TTL prism attachment for PENTACON six and PRAKTISIX

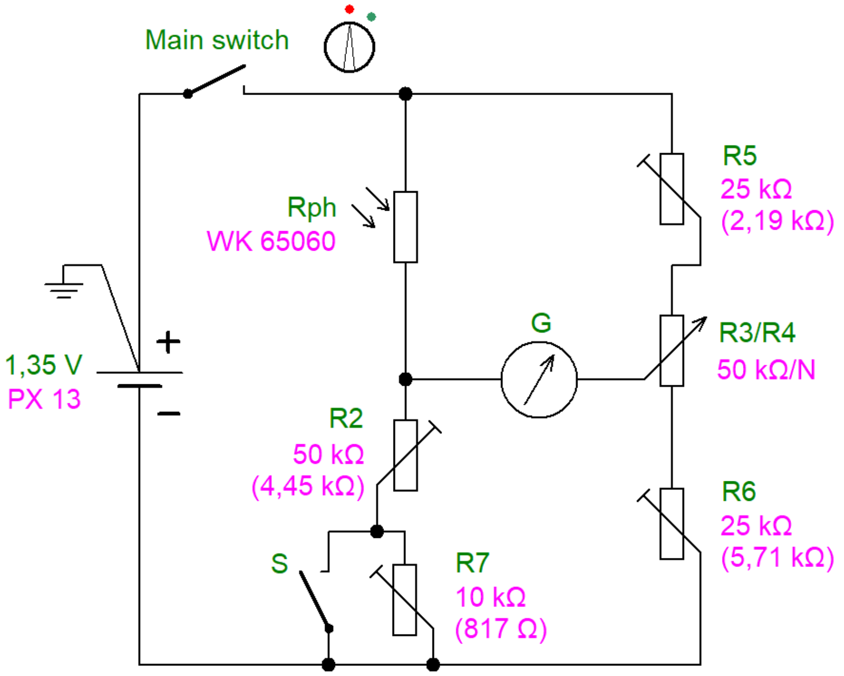
serial no. 20265, bought on eBay from https://www.foto-herbst.com Amtsberg, Germany with measuring part not working, optical part is fine within operational wear.

The front leatherette cover is marked on underside with a quality mark ⚠1, which indicates a high quality product, corresponding to the average of the world market, e.g. according to:

https://de.wikipedia.org/wiki/G%C3%BCtezeichen_(DDR) .

Ordered 14.1.2022, delivered 17.1.2022, price: viewfinder + case 39,95 €, + shipping 16,50 €.

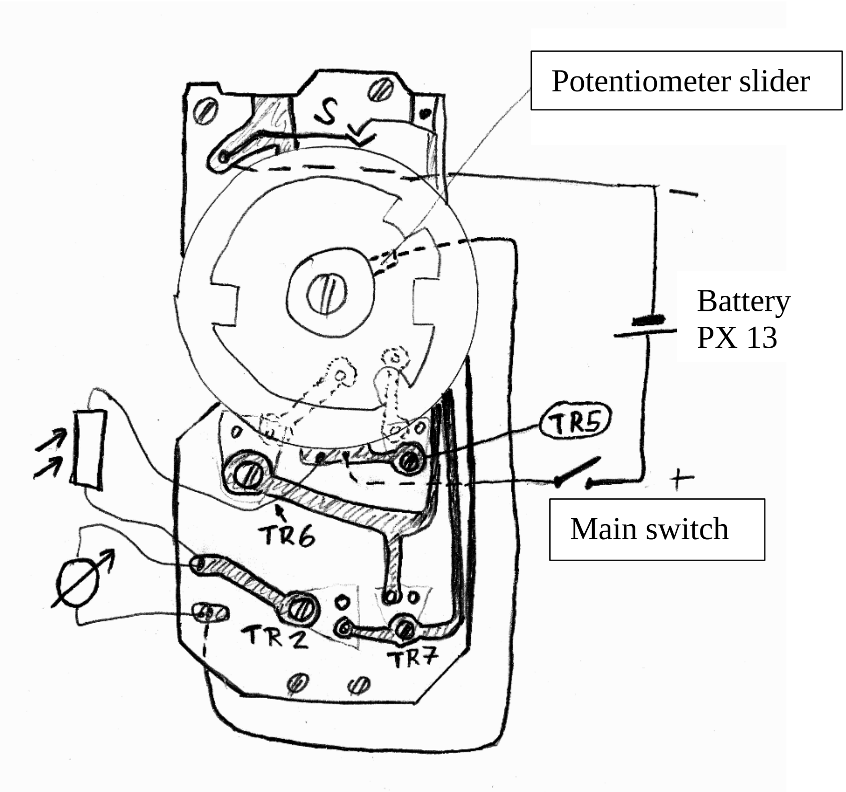
Because the seller specified that electrical measuring part is not working, I first checked it and galvanometer needle did not truly respond. So, I disassembled viewfinder, cleaned it, and found that only defect was corroded surface of battery case (which is accessible from outside, incidentally). After cleaning battery case from corrosion, exposure meter works well. When I had viewfinder disassembled, I drew its wiring diagram, and it is shown below with some explanations:



