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HK shot counter

for small arms – digital AND battery-free

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Police Union

Heckler & Koch Bolt Motion Sensor System (BMSS)

Digital, battery-free shot counter for small arms – basis for logistics management, maintenance management and ammunition management

By Marc Roth[1]

While almost all fields of small arms and ammunition development and use are relatively high tech nowadays, the precise number of rounds fired by a particular weapon system – both with live rounds and movements of the bolt group/slide with non-live rounds — has always been a technical unknown. An automated or otherwise reliable recording of these figures was the great unfulfilled wish of procurement officers and users in law enforcement, but also of the weapons and ammunitions industry. The classic (purely weapon-related) logistical and contractual aspects have been recently overtaken by "ammunition management" as the main driver for the realisation of a digital shot counter. Recording the number of rounds fired by a weapon and generating raw data raises the question of how and to what extent this data is read out in the first step and, in the second, processed, entered into more complex systems and then further processed – all (in the age of SIGINT[2]) while guaranteeing IT security at all times.

This article is intended to spark discussion and therefore presents a basic outline of the problem, as well as conceptual considerations on the subject of "shot counters." The article also describes the Heckler & Koch BMSS in its current state of development. The BMSS is not yet a series product available on the market, which is why all technical details represent a snapshot of its development at present and are subject to change.

Photo: Vladislav, Adobe Stock

Weapons-related drivers: Addressing basic needs – maintenance intervals, spare parts stocking and service life status

In law enforcement, all handgun users and, above all, managers are faced with the problem of reliably planning maintenance and spare parts stocking when the quantitative and qualitative degree of use of the weapons often vary considerably and, above all, are often unknown – the larger the fleet of weapons, the greater the inevitable "inaccuracies" in the planning of logistics and resources.

As a logical consequence, this planning process, or at least partial aspects of it, often takes place somewhere between a rough estimate and a educated guess.

To nevertheless guarantee operational safety through adequate maintenance, many official users define fixed maintenance intervals, so that each weapon is inevitably checked frequently enough and critical small parts are replaced. Ideally, these maintenance intervals are based on the worst-case scenario for the individual weapons fired the most by the particular law enforcement authority. As testing small parts that may be subject to high levels of stress is likely to be time-consuming, disproportionate or difficult, "standard replacement parts" are often defined which – regardless of their condition – are replaced by new parts during predefined inspections without further examination.

The inevitable consequence is that some weapons are inspected and their parts replaced by maintenance staff on a regular basis even though they have neither fired a live round nor been used for "dry" training with non-live rounds since the last routine maintenance was carried out. This incurs costs for spare parts and the stocking of these as well as taking up maintenance resources without delivering any objective added value in terms of operations/safety for weapons used infrequently or not at all.

Another central aspect is the unknown service life status of a weapon or its individual parts, which is of practical relevance in many respects.

It is not known, for example, whether and when the weapon has reached or even exceeded the end of its service life. The fact that longer service lives are generally agreed for essential components and the weapon as a whole via the Technical Terms of Delivery and thus contractually between the public procurement authority[3] and the manufacturing industry than is the case for small and additional parts plays a role here. This is not only a question of occupational safety in the sense of operational safety on the part of the official user, but is also relevant in the contractual relationship under civil law between the public contracting authority and the manufacturing industry with regard to warranty claims and, in the worst-case scenario, liability claims.

When it comes to warranty claims in particular, there are always significant differences in technical assessments between the public contracting authority and the manufacturing industry concerning the number of rounds fired by individual weapons and whether these have reached or exceeded the end of their service life. Often, "example catalogues" including photos of wear marks at sensitive points of the weapon are used as an aid. These are sometimes even agreed on as part of the Technical Terms of Delivery or contract. However, experts on both sides know that such wear marks should be treated with caution and can often only serve as an indication of a specific total number of rounds fired. The reason for this is that if, for example, a weapon exhibits a permanently poor lubrication state at certain points, it can give the incorrect impression of an extremely high total number of rounds fired, although the end of the weapon's service life in terms of number of rounds fired is actually still a long way off. Conversely, with continuously good care, especially lubrication, the end of a weapon's service life contractually agreed upon may have long since been exceeded and the weapon may appear to only have had a moderate amount of use.

