. $\mathbf{R_i}$ and battery voltage are measured at no load condition.

2. The 30A load is switched to the battery for 5 seconds. The change of $\mathbf{R_i}$ and battery voltage is recorded and is used for the final grading.

3. As the test proceeds the measurements are displayed and printed when a printer is connected. Finally, the car battery is graded as follows:

   CHARGE: When the no load battery voltage is low.
   GOOD: When the battery under load has successfully past.
   FAIR: When the battery under load is marginal.
   FAIL: When the battery under load performs unsatisfactorily.

The printed label can be used as customer proof.

13. Infratek 23DC-SOURCE TESTER EQUIPPED WITH LABEL PRINTER

Before testing make sure the RS-232 connector is connected to the DC-Source Tester. Hang the carrying case with the printer and tester around your neck, turn on the tester and turn on the printer. At start-up the tester is in **MAN** (manual) operating mode. Connect the test clips to the first battery and press the key $\mathbf{R_i}$ to obtain the $\mathbf{R_i}$ reading. Pressing the **STORE** key stores the data and prints a label. Stick the label on the battery you tested and visually compare with the reference label. If the prescribed limits of $\mathbf{R_i}$ or of the battery voltage are exceeded the battery must be serviced or replaced.
The label contains the following information: Type of tester used, The date (month and year), The battery number N=1 through 500, The battery voltage, and The battery resistance $\mathbf{R_i}$.
In the **AUT** (automatic) operating mode the $\mathbf{R_i}$ measurement is started, stored, and printed automatically - the whole sequence takes approximately 3 seconds.

Caution: Turn off the printer and the tester when finished.

Printer Batteries:

The high speed thermal printer requires two 12V/1.1Ah batteries which contain sufficient energy to print more than 1000 labels. When you expect long standby periods turn the printer off. Charge single batteries using a charger or a DC power supply with current limited to 300mA or charge both batteries in series using a 24V power supply with 300mA current limiting.

14. EFFICIENT AND RELIABLE BATTERY TESTING USING THE WINDOWS SOFTWARE

The Infratek 23 DC-Source Tester and the available PC software are designed to handle large amounts of measurement data. You can organize your maintenance procedures as you require, either you a) measure single cells, 6V-12V- or 24V blocks, or b) measure up to a 100V battery string. We strongly recommend you tag every cell or block with a number in the range N=1 to 500. The cell or block numbers should be in ascending order from N=1 to 500 and should correspond to the memory location N in your tester. For example, the measurement data of battery N=102 should be stored in the tester memory N=102. This is a simple way to keep data in perfect order and to keep your computer files simple.
The following programs are available: **BatHandler, BatAnalyze, BatAlarm.**

14.1. BatHandler

With the **BatHandler** program you can transfer the measurement data from the tester memory to your computer; for example, read data from memory location N=50 to 95 (this takes approximately 4 seconds). When you start your maintenance plan and have taken first time measurements you can define these data as a reference file for future use. Next time you take measurements at this battery site you can compare the new data to your reference file. If you have a notebook computer you can download the data at the site and run the **BatAnalyze** program to obtain a battery grading.

14.2. BatAnalyze

With the **BatAnalyze** program you can compare new measurement data with the reference file. You can set the allowable tolerances for battery voltage and resistance. For resistance we recommend you use 40 % tolerance, which is equivalent to a 20-40 % decrease of battery capacity. We suggest you download the measurements on site to a notebook computer and run the **BatAnalyze** program to evaluate battery conditions.