Galvanometer G has internal resistance Ri = 2414 Ω and needs approx. ± 25mV for full deflection

Position of adjustment resistors on unopened viewfinder (after removing the leatherette cover):

Imperfectly outlined printed circuit board, top view in direction it is placed in viewfinder (setting resistors are marked TR..., while in wiring diagram they are marked only R...):



Explanation of wiring diagram:

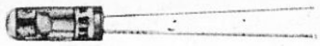
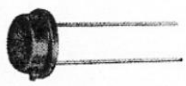
- S switch is on during measurement with working aperture, off during measurement with open aperture (full-aperture). It is therefore operated by bottommost ring with aperture numbers, is off when set to any aperture number (open aperture metering), is on when set to comma mark opposite aperture numbers (working aperture metering). S switch shorted resistor R7 which is used to correct for faulty lens aperture in case of full-aperture measurement.
- The working potentiometer R3/R4 – 50 kΩ/N (linear) is operated by upper ring with times.
- The resistances values are total values obtained from repair manual, resistances are of special design, and (probably) had manufacturing tolerances of ±20%. The values written in brackets are values of used resistors sections and were measured with galvanometer and photoresistor disconnected, so the measured values are real. Switch S was open during the measurement.
- The resistances of trimmers sections used (in brackets) are as they were set when I got the viewfinder. Considering subsequent comparison of this exposure meter with the Nikon D7200 (with lens set to about same shot as this exposure meter had when tested on Praktisix), which showed about the same readings for both, resistor settings are most likely still factory-set for used piece of photoresistor. Of course, I don't know how parameters of each piece of photoresistor differed from factory, so I can't predict whether other pieces of TTL viewfinders with different photoresistor can be set according to them, it can only be done according to calibration procedures given in repair manual.
- The numbering of trimmers and potentiometer is the same as in original TTL viewfinder repair manual, where potentiometer is somewhat illogically labeled as two resistors (R3 and R4) divided according to position of slider, and not as one component.

The photoresistor in my viewfinder is type WK 65060 (it has this marking printed around the perimeter) it comes from the production of Czech Tesla Blatná. In catalogue published probably in 1979 by Tesla Lanškroun under Czech title „Součástky pro elektroniku 1980 – 1981“, that is in English "Components for electronics 1980 – 1981" (I do not have older catalogue now) is its description as follows (it's there on two pages side by side, but because I have the possibility to scan only one A4 page at a time here are cut-outs of parts of both pages concerning photoresistor WK 65060 underneath and the lines concerning photoresistor and belonging together are highlighted in yellow, catalogue is in Czech, English translations are my work):

<u>Upper part of page 22:</u>

OPTOELECTRONIC COMPONENTS

OPTOELEKTRONICKÉ SOUČÁSTKY

	Type / Typ	Description / Popis	Dimensions (mm) / Rozměry (mm) ϕD / øD	L	l	Mass (g) / Hmotnost (g)
	WK 650 49	Fotoodpor CdS	5,9	17	37±1	2,5
	WK 650 60 WK 650 61 WK 650 62 WK 650 67	Fotoodpor v kovovém pouzdru se skleněným okénkem (Photoresistor in metal case with glass window)	9,2	4	25	1

<u>Upper part of page 23:</u>

Resistance in darkness / Odpor za temna	Resistance at 100 Lx / Odpor při 100 Lx	Nominal load (W) at +25°C / Jmenovité zatížení (W) při +25 °C	Nominal voltage (V=) / Jmenovité napětí (V=)	Highest sensitivity at wavelength / Největší citlivost při vlnové délce	Climate resistance category / Kategorie klimatické odolnosti	Specifications, sales data / Specifikace, odbytové údaje
10 MΩ ¹)	5 kΩ . . . 40 kΩ	max. 0,1	350 ²)	650 nm	25/055/21	T 416 10 ks, 114
40 kΩ . . . 300 kΩ	0,6 kΩ . . . 3,6 kΩ	max. 0,05	10	540 . . . 580 nm	10/055/10	T 474
50 kΩ . . . 200 kΩ	1 kΩ . . . 5 kΩ		10			T 502
70 kΩ . . . 300 kΩ	0,485 kΩ . . . 2 kΩ		1,5			T 555
10 kΩ . . . 100 kΩ	0,8 kΩ . . . 4,7 kΩ		10 50 ³)			T 504 10 ks, 114

