RTTS V1.02

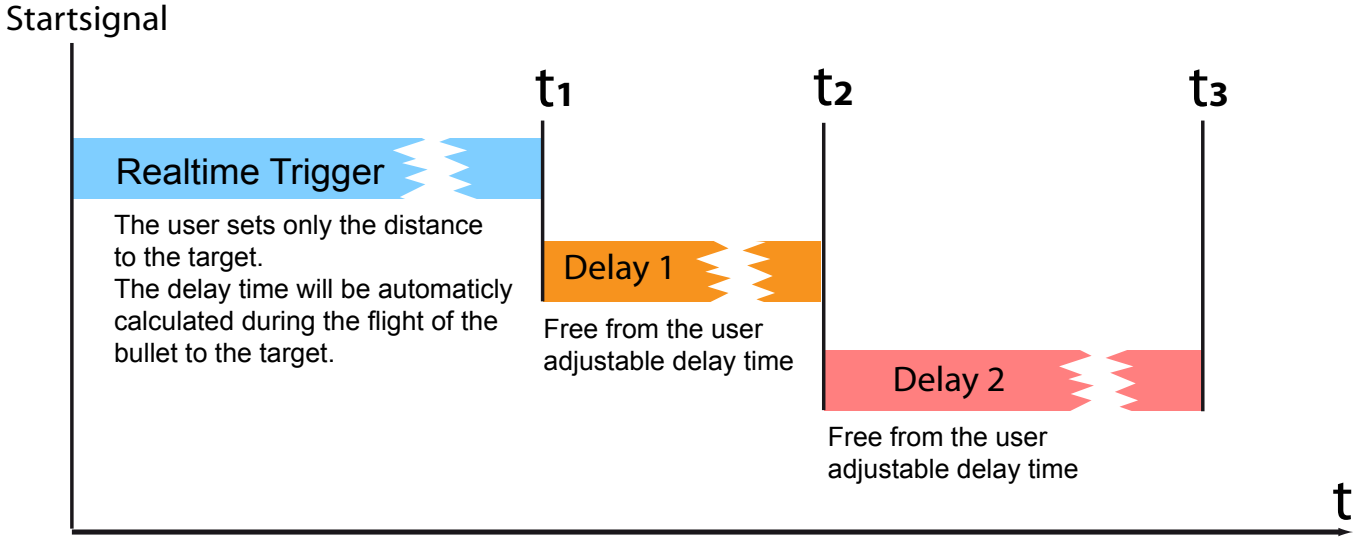
Real Time Trigger System:
The ultimate tool for high speed photography

The R eal T ime T rigger S ystems are specially developed to photograph very fast and free flying objects precisely. The RTTS makes the very exact synchronisation of measurement units (e.g. Oszilloscopes), flashes and/or cameras in realtime to free flying objects, like bullets, possible.

Function:

Sequential delay times.

1 Realtime Trigger,
2 independed adjustable sequential delay times



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Extremely simple in use, highly precise, reduction of cost and friendly to your nerves. **100% hit rate** ...

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The RTTS are used in ballistics, criminology, defense technology, aircraft construction, material test, security, physical experiments and many other fields.

General technical data RTTS

* H ighly precise speed measurement with 40 MHz resolution.
* Speed measurements from about 10 m/s upwards.
* Measurement of the PC and software response and CPU time during every measurement.
* Highly precise triggering of any projectiles with any rates to almost any distances. Even projectiles with projectile rates fluctuating very strongly are triggered very precisely.

That the cameraflash is triggered on the just fired, speed measured, and at that time on target flying bullet. It is guaranteed that the trigger is always done with extreme precision.

