Найти

Digital photo » Picture in numbers

Autonomous use of Canon EOS lenses

Preamble

Eight years ago, I published my article " On the history of creating cameras, standards and self-made cameras ." It has become a program for my work for all these years. Today we can state that much of what was written in that article has already come true, and the rest, I hope, will come true. There were mirror-free cameras with interchangeable lenses, and Pentax Q , in my opinion, is very similar to the prototype to which the above-mentioned article was devoted. The fact that the SLR cameras are an endangered class was clear to the engineers 10 years ago. The development of events confirms this.

Briefly I will recall the arguments. From the point of view of engineering minimalism or the KISS principle (keep it simple, stupid) , it is necessary to use only those nodes that are necessary for the normal functioning of the device. The appearance of SLR cameras was due to the fact that the film is afraid of light, and it is impossible to simultaneously view the image projected onto the film and not to light it. Therefore, it was quite logical to use the conjugate plane with frosted glass and use the fast switching between the plane of the film and the plane of the glass due to the rotation of the mirror. Considering the image on the frosted glass, it was possible without parallax to aim at the object and focus, achieving a sharp image on the frosted glass.

Part of its functions, the SLR cameras lost with the advent of autofocus, the focusing was already carried out not on the frosted glass, but with the help of a range finder, however, also conjugated with a mirror. But in the case of a rangefinder, the mirror was no longer an obligatory element, other solutions are possible. They were in film photography, they appeared and are used in digital. For example, the functions of a range finder combining two images visible through the right and left edges of the lens can be embedded in the matrix, giving certain elements specific functions. Conjugate planes - both the plane of frosted glass, and the plane of the sensors of the range finder - have one congenital defect: they need to be adjusted. And the higher the resolution, the more accurately this should be done. And since the camera we have not made of platinum-iridium alloy,

A system with contrast focusing, when we are looking at focusing, the same image, which will be registered, does not require adjustment. In other words, it requires alignment from the skew, but not from the position. How could I solve the skew problem, I wrote eight years ago. Until it is implemented in industrial designs, but we are waiting-with. The claims to the slowness of focusing by contrast today do not seem to be of principle even in the released cameras, and given that the slower speed, than with phase focusing, is determined only by the speed of the processor, and they develop strictly according to Moore's law, then, of course, the difference between the rangefinder phase focusing and focusing in contrast will disappear just a few days ago. Further, the focus brake will be not the laws of electronics, but mechanics. The lens has a mass, and if it needs to be moved with great acceleration, then you need to apply a lot of force. I note, however, that the optical design, optimal for different methods of focusing, is different.

Thus, the mirror chambers go to the past, leaving behind a giant fleet of lenses. Lenses from mechanical SLR cameras are in full use by modern digital cameras, and their interface does not raise any fundamental problems. In order to obtain all the information necessary to create a transitional ring, a ruler or an improved version is sufficient - a caliper. Even optical measurements, which may be needed, are reduced to measuring distances when moving the lens through an optical bench. Lenses for mechanical SLR cameras were produced in two types: completely self-contained and mechanically coupled with a camera. Mechanical coupling usually touched the aperture of the diaphragm, and in some lenses it was possible to rotate the focusing ring with the help of the camera motor.

Electrically-controlled lenses gave rise to a number of problems. The optical unit can be in excellent condition, however, in order to use it with another camera, one must at least be able to control the diaphragm. In other words, in order to be equal in functionality to older, purely mechanical lenses, one must at least

come up with a device that, when pressed, will give commands to the lens instead of the camera. In the future, naturally, I want to get an opportunity to use not only the optical scheme of the lens, but also its motors. And give commands from the computeror from another system. The main part of this article will describe how to manage Canon EOS lenses using three buttons. Two of them set the value of the working aperture, and another is the analog of the diaphragm preset ring for mechanical lenses and serves to fully open the diaphragm or close it to the operating position. Demonstration programs for controlling the aperture and the focusing drive from the computer will also be offered.