As a logical consequence, it can therefore be assumed that the "inaccuracies" in the predominantly visual assessment of the total number of rounds fired by individual weapons can inevitably go both ways: the manufacturing industry can – without knowing it – benefit from the fact that law enforcement users replace weapons too early, because suboptimal care/lubrication creates the visual impression of a high total number of rounds fired. On the other hand, the public contracting authority can benefit in some cases because the weapons, if well cared for, achieve significantly higher total numbers of rounds fired and can visually suggest a moderate amount of use at most.

Nevertheless, the latter scenario in particular must be viewed critically from a safety point of view, as the service life contractually agreed upon is based on the corresponding design and the verification of this by the manufacturing industry through endurance firing. Therefore, after reaching this maximum number of rounds, increased caution is advised at the very least, for example with regard to the onset of micro-hairline cracks, especially on highly stressed parts such as the breech face, ejection port or lugs, but also the barrel wear. In short: it is of course generally a good thing if a weapon lasts longer than agreed, but just as with vintage cars and older people, the amount of monitoring and care needed will increase. Therefore, reliable information about the end of a weapon's service life based on the number of rounds fired is of vital significance.

Weapons-based shooting logs or accompanying booklets are updated more often for precision rifles, but tend to be the exception rather than the rule for general armaments such as pistols, submachine guns and rifles. Experience has shown that in this context – with the exception of precision rifles – shooting logs or accompanying booklets are rarely updated consistently to document the total number of rounds fired by individual weapons, even if these are available and there is actually an official obligation to enter this information. Often, shooting logs are kept in a state ranging from "full of gaps" to "(almost) untouched," which, in the worst-case scenario, can cause more confusion than enlightenment in discussions regarding the remaining service life of the weapon in question, as the low number of rounds entered can be used as supposed "negative proof," at least formally, to argue that the weapon has fired a low total number of rounds.

Ammunition-related drivers: Ammunition "scandals" lend unexpected momentum to law enforcement's demand for digital shot counters.

For decades, demand for a shot counter only existed for the logistical reasons and reasons of preserving materials outlined above. Recently, however, so-called "ammunition scandals" have emerged in the military and police sectors, which have lent the demand for tamper-proof shot counters a hitherto unknown dynamism and intensity, both qualitatively and quantitatively, due to them being "addressed and processed" politically and in the media.

Ultimately, disciplinary and political decision-makers were left with the understandably uneasy feeling that it would be a nightmare scenario if lost ammunition from official stocks were used to commit crimes resulting in injury or death, or even terrorist attacks.

This led to the logical demand to set up an ammunition recording and consumption management system that is as complete and tamper-proof as possible and to establish this with law enforcement authorities as quickly as possible.

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[1] The author is a lawyer and publicly appointed and sworn expert on firearms, silencers and ammunition since 1848, and works as authorised signatory at Heckler & Koch GmbH in the roles of Vice President Product Strategy and Special Tasks. In his work, he has been advising Tier 1 military and police special forces, as well as intelligence agencies of various nations, for more than 20 years, and focused on US Special Forces in connection with the anti-terror operations in Afghanistan and Iraq between 2003 and 2013. Since 2008, the author has played a central role in the design and development of the "digital shot counter" BMSS and its peripheral equipment.

[2] "Signals Intelligence," the internationally established collective technical term for all types of detection of electronic signals, primarily by official authorities or intelligence agencies/law enforcement and on the battlefield. Signals intelligence is the act of intelligence-gathering by interception of electromagnetic signals, both with communications content (communication intelligence – COMINT) and without communications content (electronic intelligence – ELINT). The term electronic intelligence also includes Foreign Instrumentation Signals Intelligence (FISINT) and Measurement and Signature Intelligence (MASINT). SIGINT used to be primarily concerned with radiotelephony, but today it covers practically all types of detectable acoustic and electronic waves.

[3] Public procurement authority as the official user of the weapon system

The BMSS[4] and its system components: bolt group/slide sensor installed on the weapon, BMS bolt group/slide, readout pen and a commercially available PC with commercially available software

The key components of the BMSS (Bolt Motion Sensor System): battery-operated Multipen readout device (1) – active "Request Part" and weapon with battery-free BMS module (2) – passive "Respond Part."

Photos: Heckler & Koch

Fig. 2: Any commercially available laptop capable of processing the read-out data is suitable as an optional component provided by the user; a direct EPR database connection would also be an option. The data could then be entered or migrated, for example, into SAP-based weapons management software.

