

La recherche du temps perdu

Or why Bronicas ETR, SQ and GS sometime fail to meet exposure times

By M.Vettore

Bronica's ETR, SQ and GS families born from a common project, the Zenza Bronica mechatronic approach of late '70 to put together modular systems able to cover different formats but sharing very similar design.

The Bronica designers led by the selected market target, chosen to put a electromagnetically driven central leaf shutter in each lens to permit the flash synchronization at all shutter speeds..

The designers decided to opt for a Seiko #0 shutter instead of made it internally.

Let's see how the system works:

At 1/500th of a second shutter time the operation is entirely mechanical, to be note, some cameras (i.e. SQ-Ai) cannot operate without battery power but this is another story not related to the shutter operations.

When the shutter release button (A) is depressed (1) with the shutter speed dial positioned to 1/500th (or without battery when allowed), a chain of gears, springs, sprockets, levers and other mechanisms (B) starts running (2) till the shutter (E) will open (3), the simplified representation is on the side pictures.

When the shutter is opened another mechanism (C) starts running (4-5) causing the shutter closing movement.

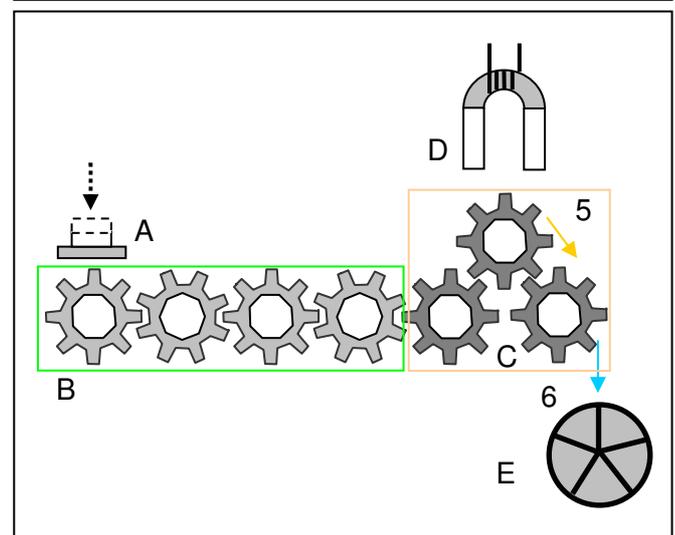
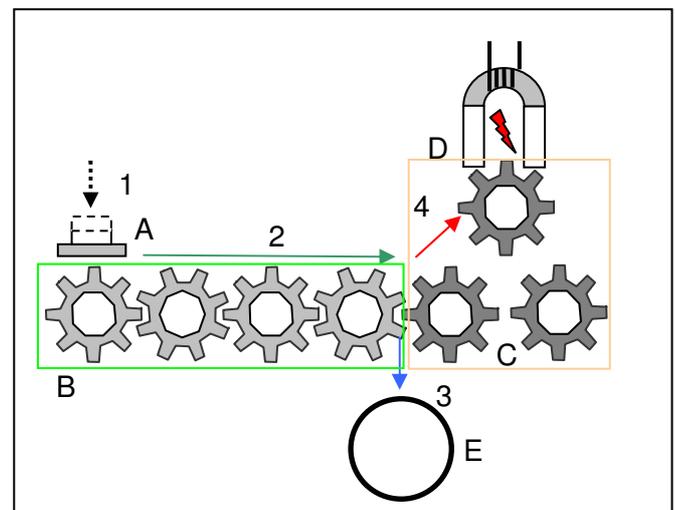
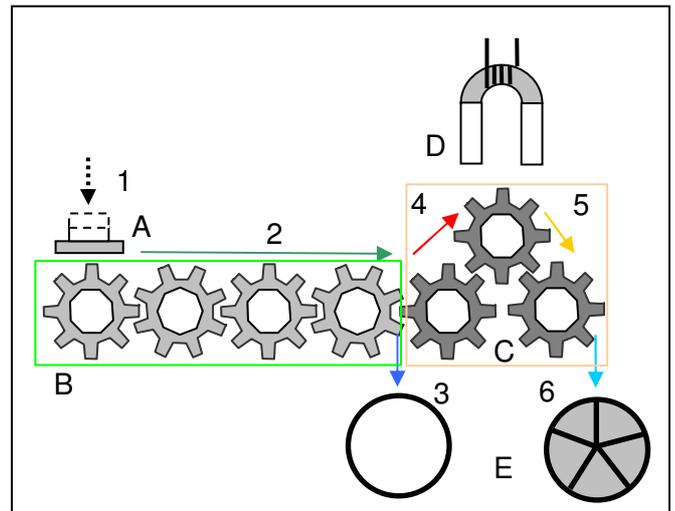
The inertial delay of this mechanism is about 2 milliseconds, which is 2/1000 sec or **1/500 sec**.