In history with another system, we attack the same rake that was described in the above article with the 4/3 system. Sony has announced the openness of its standard for interfacing lenses with NEX cameras. But, as it turned out, not all. In the information message the website says that only legal entities are allowed to apply, from physical persons the applications are not accepted (we will not accept inquiries from individuals). So, we are again confronted with an army of lawyers fed us, guided not by ideas of justice, not logic, but solely by their corporate interests: how to extract more profit from their unproductive activities. Logic requires that if an asymmetric approach is applied, then lawyers should at least explain to us the reasons for this selective approach.

In the most legally complex country there is such a thing as fair use(fair use), which describes the exceptions and limitations of the exclusive right granted to the author of a work of art by law. "Fair use" is allowed without obtaining permission from the copyright owner as long as it contributes to "the progress of science and useful arts" (Article 8, paragraph 8, Article 1 of the US Constitution). Sometimes, referring to this norm, and it is possible to defend something. In most cases, even when we see obvious errors in the implementation of a device or the ability to optimize it, the engineer will think 10 times whether to undertake this work. Because they will be dragged through the courts until you prove that you have not violated the copyrights of a company so rich that you can afford to keep an army of hooks. Talking about the efforts made and prolonging the terms of protection of copyright, that any device on 99 percent is created on the basis of the open public information, gleaned, for example, from textbooks. And, in a number of cases, the authors of this open, publicly available information expressed ideas close to those formulated in the GNU General Public License today. It would be nice if the lawyers explained to us why not distribute the licenseGPL GNU for all information from the textbooks, and thus prohibit the closure of access to developments made on the basis of information obtained from them.

One of the authors of the prototype of the modern oscilloscope Karl Ferdinand Brown decided not to patent his invention, published and made many public demonstrations. Although his followers filed a bunch of patents, developing this idea, today it would be possible to return historical justice by forbidding hiding information about any device that used an oscilloscope :-). Actually, a patent, like a scientific publication, does not hide, but on the contrary - discloses information, fixing priority and giving certain privileges in its use. At a certain stage, this contributed to the development, but very quickly it turned out that the validity period exceeded the lifetime of the idea, and the concept of novelty was too vague. In addition, you can register a new, but trivial solution, which is not formulated only because of its lack of demand at the moment, and in the case of setting the task, it will be solved in a similar way by any engineer. All this breeds losses in the pace of technological development, exceeding the benefits of accessibility of information. The story with an interval of several hours between applications for the phone shows that his invention was inevitable, and the patent was not a reward for the effort, but a prize in the lottery. The competition between the KB allowed us to go into space, hurry and risk, but it's scary to imagine the extent of accidents, if the principle worked there: the winner gets everything, and the loser, after years of work, is deprived of the right to its results and the possibility to continue it. In other words, instead of stimulating intellectual activity, we are being pushed to inaction (Slack), which, however,

Access to information would not undermine the economic interests of large companies. Any piece and handicraft production has an order of magnitude greater cost. Competitors have long since dismantled and know everything, the benefit under certain conditions, reverse engineering (reverse engineering) legally invulnerable. The lack of information makes it necessary to spend a lot of time on the invention of a bicycle, and not to test new ideas. By the way, the firms do not disdain the information that was extracted in universities and published for general familiarization. There is also a long-term problem of training: hiding information, firms are forced to spend a lot more money on retraining young professionals, even with higher education. We live in a century when the stimulation of technical self-education becomes a matter of survival. There are more and more "wires" around us, which we do not notice, but when the loop hits the neck, it will be too late.

