

PX13/PX625/MR9 and PX27 mercury cell problem and its solutions.

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General information.

The now (for environmental reasons) banned mercury cells have caused problems for a lot of (vintage) camera and exposure meter owners who are now facing inaccurate exposures. The constant output voltage (1.35 volts) of the mercury cell was used as a reference voltage and for powering the meter and surrounding electronics. Depending on the circuits in an exposure meter a constant voltage is actually necessary or not. A Pentax Spotmatic, for instance, has a 'bridge' measuring network and does not need an exact 1.35 volts. This camera works perfect on a 1.55 volts alkaline or 1.6 volts silver-oxide cell. When an alkaline or silver-oxide cell is used instead of a mercury cell without an adapter or other special measures, deviations of up to 4 Light Values! (Konica TC) can occur. A camera or exposure meter will not be damaged when a silver-oxide or alkaline cell is used instead of a mercury cell. To check whether or not a camera or exposure meter works correctly on an alkaline 625-cell; measure the exposure on a bright sky and in a dim lit room with a fresh alkaline cell and a mercury cell. If the readings are the same with both cells in bright and dim conditions the mercury cell can be replaced with an alkaline cell without any problems. If the exposure readings in dim and bright conditions are more than 0.5 L.V. 'off' an alternative power source will be necessary once the mercury cell is depleted. For slides a variation in exposures of 0.3 L.V. can already be a problem. If the camera or exposure meter does not work properly on alkaline or silver-oxide cells there are a few options:

- Stock enough mercury cells to last a few years. (Hint: find them on the web.)
- Have the camera or exposure meter adjusted to work correctly on PX625S silver-oxide cells.
- Modify the camera/exposure meter by soldering one (or more) Schottky diode(s) in series with the wire from the battery compartment so it can take PX625S or SR44/S76/357 silver-oxide cells. (option 5 page 3)
- Use zinc-air cells, see page 2.
- Use one or more ready-made (\$14,00, see page 6) or homemade battery adapter(s).

There are 'adapters' that cost only a few dollars, these metal or plastic rings are intended for physically adapting zinc-air 675-cells so they will fit in a 625-battery compartment but do **not** lower the voltage, therefore, these rings cannot be used with alkaline or silver-oxide cells. The more expensive adapters (up to \$ 35.00) adapt the common SR44/S76/357 silver-oxide cell in size **and** lower the voltage to an average of 1.35 volts. Another (a lot cheaper) option is to make a homemade adapter.

In the following pages there is more detailed information on all kinds of things related to this mercury battery problem and the various possible solutions. It concerns mainly the PX13/PX625/MR9 (these are the same) and also the PX27 (page 5). From pages 6 to 8 is a comprehensive D.I.Y. guide for making a homemade adapter like the one the right.



Mercury cells such as PX13, PX14, PX27, PX32, PX400, PX625, PX640, PX675 and other types are (because of environmental reasons) no longer available, produced and imported in most countries all over the world. The mercury in the cell is a highly toxic heavy metal and can do a lot of damage to the environment. There are many manufacturers that made the 625-cell under their own part number: 4370, 4371, PX13, V13PX, EPX13, V625PX, PX625, KX625, RPX625, EPX625, HD625, PN625 RM625, 4625, 625, H1560, H-D, HS-D, M01, MR9, 1124MP, M20 and 8930. If you can find any of these mercury cells keep a few of them in stock, when stored below 20°C (68°F) they have a shelf life of 10 years, in a refrigerator even much longer, protect the cells from moisture and/or ice. Many salesmen do not know the difference between mercury and alkaline cells and will try to sell you (in all ignorance) alkaline cells stating these cells are the same as mercury cells and are interchangeable without any problems, sadly however, this is not true! There are rumours mercury cells are still produced and available in China, look for those on the web. When purchasing a mercury cell make sure it says '1.35 volts' or 'mercury' on the package or check for this voltage with a multimeter, 1.5 volts means it is an alkaline cell. Mercury cells have a larger capacity than other same sized cells with the exception of zinc-air cells. 625-mercury cells have a capacity of 350-450 mA/h (milli-amperes/hour) depending on make and type. The main reason mercury cells were used is the constant output voltage of these cells during their lifespan. This constant output voltage makes simple and effective exposure meter circuits possible without the need of (expensive) reference components and a lot of electronics. Their large capacity and low prices also made it popular.

Zinc-air cells are intended for use in hearing aids to replace mercury cells. The cheap **675**-hearing aid cells are sold in blisters and can be used in most cameras/exposure meters directly but their lifespan is limited to only 1 to 2 months whether current is drawn or not since they literally dry-out over time. These cells are smaller than 625-cells and need to be held in place with an adapter-ring. There are cheap adapter-rings (a few dollars) made from plastic or metal but anything to centre the cell will do also, like a rubber O-ring, faucet washer or a rolled piece of paper. As long as the seal remains on the battery it will have a shelf life of at least 8 years. After the seal has been removed air gets in the cell through little holes, the cell becomes activated and after 15-30 minutes the output voltage will be stabilized around 1.4 volts and the cell is ready for use. This cell needs access to fresh air or it will not be able to deliver current so a hole in the battery compartment is necessary. Zinc air cells have a capacity of 450-600 mA/h during a month or so (see chart on page 3).

Tip 1: This large capacity, however, is not needed for most cameras/exposure meters. If some holes are closed the cell will last longer and will be able (if the camera/ exposure meter draws less than 2 mA) to deliver enough current for most cameras and exposure meters. Fill some holes (leave 2 holes open) with nail polish or glue. Once the glue or nail polish has hardened the '+' side of the cell must be cleaned or sanded to ensure proper contact with the camera or exposure meter.