14.3. BatAlarm

The **BatAlarm** program allows on-line comparison of the maintenance measurements with the reference values of this particular battery site. First load the **BatAlarm** program to your notebook computer, then load the reference file for this particular battery site (the reference file you created using the **BatHandler** program). Connect the RS-232 cable from the notebook computer to the DC-Source Tester. The cable can be up to 15m long. Let us assume at this particular battery site, batteries N=50 to 80 are installed. Consequently the reference file numbering also ranges from N=50 to 80. First select memory location N=050 on your DC-Source Tester using the **INCR=10** and **INCR=1** menu. Now you are ready for on-line testing. Measure battery N=50 and send the data to the notebook computer by pressing the **STORE** key. The new measurement is instantly compared to the reference value N=050. If voltage and $\mathbf{R_i}$ are within specified limits (you set the allowable tolerances yourself), two large green dots will be displayed. If one limit is violated one large red dot is displayed. If both limits are exceeded two large red dots will appear. Based on the displayed warnings you can take immediate action. For example, you may mark a battery for servicing or for replacing. Pressing the **STORE** key not only transfers data to the notebook computer it also stores data in the tester and increments the internal memory counter N by 1. Therefore, after transferring the data of battery N=50, the tester is ready to measure battery N=51. As described above you continue up to the last battery N=80. The measurement of a battery parameters and its data transfer to the notebook computer takes not more than 2 seconds.

The **BatAlarm** program offers the most efficient way to test batteries. In addition you have stored long-term data in your notebook computer. You can print these data to be used for your ISO9000 / 14000 quality assurance system, or you can perform statistics using a spreadsheet program such as **EXCEL**.

15. INSTALLATION AND DESCRIPTION OF WINDOWS SOFTWARE

15.1. Installation and Overview

I Distribution Kit for Win95/98NT

The software package includes 3 disks. To install the software on your PC or notebook computer insert the first disk into your drive and double click the setup icon. Follow the installation instructions.
Copy the file "serpdrv" into the new installed directory.

II Make sure that the number setting of your PC is set to decimal point (not comma!). You can check it here:
START → Settings → Control Panel → Regional Settings → Numbers → Decimal Point.

III After installation you find the following executables:

- **BatHandler** Reads the data stored in the DC23 memory to your PC.
  Triggers a measurement from your PC, or provides a display.
- **BatAnalyze** Compares your measurements to the reference files and provides a fast battery condition overview.
- **BatAlarm** Compares current measurements with your reference values.

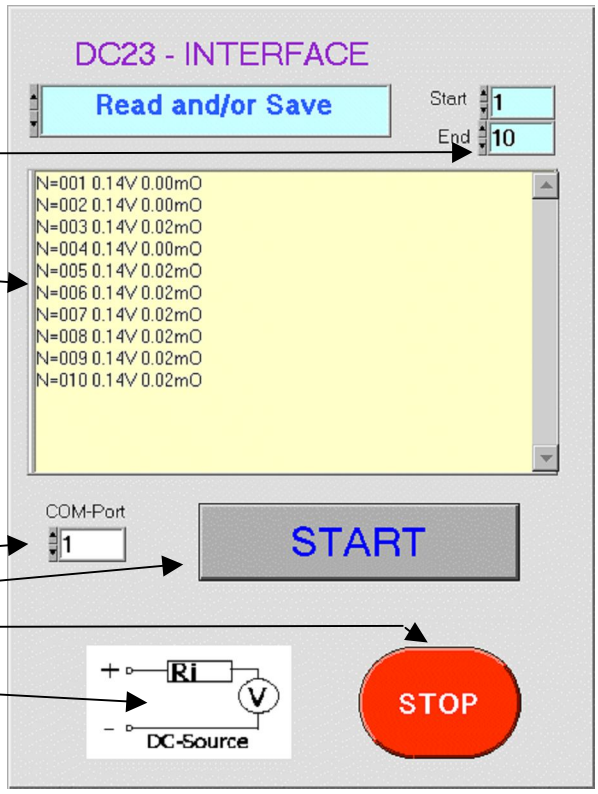
IV For proper communication between your Infratek 23 DC-Source Tester and your PC/Notebook computer, use a regular 9-pole D-Sub RS-232 cable (1 to 1 connection, no pins are crossed out). Connect the cable to the tester and the PC and run the program you wish to use.