Technical data RTTS V1.02:

* Up to three independent flash units or cameras can be connected to the RTTS V1.02.
* A main trigger calculated in real time! You only enter the trigger distance in the computer. The software calculates the trigger time from the measured speed and then programmes it automatically to the PC-card. So you have the guarantee that the point of trigger is very exact, because the trigger output is a result of projectiles speed, measured just before.
* Two Slavetriggeroutputs are available. The highly precise slavetrigger times e.g. allow the photographic determination of the speed from splinters or the exit velocity of medias or similar things under fire.
* All triggertimes are digital preselectable with 1 microsecond resolution.

There are many possibilities for photographing projectiles. In order to show you the advantages of the RTTS, in the following section we would like to explain to you some different kinds of triggers used most frequently.

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(1) Triggering by manual delay period adjustment:

This is surely the most used Triggermethod. After the velocity of a projectile was determined with a velocity measuring system, normally the delay period must be adjusted to the trigger system manually. Triggering itself occurs through one of the two measuring light screens or with a photosensor as in Pos(1). At the end of the delay period, the flash is triggered.

System-dependently these are some disadvantages
Parly, there are considerable differences of triggerpoints caused by using one projectile for speed measurement and another for triggering since there may be a difference in projectiles speed, too. And so, sometimes, it's necessary to do several high-cost attempts until you receive an exact result. To achieve an exact triggerpoint is often a lucky hit because the speed of the projectile depends on the ammunition and on the weapon being used.
Please consider about the following table, this table illustrates very clear the real difference between triggering with the RTTS (4) and the manual Triggermethod (3). In contrast to the manual trigger delay setup, the RTTS triggers very reliably and precisely by automatic adaptation of the Triggerdelay to the measured speed.

(2) RTTS, trigger point calculated during projectiles flight.

The customer determines the desired trigger point before the measurement. According to the speed measurement, the RTTS calculates the trigger time for the projectile measured just like before. After that the calculated data is programmed into the hardware. At the expiration of the trigger time, the trigger will be activated hardware controlled.

Advantages

- Very flexible usage
- Very high accuracy of the trigger point.
- The triggerpoint is still calculated by the RTTS while the projectile flies to its target.
- The triggerpoint can be calculated linear within a short area up to 10 meters. (linear means: A fixed speed loss per meter has been automaticaly considered in the calculation of the trigger point). Even great variations in velocity are insignificant for the exact triggerposition in such a short distance.
- Triggering with exterior ballistic calculation is also possible for longer trigger distances, too.
- The maximum trigger distance in the case of a 1000 m/s projectile: To about 750 meters.
- The usually time for a complete calculation of triggerpoint with a PENTIUM 100 System will be about 12 mikrosekonds with linear calculations. A bullet with 1000m/s will move 12mm in this time.
- Through the very high efficiency of the RTTS system (can achieve a virtually 100 percent hit rate) the costs for ammunition, working time and material to be tested can be lowered drastically.
- With the very high accurancy of the RTTS system it is now possible to get an insight into very fast processes, e.g. the effect of projectiles can be shown exactly and reproduceable.
- Even photos in macro area, which require a very accurate positioning deriving from the high scale model, are no longer a problem by using the RTTS system.

Disadvantages

Please search for yourself, we can't find any.

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Table (1)

In the following table we want to show you optically the advantages of the RTTS.

1.
In the left column you see the pictures we captured with a SensiCam camera, triggerd with the RTTS.

2.
In the second column you will find the number of measurement. This numbers you will find also in the charts below the following table.

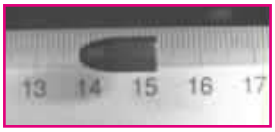
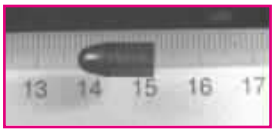
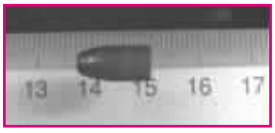
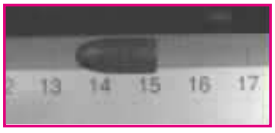
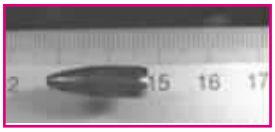
3.
The third column contains the, with the RTTS measured, speed of the shown bullet.