There are 'replacements' for the PX625, the 'Wein' MRB625 and 'Rittz' MX625. Regrettably these cells are

expensive compared to 675-hearing aid cells. These cells are 675-cell sized and come with metal adapter-rings to centre them. Both of these cells have fewer holes than 'normal' 675-cells and, therefore, will last longer. Unfortunately these metal rings are quite loose around the cell and not easy to apply. The Wein MRB625 also has a somewhat lower output voltage (1.36 volts). It has only 2 holes instead of the usual 4 or more; this causes the cell to dry-out more slowly and will therefore last longer, up to 3 months according to the manufacturer. If the seal is put back on a zinc-air cell (when not in use for a longer period of time) it will stop functioning, and keep the cell from drying out further and thus prolong the lifespan of the cell. If you don't mind changing and buying these expensive 625-substitutes regularly you can have a very good substitute in these cells. If the camera or exposure meters 'eats' batteries it is probably best to use cheap 675-hearing aid cells. Zinc air cells, however, cannot be stacked directly on top of each other since the holes from one cell (or more, if 3 or 4 cells are used) are sealed off by the negative side of the other zinc-air cell(s) and will not be able to deliver current. Some cameras and exposure meters actually use the protruding rim of the 625-cell to make contact with the battery compartment. A zinc-air cell with a ring to centre it will not work in this case. A way around these 2 problems is described below.

TIP 2: make an empty battery casing as described on page 9 (the first half of the page). Make 3 small dents in the outside of the plus (+) side of the battery casing so that on the inside 3 small bumps appear as shown on the right. A 675-cell that is placed inside the battery casing will now be somewhat elevated so air can get to the air holes. This way zinc-air cells will fit in most battery compartments and, an even better feature of this construction, the adapters with 675-cells can be stacked! For cameras like the Rollei 35's this is not a good option because the (half full?) film must be taken out of the camera to change the batteries.



Alkaline cells such as LR44 (60-80 mA/h) and 625-alkaline 'replacements' such as the V625U, KA625, R625, EP625G and LR9 (150-200 mA/h) are not suited for most (vintage) cameras and exposure meters. These cells are often sold (a piece or in blisters) on markets, in warehouses, dumpstores and drugstores. They cannot be used because of their too high voltage and, more important, their sloping discharge properties (see 'discharge comparison' chart on page 3). A fresh cell has a voltage of 1.55 volts, then rapidly falls to 1.45 volts and falls slowly down to 0.9 volts. Alkaline cells are inexpensive and **only** if there is no difference or if the differences in readings of the exposure meter are smaller than 0.5 L.V. in all light conditions compared to readings with the original mercury cell, these alkaline cells can be an excellent replacement.

NiCad or **NiMH** rechargeable cells like the Varta V60R, which has a 625-housing, are also not an option because of its limited capacity (60-80 mA/h), sloping discharge curve and high self-discharge rate. When fully charged they have a voltage of 1.38 volts but falls very rapidly down to a much too low 1.2 volts.

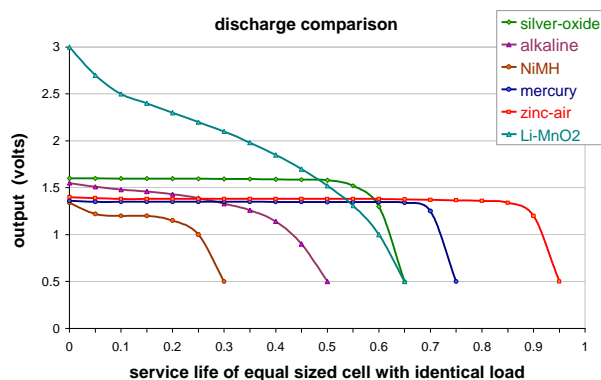
Lithium Manganese (Li-MnO₂) cells are not suited because of a much too high output voltage (3 volts) and their enormous sloping discharge characteristics (see chart on page 3).

Silver-oxide cells, under certain conditions, can be good alternatives. The voltage of these cells, 1.6 volts, is too high to be used directly without reducing the voltage. Silver-oxide cells, however, do have a constant output voltage like mercury cells. An adapter with a build-in device to lower the voltage to (an average of) 1.35 volts is the solution. An SR44, S76, 11077SOP, SP76, EPX76, SB-B9, RW42 or 357 silver-oxide cell (150-190 mA/h) with an adapter fits in the battery compartment of a camera/exposure meter. There are also alkaline cells with the same outline as the SR44 such as LR44, A76, 1166A, V13GA, PX76A and RW82, do not mistake these for silver-oxide cells, they are not the same and certainly not interchangeable.

An **adapter** has two functions.

1. Adaptation of the somewhat smaller SR44 cell to the larger and differently shaped 625-cell.
2. Lowering the output voltage of a silver-oxide cell from 1.6 volts to the desired 1.35 volts.

Below are the discharge characteristics of various equal sized batteries under identical load conditions.



Attention! The 'battery check' reading on a camera or exposure meter may give erroneous readings when a battery adapter is used because the 'load' of the test circuit may be too high, this does not mean the adapter does not function properly. When a fresh silver-oxide cell is used with an adapter, mark or remember this 'battery check' reading and use it as a new 'full battery' reading when using an adapter.

Be sure **never** to short-circuit the cell and adapter, this may result into failure of the Schottky diode.

Alkaline cells cannot be used in an adapter because their output voltage is not constant enough during its lifetime. Only Silver-oxide cells can be used because they have a constant output voltage like mercury cells.

Options for replacing the PX625.

Option 1: have the camera/exposure meter adjusted to work correctly on a (1.6 volts) silver-oxide cell. This is a sometimes costly, but probably best, long-term solution. An old camera or exposure meter is bound to be a little inaccurate after more than 10 years of service and it can't do any harm to have it serviced anyway. The cost of servicing and/or adjusting or calibration is dependant on make, model and service department that does the calibration. An adapter is not necessary in this case.

Option 2: zinc-air cells can be a good solution in some cases but only if battery compartment is accessible from the outside of the camera. Info on zinc-air is on page 2.