When the shutter speed dial is setted to a time different from 1/500th (and the battery supplies the power needed) another mechanism will be activated.

The shutter, at the end of phase 2 illustrated on the picture and just before the shutter opens, closes an electrical contact signaling the event to the camera which in turn start a timer supplying power to an electromagnet (D) locking the mechanism C on phase 4 with shutter opened.

When the time expired the electromagnet is de-energized freeing the mechanism C to close (5-6) the shutter.

The result time shutter stays open is determined by the time timer keeps electromagnet energized plus the delay due to phase 5 of mechanism C.



On the side picture the electromagnet and part of mechanism C are in color.

The screw inside the red circle is used to adjust the mechanism C delay time.

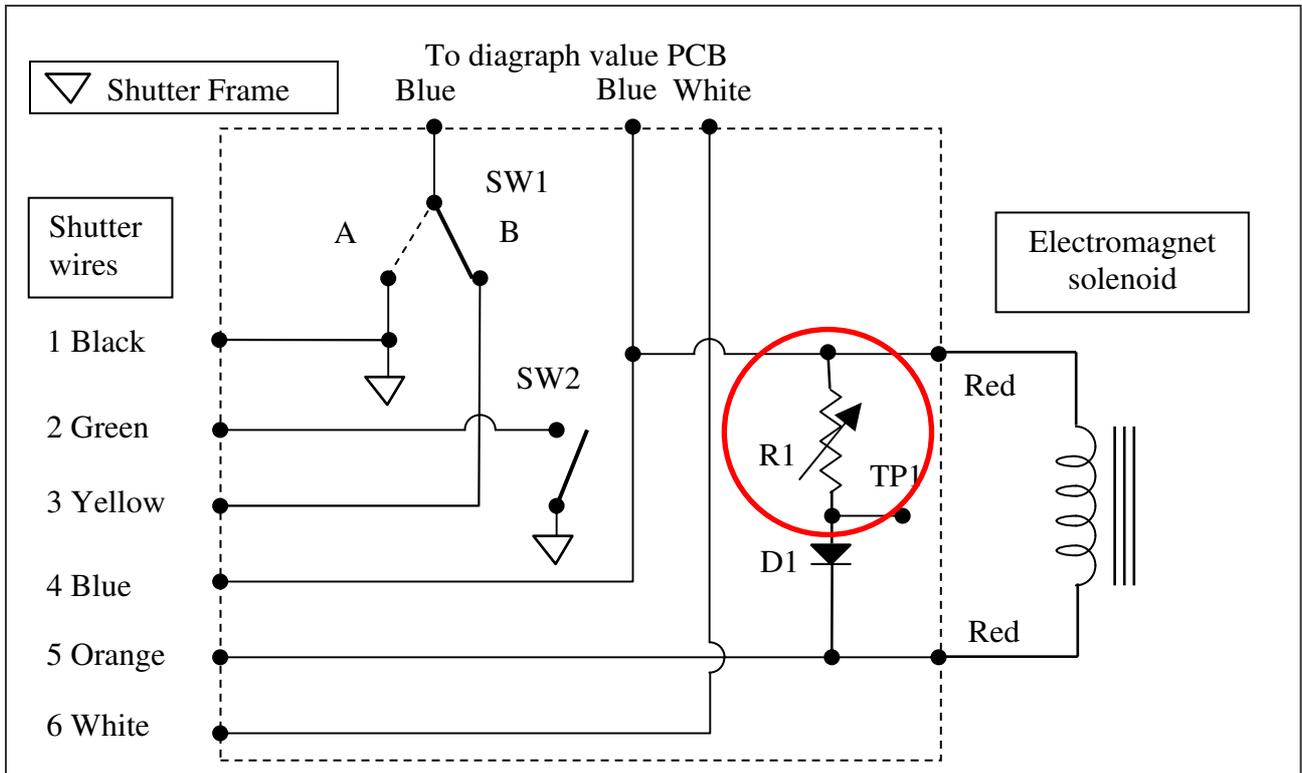
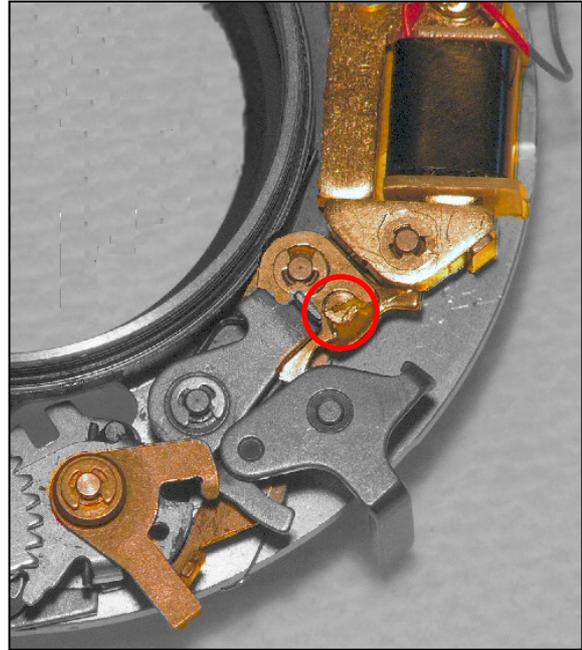
The precision of mechanism inertial delay affects, in practice, the faster shutter times; it is very evident at $1/500^{\text{th}}$ (2 ms), still important at $1/250^{\text{th}}$ (4 ms) and $1/125^{\text{th}}$ (8 ms), insignificant at $1/60^{\text{th}}$ (16.67 ms) or slower times.