Lenses of the Canon EOS (Electro-Optical System) system appeared in 1987. Generally speaking, they were by no means the first with a fully electric communication of the camera with the lens, but the scale of the release of lenses with this bayonet allows raising the issue from the field of antitrust laws. The lens is by definition an optical instrument. And something added to it, not related to its main activity, which makes it attached to the camera of a particular manufacturer. In other words, the enormous resources of human labor spent on fabricating optics will be wasted in vain if Canon's SLR cameras leave the market. Similar to the accusations of linking Internet Explorer to Windows, questions arise to the antimonopoly committee: but where did they look? :)

Preface - warning

So. We have the following situation: there are lenses, but there is nothing to use them. The problem admits two obvious solutions. To alter the lenses so that they can be used with other cameras, or quickly burned, so that they do not callurize the eyes. A comprehensive solution will be proposed below. Some of your lenses may be able to use. The other part will burn so that it will not be subject to recovery. As you know, education in the USSR was free, and knowledge was very expensive. So with the information that will be set out below. We give it to you from bounty, but its blind use can cost several burnt lenses. Some may say: "Why did we give such information?" In response, I will give an example with tables of integrals. As we were told at the institute, misprints are not found only in the Small Guide to the Integrals of Ryzhik (IM Ryzhik, Tables of Integrals, Sums, Series, and Works.) OGIZ, 1948. 400 pp.). In the Big they are, but this does not make it useless, because it can be checked quite quickly with the help of differentiation. But it takes months to take some integrals. In the process of working on this article, I burned the motors of the diaphragm drive in two lenses. And the damage was caused not by installation errors or by the fact that I dropped them on the floor, but by the lack of information about some program commands, and also by the fact that for 25 years the protocol has changed quite a lot, and what is good for one lens can be fatal for others. What is natural, as I use 1948. 400 pages). In the Big they are, but this does not make it useless, because it can be checked quite quickly with the help of differentiation. But it takes months to take some integrals. In the process of working on this article, I burned the motors of the diaphragm drive in two lenses. And the damage was caused not by installation errors or by the fact that I dropped them on the floor, but by the lack of information about some program commands, and also by the fact that for 25 years the protocol has changed quite a lot, and what is good for one lens can be fatal for others. What is natural, as I use 1948. 400 pages). In the Big they are, but this does not make it useless, because it can be checked quite quickly with the help of differentiation. But it takes months to take some integrals. In the process of working on this article, I burned the motors of the diaphragm drive in two lenses. And the damage was caused not by installation errors or by the fact that I dropped them on the floor, but by the lack of information about some program commands, and also by the fact that for 25 years the protocol has changed quite a lot, and what is good for one lens can be fatal for others. What is natural, as I use can take months. In the process of working on this article, I burned the motors of the diaphragm drive in two lenses. And the damage was caused not by installation errors or by the fact that I dropped them on the floor, but by the lack of information about some program commands, and also by the fact that for 25 years the protocol has changed quite a lot, and what is good for one lens can be fatal for others. What is natural, as I use can take months. In the process of working on this article, I burned the motors of the diaphragm drive in two lenses. And the damage was caused not by installation errors or by the fact that I dropped them on the floor, but by the lack of information about some program commands, and also by the fact that for 25 years the protocol has changed quite a lot, and what is good for one lens can be fatal for others. What is natural, as I useFreeduino Nano and built-in modern lenses microcontrollers more powerful than a desktop computer in 1987 such as IBM PC / AT. In my case, the engines burned out not from the instantaneous effect of increased voltage, but because the fixed motors remained energized when the diaphragm was closed. And the windings of the engine were shortened from overheating in a few minutes, if the lens ceased to play with the lens and left it turned on.