15.2. BatHandler Program

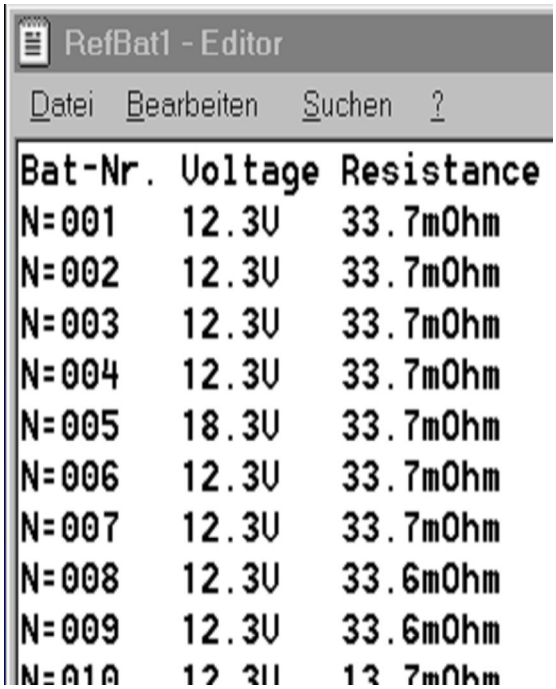
With the **BatHandler** program you can download measurement data to the PC, trigger a measurement to read data, or just read the display of the tester.
First set the COM-Port in the mask, choose a command from the menu and press **START**. To trigger a measurement for example just select **"Trig Measurement"** and press the **START** button. To read the display values use **"Read Display"** and press **START.**
To read out the stored values from the DC 23 Battery Tester choose **"Read Memory"**, set your desired battery numbers at the Start/End fields (max. 1 to 500) and press **START**.
You will be asked then to create a filename for your data If you have taken, for example, an initial (first time) measurement from your battery system define the file as "reference file - system XY" or "master file - system XY".
The next measurement (6 months later for example) can be stored using the same procedure but name it this time "June 1999" - system XY" or "measurement 1 - system XY"; which allows you to generate one file for each measurement procedure. Now you can compare the new measurement file with the reference file using the **BatAnalyze** program . A red dot indicates that a battery exceeds voltage- or $\mathbf{R_i}$ limits.

Bat Handler

- **Menu** bar;
- **Start/End** fields (max. 1 to 500);
- **Display** field;
- **COM-Port** number;
- **START** button;
- **STOP** button;
- Scheme.



The program asks "Choose file to write". Type your filename. The data will be stored in a spreadsheet compatible mode.



After the file-header you'll find your data stored by the battery number (Bat-No.), the voltage value (Voltage) and the resistance in mOhm or Ohm (Resistance).

To define a **Reference-Battery-File** there are two possibilities:

- Make an initial measurement from your battery system and declare it as your reference file;
- Take a text editor and create a new file which is based on a primary measurement of the battery system.
- When you had to replace a battery by a new one, measure it after installation, and edit the existing reference file with the new reference value.

15.3. BatAnalyze Program

With the **BatAnalyze** program you can compare new measurement data against the reference file. You can set the allowable tolerances yourself based on your quality assurance system.
The result signs show, ordered by the battery number, **GOOD** with a green and **FAIL** with a red indicator.

Follow the instructions given at the bottom of the screen to obtain quick answers about battery condition.

In the tolerance fields you set your own battery fail criteria.