Fact that factory was Tesla Blatná is given by numerical code 114 in column "Specifications, sales data" and it is explained in catalogue on its last page. Temperature range of use of photoresistor is given here in column "Climate resistance category" by value 10/055/10, where first number means lowest operating temperature –10°C, second number means highest operating temperature +55°C and third number is duration of wet heat test in days, here 10 days.

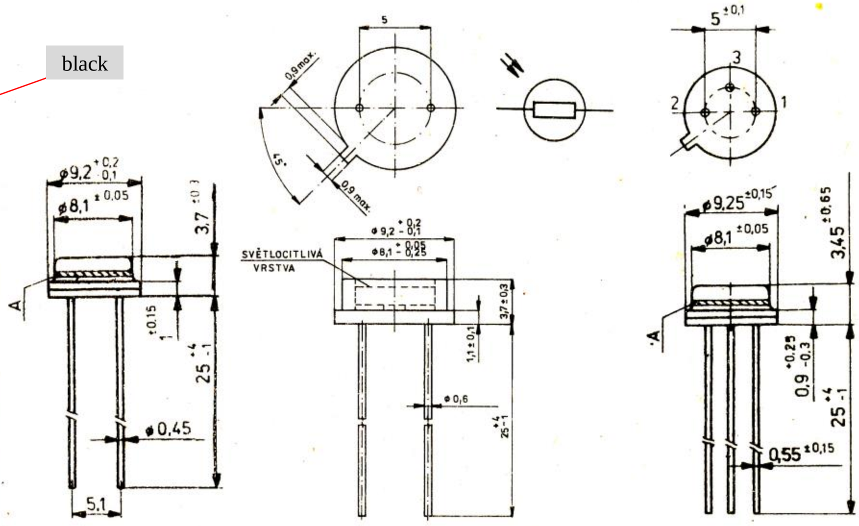
In later catalogue "Tesla 2 - Discrete parts ..." from year 1987, photoresistor WK 65060a is already listed, which was marked with a black stripe. As can be seen from a comparison of these two catalogues, photoresistors were probably not significantly different, although it is not possible to compare for example data under minimum illumination, because in catalogue form 1979 is listed value of the resistance for darkness (i.e. in total darkness), whereas in 1987 catalogue there is given of resistance under some minimum illumination, here defined as 0,125 Lux. Relevant part of 1987 Tesla catalog page regarding photoresistor WK 65060a is on following page.

PHOTORESISTORS SINTERED

WK 650 60a—WK 650 77 FOTOODPORY SINTROVANÉ

ФОТОРЕЗИСТОР ИСПАРЕННЫЙ • VAPOUR-DEPOSITED PHOTOCONDUCTIVE CELL • AUFGEDAMPFTER PHOTOWIDERSTAND

Typ (Type)	Barevný kód typu (pruh A) (Type colour code (bar A))	Pouzdro (Case)
WK 650 60a	černý (black)	O56
WK 650 61	hnědý	O56
WK 650 62	červený	O56
WK 650 65	zelený	O57
WK 650 67	fialový	O56
WK 650 70	světle modrý	O56
WK 650 74	žlutý	O56
WK 650 75	zelený	O56
WK 650 76	fialový + modrý	O56
WK 650 77	2× fialový	O56
WK 650 81	žlutý*)	O56/1



*) Označení na spodní části plastového pouzdra.