The theme of the last year excites many, but although there are many mentions and there is even evidence of a successful completion of the work, articles containing information on "How to do this" was surprisingly small. Technical information Canon contains detailed information on the design, voltages and frequency, that is, on the one hand, it is easy to find out if you take a working lens, and on the other hand it is important to ascertain the fact of its failure. Information about the mode of communication and commands is missing. I found on the Internet two articles, information from which I was able to use: " Canon EF lens control protocol " and " Canon EF-S Protocol and Electronic Follow Focus". At first glance, it may seem that since the commands described in these articles do not coincide, it means that someone might have made a mistake, but this is not so. They just dealt with different lenses. In addition, some lenses understand 1-byte commands, and for scraps of official information, modern lenses use 4-byte commands and the interpretation depends on the length of pauses between teams. And in this case, two short commands, if the lens is designed to use long, can lead to unpredictable results. In addition, it turned out that the protocol of information exchange is also not the top of perfection. Some commands are distorted, this depends on both the interference and the voltage on the battery. In general, if you are going to repeat the experiments described below, then you should do it consciously, figuring out why and why this or that team is used. Perhaps what worked for me would be dangerous for exactly the same lens, but with a different firmware version of the internal software. I strongly

recommend in the course of work to constantly monitor the current consumed by the lens. And if it seems to you that you have a bug in the program, do not rush to fix it on the move without disconnecting the lens beforehand.

So, everything you do, you do at your own peril and risk. All that can be learned from this article, it is necessary to check, and only after that to apply in practice.

Reverse engineering is akin to solving a puzzle, in which there is never any certainty that the solution found is exactly what the author has laid down. There is also no confidence in the fact that information about the design is closed from greed. It may very well be that this was done in order to hide flaws, until the correction of which did not reach the hands.

What we have as a result

Overview of the design will begin with the end, with what has happened and what can be expected from this. Made adapter ring, with a L-shaped support for a tripod, for installing Canon EOS lenses on the camera Sony NEX-5 .

The lens is controlled by the Freeduino Nano v5 microcomputer . With the three buttons installed on the adapter, you can control the lens aperture and also trigger the camera shutter via the IR channel. About the use of the IR channel for camera control is described in detail in the article " Automating the shooting of spherical panoramas using a Sony NEX-5 camera". Short presses on the top button completely open or close to the operating position of the diaphragm, if you

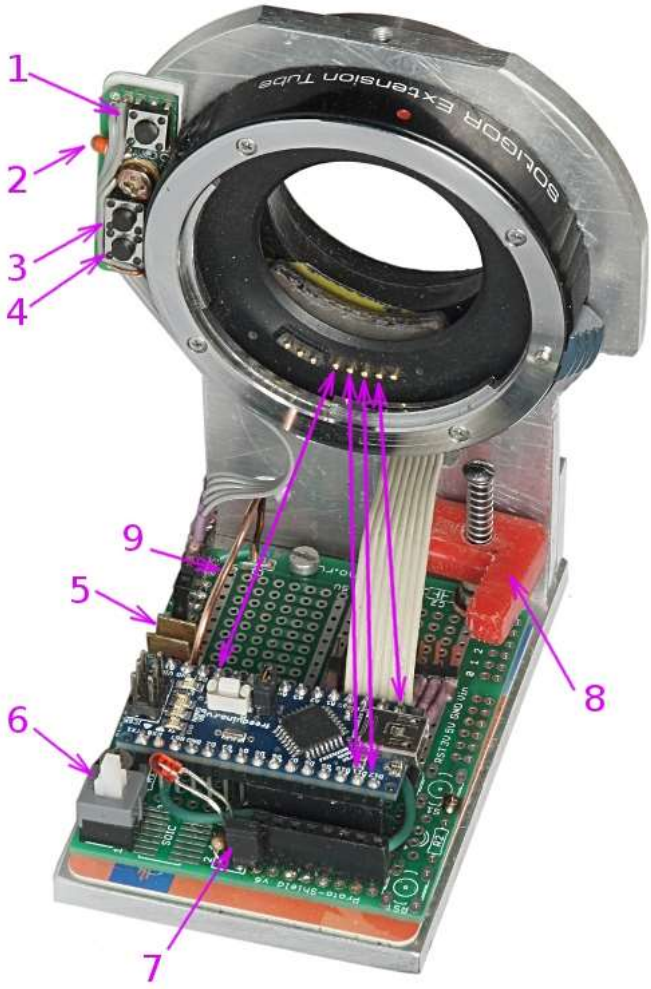
press and hold the button, then when it is released, the camera shutter will work. The two buttons below are closed and opened for half a block. Long press on the top button changes the step of changing the aperture from half-down to the whole. Similarly, a longer, more than 0.5 second pressing of the lower button decreases the step of changing the aperture. If the diaphragm is completely opened by the upper button, then when the lower button is pressed, the diaphragm will be closed to the operating position, which differs from the previous one by a half-distance, respectively. At the moment the design is working with lenses: Canon EF 50 mm f / 1.4; Canon EF 135 mm f / 2.8 Soft focus; Canon EF 100-300 mm f / 4.5-5.6 and Canon EF 28-135 mm f / 3.5-5.6 IS. It is possible to control the lenses and release the shutter using a computer connected via USB. Control can be done both from the terminal, simply by typing several commands, and using programs written in QT and Gambas.

