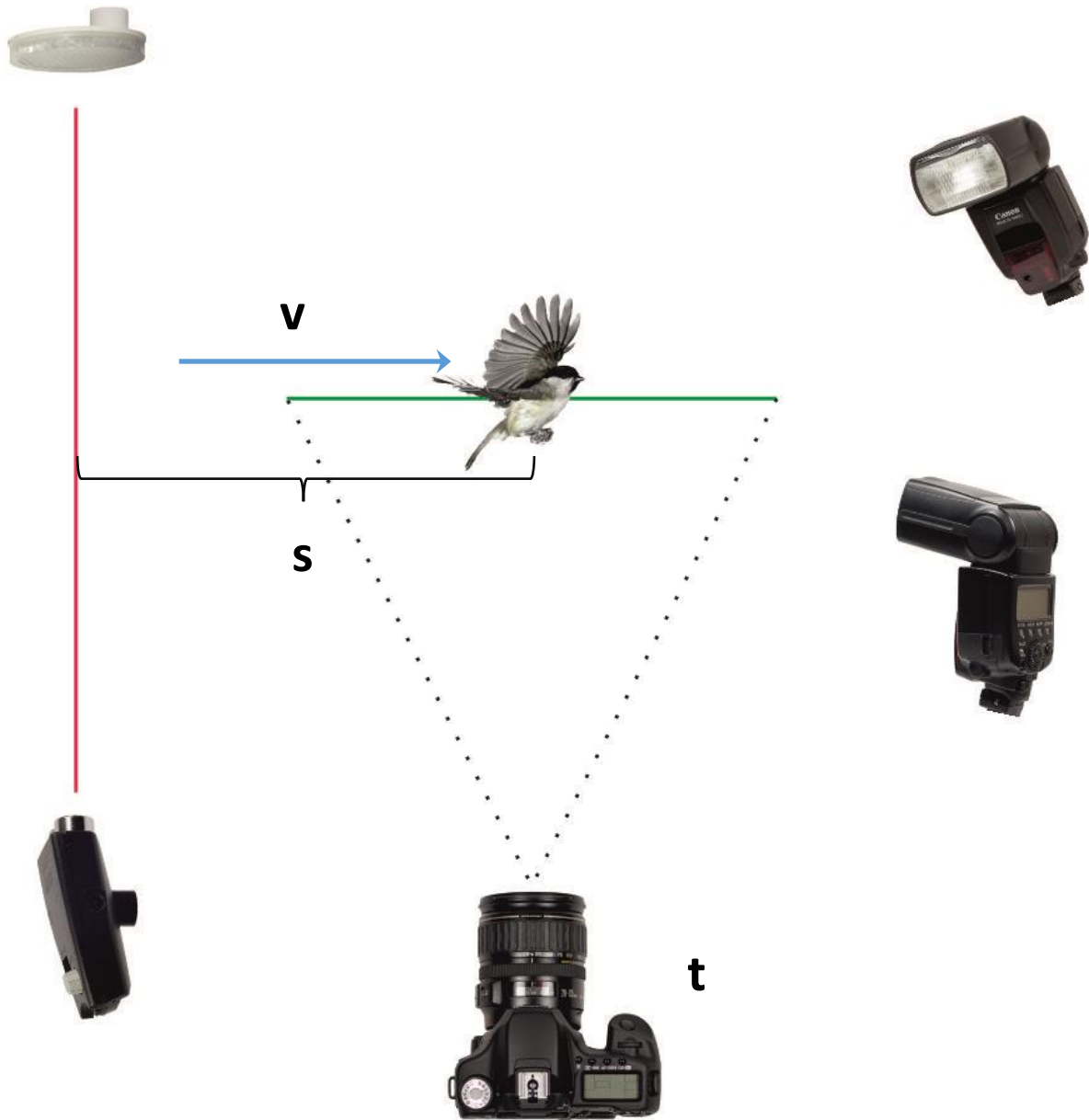


The shutter lag of cameras



$$s = v * t$$

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The shutter lag of cameras - the project

The shutter lag of the camera is one of the most important factors to be considered in high speed photography. To know it can be essential.

With this tip, we would like to give you as an interested high-speed or light barrier photographer a guidance, which makes it possible to better anticipate the results of your work with the light barrier, to plan or analyse it. We will present tables in which the shutter lag of different camera models as well as their variation have been recorded.