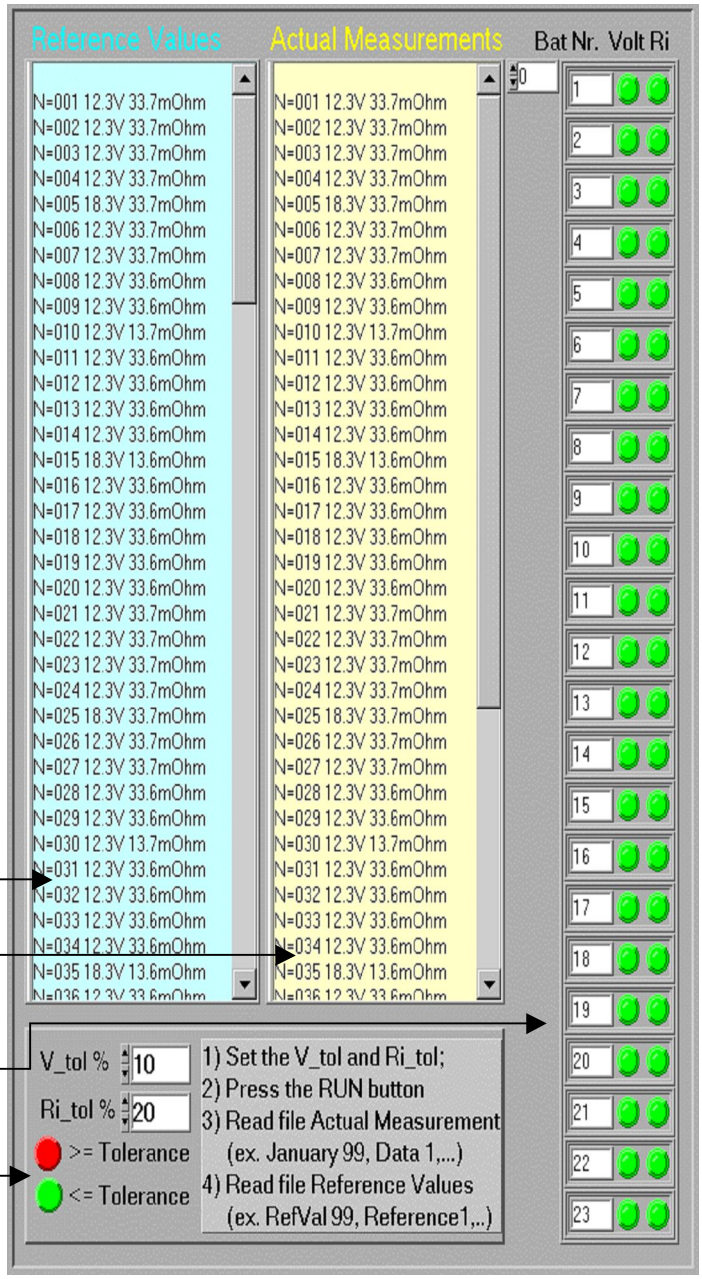
An increase of **Ri** by 40 % at same charging state roughly corresponds to a battery capacity decrease by 40 %. This slow aging normally takes place over a number of years.

