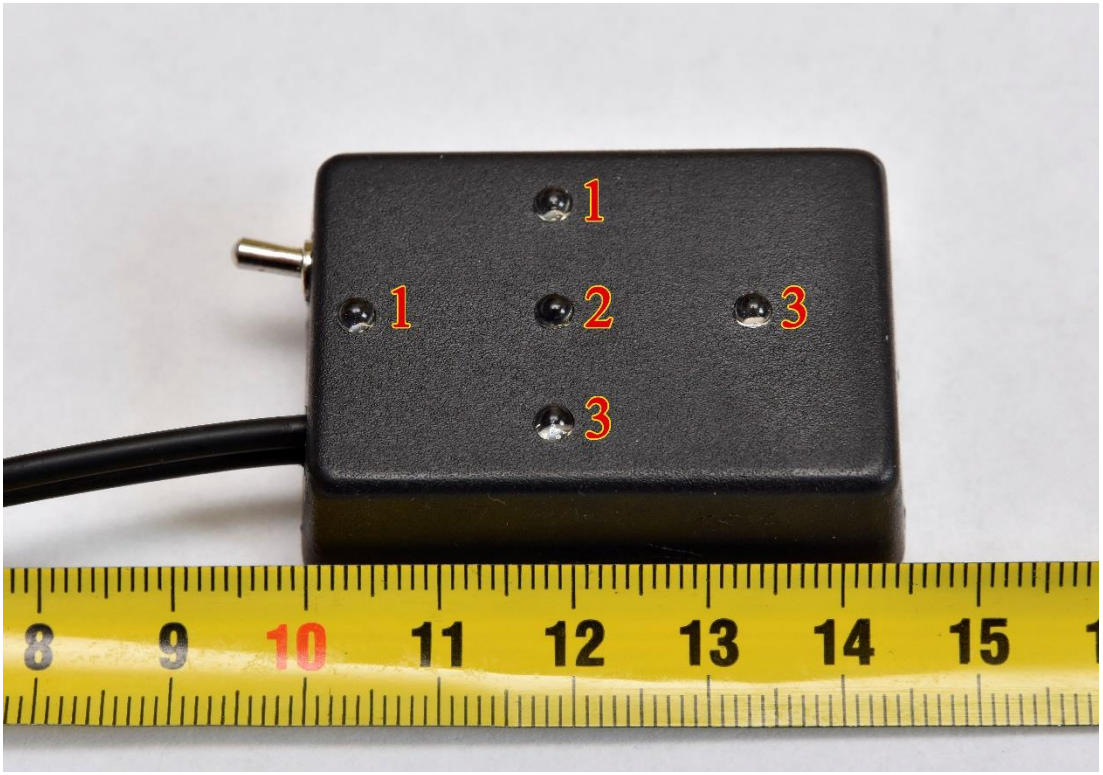
Description of 6x6 format sensor to VFMoto tester.

Original sensor that came with shutter tester for measuring 35mm focal plane shutters looks as follows (I didn't buy the most expensive version, so sensor is simpler, but sufficient for my purposes - when I don't have any older Leica...):