Option 3: an adapter is a good solution if the camera or exposure meter must remain in its original state or if the wires from the battery compartment are not easy to reach as with the Rollei 35 series. Also if the batteries last 1 year or more, or if the camera/exposure meter is not used very often a battery adapter is a good solution. Use the \$ 34.95 MR9 adapter from C.R.I.S. Camera Service (<http://www.criscam.com>) or the \$ 18.00 adapter from Gossen (contact your Gossen distributor for this one). C.R.I.S. Camera Service also has adapter solutions for PX27 and PX32 mercury cells. The MR9 adapter from C.R.I.S. has two drawbacks; the first problem is its inability to handle currents over 200 μ A (microamperes) very well because of the applied diode (probably a 'double' germanium type). Readings with a Nikon can be 'off' -1 to +3 L.V. when the C.R.I.S. MR9 adapter is used! (See page 4.) Another problem is the height of this adapter with a silver-oxide cell in it which is 0.015 inch (0.38 mm) thicker than the original PX625 cell and won't fit well in some cameras/exposure meters since the diode, that lowers the voltage, is placed in the bottom of the adapter and not in the rim like in the homemade adapter which does not suffer from both of these drawbacks. An adapter with an SR44/S76 cell has half the capacity of a PX625 cell and, therefore, will last half as long.

Option 4: adjust the camera/exposure meter yourself. This can be quite difficult and you can do more harm than good. There are no general guidelines on how to do this since every camera/exposure meter is different and needs another method or specific order of adjusting under controlled conditions. So do this **ONLY** if you know exactly what you are doing!

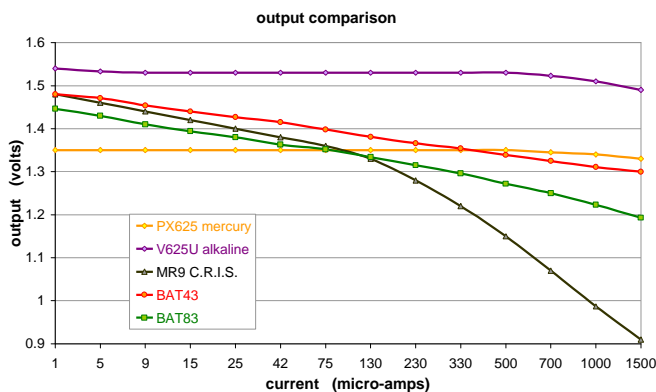
Option 5: solder one (or more) Schottky diode(s) in series with the wire from the battery compartment and use PX625 or, if possible, SR44 silver-oxide cells. A diode is a semiconductor that passes current in one direction and blocks in the other direction. Every diode has a certain voltage drop across it as current flows through it depending on the material it is made of (germanium or silicon), its structure (Schottky) and the amount of current flowing through it. How to select the best diode for the job is described on page 4. If the '+' of the battery is connected to the chassis of the camera or exposure meter, solder the diode(s) in series with the wire from the battery compartment as in the upper example on the right. If the '+' of the battery (also) has a wire attached to the battery compartment you can solder the diode as shown in the lower example. The colour of the diode and ring may vary depending on make and type. The ring or coloured band on the diode represents the cathode. Make sure you have enough room to place the diode and insulate the diode and its wires properly. If the camera takes 2 cells, solder 2 diodes in series with the wire, if the camera takes 3 cells you can solder one 1N4148 silicon diode or 3 Schottky diodes in series, 4 cells: solder one 1N4148 silicon diode and one Schottky diode in series.



Option 6: a homemade adapter can be a good solution (see option 3). A homemade adapter is cheaper and performs better than the C.R.I.S. Camera Service MR9 adapter. You do need some manual skills for the assembly of an adapter. For a comprehensive description for making a homemade adapter see pages 7 and 8.

How to select a battery adapter.

Cameras and exposure meters that last a year or longer with their batteries, such as Rollei 35's, have a maximum drawn current that remains below 200 μA (micro-amperes). For all those cameras/exposure meters the C.R.I.S. MR9 adapter can be an excellent solution as long as the battery compartment allows the 0.015 inch (0.38 mm) extra height. For cameras/exposure meters with a maximum current of 700 μA , a homemade adapter fitted with a BAT83 Schottky diode is an even better solution and is best suited for (almost) all cameras and exposure meters. Cameras and exposure meters with a maximum drawn current of up to 2 mA (1,000 μA = 1 mA) like most Nikons and cameras that 'eat' batteries might be better off with a homemade adapter fitted with a BAT43. If the 0.015 inch (0.38 mm) extra height of the MR9 adapter/silver-oxide cell poses a problem, the homemade adapter is the only solution since it has the exact height of the original PX625 mercury cell. Below is a comparison chart for an adapter fitted with a BAT43 and BAT83 Schottky diode, The C.R.I.S. MR9 adapter, PX625 mercury and V625U alkaline cells are also shown in the chart. All measurements are made at room temperature with a silver-oxide cell as a power source.



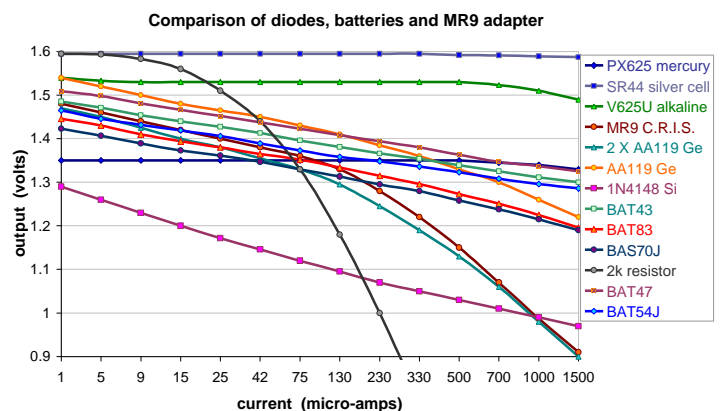
The X-axis from the chart is neither logarithmic nor linear for the following reasons:

1. Every increase in Light Value means doubling of the light-level of the previous Light Value resulting in the following light-level scale: 1, 2, 4, 8, 16, 32, etc.
2. In most vintage cameras/exposure meters a CdS-cell (Cadmium Sulphide cell, a Light Dependant Resistor) was used as a light sensitive device. The variation in resistance is not linear to the amount of light falling on this resistor, therefore, the current through the resistor, if a constant voltage is applied, also will not be linear to the light level.