Reference File

Actual Measurements

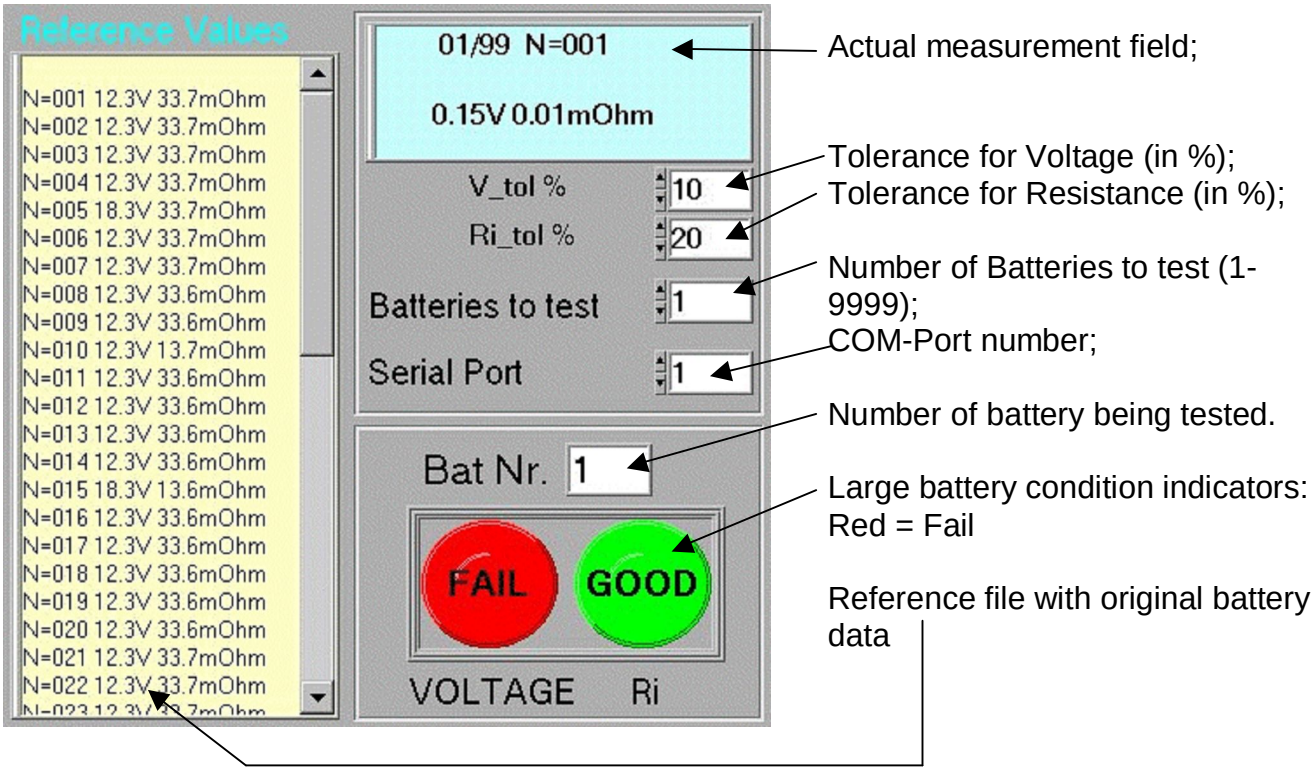
Alarm Display (Bat-Nr., Voltage, Resistance)

Tolerance Selectors



15.4. BatAlarm Program

The **BatAlarm** program allows on-line battery testing. The notebook computer is connected to the DC-Source tester. Measurements are directly transferred to the notebook computer and are instantly compared to the reference values.
Simply connect the DC23 Battery Tester with a serial interface cable to your notebook computer, select the COM-Port and select the reference file and you are ready for testing.



There is a large variety of RS-232 cables with different lengths to give sufficient range to move. (1 to 1 connected)

Caution: **Before you make measurements set the tester memory location N to the first battery number. Also, the numbers N in the reference file must correspond to the battery number N.**

Measurement procedure:

1. Switch on the DC23 Battery Tester and load the **BatAlarm** program on your PC;
2. Connect the DC23 Tester to the PC or notebook computer with a one to one connected RS-232 interface cable;
3. Set the **V_tol** and **R_i_tol** values;
4. Insert the number of batteries to test;
5. Set the COM-Port number;
6. Run the **BatAlarm** program;
7. Choose the reference file to load and define a file to store the current measurements;
8. Set the tester memory location N to the number of the first battery. This number is equal to the N of the first reference value.
9. Press the **R_i** key to start a measurement;
10. Press the **STORE** key to transfer the data to the notebook computer or PC.

If the DC23 Battery Tester is set to **AUTO** operating mode you don't have to press any key - just connect the test clips to the battery. From now on every new battery measurement is compared with its individual reference value. If limits are exceeded the alarm button will turn red.

16. BASICS OF BATTERY MEASUREMENT

In addition to the information given in this manual please also consult the booklet **BATTERY MAINTENANCE, USING THE INFRATEK 23 DC-SOURCE TESTER**.

