LeakTest

LT-10

car battery discharge current recorder

Operation manual

CONTENT

1. LEAKTEST – WHAT IS IT?

It's a discharge current recorder that helps detect if car battery problems are caused by the battery discharging while parked.

- ✓ Measurement under normal conditions (car is locked)
- ✓ Time unlimited measurement
- ✓ No interference with vehicle installation
- ✓ Simple and intuitive operation
- ✓ Free app for data evaluation
- ✓ Estimation of car battery life

LeakTest does not contain any controls or display. For more information about the operation of the device, see section *7. Operating Principle of the Recorder.*

> ## ⚠ Safety warnings
>
> LeakTest is suitable for vehicles with a 12V car battery with a grounded (grounded) negative terminal.
> When working with the LeakTest recorder, please observe the following instructions:
> - Do not use the recorder contrary to these instructions.
> - Do not use the recorder if it shows signs of damage (e.g. damaged wire insulation, etc.).
> - When working, observe all safety guidelines applicable to working on motor vehicle wiring, especially when working on the car battery.
> - Measurements should only be carried out by a person with adequate technical knowledge.
> - Do not expose the recorder to direct sunlight.
> - Avoid spilling liquid on the recorder.

2. SCOPE OF SUPPLY

- Recorder LeakTest itself (see picture below)
- USB cable
- Instruction manual
- SW application LeakView (free download from www.leaktest.tech/en)

1 – Test leads with crocodile clips

- Red - to plus battery pole (+)
- Black – to minus pole (-)
- Green – to vehicle frame (earth)

2 - USB connector

3 - LED indicators (under the transparent cover)

- Yellow – lights up when connected to a computer
- Green - flashes quickly when the recorder is working
- Red - flashes once per measurement period (recording in progress)

Measurement procedure

1.	🖥	**Measurement settings** in app. LeakView, see section *4.4 Measurement Setup*
2.	🚗	**Connection to the vehicle** and start of the measurement, see section *3.1 Connecting to a vehicle*
3.	🚗	**Disconnection from the vehicle** after the test, see section *3.2 Disconnecting from a vehicle*
4.	🖥	**View results** in LeakView, see section *4.5 Downloading measured data and below*

3. LEAKTEST OPERATION

3.1 Connecting to a vehicle

Procedure (Fig. 1.):

1. Make sure the engine is switched off and the vehicle is secured against movement.

2. Place the LeakTest in a stable place near the car battery where it will not interfere with the closing of the door (bonnet).

3. Attach the green crocodile clip to a suitable point on the metal structure of the vehicle (e.g. bolt, bracket, cut-out in the profile, ...).

   Note: Use a different location than where the ground cable is connected from the negative terminal of the car battery. Make sure this

location has a good electrical connection to the negative terminal of the car battery. If necessary, clean it of paint or dirt.

4. Connect the black crocodile clip to the negative (minus) terminal of the car battery.

   Note: No other wire should be attached to the negative terminal of the car battery other than the ground cable to the car body. Any current flowing through such a conductor will not be included in the measurement.

5. Last, connect the red step clamp to the positive (plus) terminal of the car battery.

   Note: Correct connection of the LeakTest logger is indicated by a rapidly blinking green LED.

6. Close and lock the vehicle properly.

   Note: If the vehicle is not in its normal resting state (e.g. with the bonnet open), the current draw from the car battery may be higher and the measurement will be distorted.
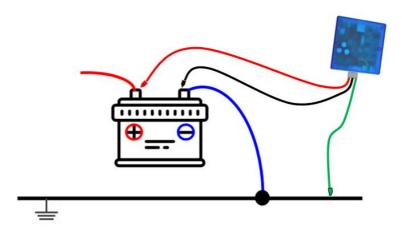

Fig.1: Connecting LeakTest to the vehicle

The measurement starts automatically when the LeakTest recorder is connected to the car battery (if a recording start delay has been set, the countdown starts).The storage of the measured values is indicated by a red LED that flashes once per set recording period.

Note: The principle of operation of the LeakTest recorder shows that it can also record the charging current of the car battery. However, it is not recommended to drive with a LeakTest connected.

3.2 Disconnecting from a vehicle

1. Allow sufficient time to elapse according to the measurement parameters set.

   Note: The recording will stop automatically after the set measurement time has elapsed, all LED indicators will be switched off.

   Recording can also be terminated before the set time has elapsed by simply disconnecting. In this case, the saved record will contain the actual number of records (not the set number of records).