Since the number of camera types on the market and of those in use is very large, we begin with a small number of measured cameras. As soon as opportunities arise to measure additional cameras, the tables will be expanded. In this way, a comprehensive reference work should be developed over time.

Perhaps this tip also might help you to make the right decision when it comes to purchase a suitable camera for light barrier photography.

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The shutter lag

In the light barrier photography the camera's shutter lag is a central parameter, as already indicated, which has to be taken into account. Multiplying the shutter lag with the speed of the object to be photographed gives the travelling distance. It is the distance the object travels from the moment of releasing the camera, more precisely from the interruption of the light barrier until the photograph is actually recorded. The [Figure 1](#): illustrates the relation. Where v is the speed of the object, t is the shutter lag of the camera, and s is the travelling distance.

The overall lag consists of the delay of the light barrier and the shutter lag of the camera.

The delay of the light barrier is very short, usually less than a millisecond, for eltima light barriers even less than 0.2 milliseconds. If the light barrier triggers the camera and not the flash itself, its delay can be neglected. What remains is the camera's shutter lag. As the measurement results show, this is 250 - 1000 times greater than the one of the light barrier.

In this consideration, it quickly becomes clear that it is advantageous, on the one hand, to have a system with the lowest possible lag and, on the other hand, to know the lag.

The variation of the shutter lag

Another important factor is the variation of the shutter lag. The lag time of the cameras can vary for a number of reasons. This is due to mechanical reasons or because one or the other system still has to

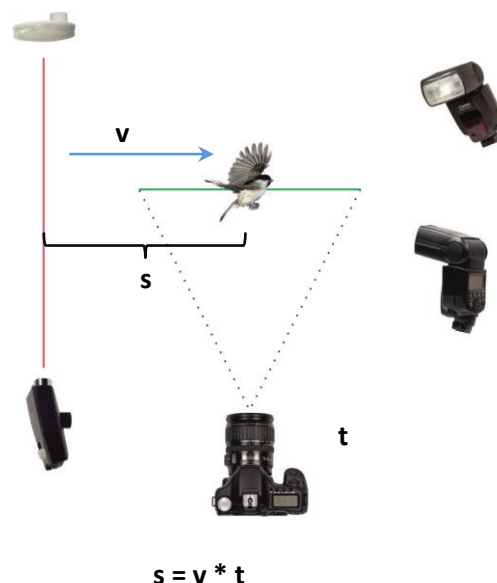


Figure 1:
Effect of the shutter lag.

be activated in the camera. Also different measurements or calculations have to be performed which costs time. Due to the variation of the shutter lag, the travelling distance also changes with each release.

That is why it is very important for the reproducibility of the results, that these variations are as low as possible. In most of the cases the lag time itself can be taken into account, by considering the travelling distance - but not the variations. They are a product of chance.

Here too, it becomes clear that knowing the variation of the lag time when assessing the results is of utmost importance.

The operating modes of the cameras

Apart from power saving mode or deep sleep in which the camera is not ready for operation, cameras can still be in an active mode or in standby.

The active mode is initiated, for example at Nikon cameras, by briefly tapping the shutter button half-way, and usually lasts about 3 to 10 seconds, depending on the model and/or setting. For cameras from other manufacturers, for example Canon, the active mode starts with tapping the trigger and stops when you let loose. For instance In SLR cameras during this time the viewfinder display lights up, and reads the typical information about aperture, shutter speed, ISO, etc. When the camera is triggered during active mode, the shutter lag in many models is considerably shorter than in the other modes of operation.

At the end of the active mode the camera goes into standby. It remains operational and ready to trigger, but saves power because various displays and systems such as autofocus or image stabilizer are turned off. If the camera is triggered without first tapping the shutter button, different systems need to be activated, which costs time. The shutter lag is then greater in many models.

The behaviour of the cameras summarized

It turns out that by far not all cameras have both a low and a constant shutter lag. Depending on the operating mode, the behaviour is different. Many cameras are much faster in the active mode. For some there is hardly no difference between the modes.

Also, the variation of the shutter lag is extremely different. A few camera models are fairly constant in both modes. Some are constant in active mode only, others only in standby. Others, in turn, vary considerably in both modes.