The mechanical part of the adapter consists of the halves of the extension ring for macro photography with the wires removed. On how to do it, I wrote in the article " The device with the stretching of fur and the Canon EOS camera " a few years ago. This ring on the other side is threaded M42. The M42 thread is screwed onto the adapter ring for the Sony E bayonet.

It turned out that this bayonet is not designed for such heavy lenses. The pressing spring in the chamber does not ensure a close fit of the lens to the support ring. Therefore, in the design of the bayonet, changes were made in the style of the Exacta bayonet, that is, near the petals of the bayonet, thin cuts were made, and the petals were slightly bent inward (in the original bayonet, the slits are on the part of the bayonet located in the chamber. In the chambers Salyut and Kiev 88).

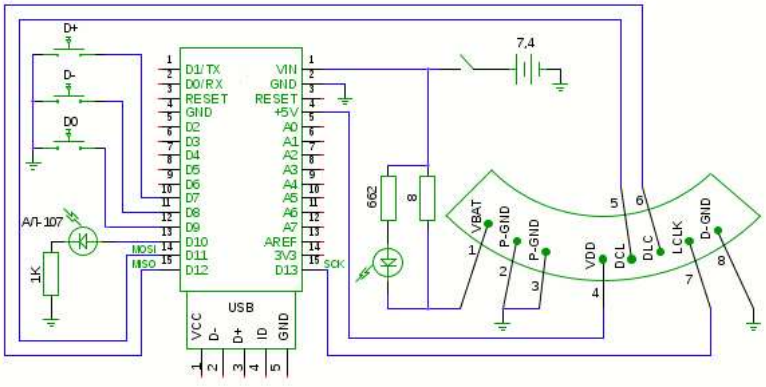
We saw through the groove and deform the petal with a light movement of the hammer.

Unfortunately, this solution has an obvious minus: the bayonet in the camera is plastic and can simply not withstand such efforts. Therefore, the bend was made minimal, and to mount the camera with the lens to the tripod, the L-shaped leg is used. In this case, all the effort on the bayonet is just a small enough weight of the camera. The entire electronics is mounted on the L-shaped mount. The battery occupies most of the place on the breadboard. Used the same battery as the Sony NEX-5 camera. The rest is occupied by the Freeduino Nano board, a power switch, a light-emitting diode for rough current control, a jumper, an opening power circuit, to include an ammeter in it.



1. *Button. Opens and closes the diaphragm.*
   With long press - release the shutter.
2. *IR LED, which controls the descent of the camera.*
3. *Button. Closes the aperture one step.*
   With long press increases the pitch.
4. *Button. Opens the aperture one step.*
   If pressed for a long time, decreases the pitch.
5. *Battery connection terminals.*
6. *Power switch.*
7. *A bridge that closes the power circuit.*
8. *Battery lock.*
9. *The arc of fixing the battery.*