Conceptual considerations for the requirements profile of a "shot counter"

In the past two decades especially, numerous attempts have been made to reliably record the firing of rounds and movements of the bolt group/slide. The collective (technical) term still colloquially used today is "shot counter." This covers a wide variety of technological approaches. Only a few of these will be briefly described here to give an impression of why the HK BMSS is technologically realised in the manner described below:

Acoustic shot counters are used primarily in the civilian sector. There are several reasons why these are generally not suitable for use in law enforcement: they require a battery and are equipped with a microphone. If they are mounted on the weapon as an attachment, they create a bulky contour in addition to extra weight. Because they can be installed and uninstalled and thus used on various weapons, they can be "tampered with," as the number of rounds registered cannot be assigned to a specific weapon with any degree of certainty. Another disadvantage is the recording reliability: if one or more other shooters fire their weapons near the microphone, external shots could then be recorded by the acoustic counter as the weapon's own rounds.

There are two other main groups of shot counters currently on the market:

Mechanical shot counters contain small parts by necessity, including small clock units. These can hardly have realistic prospects of functioning reliably with regard to law enforcement's environmental requirements or in extreme climates.

Electronic shot counters are the main category. These mainly consist of circuit boards built into, for example, standard AR15 grips. These can therefore be mounted or retrofitted to any lower receiver with a corresponding grip interface. But this is precisely where the double crux of this system approach lies: firstly, the grips along with the shot counters can be changed at any time between countless weapons of the same type or even different manufacturer models, which means that it is not possible to ensure a tamper-proof assignment of the number of rounds recorded to a specific weapon. Secondly, the lower receiver including shot counter can be exchanged as required by the user within the same weapon model – this can take place even without any intention of tampering, simply after field-stripping for cleaning and subsequent reassembly.

All battery-operated approaches have the disadvantage that batteries create additional weapon weight, are not 100% leak-proof, are climate dependent, pose a logistical supply risk and pose an aviation safety risk during transportation. Another disadvantage is that if the weapons are stored for long periods of time, it is often not possible to tell that the battery life has come to an end or when exactly this will happen. If the batteries run out, it is impossible to know how many shots were fired before the new battery was inserted and these are therefore missing from the overall recording. In the peripheral sector, there is a noticeable trend of "fancy" apps for smartphones being promoted along with shot counters to read out and process their data. It is difficult to imagine that most users in law enforcement will see any usefulness in these apps. In fact, there have been customer demonstrations by shot counter manufacturers in which the app seemed to be more important to the provider than the reliable recording of rounds or movements of the bolt group/slide. One could not help but get the impression that the app was significantly more advanced in places than the reliability of the shot counter itself.

IT security questions arise when it comes to reading out and processing the shot counter's raw data in general, and in particular with smartphone-based apps, among other things because relatively insecure Bluetooth technology is often used as a means of data transmission for reading out the data. During a customer presentation, one shot counter provider from a non-NATO and non-EU country even stated, when asked, that law enforcement users, when purchasing their system, must contractually commit to making all data generated by the fleet of weapons available to the shot counter manufacturer at all times. The data would be jointly owned by the shot counter manufacturer and would even be sent automatically from the weapons directly to the servers of the shot counter manufacturer at periodic intervals. Understandably, not all parties are entirely enthusiastic about this highly considerate "reinterpretation of the service concept."

Added to this is the fact that it is even possible to "conceal" weaknesses in the shot counter recording using apps configured in such a way or by making individual parameter adjustments.

From this brief summary, the following basic requirements for a shot counter system suitable for law enforcement can be conceptually derived:

1.) Ideally, the power supply should be battery-free and climate-stable[5], and should function under the same adverse conditions as the weapon and ammunition.

2.) The recording components (circuit board, inductor and magnets) must be installed as close as possible to the bolt group/slide and permanently installed in a main weapon component; only the upper receiver and the bolt head carrier are suitable.

3.) IT security issues must be examined and addressed just as consistently as the shot recording system itself from the outset. All recording components on the weapon must be passive. This means they must not generate an IT signature and the (logistically unavoidable) wireless transmission to the readout device must be limited to the absolute close range and be as secure as possible. Commercially available smartphones are therefore generally prohibited as a basis for use in law enforcement. Data transmission from the intermediate storage medium (the readout device) to the final storage medium (IT system/program of the law enforcement authority) should always be wired for security reasons.