16.1. General Rules

- A battery is an electrical source which can be characterized by its voltage and its internal resistance **R_i**. Its energy storage capability is based on chemical processes.

- The cell voltage of a new cell is equal to within 0.1V. **R_i** of new cells on the other hand varies up to ±50 %. In general, small cells (1Ah) have a large **R_i** (150mΩ) and large cells (1000Ah) have a small **R_i** (0.12mΩ).

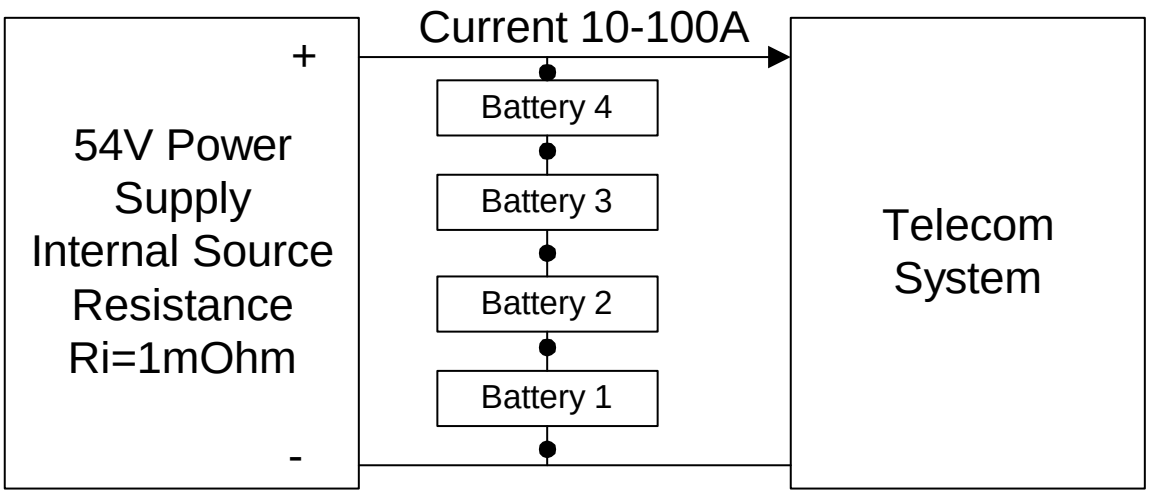
- Over years of operation **R_i** increases due to aging whereas the cell voltage hardly changes unless a cell is shorted. An increase of **R_i** indicates a decrease of battery capacity.

- A long-term maintenance plan can prevent battery break down by comparing present voltage- and Ri values to the individual reference values when the battery was new or when the maintenance plan was started.

- Take measurements always at same charging condition.
  - Stationary batteries: at preset float voltage
  - Traction batteries: fully charged
  - Car batteries: Any charging condition but use 30A battery load for testing.

16.2. Measure the Stationary Battery and not the Power Supply

Illustrative Example: Consider the following battery back-up system which keeps the four 12V batteries at a preset float voltage of 54V. The batteries supply the Telecom System in case of line power failure.



Mobile telephone systems use 100Ah batteries with an $\mathbf{R_i}$ of approximately 20mΩ. Let us assume all 4 batteries have an $\mathbf{R_i}$ of 20mΩ.

Wrong Measurement

When you measure across all 4 batteries, which you could do with the Infratek 23 DC-Source Tester, the measurement is meaningless because $\mathbf{R_i}$ is determined by the 1mΩ source resistance of the power supply.
The tester displays 1mΩ if the current supplied to the telecom system is constant. If the current varies irregularly the display will just indicate meaningless numbers for $\mathbf{R_i}$.