2. Unlock the vehicle, first disconnect the red crocodile clip, then the black and green ones.

4. LEAKVIEW APPLICATION

The free LeakView app allows you to:

- Set parameters for measurement
- Download data from the recorder's memory
- Display measured values in tabular and graphical form
- Estimation of the expected lifetime of the car battery
- Export data to .csv format

4.1 Getting the app

The application does not require installation on the PC, it is sufficient to download and run it. PC requirements: Windows 7 or higher, Google Chrome

Procedure:

1. Visit www.leaktest.tech/en, at the bottom there is a *Download* section.

2. Click on the *LeakView_en* link, it will start downloading the .zip file (size about 14MB).

3. After unpacking, the LeakView application (.exe) is created.

4. Double-click to launch the application.

4.2 Starting the app

The first time you run the application, you may see a Windows security message (because of the app is awaiting Microsoft approval).

1. Click on „More information" (Fig. 2).

2. Click the „Run in this case too" button".

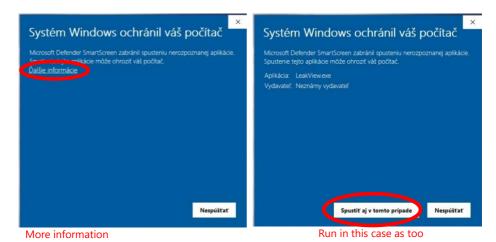More information   Run in this case as too

Fig. 2.: Windows security message

The LeakView home window appears:

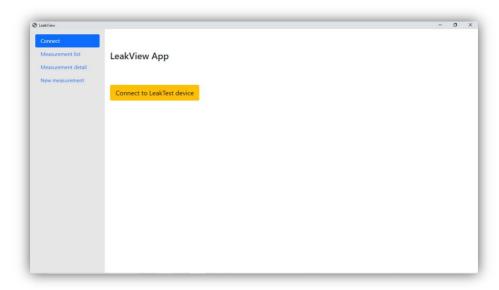*Fig. 3: The LeakView home window*

4.3 Connection to the LeakTest recorder

1. Connect the recorder to the PC with the included USB cable.

   Note: Connection is indicated by the yellow LED lighting up and green flashing.

2. In the LeakView application, click the „Connect to the LeakTest device" button (Fig. 3).

4.4 Measurement Setup

LeakView allows the following settings:

- **Measurement name:** Used to identify the measurement (e.g. plate number) *max. 10 characters*

- **Date, Time**: Time of expected connection to the vehicle.

  Note: LeakTest does not contain a real time clock, the date and time entered are not updated in the logger.

- **Record start delay**: The time interval between connecting the recorder to the vehicle and the start of recording.
  max. 255 seconds (= 4 minutes and 15 seconds)

- **Setting the three measurement phases:**

  o **Recording period**: The time interval between recordings of measured values.
  max 255 seconds

  o **Number of records:** The total number of records (i.e. entries of measured values) with the corresponding period.

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Setting different phases and measurement periods

The measurement is carried out sequentially, i.e. first phase 1, then 2 and 3. This can be used for a more detailed measurement shortly after locking the vehicle, when there is a rapid drop in battery consumption, then a longer recording period is sufficient.

If you plan to use only one period for the entire record, enter it in line 1 and enter zeros for both the periods and the number of measurements in lines 2 and 3.

When selecting the total measurement period, consider that some types of cars may take a longer time to reach a quiescent reading.

If you are planning a longer measurement, we recommend using a larger period. Otherwise, too many records will be stored in the memory, which can be cluttered and impractical; downloading data to a PC may take a long time.

Current and voltage data are retrieved internally several times per second, regardless of the set period. The value stored in memory is the average of all data acquired during the set period. This ensures maximum accuracy and objectivity of the measurement.

Procedure:
1. Connect LeakTest to a PC, open the application and connect it to the LeakTest recorder (section *4.2 Starting the application* and *4.3 Connection to the LeakTest recorder*).

2. In the menu on the left side of the window, click on „New m*easurement*" button.
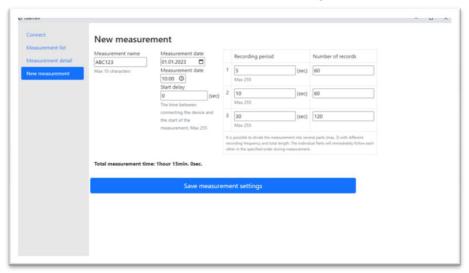
3. The new measurement window opens (Fig. 4).

Fig. 4: Window for entering parameters

4. Set the desired parameters.

5. Click on the blue button „Save measurement settings".

6. Close the application and disconnect LeakTest.

Note: It is not necessary to set the recording parameters before each measurement. It is also possible to take multiple measurements with the same settings. In this case, the measurements will be marked with the same name, date and time in the LeakView output, differing only in order (the most recent measurement will be the last).