4.) Weapons manufacturers are not IT manufacturers and law enforcement authorities generally use complex IT applications to process shot counter data, which in this context merely represents one (important) information component for the purpose of synchronisation with, for example, ammunition management, spare parts management and maintenance management. Therefore, the weapons manufacturer must offer a system that generates data records that are as simple as possible in the most IT-compatible file formats.

Fig. 3 and 4: HK416RC (top) and HK437RC (below) with BMS module visible on the left-hand side of each upper receiver.

Photos: Heckler & Koch

[4] *Heckler & Koch "Bolt Motion Sensor System" was deliberately chosen as the product name because the HK system not only senses and documents shot-induced movements of the bolt group/slide, but most types of manual movements*

[5] *Ideally, climate zone in accordance with STANAG 2895 to -46°(C2) /to +63°(A2)*

Fig. 5 and 6: Detailed view of HK416RC and HK437RC with BMS module. As can be clearly seen, this only has a slight geometric impact on the weapon and can therefore be easily retrofitted onto existing user weapons without negatively affecting the weapon handling properties. The small recess in the BMS module labelled "NFC"[6] is also clearly visible. This is used for faster positioning of the Multipen by feel to carry out the readout process. User tests showed that inexperienced users often had to spend too long moving the BMS sensor back and forth until they finally received the vibration signal to indicate a successful readout process. For some test subjects, this led to a 5- to 10-fold loss of time per readout process plus the time lost because the unsure user had to constantly stare at the display to make sure that the weapon data had been successful read out. Extrapolated to fleets of weapons stored, for example, in depot shelves and racks in their thousands or tens of thousands, this could lead to an avoidable loss of recording time of weeks or months in extreme cases.

Photos: Heckler & Koch

Fig. 7: The component BMS module installed on the weapon. The circuit board and inductor are moulded into the module. The module is mechanically attached and sealed in such a way that any physical manipulation is immediately visible. The BMS is passive, i.e. it does not send any signals unless it is "woken up" and prompted by the Multipen readout device in the immediate vicinity. The BMS therefore does not generate a tactically relevant electronic signature that would, for example, enable the enemy to locate the weapon (and thus generally also the user or the weapon storage sites or depots) from a distance. Against this background, Near Field Communication (NFC) was deliberately chosen as the transmission technology. As the name suggests, this only works in absolute close range. Specifically, the maximum distance between the BMS and Multipen for the components to communicate is a few centimetres. (See information box at the top of page 1)

[6] *Stands for "Near Field Communication," the transmission technology used. This is also known from every commercially available smartphone and is often briefly shown in car displays.*

[7] *For example, due to the well-known phenomenon of users "tinkering" with their weapons out of boredom or to subconsciously relieve stress during breaks, while on guard duty or on long journeys, often with multi-functional tools or similar.*

Photos: Heckler & Koch

Advantages of NFC technology at a glance:

- **Limited communication and data transmission range**
- **Restriction of data transmission volume and speed**
- **Low energy requirement**
- **Use of a passive system (shot counter) possible**
- **Restriction of the frequency range**

Fig. 8 and 9: The BMS bolt group/slide component (using the HK416/417 and HK433/437 series as an example) installed on the weapon. The four magnetic cylinders that pass through the inductor of the BMS module installed on the receiver during each movement of the bolt group/slide are clearly visible.

Fig. 10: Multipen display – the "welcome screen." After switching on, the following are displayed: region code (1), Multipen hardware version (2), Heckler & Koch logo (3) and the software version currently installed (4). Users can switch between screen views by pressing a button on the Multipen.