Correct Measurement

Measure one battery at a time starting with battery 1. The $\mathbf{R_i}$ measurement of battery 1 will be 15mΩ and not 20mΩ because in this electrical circuit $\mathbf{R_i}$ of battery 1 is in parallel with the series resistance of the other 3 batteries (60mΩ parallel to 20mΩ = 15mΩ).
The $\mathbf{R_i}$ measurement is determined mainly by the battery we are testing but it is also influenced by the other batteries in the system. The same holds true for the measurement of batteries 2, 3, and 4.
These facts also strongly suggest that individual $\mathbf{R_i}$ measurements should be used to determine reference values.
Furthermore, by measuring across single batteries the irregular current flowing from the power supply to the telecom system will hardly affect the $\mathbf{R_i}$ measurement. You will experience stable $\mathbf{R_i}$ readings which are replicable.

Rule 1 **When a battery string is connected to a charger or to a power supply measure the string by dividing it in at least 2 equal sections and take measurements on these sections.**

Rule 2 **For the best preventive maintenance of a battery string measure the smallest accessible unit (cell, 6V block, or 12V block).**

16.3. Traction Batteries

Traction or motive batteries come in diverse shapes, sizes, and capacities. The Infratek 23 DC-Source Tester can be used in two ways:

1. Determine whether the battery needs charging. It needs charging when the voltage is 10 % below the reference value and /or $\mathbf{R_i}$ is twice the reference value.

2. Determine long-term deviations of voltage and Ri from the reference values of fully charged batteries. The battery needs to be serviced or replaced when Ri has increased by 40 % to 60 %.

Reminder: You have the reference values stored in your tester as described in Section 11 Operating Mode “CMP”.

16.4. Car Batteries

For car battery testing a special car battery tester using a battery load is required because the problem battery is in an unknown charging condition. This tester does not require you to remove the battery from the car’s electronics. The test is simple and quick. The battery values can be printed for record purposes. For more information refer to Section 12, Operating Mode “LDT”.

17. SERVICING AND CALIBRATING THE Infratek 23DC-SOURCE TESTER

If you have trouble proceeding, read Section 17.1. In case you want to calibrate the Infratek DC-Source Tester or you want to check calibration, read Section 17.2.

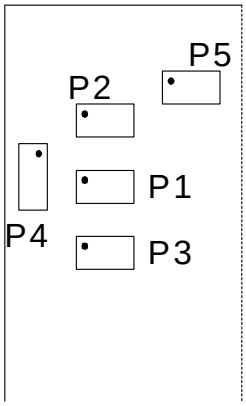
17.1. Servicing

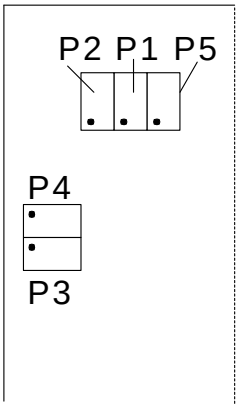
Perform the following steps; after each step check the results by turning on the tester.

Step 1: Check battery voltage at start-up. If there is no display replace the instrument battery.
Step 2: Remove the bottom cover and check all connectors. Move the connectors up and down in case they are corroded.
Step 3: Check all leads going to the input terminals and to the RS-232 output connector.
Step 4: You may experience display problems, when the left half of the display is slightly blue with tester turned on. The contrast of the display can be adjusted with P5.

17.2. Calibration

The tester is designed for long-term stability. Calibrating the tester once a year is more than sufficient. The following potentiometers are used for calibration.