4.5 Downloading measured data

After disconnecting the LeakTest recorder from the vehicle, the measured data can be retrieved from the memory using the LeakView application.

Procedure:

1. Connect LeakTest to the PC, open the application and connect to the LeakTest recorder (section 4.2 *Starting the application* and 4.3 *Connecting to the LeakTest recorder*).

2. In the menu on the left side of the window, click on the „*Measurement list*" button.

3. The list of measurements available in the LeakTest memory is displayed (Fig. 5).

   Note: The memory of the LeakTest recorder cannot be user-erased. When full, the oldest records are automatically overwritten.

4. To view the measured data of a specific measurement, click on the "*Detail*" button.

5. The data is downloaded from the LeakTest memory and the window with the values is displayed. (Fig. 6).

   Note: Downloading data can take a long time, depending on the amount of measurements stored.

6. Enter the value of the grounding resistance R in mΩ (milliOhm) in the appropriate field. The displayed current values will be automatically recalculated according to this value. If you do not know the value of R, it is recommended to enter R=1.0 mΩ (then consider the results as a guideline). For more information see section *6. Determining the earth resistance*.

Note: The larger the resistance R, the larger the calculated current values. The displayed car battery voltage values are not dependent on the resistance R.
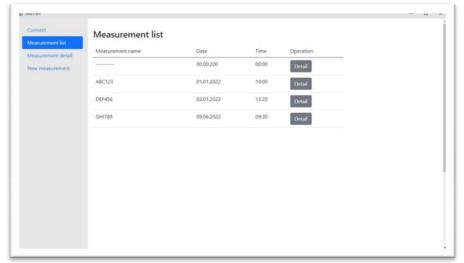

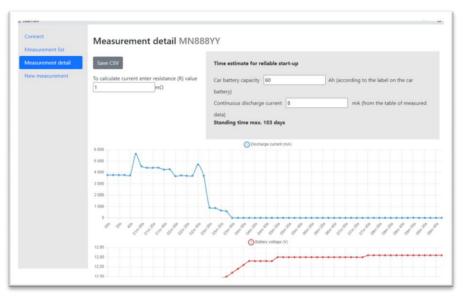*Fig. 5: List of available measurements*

Fig. 6: Window with measured values

4.6 Displaying the results

The LeakView application displays the data in tabular and graphical form (Fig. 6).

Spreadsheet:

The number of rows corresponds to the number of records within one measurement. Contains 3 columns:

1. **Time** (in *seconds*) elapsed since the measurement was started

2. **Car battery voltage** (in *Volts*), displayed to two decimal places

3. **Current** (in *milliAmps*) calculated according to the embedded value of the grounding resistance (R). The current flowing from the battery (discharge current) is indicated as positive (the "+" sign does not appear). The current flowing into the battery (charging current) is indicated by a negative sign " - ".

Graphs:

The app displays two graphs - **discharge current** (*mA*) over time and **battery voltage** (*V*) over time. The range of the graph axes is set automatically.

4.7 Export of data

In case you want to archive the measured data or process them in another way later, you can export the data to a .csv file that is compatible with Excel.

Procedure: In the "*Measurement Detail*" window, click the "*Save CSV*" button. The file will be saved in the LeakView application folder.

5. EVALUATION OF THE MEASUREMENT

5.1 Determination of the discharge current value

A typical discharge current waveform can be divided into two main parts (see Fig. 7):

- A – the current drops rapidly from the initial high value (switching off of the vehicle's electrical equipment is in progress)
- B – the current gradually stabilizes at a certain minimum value

The value of the discharge current (I_d) can be found from the part of the graph (B) when the current is already steady.
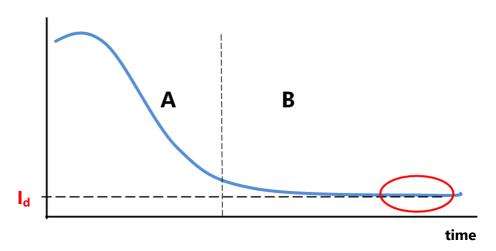

Fig. 7: Typical discharge current waveform

5.2 Assessment of the severity of the discharge current

The acceptable discharge current size varies for different types and equipment of cars.

The assessment of the severity of the measured I_d depends on whether or not the value of the earth resistance R is known.