Pouzdro O56 | Pouzdro O56/1 | Pouzdro O57

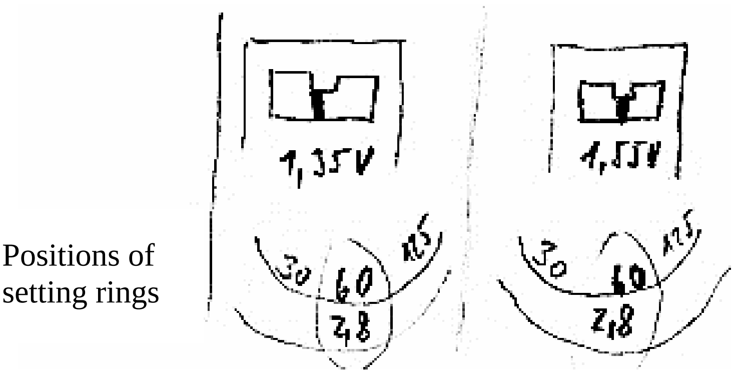
Typ	Mezní hodnoty (Limiting values): P	U_{max}	$R_{is\ min.}$	$\vartheta_{a\ min.-max.}$	R_n	při (at) E	U_{op}	λ	t_r[1]$_{max.}$	t_d[1]$_{max.}$	a[2])
	mW	V	MΩ	°C	kΩ	Lx	V	nm	s	s	
WK 650 60a	50[2])	50	10	−10 ... +55	0,6 ... 3,6 24 ... 160	100 0,125	10	540 ... 580	6	8	0,9 ... 1,1

Where:

- $t_{r\ max}$ is rise time and $t_{d\ max}$ is running down time for a step change in illumination between 0.05 and 0.5 Lx, according to note 1 in the catalogue.
- limiting dissipated power P = 50 mW is at ambient temperature +23°C, according to note 2 in the catalogue.
- λ is light wavelength to which photoresistor responds.

As you can see from wiring diagram, it IS a bridge circuit. The bridge circuit should compensate for changes in supply voltage, but photoresistor is probably not independent of voltage on it (that's why the values of resistance under illumination in catalog table are given at working voltage Uop = 10 V), and therefore I tested what changing supply voltage from prescribed 1.35 V (original mercury button cell PX 13) to 1.55 V that alkaline batteries today have commonly available under the same lighting conditions will do. I used alkaline LR 44 button cell for about 25 CZK (approx. 1 €), and because it has a slightly smaller diameter than original PX 13, so with an insulating spacer ring around it so that it is not loose and so that minus contacts in battery case are in the middle of the cell and can't short it out. The deflection of the galvanometer changes slightly when voltage is changed from 1.35 V to 1.55 V, see picture on the next page (view of pointer when looking from above at galvanometer in disassembled viewfinder):

Positions of
setting rings



Remarks: – The pictures with position of pointer show change of its position when supply voltage changes from 1.35 to 1.55 V, when nothing else has changed.

– Since position of pointer can also be changed by adjusting rings, position of rings shown below picture of pointer for a voltage of 1.55 V is for the same position of pointer that is obtained by changing voltage to 1.55 V, but this position was achieved at a voltage of 1.35 V by rotation time ring to the position shown in picture, and it is shown here to somehow document change in exposure caused by that change in voltage.

From this it can be seen that change in measurement, which is caused by a change in supply voltage of +0.2 V, is very small, estimated at a maximum of 0.2 exposures, which is within tolerance according to DIN 19016-06.83 (it is for focal-plane shutters), as well as according to the repair manual for TTL viewfinder, where permissible tolerance of its measurement is given as ±2/3 of aperture number.

The voltage of each battery decreases with time and discharge (see discharge diagrams on internet) but decrease over time is greater for alkaline batteries than for original PX 13 mercury battery. For LR 44 battery, its voltage reaches approx. 1.35 V in halfway through its life cycle. So, I think measurement change of approx. ±0.2 exposures caused by difference of LR 44 battery voltage from nominal value of 1.35 V (to both sides: 1.55 V for new battery and approx. 1.15 V for old one) is acceptable for use according to both DIN 19016-06.83 and tolerance in TTL viewfinder repair manual. Of course, this assumes that viewfinder measurement was calibrated at voltage 1.35 V, as it should be.

As stated in TTL-prism manual on page 10 in the paragraph "The power source", in its last section, "**A bridge circuit is employed in the metering system, thus eliminating the necessity for checking the working voltage of the battery.** Nevertheless, it is advisable to insert o new PX 13 battery after 1 or 2 years. Owing to danger of explosion…"

In the case of LR 44 battery, I would recommend replacing it earlier, or measuring of its voltage occasionally, because I can't tell how much viewfinder will discharge battery while measuring.