What should be done?

Knowing the time lag and its variation one can now decide which mode in which situation is best to be applied.

With slow subjects both parameters play a rather minor role.

With fast subjects one must decide whether a high reproducibility or a short actuation distance is more advantageous. This decision depends on the situation to be photographed.

If the decision is made for the active mode, precautions must be taken so that the camera is put into this mode or remains in this mode.

Should the camera be put into active mode only when needed, the photographer must be present. For this purpose, an electric remote trigger is connected in parallel to the light barrier. Just before one thinks that the light barrier will be broken by the subject, the remote control is briefly tapped. Subsequently, the camera goes into active mode for a few seconds and the lag time will be shorter.

However, it is much more elegant to automatically put the camera into active mode and hold it there. Eltima light barriers can be put into a "keep-active mode", in which they hold the camera in active mode via an electronic system. Thus, the photographer can also move away from the location, or doesn't have to follow the action with full attention. However, in this mode of operation, the power consumption of the camera increases because, for example, the display and the viewfinder lighting are turned on all the time. In many cases, however, this plays a minor role, because a low shutter lag is more important than a long battery life.

Last but not least, the results of this tip can also be used as guidance for an upcoming purchase decision.

The measuring method

The shutter lag of a camera, in this tip, probably also in general, is defined as the time that elapses from the closing of the release contacts until the shutter is fully opened. When the shutter is fully open, the camera closes the flash contacts and the flash fires. The flash light can thus be used as feedback for the open shutter. In the light barrier or high-speed photography, the moment in which the flash fires is also the moment in which the image is created, since optimally the duration of the flash is also the exposure time.

The light barrier system Joker² can be used to measure the shutter lag. For doing this, the camera is connected to the light barrier and triggered by this, by the interruption of the light beam. The flash unit attached to the camera must flash at the display of the controller. The time between the closing of the output contacts and the detecting of the flash is measured by a sensor in the controller of the light barrier system. The shutter lag is then displayed in milliseconds in the display. More details can be found in the operating instructions of the Joker² light barrier system.

In order to avoid any time delays caused by the communication of the camera with a system flash unit, it is recommended to use a flash unit without system contacts or to operate the flash unit in manual mode.

For the measurement the autofocus and the image stabilizer of the camera must be switched off. Aperture and shutter speed are also set manually. The latter is set to the camera's sync time, usually 1/160, 1/200 or 1/250, depending on the camera model. Furthermore, the camera is set to single frame. These settings correspond to those made in practice.

For each camera, two series of measurements are carried out for this tip - 10 measurements in each of the two operating modes Active and Stand-By. If a camera type occurs several times in a table, as many cameras were tested. This also shows possible scatters.

Software versions or any special settings of the cameras were not considered in these measurements. This tip was based on the knowledge of a "normal" camera user who uses his camera with its actual software version.

The Tables

The tables contain columns with the following information:

- **Camera Model**
- **Keep active** (wake-up function):
 - **on** - the trigger remains tapped continuously. The rows are highlighted in green,
 - **off** - the keep-active mode is switched off, the camera triggers out of the stand-by mode,
- **1 - 10**: the shutter lag of the respective release,
- **min/max**: the smallest/largest measured shutter lag,
- **Δ**: the variation as the difference between max and min.
- **The date** of the measurement.