The steps on the X-axis are analogue to Light Values from a (in this case) Nikon camera. L.V. 1 = 1 μA , (L.V. 2 is left out) L.V. 3 = 5 μA , L.V. 4 = 9 μA , L.V. 5 = 15 μA to L.V. 15 = 1,500 μA . Ideally the output voltage of an adapter, under varying current loads, should be equal to the output voltage of a mercury cell. The voltage drop of a (Schottky) diode, however, is dependant of the current through it. As the current increases the voltage across the diode also increases (a little), since the output of the silver-oxide cell remains the same under varying current loads, the output voltage of the adapter will decrease as the current increases.

Research on voltage lowering diodes.

A multimeter with current measurement ranges can be used to measure the minimum and maximum drawn current from the battery when it is connected in series with the battery and the camera/exposure meter. Measure the current in low light level conditions (indoors in a not too bright room) and in bright conditions (on a bright sky, not directly into the sun in case of an SLR!). If the maximum current remains below 700 μA the BAT81, BAT82, or BAT83 (DO-34), BAT41, 1N5711 or 1N6263 (DO-35), or BAS70J (S.M.D.) can be used. If the current range is between 15 μA and 2 mA the BAT43, BAT46 (DO-35) or BAT54J (S.M.D.) will do fine. If the current range is between 50 μA and 5 mA the BAT47 (DO-35) will do. Above 5 mA an Schottky diode is not an option anymore. Schottky diodes come in different packages, the DO-34 (Diode Outline) measures (max.) 3 mm long (without the wires) and 1.6 mm across. The DO-35 measures (max.) 4.3 mm long and 1.9 mm across. Very small S.M.D. (Surface Mount Device) Schottky diodes such as BAT54J and BAS70J also can be used. The 'J' suffix is very important in this case, it stands for a SOD-323 (Special Outline Diode) casing which measures only 2 x 1.5 x 1 mm (L x W x H) and has two pads for soldering it directly onto a P.C.B. (Printed Circuit Board) without the need of any wires. If little pieces of wire are soldered onto these solder pads this diode can be used also. Below is a comparison chart for various Schottky diodes, C.R.I.S. MR9 adapter, PX625 and V625U cells, 1N4148 silicon diode, AA119 germanium diode(s) and a 2 k Ω (kilo-Ohms) resistor. All measurements are made at room temperature with a silver-oxide cell.



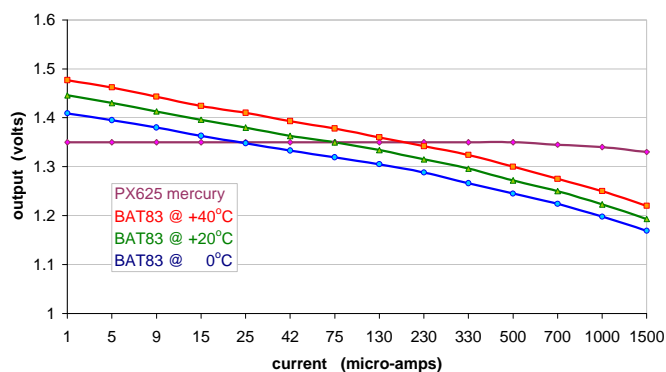
Schottky diodes, other than the ones mentioned in the chart above, also have been measured but are not included since they have identical characteristics to other diodes already shown in the chart. The BAT81, BAT82 and BAT41 have the same characteristics as the BAT83. The 1N5711 and 1N6263 are positioned exactly between the BAS70J and BAT83. Do **not** use diodes other than the ones mentioned above. Germanium diodes (AA119 or OA types) haven't got the right characteristics. 2 germanium diodes in series will perform like a Schottky diode up to 200 μA , above this point the output voltage will be too low for the exposure meter to give accurate readings. Silicon diodes, like the common 1N914 and 1N4148, clearly have a much too high voltage drop; as a result, the output voltage will be far too low. A resistor is, unlike a (Schottky) diode, a linear element this means: the voltage across the resistor is linear related to the current flowing through it and, therefore, cannot be used.

Note: The output voltage of the adapter/silver-oxide cell combination cannot be measured with a multimeter without an additional 'load'. The internal resistance of a multimeter is very high, as a result hardly any current will flow through the diode and the voltage across the diode also will be negligible, therefore, the 'measured' output voltage will be around 1.6 volts and not 1.35 volts. If the adapter/silver-oxide cell combination is loaded with a resistor of around 10 k Ω (kilo-Ohms) the average output voltage, when used in a camera or exposure meter, can be measured.

Temperature influence on Schottky diodes.

As with all semiconductors, Schottky diodes also react to changes in their temperature. When the temperature increases the voltage drop across the diode decreases, as a result, the output voltage of the silver-oxide cell/diode combination will increase. When the temperature decreases the voltage drop across the diode increases, therefore, the output voltage of the silver-oxide cell/diode combination will decrease. For Schottky diodes the temperature influence on the voltage drop is somewhere between -1.2mV/ $^{\circ}\text{C}$ to -1.6 mV/ $^{\circ}\text{C}$ depending on type and current. Most cameras/exposure meters will be used at room temperature or somewhere around it. Below freezing point a lot of cameras will also have even more problems than just with their batteries. A camera with a temperature of over 104 $^{\circ}\text{F}$ (40 $^{\circ}\text{C}$) feels very hot if you keep it in your hands. Mostly, cameras/exposure meters will be used within a temperature range of 32 $^{\circ}\text{F}$ (0 $^{\circ}\text{C}$) to 104 $^{\circ}\text{F}$ (40 $^{\circ}\text{C}$). The measured output voltage of a battery adapter fitted with a BAT83 Schottky diode at temperatures of 32 $^{\circ}\text{F}$ (0 $^{\circ}\text{C}$), 68 $^{\circ}\text{F}$ (20 $^{\circ}\text{C}$) and 104 $^{\circ}\text{F}$ (40 $^{\circ}\text{C}$) is shown in the chart below.

temperature influence on BAT83 Schottky diode



The PX27 mercury cell and its replacement.