One millisecond (1 ms) of added delay to $1/500$ sec shutter time results on $1/333$ sec effective opening time, roughly adding one half stop to the exposition, at $1/250$ sec the error is around $1/4^{\text{th}}$ stop but at $1/125$ sec only an $1/8^{\text{th}}$ of stop.

The precision of the camera timer instead, affects every lens used with the camera and all the times but not the $1/500$ sec.

A third factor affects the precision of exposure times: electromagnet release time

This factor influences, of course, the single lens and particularly the times $1/250$ sec and $1/125$ sec.



The electric diagram of shutter is depicted above; the trimmer resistor R1 adjusts the electromagnet release time.



The trimmer is accessible through a hole, the side picture shows a PS lens with brand name plate and frontal optical assembly removed; the red circle marks the trimmer screw.

It is possible to check the shutter times using a shutter speed meter, a very simple can be homemade (instructions are available at <http://www.buonaluce.com/Tester.pdf>)

Using the mentioned shutter speed method (Flash sync measure) it is possible to check the speed correctness and eventually, correct it

As described the times depend on three factors: camera timer, shutter mechanisms, electromagnet release delay. Checking operations should be started with fresh battery at 1/2 sec. shutter speed if the measure (repeated at last three times) meets the standards (500 ms +/- 5 ms) go to fast times verify, if not, check the camera with another lens if available. If the 1/2 sec shutter time is still outside limits the camera timer should be adjusted. The instructions to access and adjust the camera timer trimmer for ETR, ETR-Si cameras can be found on

the repair manuals available on the net, for the other cameras the manuals are not available and a camera exploded drawing should be requested to Tamron (www.tamron.com). In practice the left side panel of the camera (shutter speed selector side) must be removed and Shutter Speed VR trimmer must be identified.

Fast times verify (using the flash sync method):

- Start verifying the 1/500th, the measured times should be between 1.3 to 1.7 ms, if the values go outside the limits the shutter mechanism is much unadjusted or worn out. The procedure to adjust it, is very intricate, usually shutter must be replaced.
- Verify at 1/250th measured times should be within 2.4 to 3 ms
- Verify at 1/125th measured times should be within 6 to 7 ms.
- Verify at 1/60th measured times should be within 13.9 to 15.2 ms.