Canon

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
EOS R	on	53,81	54,13	53,18	54,78	53,27	53,15	53,14	53,02	53,10	53,01	53,01	54,78	1,77	06.04.19
	off	93,15	84,55	85,28	89,17	86,17	90,18	86,30	90,13	92,17	98,56	84,55	98,56	14,01	
EOS RP	on	57,28	56,17	57,17	57,62	57,16	57,98	56,74	57,16	56,93	57,16	56,17	57,98	1,81	06.04.19
	off	87,60	87,18	89,70	92,13	87,65	96,65	96,12	86,69	86,14	85,17	85,17	96,65	11,48	
EOS 1D	on	59,10	59,43	59,26	59,68	59,27	60,18	59,46	59,78	60,05	59,35	59,1	60,18	1,08	14.05.17
	off	132,13	132,11	132,15	132,19	132,15	132,32	133,11	132,11	132,12	132,51	132,11	133,11	1	
EOS 1DX	on	57,12	57,18	57,10	57,14	57,14	57,41	57,16	57,14	57,84	57,12	57,1	57,84	0,74	14.05.17
	off	144,65	104,48	120,03	143,17	141,66	141,52	142,32	110,39	126,10	92,18	92,18	144,65	52,47	
EOS 1DX II	on	57,25	57,15	57,27	57,15	57,84	57,54	57,16	57,18	57,12	57,18	57,12	57,84	0,72	06.04.19
	off	117,54	129,14	110,13	113,87	143,46	117,24	130,10	93,37	93,74	112,49	93,37	143,46	50,09	
EOS 5D MK V	on	114,12	112,90	113,18	112,25	116,18	112,04	112,05	112,68	115,65	112,10	112,04	116,18	4,14	14.05.17
	off	236,19	248,17	244,19	248,11	248,66	248,18	247,11	248,36	248,55	248,58	236,19	248,66	12,47	
EOS 5D S	on	63,10	61,89	61,19	61,76	61,11	61,60	62,67	61,72	61,12	61,17	61,11	63,1	1,99	14.05.17
	off	245,10	245,10	244,15	244,17	244,47	244,16	194,15	244,14	245,29	244,10	194,15	245,29	51,14	
EOS 5D SR	on	61,16	61,28	61,16	62,13	61,43	61,65	61,65	61,66	61,32	61,04	61,04	62,13	1,09	14.05.17
	off	264,33	245,76	245,54	245,12	277,60	245,10	260,10	245,07	245,10	245,13	245,07	277,6	32,53	
EOS 5D III	on	62,56	62,18	62,19	62,15	62,00	62,43	62,18	62,13	62,59	62,81	62	62,81	0,81	06.04.19
	off	188,10	188,52	188,14	188,12	191,16	188,52	188,16	188,51	188,41	188,15	188,1	191,16	3,06	
EOS 6D	on	61,14	61,12	61,03	61,04	61,04	61,04	61,25	61,85	61,18	61,14	61,03	61,85	0,82	10.06.17
	off	144,25	140,18	104,80	140,18	144,15	140,50	144,50	140,67	104,65	144,15	104,65	144,5	39,85	
EOS 6D MK II	on	63,47	66,13	63,08	63,10	63,18	63,12	62,28	63,12	63,14	63,11	62,28	66,13	3,85	28.04.17
	off	223,34	229,13	223,34	223,65	223,96	224,10	224,43	223,86	223,26	224,05	223,26	229,13	5,87	
EOS 7D	on	62,93	62,70	63,26	63,11	62,94	62,16	62,80	62,99	62,13	62,70	62,13	63,26	1,13	28.04.17
	off	142,10	142,46	142,12	142,10	142,65	142,85	142,16	142,10	142,46	142,12	142,1	142,85	0,75	

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
EOS 7D MK II	on	55,15	55,07	55,40	55,15	55,17	56,65	55,11	55,13	55,53	55,52	55,07	56,65	1,58	28.04.17
	off	187,19	187,75	187,29	187,53	187,12	187,14	188,28	187,13	187,29	187,19	187,12	188,28	1,16	
EOS 7D MK II	on	55,31	55,15	56,97	55,13	55,11	55,51	55,30	55,11	55,19	55,17	55,11	56,97	1,86	14.05.17
	off	176,10	176,13	178,17	179,11	176,14	176,13	176,48	177,87	176,16	176,17	176,1	179,11	3,01	
EOS 50D	on	69,10	69,13	69,20	70,66	71,14	68,13	68,17	68,48	61,13	61,14	61,13	71,14	10,01	28.04.17
	off	136,31	135,13	137,20	135,60	135,93	135,65	136,11	136,63	135,44	136,12	135,13	137,2	2,07	
EOS 70 D	on	60,30	60,15	60,85	60,16	60,18	60,25	60,12	60,10	60,11	60,12	60,1	60,85	0,75	28.04.17
	off	141,40	141,27	141,00	142,57	141,14	141,13	143,19	141,18	142,66	142,80	141	143,19	2,19	
EOS 77D	on	365,88	311,71	344,55	338,15	338,76	331,12	312,13	341,16	339,17	340,65	311,71	365,88	54,17	22.04.17
	off	364,17	319,11	336,10	324,11	325,10	336,16	332,81	323,12	336,18	336,42	319,11	364,17	45,06	
EOS 650D	on	75,14	75,10	75,45	75,65	75,67	75,67	75,10	75,27	75,16	75,14	75,1	75,67	0,57	02.05.17
	off	178,11	178,44	178,43	178,18	178,17	178,13	178,65	121,90	178,32	178,80	121,9	178,8	56,9	
EOS 750D	on	77,65	77,14	77,04	77,56	77,18	77,57	77,29	77,76	77,65	77,18	77,04	77,76	0,72	11.06.17
	off	248,16	248,86	249,10	245,18	250,13	252,92	255,54	249,17	254,32	252,54	245,18	255,54	10,36	
EOS 800D	on	156,97	313,42	326,05	339,16	330,14	334,16	336,22	324,83	276,12	342,63	156,97	342,63	185,66	14.05.17
	off	199,16	292,37	328,45	330,94	340,14	287,21	319,13	343,53	336,14	316,18	199,16	343,53	144,37	
	on											0	0	0	
	off											0	0	0	
	on											0	0	0	
	off											0	0	0	
	on											0	0	0	
	off											0	0	0	
	on											0	0	0	
	off											0	0	0	