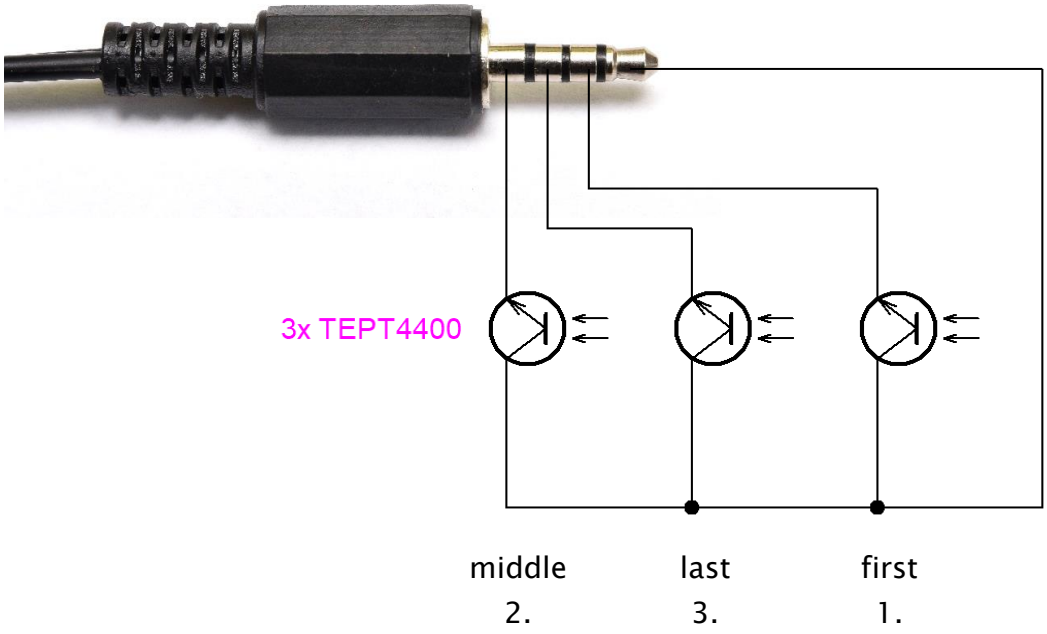
This sensor has two rows of phototransistors, I have always marked them in picture with numbers 1 to 3. Longer row, in photo parallel to tape measure, is for measuring focal plane shutters running across longer dimension of film (36 mm), shorter row, vertical in photo, is for measuring shutters running across shorter dimension (24 mm). Choice between them is made by a metal lever switch, visible on left edge of sensor box, above connecting cable.

Sensor is used by placing it as close as possible behind shutter to be measured and illuminating it from front (preferably via hole for lens) using light source with one LED, also supplied with tester. As you can see from photo, dimensions of sensor are made to be used for measuring 35 mm shutters, longest distance for my sensor between centres of phototransistors 1 and 3 for measuring shutters running across distance 36 mm is about 29.4 mm according to my calliper measurement, and this is not enough for measuring 6x6 focal plane shutters, so supplied sensor is basically unusable for them.

Because I bought for instance an older Praktisix camera, where shutter was working quite well by ear, but since I am not able to measure shutter speeds with my ears, I decided to make a sensor for 6x6 shutter myself, when I couldn't find any such sensor for VFMoto tester on eBay and similar. After buying Praktisix I couldn't resist and measured its shutter with the 35 mm sensor, of course, it looked quite nice, but due to the measuring distance between phototransistors I had no information how shutter behaves in edges of picture window, and I rejected possibility of measuring once at one of end and then at other end, firstly it's too complicated and secondly values would not be correlated anyway, so such measurement is of no use.

Of course, since documentation for tester does not contain a wiring diagram of sensor, nor does it specify what components it consists of, I had to find out myself. After disassembling sensor, I simply sketched out wiring diagram, sensor is filled with some black potting compound, but I was lucky, it wasn't all filled, so I didn't have to "dissect" it too much. A little harder was determining what light measuring components are in there. Their dimensions and construction are of course visible, but these components most of them don't have type markings. Finally, by measuring their parameters with an ohmmeter, I choose that they would be phototransistors, and from available phototransistors on our market (TME Czech Republic) I found TEPT4400 type. I based on electrical parameters to match as much as possible measured ones, on physical dimensions and also on spectral sensitivity, to phototransistor somehow respond to LEDs light, that will be used to illuminate it. The TEPT4400 phototransistors have a half-angle sensitivity to light of 30°, and as I found out in later experiments, this angle does not match angle that phototransistors in original sensor have, but sensor works with them nonetheless, so I don't think this is important. The only implication is, that there are no TEPT4400 transistors in original sensor or are recessed differently.