When it is not necessary to measure the grounding resistance

In the vast majority of cases it is not necessary to know the exact value of this resistance. This is if:

- the discharge current I_d is **zero or negligible** (at the specified value of R= 1mOhm, the discharge current is less than about 10 mA)

- the discharge current I_d is **significantly high** (at the specified value of R = 1mOhm, the discharge current is greater than approximately 100 mA)

In these cases, it can be decided with high probability that the car battery is not discharging or is discharging.

These two cases are usually also reliably shown when the recommended value of R=1 milliOhm is specified.

In other cases (it means I_d is greater than approx. 10 mA, and less than 100 mA), the grounding resistance needs to be measured and entered into the application.

The resistance value R is known

The specific value of the grounding resistance (R) is known and has been entered into LeakView:

Value I_d	Severity
<approx. 30 mA	The value is within the permissible limit, there is no unreasonable discharge of the car battery.
30-80 mA	The discharge current is outside the normal limits, probably a fault condition.
>approx. 80 mA	The discharge current is unreasonably high, it is necessary to find and eliminate the cause.

Resistance value R is unknown

The specific value of the resistance R is not known, the recommended value R=1 mOhm was entered into the LeakTest application:

Value I_d	Severity
<approx.10 mA	Presumably, even after entering the actual value of the resistance R, the current value will be within the limits. Thus, there is a high probability that the car battery is not discharging.
10-100 mA	It is recommended to additionally measure the ground resistance value and enter it into LeakView. This will convert the current to actual values that can be better assessed.
>approx. 100 mA	Probably even after the actual value of the resistance R is entered, the current value will be too high, and thus it is an undesirable discharge of the car battery.

Note: Consult your car dealer or garage for the value of the idle discharge current for your vehicle. Also take into account any electrical equipment that has been retrofitted to the vehicle.

5.3 Estimation of time for reliable start-up

If a non-zero amount of discharge current has been measured, LeakView will help to estimate and display the time after which the discharge will reduce the capacity of the car battery to such an extent that starting the vehicle may be compromised.

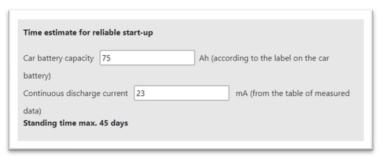*Note: If zero discharge current is detected, the time estimate is not displayed.*

Fig. 8: Time estimation window for reliable start-up

Two data are needed for the calculation:

- **Battery capacity:** The app will offer 60 Ah. Check or correct according to your reality.

- **Discharge current detected:** The application will try to analyze the measured data and offer a value. Check the reading from a graph or table, correct it if necessary.

Based on this, the time (in days) after which the car battery may no longer be able to start reliably is calculated (Fig. 8).

This estimate is only a guideline, it does not take into account the condition and age of the car battery. It also assumes that the car battery is fully charged at the start (e.g. after a sufficiently long drive).

Note: A reduction of one-third of the capacity of the car battery is considered critical.

6. DETERMINATION OF GROUNDING RESISTANCE

To obtain accurate values of the measured current, it is necessary to know the value of the resistance of the connection between the negative terminal of the car battery and the vehicle frame.

It usually ranges from a few tenths of a mΩ to a few mΩ (milliOhm). The magnitude of this resistance is specific to each vehicle, so its value must be determined by measuring it on a particular vehicle. This measurement only needs to be made once, the value found can then be used for any future measurements on a specific vehicle.

Note: If you do not have the possibility to carry out the measurement yourself, you can ask an expert for this service.

Required instrumentation:

- a clamp-on direct current (DC) meter with a resolution of at least 0.1A
- a multimeter for measuring DC voltage with a resolution of at least 0,1 mV

Note: The required instrument parameters are met by a number of affordable instruments on the market.
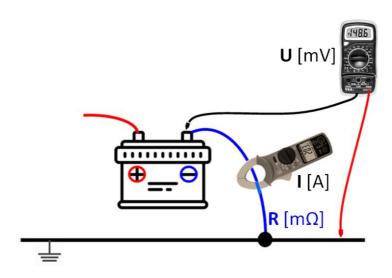
Fig. 9. Grounding resistance measurement

Procedure:

1. Make sure the engine is switched off and the vehicle is secured against movement.

2. Switch the multimeter to the lowest DC voltage measurement range. Connect the black measuring cable to the negative terminal of the battery. Connect the red measuring cable to the location on the skeleton where you connect the green crocodile clip of the LeakTest logger.

3. Switch the clamp ammeter to the DC measuring range. Encircle the grounding cable going from the negative terminal of the car battery to the car body.

4. Cause the car battery to draw at least a few A, for example by turning on the lights.

5. Wait for the readings on both instruments to stabilize, then note them down (voltage in millivolts, current in amperes). Be sure to record both readings at the same time (for example by taking a photo of both displays in one shot).