Leica

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
V Lux114	on	272,81	272,08	278,18	290,79	249,84	199,17	282,84	294,14	203,14	286,16	199,17	294,14	94,97	22.04.17
	off	291,33	210,28	213,16	290,55	291,12	264,11	277,20	268,97	282,78	272,97	210,28	291,33	81,05	
	on											0	0	0	
	off											0	0	0	

Nikon

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
Z6	on	69,28	70,36	69,18	69,05	69,52	69,85	69,10	69,54	69,06	69,19	69,05	70,36	1,31	06.04.19
	off	95,11	83,23	71,14	76,47	71,11	89,12	73,19	102,70	75,13	96,31	71,11	102,7	31,59	
Z7	on	69,12	69,17	69,14	69,17	69,42	69,77	69,18	69,92	69,37	69,16	69,12	69,92	0,8	06.04.19
	off	80,17	111,16	74,60	71,11	75,18	106,13	71,10	78,11	89,58	74,21	71,1	111,16	40,06	
D4	on	44,11	45,46	44,66	44,18	44,35	44,91	45,18	45,05	44,19	44,22	44,11	45,46	1,35	14.05.17
	off	297,02	297,18	278,12	279,17	279,13	279,15	279,12	278,16	278,93	279,10	278,12	297,18	19,06	
D5	on	56,15	52,12	56,54	53,16	53,58	53,70	53,16	52,15	53,12	52,98	52,12	56,54	4,42	22.04.17
	off	191	191	191	192	192	191	191	191	192	192	191	192	1	
D5	on	44,17	44,11	43,18	44,15	44,31	44,19	43,19	44,12	44,10	44,17	43,18	44,31	1,13	14.05.17
	off	191,05	193,16	193,87	196,15	194,49	189,15	191,51	195,75	193,04	190,13	189,15	196,15	7	
D500	on	53,12	53,17	53,15	53,28	53,32	53,12	53,14	53,12	53,10	52,10	52,1	53,32	1,22	22.04.17
	off	182	179	180	182	182	181	181	205	181	184	179	205	26	
D500	on	53,65	53,17	52,14	53,12	52,11	52,97	52,11	53,16	53,14	53,11	52,11	53,65	1,54	14.05.17
	off	196,12	222,13	194,65	220,13	226,39	226,13	219,97	226,15	228,14	238,99	194,65	238,99	44,34	
D600	on	68	56	110	56	65	107	91	88	96	105	56	110	54	22.04.17
	off	190	192	191	192	190	190	189	188	190	190	188	192	4	
D610	on	55,13	55,16	56,11	56,10	56,17	55,64	57,17	55,03	56,18	56,59	55,03	57,17	2,14	22.04.17
	off	215	215	215	215	215	215	215	215	215	215	215	215	0	
D700	on	44,10	43,33	44,15	44,68	44,69	43,15	44,77	44,17	44,65	44,17	43,15	44,77	1,62	14.05.17
	off	224,92	224,14	224,70	223,13	223,14	224,11	224,11	224,12	224,15	224,80	223,13	224,92	1,79	
D750	on	55,11	55,11	54,18	54,17	54,13	55,39	55,80	54,19	55,22	54,54	54,13	55,8	1,67	22.04.17
	off	187	188	187	187	187	188	186	187	188	187	186	188	2	
D750	on	55,57	54,13	55,12	55,11	54,04	54,29	55,15	55,16	54,15	54,11	54,04	55,57	1,53	14.05.17
	off	276,14	287,65	267,31	269,11	268,17	264,98	276,30	264,56	264,11	264,65	264,11	287,65	23,54	