"Wiring diagram" of sensor as I have drawn it and in relation to its connector for connection to tester is as follows:



Marking of phototransistors with assigned numbers 1 to 3 corresponds to numbers 1 to 3 of longer dimension on picture of original sensor. Markings first through last correspond to direction of shutter run of original sensor in direction from switch, because at first, I thought that direction of run was important for tester to work, but with further testing I found that direction of shutter run does not matter, tester assigns values itself. So, you need to correctly connect onto connector only emitter of middle phototransistor (number 2) and common wire of collectors. For emitters of phototransistors 1 and 3 order does not matter, tester will assign it itself.

Of course, my 6x6 sensor has no switch and has only one row of phototransistors, because as it seems, 6x6 format is a square and therefore sensor can be physically turned to sense shutter run.

I built phototransistors into a plastic box by gluing them into drilled holes, "wired" and led out with a piece of four-wire cable with JACK connector attached. Since side dimension of image window of 6x6 cameras is 55,5 mm (taken as smallest dimension from followings, that I measured: Praktisix et al. have 55.5 mm, Flexaret II has 56.2 mm and Kowa six MM has 55.5 mm) distance of outermost phototransistors on sensor must be such that they fit into this hole. I have determined that at each edge I leave a gap from phototransistor of about 1.75 mm (they cannot be there tightly), then with a diameter of phototransistors 3 mm, distance of their margins that are closer to image window edges comes out to 52 mm and distance of centres of outermost ones will be 49 mm. The middle phototransistor is, as its description implies, in middle on straight line between them. After making and measuring, actual distance of centres of outermost phototransistors came out to be 49.6 mm, well, I am not most accurate, but it is possible to measure with it, only sensor always needs to be placed exactly in picture window, in order to prevent any of phototransistors does not "hiding" behind edge of picture window.

Components were available in Czech Republic at time of writing (elsewhere you will need to find them at local dealers):

TEPT4400 phototransistors are sold by for example TME Czech Republic, s.r.o., on their websites TME – TEPT4400.

Connector is JACK type, 3,5 mm diameter, 4-pole, malé, for cable, had for example TME – JACK under their symbol „JC-138“.

I built 6x6 sensor into a plastic box 76x59x17 mm type Z71, for example from TME – box for 6x6, available under their symbol „Z71 ABS“

Note: original sensor for measuring 35mm film shutters is built into a plastic box 45x31x15 mm, also available from TME – box for 35 mm, available under their symbol „Z43-ABS“.

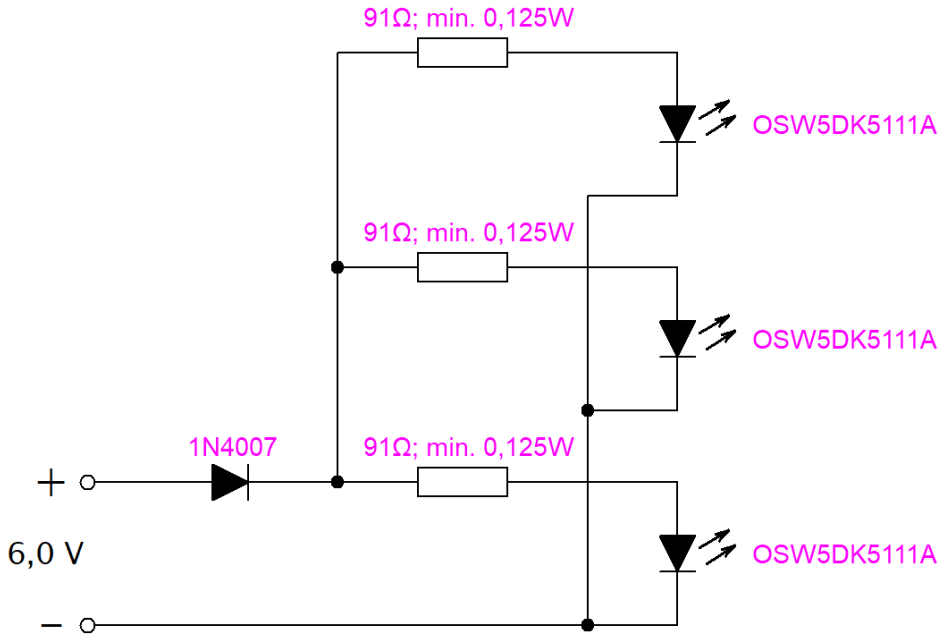
Lighting for NUF 6x6 format sensor to VFMoto shutter tester.