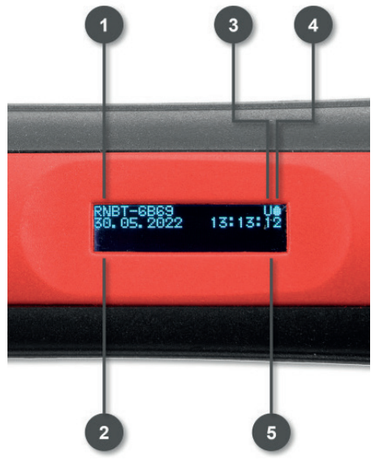


Fig. 11: The start screen displays: the Multipen "device name" in the form of an alphanumeric identifier (1), the date (2), the UID memory (3), the current battery charge status (4) and the time (5). The time must be programmed manually (as intended by the concept) (see below). For international operations in varying time zones, it is advisable to leave the "home time" unchanged once programmed, as this can always serve as a reference and the readout time can always be documented and, if necessary, recalculated or reconstructed for the relevant time zone based on the home time. As the Multipen deliberately does not receive or transmit any GPS signals to avoid the risk of an electronically detectable signature[8], no connection can be established between the programmed time and the readout location, and no local "radio-controlled time" can be received. This means that if, for example, the exact readout time is relevant as part of an investigation into the time/period in which rounds were fired or ammunition consumed, the time zone of the location of the weapon and pen must be manually compared subsequently with the programmed "permanent" home time zone, or reconstructed using IT forensics.

[8] *The only exception is the NFC or absolute close range when the weapon is read out (see above).*

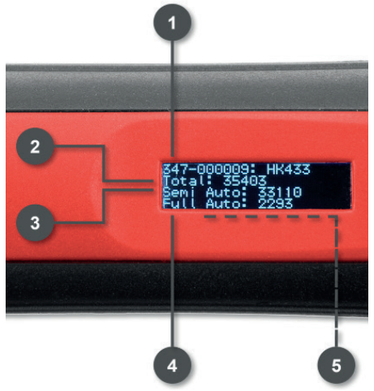


Fig. 12: After the readout process, the following is displayed: the serial number starting with the HK weapon code for the model, followed by the individual number for the weapon and the model name (1), the total number of all fired rounds recorded (2), broken down into the number of movements of the bolt group/slide caused by single fire (3), sustained fire (4), followed separately by the bolt group/slide releases from the rearmost bolt group/slide position (5)[9].

Fig. 13: The following can also be displayed: the battery charge status (1), the amount of internal Multipen memory used as a % (2) and the time remaining until the Multipen switches off automatically to save power (3).

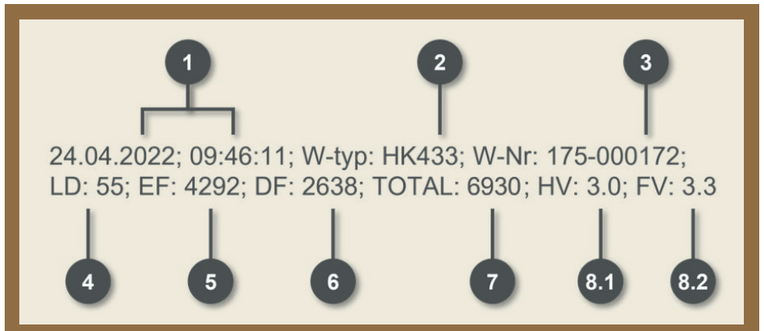


Fig. 14: Overview of all BMS manufacturer and sensor data generated in the weapon by means of BMS and read out via Multipen – readout time (date and time of the readout process) (1), weapon type "W-typ"(2), HK weapons code with serial number "W-Nr" (3), number of manual bolt group/slide releases "LD" (4), number of rounds fired in single fire "EF" (5), number of rounds fired in sustained fire "DF" (6), total number of rounds of all shot-induced movements of the bolt group/slide recorded "TOTAL" (7) and version of hardware "HV" (8.1) and firmware "FV" (8.2).