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
D750	on	54,30	55,13	55,17	54,15	54,41	54,73	54,06	54,16	54,25	54,14	54,06	55,17	1,11	14.05.17
	off	272,79	270,53	271,11	271,98	273,12	272,12	273,41	288,10	271,15	272,11	270,53	288,1	17,57	
D800	on	44,75	45,10	45,83	45,01	44,82	45,41	44,35	45,14	44,12	44,45	44,12	45,83	1,71	14.05.17
	off	306,18	307,65	306,0	306,17	305,14	305,12	304,34	305,41	305,35	306,11	304,34	307,65	3,31	
D850	on	54,18	55,45	55,85	54,20	54,65	55,78	55,10	55,15	54,43	55,16	54,18	55,85	1,67	28.10.17
	off	190,17	189,18	189,28	188,17	191,18	188,27	189,17	188,11	190,15	190,12	188,11	191,18	3,07	
D810	on	66,99	58,15	56,17	55,16	56,39	56,95	57,22	56,65	57,09	56,20	55,16	66,99	11,83	22.04.17
	off	204,13	205	203	201	202	203	202	207	202	202	201	207	6	
D5600	on	188	324	288	277	334	333	335	335	283	299	188	335	147	22,04.17
	off	191	191	191	192	192	191	191	191	192	192	191	192	1	
D7200	on	55,15	54,56	54,65	55,38	55,14	55,66	54,51	55,40	55,90	54,16	54,16	55,9	1,74	22.04.17
	off	192	190	189	235	240	230	230	190	233	236	189	240	51	
D7100	on	55,11	56,93	55,17	56,13	56,13	55,87	55,18	56,65	55,11	56,99	55,11	56,99	1,88	15.05.17
	off	377,14	378,31	379,51	379,15	378,11	378,75	378,77	378,18	378,13	378,37	377,14	379,51	2,37	
D7500	on	56,46	56,04	55,13	56,18	56,64	56,99	56,50	56,07	57,85	55,10	55,1	57,85	2,75	28.10.17
	off	203,18	196,17	199,76	206,18	251,01	209,31	196,17	198,11	205,18	202,73	196,17	251,01	54,84	
Df	on	56,13	55,13	56,02	56,90	56,13	56,16	56,14	56,16	55,17	56,40	55,13	56,9	1,77	22.04.17
	off	200	202	202	202	202	202	202	202	202	202	200	202	2	

Olympus

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
OM-D E-M1	on	90,16	98,06	107,12	89,16	94,10	139,16	94,09	94,17	134,51	68,15	68,15	139,16	71,01	14.05.17
	off	105,16	96,23	98,42	100,16	111,83	105,11	96,60	108,18	98,11	105,21	96,23	111,83	15,6	
OM-D E-M1 MK II	on	55,08	67,11	55,49	70,12	56,65	65,17	71,17	67,17	59,16	69,11	55,08	71,17	16,09	02.05.17
	off	63,43	59,11	53,32	55,19	59,67	55,95	64,65	68,47	63,96	65,19	53,32	68,47	15,15	
OM-D E-M1 MK II	on	94,65	87,18	91,34	84,15	103,13	113,10	91,29	113,47	96,34	97,12	84,15	113,47	29,32	06.06.17
	off	53,65	71,14	55,02	60,09	58,13	56,79	62,14	64,33	70,23	58,11	53,65	71,14	17,49	
OM-D E-M1 Mk III	on	42,10	43,20	44,18	47,57	40,15	43,00	44,49	41,21	44,19	39,14	39,14	47,57	8,43	18.02.20
	off	62,08	78,11	71,56	75,17	63,12	72,14	70,17	66,30	64,83	70,714	62,08	78,11	16,03	
OM-D E-M5 MK II	on	96,87	97,57	99,47	99,18	101,14	93,10	94,12	97,15	103,97	101,11	93,1	103,97	10,87	10.06.17
	off	131,15	128,15	127,12	159,18	125,13	140,25	134,78	143,90	116,13	122,59	116,13	159,18	43,05	
OM-D E-M10 MK II	on	151,90	127,20	124,64	127,15	133,11	135,31	123,42	132,69	124,16	128,68	123,42	151,9	28,48	10.06.17
	off	143,93	137,19	142,10	146,12	136,13	144,10	143,18	148,13	141,14	152,11	136,13	152,11	15,98	