Since VFMoto shutter tester is supplied with only lighting with one LED, which, although fully suitable for illumination of all three phototransistors of original sensor at their longest distance for measuring when running shutter over the 36 mm dimension (approx. 30 mm), but it no longer illuminates edge sensors for 6x6 dimension, I had to make a lighting unit as well.

For illumination I chose three LEDs, each placed above corresponding phototransistor, so their centres are at equal distances. Well, and since I couldn't find anywhere in parameters of VFMoto tester maximum current that its built-in power supply can give to lighting, I chose to power my unit from an external power supply. Because built-in power supply in tester supplies only one LED, probably directly connected (without any series resistor), it would not be a good idea to supply with it a trio of directly parallel connected LEDs, because in that case currents into them would be divided according to their parameters, and parameters will never be exact the same, so LED would probably do so called "craziness", i.e. currents would be distributed differently according to diodes, which could lead either to various lighting or to overloading and destroying some of them.

I used the same box for lighting unit as for 6x6 sensor (see above) and LED diodes I glued into holes in it again. For power supply, I fitted box with two slots (female) for banana plugs, but this can be customized by anyone.

Wiring diagram of lighting unit is as follows:



Components were available in Czech Republic at time of writing (elsewhere you will need to find them at local dealers):

I chose LED type OSW5DK5111A, sells them for example TME Czech Republic, s.r.o., on their websites TME – OSW5DK5111A. I chose these diodes because they have a high luminous flux, their luminous flux at 20 mA is supposed to be 40 000 mcd. They have a 5mm housing diameter and a 15° beam angle for 50% output, which is fine because lighting uses 3 diodes and each shine on "its" phototransistor.

I have designed 91 Ω resistors, any will do, because if lighting is supplied with 6.0 V there is a loss of about 0.062 W on each of them.