I found a multilingual version of instruction manual with English on internet at:

https://cameramanuals.org/praktica_pdf/pentacon_ttl-prism-lang.pdf

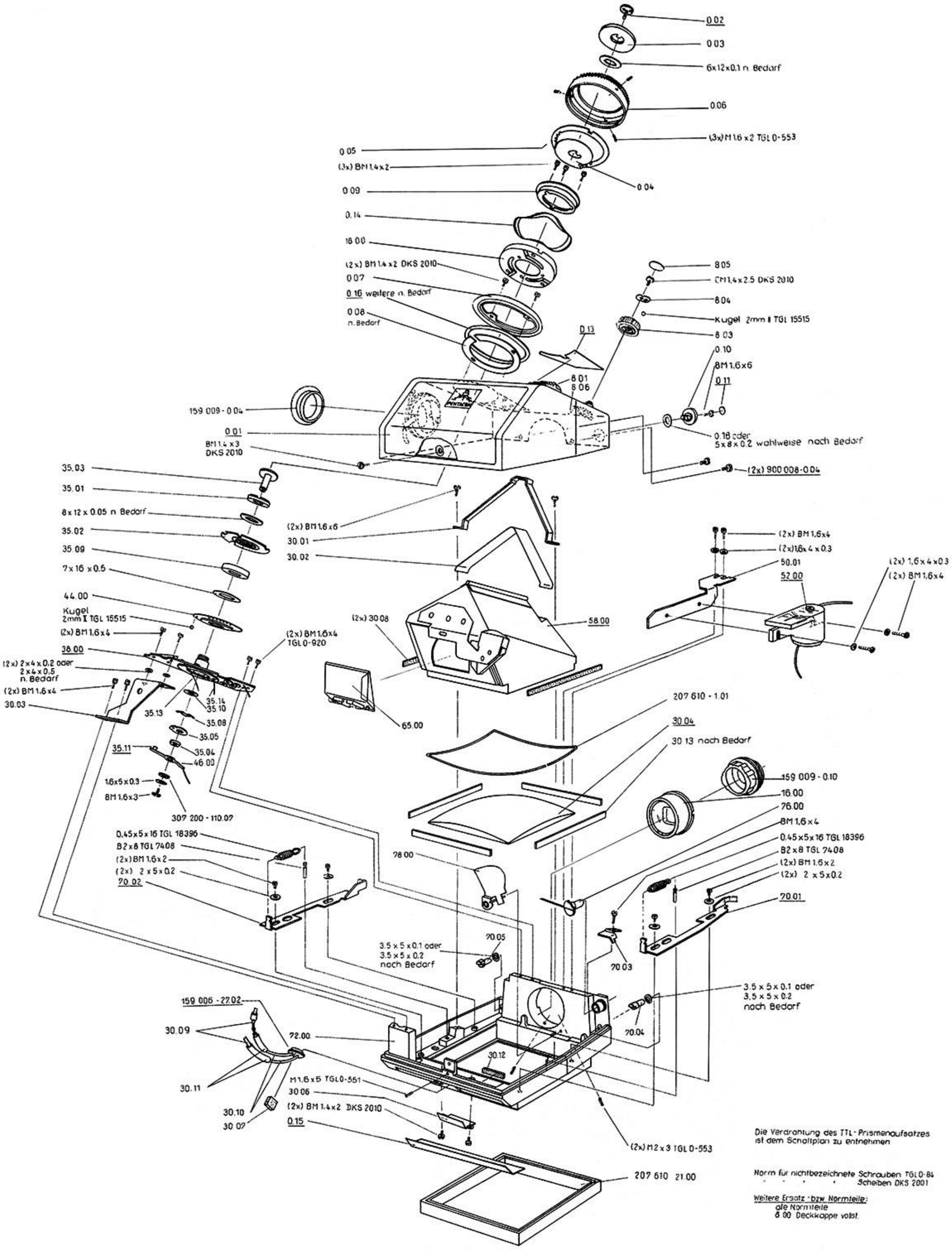
(it's Mike Butkus, and all his manuals are on: https://butkus.org/chinon/index.html)

but they have everything outside of printing encrypted, which is useless, so only for browsing...

11 February 2022	first version
1 November 2022	revision, information and part numbers from the original repair manual „**TTL prism attachment for PENTACON six and PRAKTISIX, 207 520**“, from company „**VEB PENTACON DRESDEN, Kamera – und Kinowerke**“, production status as of 1 April 1969 were used.
5 February 2023	translation to English language and insignificant small changes.
24 June 2023	Added parts from catalogue " Components for electronics 1980 – 1981" concerning photoresistor WK 65060.

Luděk Ruffer lruffer@volny.cz

Appendix: original drawing of the mechanical assembly of the viewfinder:



TTL-Prismenaufsatz
207 520

VEB PENTACON DRESDEN

Stand vom 1.4.69