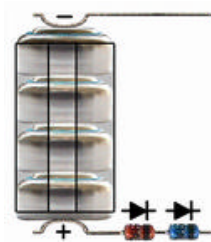
Cameras and exposure meters that take PX27 mercury cells (150-180 mA/h) also will need a replacement. If PX27 mercury cells can be found keep a few of them in stock, when stored below 20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$) they have a shelf life of 10 years, in a refrigerator even much longer, protect the cells from moisture and/or ice. There is a silver-oxide replacement, the SPX27BP, this is the best alternative as a replacement. An alternative for this battery is a stack of 4 alkaline LR44 or 4 silver-oxide SR44 cells. Stack 4 of these cells atop of each other and wrap a thin sheet of plastic around it as shown on the left. Use cello-tape or glue to keep the roll together, make sure the cells do not stick to this roll.



The plastic roll must be somewhat loose around the cells and not only keeps the cells together but also isolates the

individual cells to prevent them from being shorted by the metallic wall of some battery compartments. This stack will fit in most battery compartments (provided the battery compartment contacts allow 1.5 mm extra height). Most cameras and exposure meters will not have any problems with a voltage of 6.2 volts instead of 5.6 volts from the original PX27 mercury cell. Minox 35 cameras for instance work perfectly on this somewhat higher voltage and do not need to have the voltage lowered to 5.6 volts. If this stack won't fit in the battery compartment, 386-silver-oxide cells can be used. A 386-cell (120-140 mA/h) is 1.2 mm shorter compared to the 357 (SR44) cell (150-190 mA/h) and if 4 of these cells are stacked they will be 3.7 mm short. If this gap is filled with a 3.7 mm thick conducting metal ring the exact height of a PX27 will be reached. There are adapters on the market that use 4 of these SR43/386-cells to replace the PX27, such as the 'Minox battery conversion kit' for info look at: (<http://www.rolleicamera.com/sales-batt-adapt.htm>.) or the V27PX adapter from C.R.I.S. These adapters do not have a voltage lowering circuit and deliver 6.2 volts. The adapters are suited for the Rollei 35SE, 35TE, 35LED, Minox 35's and a lot of other cameras and exposure meters. C.R.I.S. Camera service (<http://www.criscam.com>) also sells battery adapters for PX32 mercury cells. If you still own a PX27 cell you can easily check if a stack of 4 alkaline or silver-oxide cells are the answer to the problem by measuring exposure on a bright sky and in a dim lit room with the PX27 and with 4 LR44 alkaline cells. If the readings of the camera/exposure meter are the same with both types of cells the PX27 can be replaced with a stack of 4 alkaline or 4 silver-oxide cells without any problems. Do not use alkaline and silver-oxide cells together! Stacking 4 zinc-air 675-cells is not an option because the air holes from 3 of the 4 cells will be closed off by the other cells and will not be able to deliver the necessary current.

If the readings of the exposure meter are not the same with both kinds of batteries only silver-oxide cells can be used **and** a 1N4148 silicon diode with a BAT83 Schottky diode must be soldered in series with the wire from the battery compartment. This will give the proper voltage drop and will bring the output voltage down to around 5.6 volts. Solder these diodes in series as shown on the right. If only the '-' side of the battery compartment has a wire attached to it; solder the 2 diodes in series with this wire, the cathode of the diodes (the stripe or ring) must point towards the '-' of the battery stack (in this case).



The PX27 cannot be replaced with 2 lithium-manganese CR1/3N or DL1/3N cells. These cells have a nominal voltage of 3 volts (when fresh) and a height of 2 SR44 silver-oxide cells. These lithium-manganese cells, however, have an extremely sloping output voltage (see 'discharge comparison' chart on page 3). From the moment these cells are used their voltage will drop steadily. When it is halfway its capacity the output voltage has already dropped down to 2 volts and will continue to drop further to 1.2 volts before ending its useful life. Therefore, these lithium cells are NOT a good replacement for the PX27.



Required materials for making a PX625/MR9 battery adapter.

Be sure to read the entire manual before starting to make the adapter.

Important liability notice: *Modifying a camera/exposure meter and/or making a homemade adapter are at your own risk. The author of this article is not liable for any personal injuries or any damage caused as a result of any actions taken because of this article. The contents of this article may be used, copied and distributed freely as long as the contents are not changed in any way.*

Materials required:



An alkaline cell of the type 625; **never** use a Mercury cell! (see page 2). If there is any doubt about the kind of cell, it is better not to use that cell at all because of the hazardous nature of the materials that can escape when opening a Mercury cell.

A Schottky diode as mentioned on page 4. One or more of the mentioned types should be available at your electronic parts shop. The BAT83 is (standard) included in the 625-kit*. If you need another diode please ask when ordering the kit.

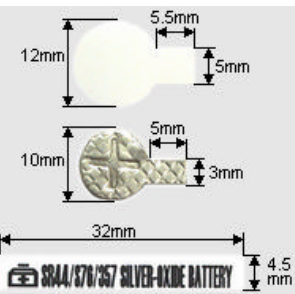
Glue. Preferably, a 2-component glue; however, any filling glue that can bond metal and plastic together will do.

Solder of the type used for soldering electronics. This is called 60/40 rosin core solder, with a diameter of 0,7-1 mm; it is sold on a reel, a piece of cardboard or as a coil in a plastic container. A piece (± 15 cm) is included in the 625-kit*. Do **NOT** use plumbing solder and/or solder that needs external flux.

A 100 Ω (Ohms) resistor (0.25 Watts). This resistor is used to drain the cell and is included in the 625-kit*.

A plastic sticker cut in the shape, shown below. This is used as isolator and therefore may not be made from conductive material. This precut sticker is included in the 625-kit*.