4.
In the fourth column shows the from the user adjusted triggerdistance and the from the RTTS for this shot calculated delay Time. Please note, how the delay time is changed by the different speeds.

5.
The fifth column contains the difference from the RTTS- to the manual kind of trigger, if you would work with the manual triggermethod.

6.
In column six you will find some comments to the shown pictures.

Please note, that with the manual trigger only two projectiles would be shown on the pictures. From one of them you would only see the base

Pictures triggered by RTTS	Nr.	V in m/s	Triggerpoint and trigger delay RTTS	Manual Triggerpoint	Comments for manual Triggering
	1	340,48	1,23 meter 3,619 mSek	1,230 meter 3,619 mSek +0,0 mm	Reference Setup for manual Trigger. First shot with manual trigger no picture.
	2	349,32	1,23 meter 3,527 mSek	1,262 meter +32mm	Bullet approx. 5mm outside the picture area.
	3	397,84	1,23 meter 3,096 mSek	1,437 meter +207mm	Bullet approx. 180mm outside the picture area.
	4	394,66	1,23 meter 3,121 mSek	1,426 meter +196mm	Bullet approx. 185mm outside the picture area.
	5	366,85	1,23 meter 3,358 mSek	1,325 meter +95mm	Bullet approx. 70mm outside the picture area
	6	389,85	1,23 meter 3,160 mSek	1,408 meter +178mm	Bullet approx. 152mm outside the picture area
	7	415,21	1,23 meter 2,967 mSek	1,500 meter +270mm	Bullet approx. 245mm outside the picture area
	8	343,36	1,23 meter 3,589 mSek	1,240 meter +10mm	You would see the bullet in the left picture area
	9	347,54	1,23 meter 3,545 mSek	1,256 meter +26mm	you would see the base of the bullet in the picture
	10	391,02	1,23 meter 3,151 mSek	1,413 meter +183mm	Bullet approx. 158mm outside the picture area
	11	834,24	1,23 meter 1,475 mSek	3,014 meter +1784mm	222 Rem. Magnum Bullet 1.759 meter outside the picture area.

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RTTS V1.02

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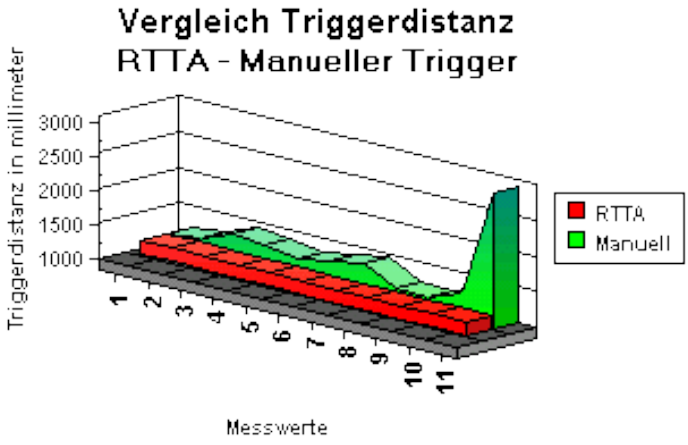
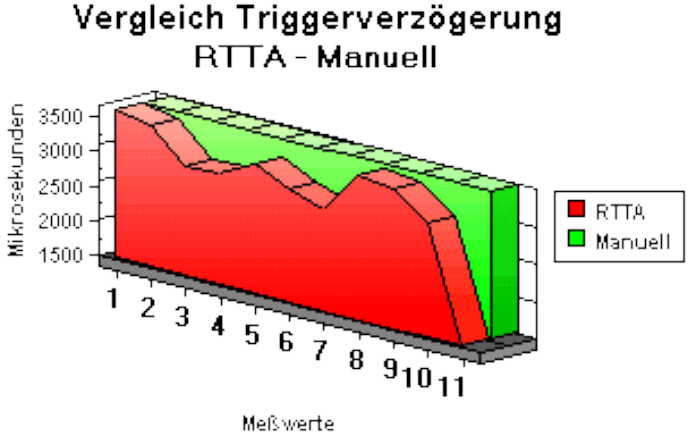
With the following two diagrams , we would like to represent the values of the table above again in a graphic chart. In the first chart, you see that the trigger position is kept very precisely from the RTTS (blue graph). The green graph shows, that the trigger position varies directly proportionally while manual triggering with the speed of the projectile. The user has to define, while manual triggering, a very big area around the projectiles of this series to see at all. Unfortunately, the user will see his point of interest very small. Details as in the pictures from table (1), are no more to be recognized.