Despite the fact that there is very little available information, nevertheless, the pinout of the lens contacts is reliably known. These are the wires of a 4-wire serial SPI interface , or, which is probably more accurate, its close analog. The ground was connected to ground, the contact for the transmission of the clock frequency (62.5 kHz) of LCLK was connected to the corresponding SCK leg of the computerFreeduino, the DLC foot of information transfer from the lens to the camera was connected to the MISO leg, the next DCL leg with the MOSI leg, the next contact is the power supply of the lens microprocessor, judging by the available technical descriptions of the Canon, it should have a voltage of 5.5 V. I fed exactly 5 V from the stabilized output of Freeduino. The next two legs are the power supply ground, and the last leg is the 6V power supply. I applied voltage to it directly from the battery through a resistance of 8 ohms. Measurements showed that the currents of different lenses vary very much. Without limiting resistance, the stepper motor drive of the diaphragm consumed from 200 mA to 1.5 A at the lens of 135 mm.



Programs

The program for Freeduino Nano was written in the latest development environment of Arduino IDE 1.0. It includes the SPI library . I note that the transition to a new environment required updating old libraries, and some teams have changed.

However, the maximum frequency division ratio of 128, which at 16 MHz clock speed of the processor does not allow us to get the desired 62 kHz. Therefore, the processor clock speed was reduced by half, to 8 MHz. This, naturally, was reflected in the pauses (they became twice as long as the nominal value), and at the speed of the serial port (it became twice as small as the preset port), i.e., the program preset 38400, and the computer should choose 19200.

```
CLKPR = B10000000;
CLKPR = B00000001;
```

In the future, with the transfer of data from Freeduino using the standard SPI_MODE3 protocol, there were no problems, all lenses worked.

```
pinMode (chipSelectPin, OUTPUT);
SPI.begin ();
SPI.setBitOrder (MSBFIRST);
SPI.setClockDivider (SPI_CLOCK_DIV128);
SPI.setDataMode (SPI_MODE3)
```

But the transfer of information from the lens to the Freeduino passed only for the lens Soligor AF 70-210 Macro 1: 2,8-4, and with the remaining lenses there were problems with receiving information, it only occasionally slipped casually.

Connecting the L-CARD E-154 and emulating it with an oscilloscope made it possible to detect that the level of the back signal on the DLC leg is negligible, while at the lens 70-210 it had an amplitude of 5 V. Here, on the strength of 0.5 V The two-day struggle showed that the problem is solved if a DLC leg with a power supply is connected through a resistance of 10 kΩ, that is, a standard pull-up is performed. Then I refused the resistance and performed it programmatically with the help of the command:

```
digitalWrite (12, HIGH);
```

After that, the amplitude of the signal increased to 5 V, although the lenses 28-135 still had a signal bounce, and sometimes a mistake was detected by the repeated request.

The full text of the program can be downloaded here .

To initialize most lenses, just use the following commands:

```
 myInts [0] = SPI.transfer (10);
```

My program uses a longer sequence that simultaneously requests information from the lens.

Fully open the aperture can be a sequence of two commands with a pause between them:

```
 myInts [0] = SPI.transfer (19); // Getting ready to change the aperture,
                                 // for most lenses is similar to command 18,
 delay (30);
 myInts [1] = SPI.transfer (128); // Open the aperture completely
```

To close the aperture by several steps indicated by the variable sd (sd = 10 changes the aperture by half), you can use the following sequence:

```
 myInts [0] = SPI.transfer (7);
 delay (p);
 myInts [0] = SPI.transfer (19);
 delay (p);
 myInts [0] = SPI.transfer (sd);
```

Open:

```
 myInts [0] = SPI.transfer (7);
 delay (p);
 myInts [0] = SPI.transfer (19);
 delay (p);
 myInts [0] = SPI.transfer (-sd);
```