A conductive and solderable self-adhesive shielding foil, made by 3M, type 1345, cut in the shape as shown on the left. This foil is intended for shielding of components from R.F. and E.M.C. signals. It is expensive material and often hard to get. Look for well stocked electronics shops that should have these or comparable foils in stock. Aluminum foil is not an option because it cannot be soldered. A precut foil is included in the 625-kit*.



A flexible plastic or paper strip (32 X 4.5 mm). Almost any plastic may be used, as long as it is as thick as paper and non-conductive. A preprinted strip is included in the 625-kit*.

Tools:

A drill and a vise with 3, 6 and 10 mm drill bits. Or, a stand drill with a vise and the necessary drill bits. A center punch can prove to be very handy.

A 40-60 Watts soldering iron with a small tip or a soldering station for use with electronics.

A breakaway utility knife or scalpel.

Scissors for clipping the sticker, foil and strip. When the 625-kit* is used the scissors are not necessary.

A flat miniature file or needle file, maximum 5 mm wide.

A small screwdriver.

A side cutter.

A clothespin.

Contents of a 625-kit* :



Ordering information for kit(s) and adapter(s).

Kit prices (excluded shipping and handling):

1 kit = (U.S.)\$ or € 3.00
2 kits = (U.S.)\$ or € 5.00
3 kits = (U.S.)\$ or € 7.00
4 kits = (U.S.)\$ or € 9.00
5 or more kits = (U.S.)\$ or € 2.00 per kit.

Shipping and handling costs:

Shipping 1 to 4 kits to any country adds (U.S.)\$ or € 1.00 per shipment, 5 to 10 kits adds (U.S.)\$ or € 2.00 per shipment. Example: 3 kits included shipping = (U.S.)\$ or € 8.00, 9 kits incl. shipping = (U.S.)\$ or € 20.00.

A *625-kit comes with a BAT83 Schottky diode; if another diode is required (see page 4) please include this in your order.

For information on availability of **ready-made adapters** (1 adapter = (U.S.)\$ or € 14.00, without shipping) or for ordering kit(s) or questions and/or remarks e-mail to:

battery.adapter@wanadoo.nl

Or use the home address below.

Frans de Gruijter
Zuidkade 161
2741 JJ Waddinxveen
The Netherlands

Instructions for making a PX625/MR9 battery adapter.

The adapter is made from an electrically empty (dead) 625-type **alkaline** cell. The used cell must be an alkaline cell, for example: V625U, GP625A, KA625, EPX625G or LR9. An alkaline cell has a nominal voltage of 1.5 volt. Mercury cells (see page 2) are **NOT** to be used because hazardous materials are used in these types of cells, among those the extremely toxic mercury, which is why the mercury cell is now banned in most countries. To drain the cell, a 100 Ω (Ohms) resistor is placed over the contacts of the cell, as shown on the left. Make sure that the leads of the resistor do not short the battery contacts, if it does; the cell will get very hot and might even rupture. Discharge around 2 days.



After the cell has been discharged the cell can be emptied. Because of health risks it is advisable to take some precautions. Drilling and removing the insides of the cell is best done in a very well ventilated area or outdoors. Make sure to use household or surgical gloves. Avoid any contact with the insides of the cell with your skin or other body parts. This way health risks are kept to a minimum.

To remove the insides from the cell, first it has to be opened. This is done by drilling a hole of about 3 mm exactly in the middle of the cathode (-) of the cell. A center punch can prove to be very handy for centering your drill. Make sure the cell is held securely in a vise. Do not apply too much force to the vise because the cell will easily bend on its edges. When drilling, use surgical or household gloves and safety glasses. Do not drill too far into the cell, so you won't hit the bottom of the cell. Some cells might leak some fluid when drilling! Use a low speed when drilling so that the insides of the cell won't fly around and also to make sure that the cell does not get too hot due to friction.



Next, the 3 mm hole must be made larger. Use a 6 or 7 mm drill. After this, you can proceed to the 10 mm drill.



Now, only the rim of the metal electrode and the isolator ring remain. To remove these the empty cell needs to be placed in the vise again. Do not apply too much force to the vise, as the cell will easily bend on its edges. Safety first: use surgical or household gloves. An approx 5 mm wide gap must be made in the rim of the cell casing, as shown on the left. When a DO-35 (page 4.) diode is used, a 6 mm gap is required. The Schottky diode will later be placed in this opening. The electrode ring and the isolator ring now have been cut and can easily be removed by pulling them out with pliers as shown below.



The insides of the cell can now be removed. Do this in a well-ventilated room or outdoors making sure that you use household or surgical gloves. Scoop out the insides with a small screwdriver or a pick. The insides of the cell should be treated as chemical waste. After the rings are removed from the battery casing, the inside of the battery casing must be cleaned with water and soap to neutralize the acid remains. Dry the battery casing well to avoid rust.



To be able to solder the Schottky diode in the rim of the battery casing, the inside of the rim must be tinned with a thin layer of solder at the spot where the Schottky diode is to be soldered. Cut the cathode (near the black stripe) of the Schottky diode so there is 5 mm of lead left, as in the illustration on the left. Tin the 5 mm long cathode of the Schottky diode. To prevent damage to the Schottky diode; do not heat it for



longer than 2 seconds. Let the Schottky diode cool down for some time after soldering. Use a soldering iron of 40 to 60 Watts or a soldering station. In order to let the solder flow and adhere to the inside of the rim, the rim has to be thoroughly cleaned and/or scratched. Heat the rim of the battery casing for about 10 seconds and then let some solder flow into the rim. The battery casing will become very hot! For easy soldering you can put the battery casing in a vise.

After the battery casing is cooled down the Schottky diode can be placed. Heat the tinned rim on the inside of the battery casing until the solder begins to flow. When the solder flows the diode must be soldered in place as shown on the right. Maintain a clearance of 0,5 mm between the end of the Schottky diode and the rim of the battery casing. To prevent damage to the Schottky diode, do not heat it for longer than 2 seconds. Hold the Schottky diode motionless in place, until the solder has solidified. After soldering make sure the solder does not stick out as shown on the left.