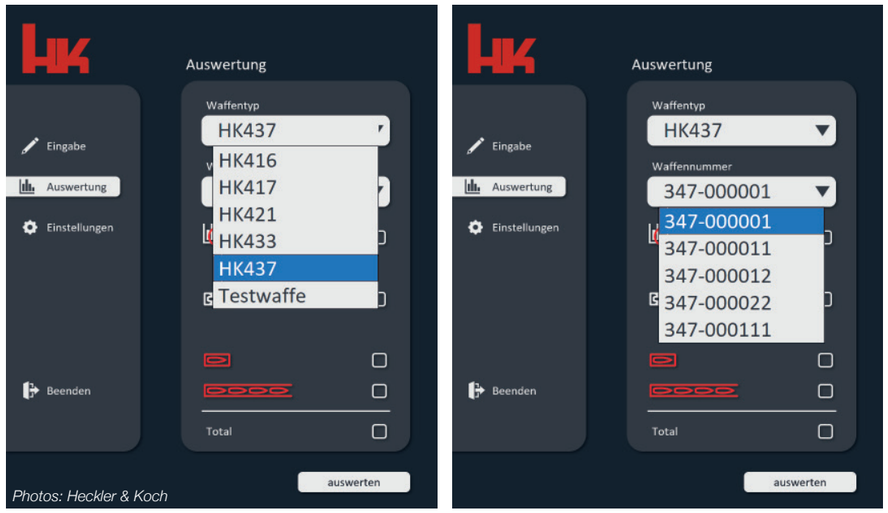
Photos: Heckler & Koch

Fig. 15: The readout process from the BMS installed on the weapon to the Multipen readout device is wireless. The Multipen is simply switched on and then positioned with its tip in the recess on the BMS, with or without physical contact. The Multipen vibrates, like a smartphone, to provide a haptic confirmation of a successful readout process. The on/off switch can be seen to the right of the display on the Multipen, the menu/view selection to the left and the readout button on the outside far left. The latter must be held down during the process until the device vibrates to confirm success – this prevents unintentional reading out, "in passing," so to speak.

[9] *Not visible in this picture; appears as an additional row in this display view after the button is pressed.*

Fig. 16: After the weapon BMS has been read out, the Multipen is connected to a laptop via USB cable; data transmission from the Multipen to the laptop is exclusively wired.

Fig. 17: Any commercially available laptop, for example, can be used to display the read-out data.



Photos: Heckler & Koch

Fig. 18 and 19: Once the cable connection is established between the Multipen and laptop, the weapon model (left) and then its serial number (right) are selected from a drop-down menu in HK's own display software. On the right, the boxes next to the pictograms can be clicked to display one, more than one or all three of the categories single fire, sustained fire and movements of the bolt group/slide with non-live rounds.

Fig. 20: Under the heading "Diagram," a combination can be displayed of a kind of fever chart showing the total number of movements of the bolt group/slide with the last (in this display five) readout processes with date and time (see footnote), as well as the numerical increases. In this view, between the vertical lines representing the readout times, the rounds fired between these times and movements of the bolt group/slide with non-live rounds are displayed as subtotals. To the left, under the heading "Analysis," the total number of rounds displayed below is shown broken down into the three categories mentioned, which are shown as pictograms for the safety/fire selection lever as on the receiver ("safe" corresponds to movements of the bolt group/slide with non-live rounds, single/sustained fire corresponds to the respective shot-induced movements of the bolt group/slide in the two fire selection modes).

Photos: Heckler & Koch

Fig. 21: In this alternative display form, fever charts that break down both the subtotals per load mode available at the respective readout time and the respective total number of rounds fired can also be visualised.

Output formats and options for processing BMS data – TXT files as a universal basis for, for example, SAP-supported law enforcement weapons and ammunition management applications

The BMS data is deliberately output in the simple and universally applicable TXT file format. The Excel-based HK display interface is currently primarily intended as a development tool, but has been very positively received by users in a number of demonstrations as it (more than) adequately serves many users' logistical and administrative "basic needs" regarding weapons management, and offers many practical advantages due to its simple and universal application on any commercially available laptop. For purely IT-related reasons, however, Excel will have to be replaced by a different application in the medium term, which means that Excel cannot be part of the BMSS series concept.

Entirely independently of this or building on this, it is possible to migrate the BMS TXT files directly into, for example, SAP applications or other complex management programs used by law enforcement. Ideally, the latter can ultimately bring together weapons and ammunition management and balance the total number of rounds fired by the weapons with the ammunition consumption and remaining ammunition stocks. As outlined above, holistic ammunition management or a fully transparent life cycle control starting from procurement, to person-related issuing, right through to person-related proof of consumption, has been the most recent driver of demand for the introduction of reliable shot counters on the part of law enforcement.

As far as these complex data processing programs are concerned, the weapon or shot counter provider and most law enforcement authorities have corresponding interests: based on expertise if nothing else, the weapons manufacturer is not in a position to provide such a complex IT service, nor can it be held legally liable for such a service, especially in terms of IT security. Reflecting this, larger law enforcement authorities have already developed such administration programs to a high degree of maturity in recent years, sometimes at great expense. These programs merely need to be filled with reliable shot count data. In addition to this, entirely understandably, law enforcement authorities generally have little interest in external (weapons) manufacturers having to be familiarised with their IT infrastructure to such a degree, for IT-security reasons alone.