At the second chart , the RTTS trigger delay is compared to the manual triggering. While manual triggering (yellow graph), the trigger delay in the case of all measured values the same. The RTTS (blue graph) adapt the trigger delay to the real speed of the right now measured bullet and set the trigger point in this way very precisely



Annotation to the ammunition shown in the table.

We received the used cartridgees .22 lfB in a plastic bag from a gunsmith. Neither make nor approximate speed values of the ammunition were known. (Normally a horrible scenario and immpossible to do with the manual system like pos. (1)). With the RTTS, we captured from the first shot the desired pictures. The picture no. 12 was also placed for the demonstration of the possibilities of the trigger system in this measuring series.

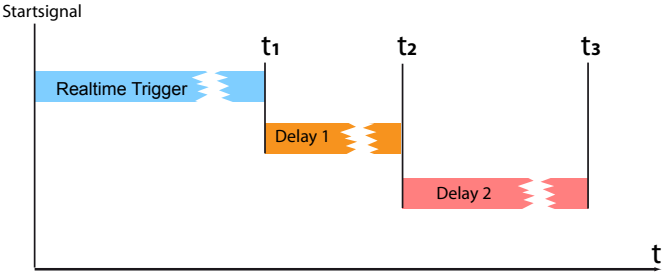
This measuring series was fired and photographed real.

Its not a Trick, ... it's Kurzzeitmesstechnik

Comparison between RTTS V1.02 and V1.03

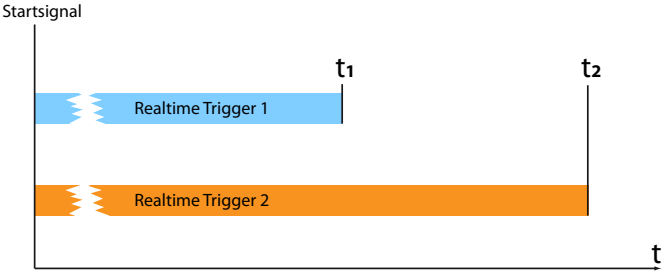
RTTS V 1.02

3 sequential trigger with one Real Time trigger and two following manual adjustable delay times.



RTTS V 1.03

2 parallel starting, independant Real Time trigger.



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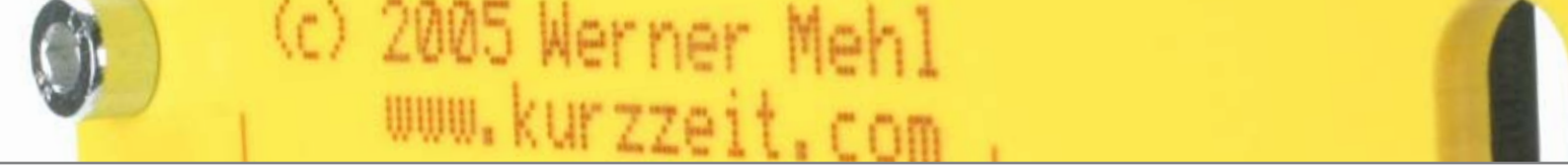

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