Now, the isolator has to be placed on the bottom of the battery casing. This isolator is made of a plastic sticker with a diameter of 12 mm and a "flap". This sticker is included in the 625-kit*. The "flap" is to be placed in the battery casing as shown on the left. Let the "flap" overlay about 0,5 mm into the hole of the rim. Cut away the piece of "flap" which is sticking out above the battery casing with a knife or a scalpel.



When the isolator is in place, place the precut conducting selfadhesive foil on the plastic isolator. The conductive foil must be placed in the middle of the plastic isolator so that everywhere around the conductive foil there is 1 mm of plastic isolator visible as shown in the illustration on the right. This precut conductive foil is also included in the 625-kit*.



The anode of the Schottky diode must now be shortened. Leave about 3 to 4 mm of lead remaining on the Schottky diode. Tin the anode of the Schottky diode. Loosen the "flap" of the conductive foil from the rim of the battery casing. Solder the anode of the Schottky diode onto the loosened "flap" of the conductive foil at the spot where the "flap" falls in the rim of the battery casing, as shown on the left. Try to do this in less than 2 seconds. If soldering takes more than 2 seconds, the Schottky diode might be damaged and the plastic isolator may melt. After soldering the Schottky diode let it cool down and bend the Schottky diode back as far as possible into the rim as shown on the right.

The anode of the Schottky diode and the "flap" of the conductive foil should **not** be in contact with the battery casing. If you own a multimeter you can check this by measuring the resistance between the anode of the Schottky diode and the casing. If a shortcircuit is measured, bend the Schottky diode inwards and investigate where it was making contact with the battery casing and solve the problem. An Schottky diode conducts only in one direction and therefore it needs to be measured in both directions. The resistance should be measurable **only** in one direction.

Now, only the paper insulation strip needs to be glued in place to finish the adapter. Preferably you should use a fast hardening 2-component glue, however, any filling glue that can bond metal and plastic will do. Superglue is not advisable because it is not filling glue. Put a thin layer of glue onto the strip and fill the rim of the battery casing with glue. Glue the strip into the casing as shown on the left. Do not use too much glue, for it will seep into the bottom of the casing preventing the, later to be placed cell, from making contact with the conductive foil. When the strip is in place, the battery casing must be stuffed with foam rubber or with compressible earplugs without moving the strip. These materials swell in all directions and will therefore push the strip firmly to the inside of the battery casing. See illustration on the left. Turn the adapter upside down (foam rubber pointing down and the adapter on top) while the glue is hardening! After the glue has hardened the foam rubber must be removed and the battery casing must be checked for excessive glue seeping out from under the strip. Cut off the piece of strip that sticks out above the rim with a knife as shown on the right.

Put a **silver-oxide** SR44, S76 or 357 cell in the adapter, as shown on the left. This cell should lay somewhat loose in the adapter and should fall out when kept upside down. If the cell is somewhat stuck in the adapter: either the Schottky diode is bent too far inwards and needs to be bent outwards carefully (take care while bending as the Schottky diode breaks easily). Or, the strip has too much glue and is bulging too far inwards into the battery casing. If so, remove the strip and the remains of the glue and glue the strip back with somewhat less glue. If the SR44 cell fits easily in the adapter it is ready for use.

Cameras/exposure meters that use PX625/MR9 cells.

Aetna/Maxwell:	L1, D1 and D3 exposure meters.
Agfa:	Optima sensor 500, Selectronic/S, Agfamatic 300/4000/4008/5008/6008, Optima 535/1035/5000/ 6000.
Alpa:	9d.
Argus:	270 Insta-Load.
Bell&Howell:	FD 35.
Bewi:	Super L exposure meter.
Bolex:	Exposure meter for H8/H16.
Canon:	F, F-1, Ft, Ftb, Ftb-QL, FTb booster finder, Finder Illum., TX, EF, TL, TLb, EX Auto, Canonette QL17, QL19, QL25, 19E, newQL17, newQL17L, newQL19, new28, QL17GIII, QL19GIII and A35F.
Capitol:	D-1, D-3 and L-1 exposure meters.
Chinon:	CS and CX II.
Dot Line:	DL0016, DL0017 exposure meters.
Edixa:	LTL and Prisma camera.
Exakta:	TL1000, RTL1000, Examat (Harwix) and Travemat (Schacht) exposure meters.
Fuji:	35FS and V2.
Gossen:	Super Pilot CdS, C-Mate CdS, Lunasix, Lunasix 3, Luna Pro CdS, Super pilot SBC, Sixtar 2 SBC, Sixon 2, 35SL, Compact A rangefinder.
Hanimex:	CdS metered prism finder.
Hasselblad:	K431 and K650 CdS meters and K433 zone meter.
Kalimar:	K164H, K609H, K610H, K615H and K616D.
Keystone:	Retina II F
Kodak:	Auto S1, Auto S2, Autoreflex, AutoreflexTC, AutoreflexT4, C35, EE-Matic deluxe F, EE-Matic de Luxe FM.
Konica:	CdS exposure meter.
Kopil:	SE, SER, SET, SET-R, SET-R2, Super 66, TTL meter for Six and SixMM.
Kowa:	CL, M5, Leicaflax SL2, MR3 and MR4 exp. meters.
Leica:	EE Super Deluxe.
Majamatic:	SRT100, SRT101, SRT102, SRT200, SRT201, SRT202, HiMatic7, HiMatic7s, HiMatic9, HiMatic11, AL-E, AL-F, SR1, SR7, Autopak 700, 16MG-S, Flash- and Color- Meter.
Minolta:	110S.
Minox:	Automex II, Automex III, Sensorex, F, FM, and TTP clip-on meters.
Miranda:	F Photomic S model1 and model 2, Photomic illum. Photomic Finder: T, Tn, FTn finder, Nikkormat (or Nikomat) FT, Nikkormat FTn, Nikkormat FT2 (early).
Nikon:	S56, S800, S801macro.
Nizo:	OM1, OM1n, 35RC, 35 UC, 35RD, 35SP, 35SPn and Pen FT.
Olympus:	Spotmatic SP-F/MD/DATA and clip-on meter.
Pentax:	Petriflex 7, FT, FTIIF1X and Petri Racer.
Petri:	Practicamat, LTL, LTL3, MTL3, Super TL2, Super TL3, TL 1000, exp. meter for 66.
Praktica:	160 and 117 DX1 exposure meters.
Prinz:	Simplex, Simplex II, SLX-500, TLS EE and TLS 400.
Ricoh:	35, 35T, 35S, 35 Classic, SL35, SL35M, SL26, XF35 and A26.
Rollei:	35RF.
Sears:	L164A, L164B and L164C exposure meters.
Sekonic:	UF, UF II and Selector CdS exposure meters.
Soligor:	TriColor meter.
Spectra:	Spiraflex TTL.
Spiratone:	CdS exposure meter.
Stitz:	Super DM, 135 EE and exposure meter.
Topcon:	35EE, 35EF, 35 ES and 34 exposure meter.
Vivitar:	VS-1.
Voigländer:	Mat124, MAT124G, Y12, Y24, Half 14, Lynx 14, Lynx 5000, MinisterD, Penta J3, J4, J5, J7 and Minister 700D.
Yashica:	Contarex Super, Contaflex Super BC, Contaflex 126, Contaflex 126SLF, Icarex 35S, Icarex 35CS and Icarex SL706.
Zeiss-Ikon:	