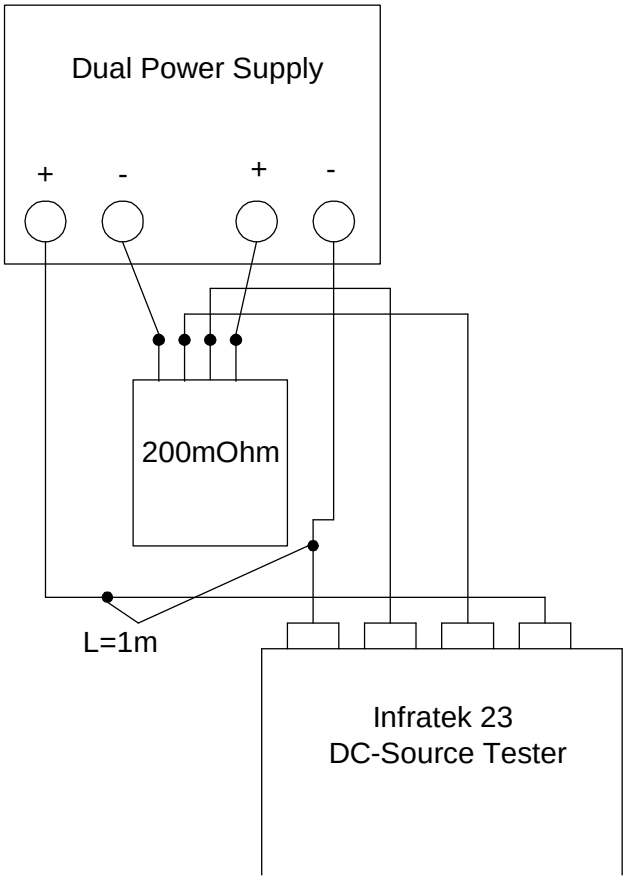
<u>Voltage Calibration</u>: Use a DC calibrator.

Step 1: Apply 15V at ±VOLTDC input terminals
Adjust P1 for 15.0V display.

Step 2: Apply 1V. Adjust P2 for 1V.
Repeat steps 1 and 2 twice. Check 30V and 99V.

LCD contrast = P5

R_i Calibration: Use the 200mΩ (1 %) 4 pole resistor supplied with the tester. A dual 5V DC power supply that can deliver 2A is needed for R_i calibration.



Step 1: Press the R_i key. The tester measures the 200mΩ resistor and displays the measurement. If the display is more than 1 digit off adjust P3. Repeat measurements and adjust P3 to get a 200mΩ reading. All other ranges are now also within specification.

This concludes calibration to be within ±2 %. For better accuracy determine the precise value of the 1 % 200mΩ resistor.
Reinstall the bottom cover.

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KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ

Wir
We **Infratek AG**
Nous

(Name des Anbieters) (supplier's name) (nom du fournisseur)

Weingartenstrasse 6, CH-8707 Uetikon am See

(Anschrift) (address) (adresse)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

INFRATEK 23 DC-SOURCE TESTER

(Bezeichnung Typ oder Modell, Los-, Chargen- oder Seriennummer, möglichst Herkunft und Stückzahl)
(name, type or model, lot, batch or serial number, possibly sources and numbers of items)
(nom, type ou modèle, no de lot, d'échantillon ou de série, éventuellement sources et nombre d'éxemplaires)

auf das sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder nomativen Dokument(en) übereinstimmt.
to which this declaration relates is in conformity with the following standard(s) or other normative document(s)
auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou autre(s) document(s) normatif(s)

EN 61326; EN 50081-1; EN 50082-2; CEI/IEC 1010-1, Amendment 1/2;

(Titel und/oder Nummer sowie Ausgabedatum der Norm(en) oder der anderen normativen Dokumente)
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Gemäss den Bestimmungen der Richtlinie(n); following the provisions of Directive(s); conformément aux dispositions de(s) Directive(s)
(falls zutreffend) (if applicable) (le cas échéant)

89/336/EWG

Uetikon am See, 1.9.1999 Dr. Hans R. Oppliger Hans R. Oppliger

(Ort und Datum der Ausstellung) (Name und Unterschrift oder gleichwertige Kennzeichnung des Befugten)
(Place and date of issue) (name and signature or equivalent marking of authorized person)
(Lieu et date) (nom et signature du signataire autorisé)

Infratek AG
Weingartenstrasse 6
CH-8707 Uetikon am See

phone: +41-(0)44-920 50 05
fax: +41-(0)44-920 60 34
www.infratek-ag.com
e-mail: info@infratek-ag.com