6. Calculate the grounding resistance value according to the formula:

$$R[m\Omega] = \frac{U\,[mV]}{I\,[A]}$$

Example:
Measured current (I): 3,4 A
Measured voltage (U): 4,7 mV
Then resistance (R) = 4,7 / 3,4 = 1,38 mΩ

Note: The value of R should be no more than a few milliohms. Otherwise, it may be necessary to clean the contacts of the ground cable.

7. Enter this value in the R resistance input field in LeakView on the "*Measurement Detail*" screen (Fig. 10).

To calculate current enter resistance (R) value

| 1,78 | mΩ |

Fig. 10: Window for inserting the resistance value R

7. OPERATING PRINCIPLE OF THE RECORDER

The LeakTest recorder measures and records the potential difference between the negative terminal of the car battery and the car body. This difference is directly proportional to the current leaking from the car battery (the so-called discharge current).

Power supply

The power supply of the recorder is provided by the car battery to which it is connected. The actual consumption of the device is low and has no influence on the measured values. The data stored in the memory of the device is not dependent on the power supply.

Measured data

The measured data is stored in the internal memory of the logger and then displayed on the PC using the LeakView application.

The following data is stored during recording:

- Time stamp of each recording
- Car battery voltage value
- Value corresponding to the magnitude and direction of current

7.1 Car battery discharge current

In theory, no current should be drawn from the battery of a parked car. However, most vehicles do have some current draw, mainly due to the built-in electrical equipment. The magnitude of this current should not exceed a certain permissible value.

Car manufacturers guarantee a standing time after which it should still be possible to start the car. This is usually 40 to 50 days. This then implies a maximum standstill consumption, which depends on the capacity of the installed battery.

Examples of maximum current draws for different car battery sizes and guaranteed standstill times:

Battery	50 days	40 days
44 Ah	13 mA	17 mA
60 Ah	18 mA	24 mA
70 Ah	20 mA	27 mA
80 Ah	23 mA	30 mA
95 Ah	27 mA	36 mA

However, in the event of a fault, the continuous draw on the car battery may increase, causing it to discharge excessively. This can result in premature loss of the battery's ability to start the vehicle reliably.

The inability of a vehicle to start can generally have various causes, such as a faulty car battery or a charging fault. However, inadequate discharge of the car battery, as mentioned above, may also be the cause. LeakTest can reliably check this possibility. This saves time and money, e.g. avoids the unnecessary purchase of a new car battery, and helps to focus the search for the cause in the right direction.

Different methods are used to detect the amount of current drawn from the car battery when the vehicle is at rest - measurement with a digital multimeter or a clamp ammeter. These methods of

measurement have a number of major disadvantages - the need to disconnect the battery, the difficulty of inducing a closed and locked state of the vehicle, the difficulty of making long-term measurements, and so on.

LeakTest offers a simple and practical solution without these disadvantages.

8. REPAIRS AND MAINTENANCE

The device does not contain any user replaceable elements. Do not disassemble or tamper with the LeakTest. In case of malfunction, contact your supplier.

9. PROBLEM SOLVING

In case of communication problems between the LeakTest logger and the LeakView application:

- Disconnect and reconnect the recorder.
- Check www.leaktest.tech to see if a newer version of LeakView is available.
- Check that the Baud rate for the port used is set to 38400.
- Restart the PC.

If the above steps did not help, or you are dealing with another problem, please contact your vendor or send your question directly to info@leaktest.tech.

> *Note: You may be asked to send a LeakView_log file, which is automatically created in the LeakView application folder.*

10. TECHNICAL PARAMETERS

Battery voltage measurement	
Min. measurement range	9 V ÷ 16 V
Resolution	0,01 V
Accuracy	2%
Current measurement	
Range	approx. 5mA ÷ 30A (charging current)
	approx. 0,1A ÷ 30A (discharging current)
Best resolution	1 mA
Best accuracy	2% (if the value R has been entered)
Logging	
Memory	approx. 260 000 measurements
Period of recording	1 ÷ 255 seconds
Stored data	indication of current magnitude and direction, battery voltage, time stamp
General data	
Power supply	from connected 12V car battery
Current consumption	approx. 7 mA
Operating ambient temperature	0°C ÷ +50°C
Max. input voltage	$\pm$20V between any inputs
Dimensions	80 x 80 x 25 mm
Measuring leads	silicone insulation, length 75 cm
Crocodile clips	max. opening 41 mm
Communication	USB

Manual version: 1.10; the latest version can be found at www.leaktest.tech/en