If you can add to (or correct) this list of cameras and exposure meters please do not hesitate to do so and e-mail me: battery.adapter@wanadoo.nl.

Instructions for making a PX625/MR9 battery adapter with an S.M.D. BAS70J or BAT54J.

The adapter is made from an electrically empty (dead) 625-type alkaline cell. Mercury cells (see page 2) are **NOT** to be used because hazardous materials are used in these types of cells, among those the extremely toxic mercury, which is why the mercury cell is now banned in most countries. To drain the cell, a 100 Ω (Ohms) resistor is placed over the contacts of the cell, as shown on the left. Make sure that the leads of the resistor do not short the battery contacts. Discharging takes around 2 days.



After the cell has been discharged the cell can be emptied. Because of health risks it is advisable to take some precautions. Drilling and removing the insides of the cell is best done in a very well ventilated area or outdoors. Make sure to use household or surgical gloves. Avoid any contact with the insides of the cell with your skin or other body parts. This way health risks are kept to a minimum. These precautions apply until the battery casing has been washed and dried.



Drill a hole of about 3 mm exactly in the middle of the cathode (-) of the cell. A center punch can prove to be very handy for centering your drill. Do not drill too far into the cell, so you won't hit the bottom of the cell. Some cells might leak some fluid when drilling! Use a low speed when

drilling so that the insides of the cell won't fly around and also to make sure that the cell does not get too hot due to friction. Next, the 3 mm hole must be made larger. Use a 6 or 7 mm drill. After this, you can proceed to the 10 mm drill.



Now, only the rim of the metal electrode and the isolator ring remain. A cut must be made with an iron-saw in the rim of the battery casing, as shown on the left.

Scoop out the insides of the battery with a small pick or screwdriver as much as possible and bend the (now cut) ring inwards, as shown on the right, so it can be pulled out with pliers as shown below.



For an aesthetically refined version you can grind the rings out with a small handheld grinder. With this, time consuming way, the cut with the iron saw is not necessary and the casing remains whole.

After the rings are removed from the battery casing, the inside of the battery casing must be cleaned out further and washed with water and soap to neutralize the acid remains. Dry the battery casing well to avoid rust.

Determine the cathode of the Schottky diode with a multimeter. Tin the cathode and solder a short piece of wire onto the anode of the Schottky diode as shown on the left.



Do not bend the solder-pads of the diode too far or too often for they break off easily!

To be able to solder the Schottky diode in the rim of the battery casing, the inside of the rim must be tinned with a blob of solder at the spot where the cut in the battery casing was made, as shown on the right. In order to let the solder flow and adhere to the inside of the rim it has to be thoroughly cleaned and/or scratched.



Heat the solder in the rim of the battery casing until it flows. Place the Schottky diode in the rim of the battery casing as shown on the left.

Let the solder solidify without moving the Schottky diode. Make sure the cathode does not make contact with the battery casing. Do not heat the Schottky diode too long! Scrape or cut off the part of solder and Schottky diode that sticks out from under the protruding rim when you look at it from the top, otherwise the SR44 cell won't fit.

After the battery casing is cooled down the isolator has to be placed on the bottom of the battery casing. This sticker is included in the 625-kit*. The "flap" is to be placed in the battery casing as shown on the right. Cut away the piece of "flap" which is sticking out above the battery casing with a knife or a scalpel. When the isolator is in place, the pre-cut conducting selfadhesive foil must be placed in the middle of the plastic isolator so that everywhere around the conductive foil there is 1 mm of plastic isolator visible as shown above. This pre-cut conductive foil is also included in the 625-kit*.



Loosen the "flap" of the conductive foil from the rim of the battery casing. Solder the wire from the anode of the Schottky diode onto the loosened "flap" of the conductive foil at the spot where the "flap" falls in the rim of the battery casing, as shown on the left. Try to do this in less than 0.5 seconds so the wire won't come off the Schottky diode while soldering.



Now, only the paper insulation strip needs to be glued in place to finish the adapter. Preferably you should use a fast hardening 2-component glue, however, any filling glue that can bond metal and paper will do. Put a very thin layer of glue onto the strip and fill the rim of the battery casing with glue. Glue the strip into the casing as shown on the right. Do not use too much glue, for it will seep into the bottom of the casing preventing the, later to be placed cell, from making contact with the conductive foil. When the strip is in place, the battery casing must be stuffed with foam rubber or with compressible earplugs without moving the strip. See illustration on the left. Turn the adapter upside-down while the glue is hardening so that the adapter stands on top of the foam rubber. When the glue has hardened, the piece of foam rubber must be removed and the battery casing must be checked for excessive glue seeping out from under the strip. Cut off the piece of strip that sticks out above the rim with a knife as shown on the right.