Experience has shown that the basic need of law enforcement authorities that needs to be addressed by the manufacturing industry appears to be the reliable generation and (initial) migration of shot count data. The BMSS undoubtedly achieves this.

"HK Only" — BMS as future standard equipment for all new HK weapons and retrofitting solution for existing HK weapons – but not for competitors' weapons

The ideal condition for the use of a shot counter is for it to be installed on a new weapon before delivery. This means that all detectable movements of the bolt group/slide are recorded almost without exception; currently, a reliable recording rate of at least 95% can be assumed.

However, retrofitting existing weapons with an unknown previous number of rounds fired – including movements of the bolt group/slide with non-live rounds – with the BMS also makes perfect sense.

This is because, when the retrofitting is carried out, the weapon is reset to "zero" in multiple respects: with regard to the unknown previous number of rounds fired by the weapon, this helps in the assessment of the overall service life in view of the fact that most weapons achieve a significantly longer service life than contractually guaranteed. From the time of retrofitting, it can be said with certainty in this context that the weapon has fired at least the number of rounds recorded on the BMS and, accordingly, a measurable upper limit is set for the maximum remaining service life of the weapon in the best-case scenario – without this simultaneously lengthening the total service life contractually guaranteed by the weapons manufacturer via the Technical Terms of Delivery by "X," the unknown previous number of rounds fired.

Another advantage immediately offered by a retrofit scenario is that inspection times, inspection resources, spare parts procurement and the installation of standard replacement parts can be planned based on the number of rounds, and therefore precisely, from this point onwards. Ideally, the weapon should be fully inspected at the time of retrofitting with the BMS and brought to its ideal condition through the installation of any necessary spare parts, so that the hardware is reset to "zero" before the BMS starts counting.

Retrofitting with the BMS requires rework on the receiver[10], as well as on the bolt group/slide, or replacement of the bolt head carrier, which means that this can only be carried out by the weapons manufacturer for legal reasons[11]. The retrofitting of competitors' weapons with HK BMS components is ruled out for product liability reasons if nothing else.

HK patent protection for the BMSS – technically and geographically "comprehensive"

Due to its high degree of competitive relevance, the BMSS from Heckler & Koch is protected by numerous patent applications worldwide and therefore, as well as for product liability reasons[12], will neither be offered for retrofitting nor as original equipment for competitors' products.

Photos: Heckler & Koch

DE102015008382B4 Granted
Batterieloser Schusszähler
Application: 7 / Publication: 10

Publication Number	Publication Date	Legal Status	Application Number	Application Date
AT1127523T	15 May 2019	Granted	AT2016751165T	29 Jun 2016
DE102015008382A1	29 Dec 2016	Granted	DE102015008382	29 Jun 2015
DE102015008382B4	28 Mar 2019			
DE502016004471D1	16 May 2019	Granted	DE502016004471	29 Jun 2016
EP3140605A1	15 Mar 2017	Granted	EP2016751165	29 Jun 2016
EP3140605B1	01 May 2019			
HRP20191314T1	18 Oct 2019	Granted	HRP20191314T	22 Jul 2019
WO2017001054A1	05 Jan 2017	PCT-NP (Past time limit)	PCT/EP2016/001100	29 Jun 2016
US20180142978A1	24 May 2018	Granted	US15/858828	29 Dec 2017
US10415914B2	17 Sep 2019			

DE102021104517B4 Granted
Schusswaffenanalysevorrichtung
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Publication Number	Publication Date	Legal Status	Application Number	Application Date
CA3150174A1	25 Aug 2022	Examining	CA3150174	25 Feb 2022
DE102021104517A1	25 Aug 2022	Granted	DE102021104517	25 Feb 2021
DE102021104517B4	28 Sep 2023			
EP4050297A1	31 Aug 2022	Examining	EP2022158688	25 Feb 2022
JP2022130350A	06 Sep 2022	Examining	JP2022027511	25 Feb 2022
KR1020220121732A	01 Sep 2022	Published	KR1020220024189	24 Feb 2022
SG10202201910XA	28 Apr 2022	Examining	SG10202201910X	25 Feb 2022
US20220412684A1	29 Dec 2022	Granted	US17/681302	25 Feb 2022
US11802747B2	31 Oct 2023			

Fig. 22 and 23: Overview of the two existing patent protection families for the Heckler & Koch shot counter system "BMSS."