Panasonic

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
Lumix S1??	on	133,16	148,58	120,18	124,98	116,19	109,15	118,10	123,17	114,51	122,16	109,15	148,58	39,43	06.04.19
	off	136,11	142,35	128,14	142,11	149,11	125,72	129,18	142,15	129,99	146,12	125,72	149,11	23,39	
Lumix GH4	on	104,64	106,17	103,36	107,16	101,77	103,52	103,89	108,13	83,11	108,50	83,11	108,5	25,39	22.04.17
	off	112,19	105,15	111,18	110,17	103,10	106,19	102,17	96,38	105,26	97,15	96,38	112,19	15,81	
Lumix GH5	on	204,65	183,98	113,97	84,87	108,69	121,62	112,57	99,41	98,16	111,56	84,87	204,65	119,78	22.04.17
	off	100,18	112,65	108,91	104,67	118,68	105,46	111,13	105,13	113,19	111,04	100,18	118,68	18,5	
Lumix GX8	on	318,2	217,14	279,19	333,18	111,19	268,71	280,15	291,13	279,11	274,11	111,19	333,18	221,99	22.04.17
	off	279,01	288,15	289,75	272,08	284,64	284,17	279,02	342,90	297,03	254,18	254,18	342,9	88,72	
Lumix DC-G9	on	112,87	111,86	112,11	123,05	111,13	111,35	118,13	116,10	118,11	121,73	111,13	123,05	11,92	06.04.19
	off	133,13	131,47	141,24	133,14	142,16	138,89	140,95	133,53	129,20	133,95	129,2	142,16	12,96	
Lumix DMC G81	on	119,20	113,15	101,14	117,12	101,17	107,35	94,26	104,00	123,8	116,02	94,26	123,8	29,54	22.04.17
	off	110,10	121,60	101,11	100,36	121,14	108,14	118,15	110,13	115,11	108,18	100,36	121,6	21,24	
Lumix DMC-FZ 1000	on	40,17	39,10	39,18	37,11	37,12	29,63	45,24	35,18	40,19	45,10	29,63	45,24	15,61	27.10.18
	off	115,89	118,11	112,16	102,71	99,70	105,18	98,48	112,18	103,26	101,18	98,48	118,11	19,63	
Lumix FZ2000	on	303,14	285,59	299,16	299,10	253,12	291,12	313,14	290,17	219,14	285,68	219,14	313,14	94	22.04.17
	off	313,10	284,15	303,12	297,18	297,11	292,11	290,74	292,11	286,14	303,52	284,15	313,1	28,95	

