LOW BATTERY ALARM
(cod. FK016)

This device detects the battery voltage and emits an audible alert when, based on the calibration that is done, it deems it insufficient to ensure the proper functioning of the electrical system. The circuit is designed for 12V systems, so it is intended for use in cars, campers, or vans with 12V batteries; it is not suitable for trucks and buses, whose electrical systems typically have a 24V battery (typically two 12V batteries connected in series). The multi-turn trimmer should be adjusted so that the buzzer sounds when the voltage is considered normal for the battery. In general, consider that a lead-acid battery, such as that in an automobile, initially has a voltage of 2.1V per cell (an average of 12.5V for a 12V battery) that drops to about 12V a few minutes after charging is interrupted. It can be considered almost discharged when it drops below 11.5V. To be more precise, typically, with a battery at room temperature of 25°C and at rest for a couple of hours, the detectable voltage is 12.5V at full charge and full efficiency (new or nearly new battery), 12.2V at half charge, and less than 11.7V in the case of a battery near discharge.

It is worth noting that the entire circuit consumes very little current even when the audible alarm is active, so it does not impact the state

TECHNICAL SPECIFICATIONS

- Power Supply: 10÷15V
- Maximum current absorbed: 15 mA
- Alarm threshold voltage adjustable between 0 and 11.7V.
- Audible alert via piezo buzzer
of the car’s battery in any way. Even when the battery is nearly depleted, it still has enough energy to sound the buzzer for a few hours. There is no risk of the alarm failing to perform its role because the battery is discharged, as it should provide the audible warning to prevent us from attempting to start the vehicle and deplete the remaining energy.

Practical Assembly Instructions
Solder the few necessary components, starting with the fixed resistors and the Zener diode, which you will orient as shown in the assembly diagram visible on these pages. Next, insert and solder the socket for the LM741 integrated circuit, preferably oriented as suggested in the assembly diagram. Then proceed to the bipolar power terminal block and the piezo buzzer, placing them according to the indicated polarity, as the piezo buzzer, being of the type with integrated electronics, has its own polarity to be respected. Finally, complete the soldering by inserting the integrated circuit into its socket, aligning the reference notch as indicated in the assembly diagram, and ensuring that none of the eight pins are bent beneath the body of the LM741 during insertion.

Calibration and Installation
Now the circuit is ready, but it needs to be calibrated to provide accurate indications, meaning it should sound the alarm only when the

The PCB is so small that it can be placed anywhere.
Component list:

- **R1**: 1.2 kohm
- **R3**: 4.7 kohm
- **R2**: multi-turn-trimmer multigiri 10 kohm
- **C1**: 100 nF ceramic
- **ZD1**: Zener 5.1V 400mW
- **U1**: LM741
- **BZ1**: buzzer with integrated electronics
- **Miscellaneous**:
  - 2-way terminal block with 5.08mm pitch.
  - PCB FK016 (51x31 mm)

Battery is genuinely low.

To calibrate the device, connect the input terminal block (power) with two wires (observing polarity) to the output of a stabilized power supply capable of delivering at least 12V (the current output is irrelevant). Place the probes of a multimeter in parallel on the voltage measurement setting with a minimum scale of at least 20V. Adjust the output of the power supply to the voltage value you consider to be indicative of a low battery.

Once done, use a small flat-blade screwdriver to adjust the trimmer until you hear the buzzer sound. At that point, stop and disconnect the power supply (turn it off because you no longer need it); do the same for the multimeter. The circuit is now ready to be installed.

During calibration, be mindful that modern cars have alternators that can provide voltage in the range of 11.8 to 14.8V, so never adjust the trimmer above 11.8V because this voltage can be considered normal, at least under certain operating conditions.

For installation, identify a location on the dashboard where you can easily hear the audible alert. It can also be an unused existing compartment (provided it is electrically isolated), but you can also place the circuit in a perforated plastic container to allow the two-wire power cable (we recommend using a red-black 2x0.5 mm² ribbon cable) to enter and the buzzer sound to exit.

If you mount the printed circuit board without The trimmer allows you to adjust the alarm threshold. After adjusting it to your desired setting, secure the adjustment screw with nail polish or glue.
a container, ensure that the compartment where you place it is not made of metal or expose electrical contacts of the car’s electrical system. If necessary, isolate it with electrical tape or synthetic sponge. As you can see from the photos, the circuit is so small and compact that you can position it practically anywhere inside the car without difficulty. Before closing it in a container and installing it in the car, secure the trimmer adjustment screw with a drop of glue or nail polish so that it does not shift due to vibrations while driving, inadvertently changing the alarm threshold. The power cable of the circuit should preferably be connected to the battery terminals or to the input of the main fuse box. It’s not a bad idea to add an in-line 5x20mm fuse holder with a 500mA slow-blow cylindrical fuse to the positive wire (the red one in the red-black ribbon cable). This precaution will protect the car’s electrical system in case of inadvertent short-circuit on the PCB or between the PCB and a metal part of the vehicle.

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