[10] *For handguns, foreseeable replacement of the grip*

[11] *Adaptation/replacement of essential parts triggers a legal obligation to undergo a proof-firing test.*

[12] *As outlined above, essential parts such as the bolt group/slide and receiver would have to be reworked or manufactured with HK BMS components; if restrictions on use or even property damage or bodily injury were to occur as a result, complex liability risks could arise in the legal triangle of law enforcement authority/HK/third-party provider, which are ultimately in none of the three parties' interest.*

Technical data[13] "Bolt Motion Sensor System" (BMSS)

Bolt Motion Sensor (BMS) – weapon

Weapons platforms generally suitable for BMS[14]	**Assault rifles and special weapons:** ■ HK416RC[15] (see G38/G95/ G95A1/G95KA1) ■ HK417RC (see G27/G27P/ G27k/G28) ■ HK433RC ■ HK437RC (see G39) **Machine guns:** ■ HK421RC
Energy supply of the bolt group/slide sensor BMS ("shot counter") installed on the receiver	Battery-free due to induction principle
Drop safety/climate stability of the BMS installed on the receiver and the BMS bolt group/slide	Corresponds with the guaranteed performance parameters of the weapon
Movements of the bolt group/slide recorded by the BMS	■ Single fire ■ Sustained fire ■ Forward movement of the bolt group/slide after manual release from rearmost bolt group/slide position
Reliability of recording detectable movements of the bolt group/slide	At least 90%[16]

BMSS readout device Multipen

Display type	OLED
Battery supply	NiMH (nickel-metal hybrid) battery[17]; permanently installed.
Maximum number of storable data records	250 data records[18] (corresponds to standard usage scenario[19] 250 weapons)
Data transmission from weapon-mounted BMS to Multipen readout device	Wireless via Near Field Communication (NFC) based on RFID protocols
Frequency range	LF (125-135 kHz) and HF (13.56 MHz); use of HF exclusively
Data transmission from Multipen readout device to laptop/ PC	Exclusively wired via commercially available USB cable
Battery capacity	Approx. 2,000 mAh
Battery life17	500 to 1,000 charge cycles
Readout processes per charge cycle	Approx. 1,000 data records
Battery standby time when fully charged	Up to 22 months
Battery charging method	Commercially available USB cable
Battery charging time when empty	Up to 20 hours; with approx. 100mA, which improves the service life in favour of charging speed
Temperature range function	-20°C to +60°C[20]
IP class	IP64
ICAO restrictions (aviation)	None (due to lack of lithium content); can be carried in hand luggage or checked in as standard luggage.
Other conformities	■ ISO/IEC 15693 ■ EU standard ATEX/IECEx (EU explosion protection directive) for use in Zones 1 / 2 (explosive gases), and Zones 21 / 22 (explosive dusts) ■ RoHs & REACH, CE

[13] *Subject to technical changes*

[14] *To date, primarily the weapons platforms HK433, HK416 and HK421 have been tested; there are currently no findings that would suggest that HK weapons models such as G36 and MG5 would not be suitable.*

[15] *RC stands for "Round Counter"*

[16] *During testing, assault rifles and machine guns regularly achieved reliable recording rates of over 95% across hundreds of thousands of live rounds, sometimes even under adverse environmental and usage conditions for the weapon platform concerned. Whether and to what extent such high recording rates of over 90% can be guaranteed under warranty law will be determined by law enforcement's use of the future series product in the years ahead.*

[17] *Alternative operation using commercially available replaceable batteries or with non-chargeable batteries is not possible (e.g. due to leakage risks or aviation safety risks; also see information in the table on ICAO restrictions)*

[18] *Once the maximum number of storable data records has been reached, it is still possible to read them out. However, the Multipen's memory then begins to overwrite the oldest data records.*

[19] *Per readout process, one data record is generated per weapon. This means that if the same weapon is read out multiple times, e.g. before and after shooting on a particular day, additional data records are generated per weapon accordingly.*

[20] *The readout device itself does not have to be carried when the weapon is used and therefore does not have to fulfil the same extreme performance requirements as the weapon.*

Contact for questions and suggestions from law enforcement authorities about the article:

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