Team "7" is not needed for all lenses. It is needed, for example, 50 / 1.4. To simplify the management of the lens through the computer terminal , incoming commands are shifted to -48, so that the 1 key on the keyboard corresponds to command 1 and there was the possibility to submit negative commands. So "+", pressed on the keyboard, gives the command "-5", and "C" - the command "19". The "[" command is reserved for command "128", and for "]" the command "255" is reserved. The letter "Z" is reserved for the camera shutter release through the infrared port. Thus, typing in the terminal window:

```
bash-4.1 $ echo C [>> / dev / ttyUSB0
```

completely open the diaphragm (lens 50 / 1.4 requires the command "7C ["), and typing:

```
bash-4.1 $ echo 5 >> / dev / ttyUSB0
```

we will focus the lens on infinity (the objective 50 / 1.4 requires the command "05").

Before working through the terminal, you must disable the software reset by removing the jumper on the Freeduino board. To avoid inadequate behavior of the lens when connecting the USB cable, I recommend that it be removed immediately after recording the program. Using the command "5" sending a few "0" as a pause before the command "8", you can rotate the focus ring and not to stop at infinity. Similarly, the "6" command will focus on the more and more similar objects:

```
bash-4.1 $ echo 60000000000000000008 >> / dev / ttyUSB0
```

A small movement, however, it is more convenient to do by a command:

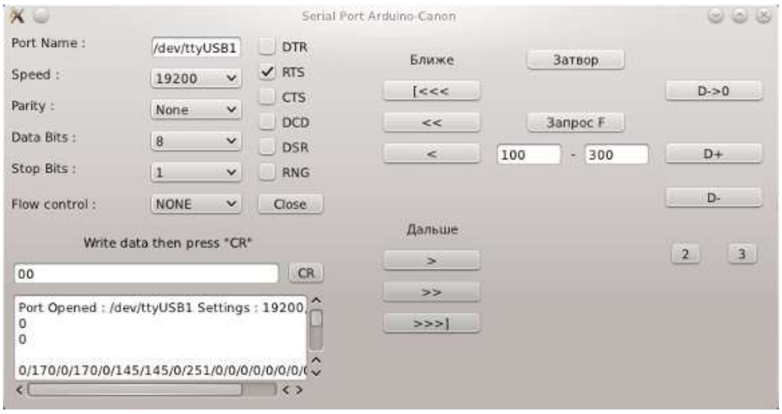
```
bash-4.1 $ echo t05 >> / dev / ttyUSB0
```

to focus away and command:

```
bash-4.1 $ echo t] + >> / dev / ttyUSB0
```

to focus on nearby objects.

Of course, it's more pleasant to manage with GUI programs, and I wrote a couple for demonstrating the possibilities and mastering the code.