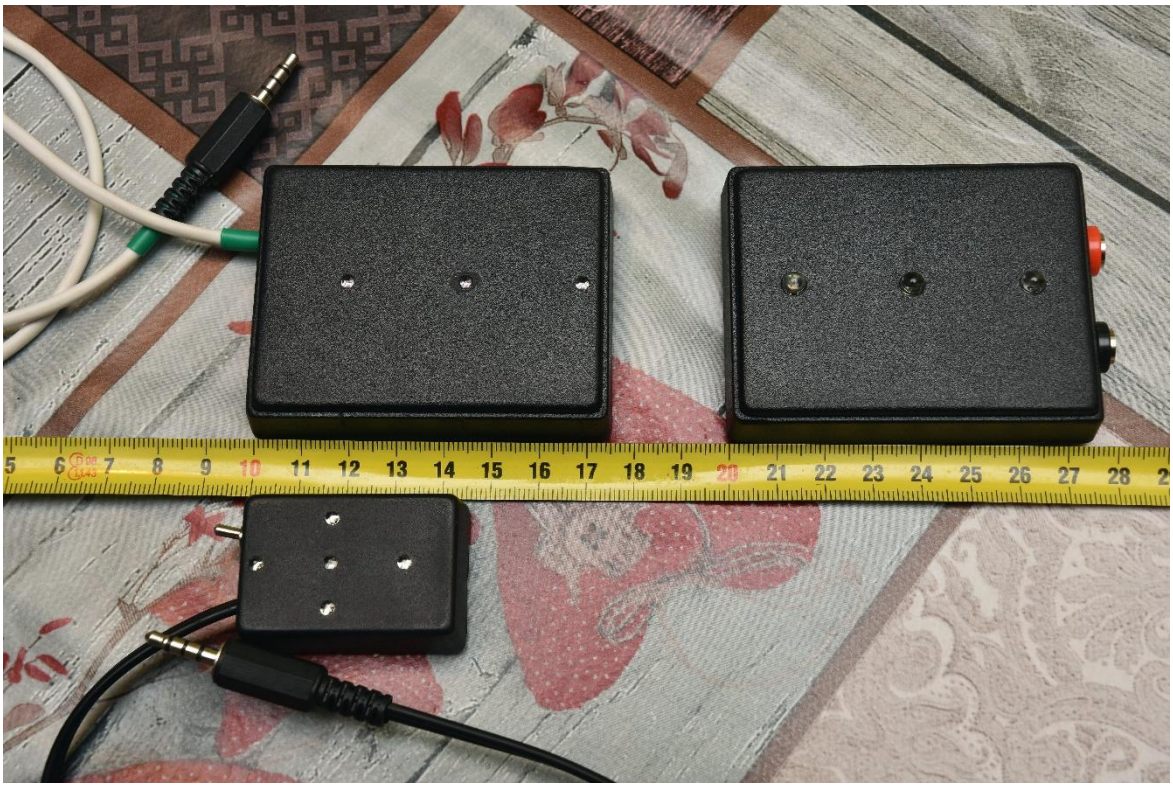
I also used a protection diode against accidental reverse polarity of supply voltage, I used type 1N4007, but any diode will do, it just has to withstand maximum considered closing voltage and total current to all three diodes, see below.

As for power supply, as I mentioned here, I suggested an external power supply, I have a stabilized power supply with adjustable output voltage, but it can be any that meets following requirements: firstly, it should be able to handle current to all three diodes (here 78 mA) and secondly it should have a DC and "smoothed" output voltage. This is because if voltage was pulsating, thus not "filtered", it could happen, that for short exposures shutter on some phototransistor would open just at time, when voltage period is somewhere around zero, which would make so-called mischief, because phototransistor would not be sufficiently illuminated in that case. Just to explain: frequency of our power grid is 50 Hz, so one period lasts 20 ms, and for example total exposure time of 1/1000 s lasts 1 ms...

Lighting is designed for a 6.0 V supply as follows: according to data sheet for OSW5DK5111A diodes, these have an absolute maximum DC current of 30 mA. In order to have some reserve, I chose a current through one diode of 26 mA. I measured that at a current

of 26 mA, DC forward voltage on LED is about 2.86 V and at protection diode at a current of 78 mA (total current to all three LEDs) is DC forward voltage about 0.77 V. So, voltage on each resistor then, at supply voltage of 6.0 V, will be: 6.0 - 2.86 - 0.77 = 2.37 V. Such voltage drop will be at a current of 26 mA (each resistor passes current to one LED) on resistance of 2.37 V / 0.026 A ≈ 91.15 Ω, which corresponds to a value of 91 Ω from the E 24 series. Power loss on each resistor in this case will be 2.37 V x 0.026 A = 0.06162 W, so any resistor with wire leads will do. Anyone can recalculate resistors to supply voltage of their choice according to this "guide".

The 6x6 sensor with 6x6 lighting unit looks like this when compared to original 35 mm sensor:



From picture you can see that I placed phototransistors on 6x6 sensor (white cable with green insulating tube is leading from it) as close as possible to one edge of box, because larger outside margin on both sides might be a problem sometimes, box has larger dimension of about 77 mm, but I could not find a smaller box to buy.

Use of equipment in this manual is at your own risk, I accept no liability for any damage caused by use or inability to use this equipment, in particular I accept no liability if equipment would damage to VFMoto tester (although I have tested this many times and tester and sensor have worked together without problems). If you do not agree with this statement, do not use this equipment.

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