Sony

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
a9	on	22,82	25,12	24,16	24,13	23,13	24,10	25,23	24,83	24,65	22,36	22,36	25,23	2,87	12.05.18
	off	132,96	110,77	136,11	133,36	109,13	128,46	127,50	122,16	133,08	105,61	105,61	136,11	30,5	
α7 III	on	24,16	23,81	25,05	23,17	22,48	22,15	22,13	22,20	23,14	22,17	22,13	25,05	2,92	12.05.18
	off	73,19	66,27	78,18	72,15	77,66	96,87	96,60	77,30	88,19	70,16	66,27	96,87	30,6	
α7R III	on	36,16	31,13	33,54	38,37	35,14	34,85	34,18	32,18	33,16	33,13	31,13	38,37	7,24	12.05.18
	off	152,12	150,10	144,21	130,77	168,14	164,86	143,06	150,14	168,84	151,65	130,77	168,84	38,07	
α7 II	on	55,12	55,65	57,11	55,11	55,76	56,70	58,32	56,65	56,72	56,14	55,11	58,32	3,21	12.05.18
	off	119,19	177,15	165,74	116,06	121,16	122,10	142,76	127,60	124,19	162,01	116,06	177,15	61,09	
α7R II	on	22,91	23,19	22,11	23,52	23,40	21,19	25,61	21,69	25,68	21,42	21,19	25,68	4,49	12.05.18
	off	130,44	130,17	127,03	132,13	131,19	135,12	124,53	134,10	128,87	135,16	124,53	135,16	10,63	
α7	on	22,57	24,65	21,17	21,15	21,11	22,44	22,10	23,00	21,19	22,85	21,11	24,65	3,54	29.10.17
	off	191,13	165,74	204,74	183,40	217,03	187,15	162,10	154,14	160,10	214,13	154,14	217,03	62,89	
α7S	on	23,19	20,09	21,13	21,10	21,16	22,16	23,47	21,10	22,17	21,01	20,09	23,47	3,38	29.10.17
	off	108,04	81,92	109,10	82,25	87,99	107,16	84,16	98,14	86,69	101,14	81,92	109,1	27,18	
α7S	on	23,19	20,09	21,13	21,10	21,16	22,16	23,47	21,10	22,17	21,01	20,09	23,47	3,38	12.05.18
	off	108,04	81,92	109,10	82,25	87,99	107,16	84,16	98,14	86,69	101,14	81,92	109,1	27,18	
α99 II	on	54,16	55,51	54,15	54,14	55,51	54,15	55,13	55,18	54,11	54,39	54,11	55,51	1,4	12.05.18
	off	129,72	131,34	119,14	148,92	152,67	114,19	118,18	117,15	118,88	113,57	113,57	152,67	39,1	
α77 II	on	55,13	53,48	52,17	52,58	52,17	52,14	53,16	52,12	52,95	52,76	52,12	55,13	3,01	12.05.18
	off	136,31	124,18	129,01	118,19	133,16	117,13	113,13	129,13	133,82	118,69	113,13	136,31	23,18	
α6500	on	21,19	21,46	23,14	22,16	22,40	22,63	21,12	22,50	21,16	22,11	21,12	23,14	2,02	12.05.18
	off	168,76	149,98	143,17	153,11	144,53	150,23	153,81	147,65	177,11	158,82	143,17	177,11	33,94	
α6300	on	25,16	22,94	23,52	23,17	23,18	22,19	25,15	23,11	22,58	22,26	22,19	25,16	2,97	12.05.18
	off	150,90	147,88	158,65	148,64	150,17	157,16	160,65	160,16	159,12	159,06	147,88	160,65	12,77	

Camera	Keep-active	1	2	3	4	5	6	7	8	9	10	min.	max.	Δ	Date
α6000	on	22,14	23,87	22,83	21,15	24,22	23,14	22,16	23,02	22,28	22,56	21,15	24,22	3,07	12.05.18
	off	188,03	219,17	214,19	194,14	183,17	217,11	207,12	185,85	218,96	211,75	183,17	219,17	36	
Rx10 IV	on	21,15	21,12	21,14	21,84	21,17	22,67	22,12	23,26	21,38	21,15	21,12	23,26	2,14	12.05.18
	off	48,97	49,11	38,92	46,28	39,42	48,17	56,14	41,13	49,64	53,55	38,92	56,14	17,22	
Rx10 III	on	12,13	11,17	12,54	12,16	11,24	12,10	13,88	11,11	11,05	11,12	11,05	13,88	2,83	12.05.18
	off	56,14	40,52	48,15	42,12	67,55	68,03	31,16	38,70	31,03	42,14	31,03	68,03	37	
50x	on	9,51	11,10	10,64	10,64	10,11	10,10	10,19	10,15	10,16	10,12	9,51	11,1	1,59	12.05.18
	off	132,40	138,35	103,19	106,12	84,46	100,16	98,12	92,16	159,17	85,10	84,46	159,17	74,71	
G	on	8,14	9,11	8,34	9,27	8,58	10,89	8,12	9,51	8,75	9,40	8,12	10,89	2,77	12.05.18
	off	130,65	110,13	48,88	125,18	133,15	113,11	83,71	139,17	60,14	119,10	48,88	139,17	90,29	
	on											0	0	0	
	off											0	0	0	
	on											0	0	0	
	off											0	0	0	