Since at the time of writing this article there was a third version of Gambas, written using QT4 libraries, it seemed to me interesting to understand exactly it, and therefore the program on Gambas is more functional. It allows you to focus the lens at infinity or at a minimum distance with one touch of a button, and there are two groups of buttons that allow you to move the lens at different steps. There are buttons that close and open the aperture, as well as a button that causes reading of information about the lens attached to the adapter. In addition, you can send and receive commands in the terminal window. The program is designed primarily for debugging work and checking the available commands for different lenses. The commands used in this program work with all used lenses, but for some of them they could be substantially shorter and easier. In this case, the command is used, to which all the above-mentioned lenses react. Some of the exceptions are the lens 28-135, which does not correctly execute the move command to the extreme position. Perhaps this is due to the fact that the state of the lens - at 3 minus, he repeatedly understood, and the inability to perform this command is associated with mechanical damage. The lenses produced in the 90s, Canon EF 28-80 and Soligor AF 70-210, also seem to work, but as the motors of the diaphragm drive burned them during the experiment, the reaction of the lenses to the commands of the diaphragm control was estimated by the presence or no signal output to the motor. Management program with Some of the exceptions are the lens 28-135, which does not correctly execute the move command to the extreme position. Perhaps this is due to the fact that the state of the lens - at 3 minus, he repeatedly understood, and the inability to perform this command is associated with mechanical damage. The lenses produced in the 90s, Canon EF 28-80 and Soligor AF 70-210, also seem to work, but as the motors of the diaphragm drive burned them during the experiment, the reaction of the lenses to the commands of the diaphragm control was estimated by the presence or no signal output to the motor. Management program with Some of the exceptions are the lens 28-135, which does not correctly execute the move command to the extreme position. Perhaps this is due to the fact that the state of the lens - at 3 minus, he repeatedly understood, and the inability to perform this command is associated with mechanical damage. The lenses produced in the 90s, Canon EF 28-80 and Soligor AF 70-210, also seem to work, but as the motors of the diaphragm drive burned them during the experiment, the reaction of the lenses to the commands of the diaphragm control was estimated by the presence or no signal output to the motor. Management program with and the inability to perform this command is associated with mechanical damage. The lenses produced in the 1990s, Canon EF 28-80 and Soligor AF 70-210, also seem to work, but since the motors of the diaphragm drive burned them during the experiment, the reaction of the lenses to the commands of the diaphragm control was estimated by the presence or no signal output to the motor. Management program with and the inability to perform this command is associated with mechanical damage. The lenses produced in the 1990s, Canon EF 28-80 and Soligor AF 70-210, also seem to work, but since the motors of the diaphragm drive burned them during the experiment, the reaction of the lenses to the commands of the diaphragm control was estimated by the presence or no signal output to the motor. Management program withcomputer can be downloaded here , but it is offered only as a test alpha version for acquaintance with the code.

PS

The above articles gave me quite a lot, although the information contained in them did not allow to avoid burning out the two lenses. Perhaps the most underrated team in these articles is the "8" team. In the radiotelegraph code "88" means "I love, I kiss", the lenses also need to be loved, otherwise they will burn. Command "8" stops all operations and disconnects power from the motors. Actually, when you install the lens on the device, the diaphragm is almost always open, in this case the additional safety is provided by the limit switch. To close the aperture manually, press the special button. And the aperture will be closed only while the button is held down. With our device, it is often useful to keep the diaphragm closed. But in this case it is vital to remove the voltage from the motor, Moreover, in the device, security is additionally provided by removing the power supply from the lens. In this case, for simplicity, I did not complicate the circuit and install a thyristor in the circuit. The L293D-type chips installed in the lenses are quite capable of coping with this task, if only they are given a timely command.

The lens 28-80 went out of order, and it's impossible to say for sure, but there is a suspicion that it did not react or did not always react, or reacted in combination with something wrong to the command "8". If you watch the level of the signal on the DLC leg, then the command "8" will reset the signal to 0. At part of the lenses, it then remains in this position. For some, it's just a short pulse. The command "7" usually translates the signal on the leg to the upper position, 5 V. A number of lenses are capable of executing single-byte commands of the type "5" or "6". Some need to pre-submit "7" or "8". Moreover, between the team "7" or "8" and the next team need a pause, which can be replaced by a series of zero parcels.

More about the features of the design and the revealed differences between the tested lenses - in the second part, and how to get the most pleasure from using - in the third.

February 24, 2012 Vladimir Rodionov

Additionally

Discussions in the conference:

- [yesterday, 23:52] ZK vs BZK. When is the end of the ZK? (part 10) (4345 posts)
- [Yesterday, 22:22] Full Frame FF of the SONY A7 / A7 II camera (24 mp), A7r (... (506 posts)
- [yesterday, 22:06] The maximum quality in the minimal form factor. What to buy? Definition of ... (2842 posts)
- [Yesterday, 21:40] A branch of camera choice for those who have not decided yet, buy ... (1882 posts)
- [yesterday, 20:53] FOWON vs. BAYER Foveon vs Bayer (It was: Detailing the snapshots of the FOV ... (1059 posts)
- [yesterday, 18:09] Fixes for Canon Volume II. (part 4) (1507 posts)
- [Yesterday, 13:57] Be a man, share a stranger (60 posts)