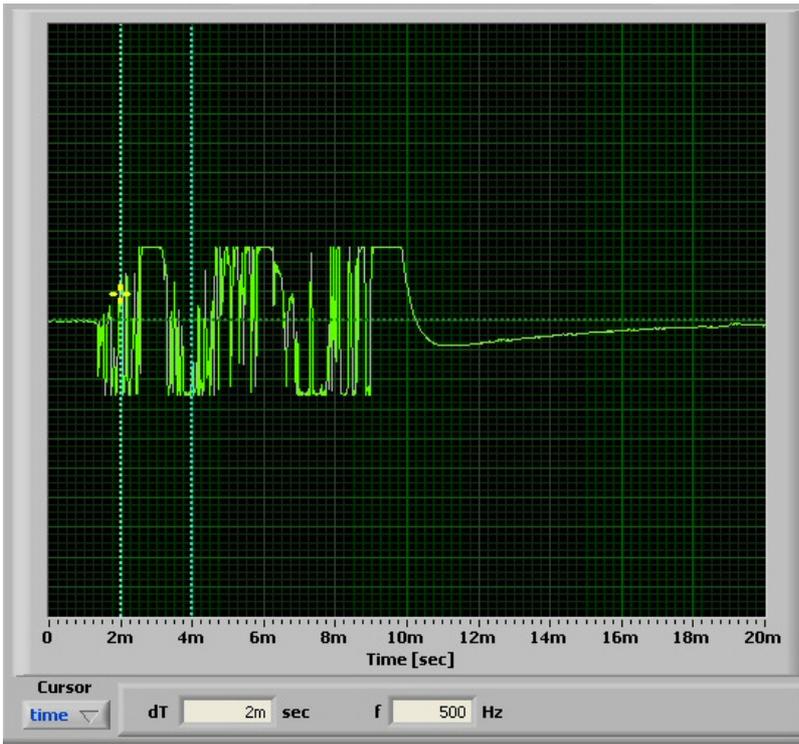
If the last three measures differ from the limits a chance to adjust still exists.

To access the electromagnet release time adjust trimmer the lens frontal optical group must be removed. Instruction on how to remove it can be found for some S and PS lenses at <http://www.buonaluce.com/Slens.pdf> and <http://www.buonaluce.com/PSlens.pdf> although for other lenses the procedure is very similar even identical.

When the shutter front side is visible turn the diaphragm selection ring at the lower f number: the trimmer adjustment screw will be accessible through a hole (see picture above).

To adjust operate as follow:

- If available use a plastic screwdriver, if not take out the screwdriver before shooting in order to avoid short-circuiting the trimmer to the ground.
- Start the adjustment at 1/250th the optimal measure should be 2.7 ms.
- Turning the screw clockwise results in larger time, anti-clockwise in shorter time. Turn the screw very gently, applying small degree movements, never force the screw past the limits, the trimmer full span is less than 270°.
- Repeat the measure several times.
- When the time is adjusted for 1/250th test at 1/125th and 1/60th, the measures should be within the limits too. If not, try to adjust it back again at 1/250th, if at the slower times the measures go up the limits (> 7 ms at 1/125th or > 15.2 ms at 1/125th) reduce the time to values between 2.7 ms to 2.4 ms and check again at slower times On contrary increase the time between 2.7 ms to 3 ms.



Pitfalls

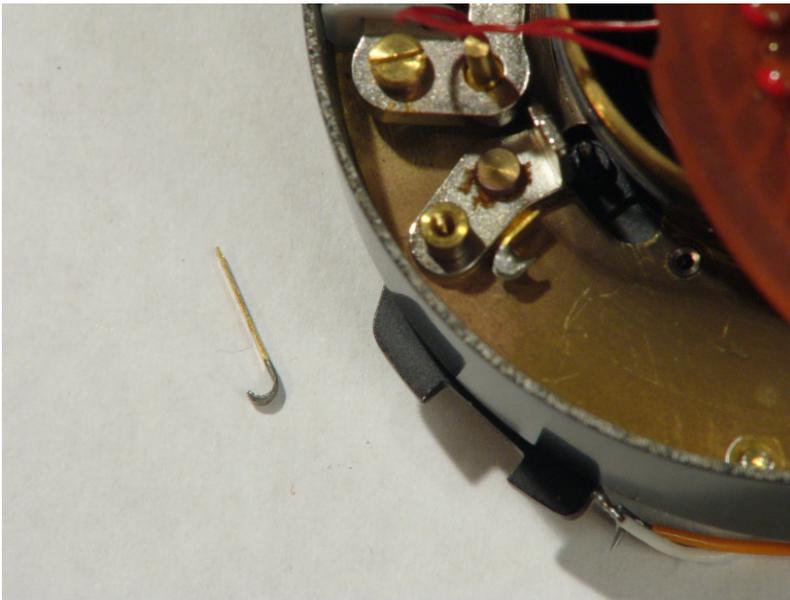
Sometime the readouts are inconsistently i.e. 4 ms at 1/250th but within the limits at the other speeds or the waveforms are very strange like the one on the side picture.

Usually the reasons are:

- Broken flash contact.
- Bad repaired flash contact.

The main failures of Seiko shutter are mainly the springs worn out, then the flash contact breaking. Because the way the contact is fixed to the frame it is impossible to replace it and by the way the shutter is not officially serviceable, it must be replaced entirely. Because the cost of the spare part, frequently the repair services operating on lenses close to the end of professional life, prefer to repair the flash contact instead of replacing the whole shutter (see the side picture).

I wish to address this and other issues on a future article.



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