



# Full Equipment Catalogue



CERTIFICATE NUMBER: 980010





The Nimbus Car Protection System comprises of a series of covertly-fitted pyrotechnic devices that are fired from within the vehicle. The system is designed to Distract, Disorientate and Deprive the aggressor and allow the VIP to escape in safety

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## Introduction

Established in 1972, MS Instruments specialise in the design and manufacture of live-fire training systems and ballistic instrumentation.

Over the years, MS Instruments has proved itself to be a leading innovator in the design and manufacture of ballistic measurement instrumentation and Live-Fire training equipment for ground and air training. Working with the expertise of Wiltshire Ballistic Services (WBS), part of our company group, MS Instruments provides proven, rugged and well-built products for most internal and external applications.

Our products are used by a number of manufacturing companies, governments and Armed Forces worldwide and once combined with our leading edge software, this instrumentation delivers flexible and individually tailored solutions.



Our equipment is designed to be of the highest accuracy, and because it is in constant use for trials at WBS, we are able to continuously test and develop our products. MS Instruments strives to be the world's leading expert on ballistic instrumentation. As a result, we have been approached to work on a number of specialised projects, a recent development being our covert vehicle protection system (NIMBUS). We are also asked for advice on much larger projects as well.

The MS Instruments Full Equipment Catalogue is split into seven capability areas, as detailed in the next section: 1) Live-Fire Ground Training 2) Air-to-Ground Strafe and Bomb-Scoring Systems 3) Nimbus Non-Lethal Vehicle Protection System 4) Ballistic Instrumentation and Range Design 5) Automated Flight Follower 6) Ballistic Testing 7) Forensic Testing. Many variations of the equipment are optioned; but if you have a specific requirement then let us know, as we try to be as flexible as possible.



MS Instruments – An Investors in People Award Winner

I sincerely hope you find something that interests you. If you require any further information, please check our website [www.msinstruments.co.uk](http://www.msinstruments.co.uk) where we have downloadable video-clips and more information about the company. Alternatively, please contact us directly by telephone or email, and we'll be delighted to discuss your professional needs further. Please remember, that we are a flagship company within the Ballistic ToolKit group of companies (details of which you will find at the back of this catalogue), so if we don't have quite the solution, we can approach the wider membership of that group and tailor any solution to your exact needs.

My best regards to you.

Paul Everington  
Managing Director  
MS Instruments



# The Seven Capability Sectors

## 1. LIVE-FIRE GROUND TRAINING

Live-Fire Ground Training is probably the most effective and safest way to prepare soldiers for the field.

Unlike other training system suppliers, we are trying to bring the training environment as close to reality as possible. By using real guns and real ammunition in a real environment, a training experience can be achieved that gives the trainee a chance to operate in a near-real situation and make real-time decisions.

We have this expertise, as we are one of the World's leading developers of ballistic instrumentation. Our equipment has been used by manufacturers and Government test establishments worldwide, for over 40 years, to check the performance of weapons and ammunition before they are brought into active use. A detailed insight into the complete firing system, including operator influences, gives us considerable skills in providing highly-effective training systems.

Initial training consists of basic weapon handling and identification as well as basic weapon training with the first priority of obtaining a consistent group of shots which can then be applied in different circumstances e.g. position, distance or nature of target.

The technologies supporting the training are highly flexible and can be adjusted to any scale and personalised to all customer needs. It consists of different components such as manual targets and pop-ups, slice, twist and swivel mechanisms, as well as field-firing equipment. Furthermore different targets can be chosen ranging from simple aiming marks, more "human shape" static targets to moving or even "fall-on-hit and bounce" targets in order to achieve different training goals.

With the help of the fully wireless controlled equipment, hits and missed shots are recorded and displayed either on a monitor at the firing point or on a central range controller.

As our automatic scoring systems are highly accurate, the position of missed shots is also known reliably, enabling instructors to identify clearly the shooter who has achieved tight grouping but requires more assistance with zeroing.

Not only is the system easy to handle and light enough to be carried by hand, it is still robust enough to be used in all kinds of environments.

It saves time and money, and helps to make training as realistic as possible whilst fulfilling the highest safety standards.

MS Instruments' Live-Fire Ground Training Systems help to make training more effective, and to enhance trainee motivation and training standards.

It takes training to the next level. Our versatile automatic marking systems are regularly used in portable roles, but have also been installed on fixed ranges for the Police and Army worldwide.



Battle Effects Simulator (BATES) Type 220-221

## 2. AIR-TO-GROUND STRAFE AND BOMB-SCORING SYSTEMS

The equipment has been designed for rapidly training and assessing the performance of a pilot in air-to-ground gunnery and bombing.

Pilots get the opportunity to aim and fire at visible targets, with shots that hit and miss the target being measured automatically with high accuracy. The individual shot coordinates of multiple pilots can also be measured and displayed immediately and be used for relaying the score to the pilot.

The measuring area is highly adaptable with a size of up to 400m<sup>2</sup> and all results and information, such as aircraft type, fowls or store and attack profile can be easily monitored and recorded. Also the fact that the system is easy to set up and to handle, and may even be controlled by a portable PC, makes training not only less complicated but also more effective and less costly. All the data can then readily be combined into daily and monthly statistical reports.

Results can also be transmitted to the operational base for after-action review if required.

By undertaking live training in the real outdoor environment, the pilots are also subjected to environmental factors such as wind/weather and straining their eyes to the sun that they would not be aware of when training using a simulator. This system therefore not only helps to take experienced pilots a step further, but also helps student pilots to be prepared for a real life situation.

Due to long term feedback of different Air Forces such as the UK RAF, who have used our systems on their training ranges for over 20 years, we can be sure that the Air-to-Ground Strafe and bomb-scoring systems help to train pilots more efficiently and improve their skills more effectively. Moreover, these systems have since been procured by other Air Forces in Europe, Middle and Far East and South America due to its versatility and rugged design.



Strafe and Gunnery Target Type 590

### 3. NIMBUS NON-LETHAL VEHICLE PROTECTION SYSTEM

People often talk about bullet- proof cars, however such vehicles exist only in the movies.

In a response to attacks and kidnapping of westerners in Iraq and Afghanistan, MSI developed a solution: NIMBUS. The system provides immediate counter measures by using smoke, sound and airburst to distract and disorientate attackers, depriving them of the initiative and thus giving the edge back to the inhabitants of the vehicle. Furthermore the car disappears from view so attackers can only spray the area with random fire, which decreases the chance of getting hit or shot through any existing armoury protection.

Various different pyrotechnic units are used to Distract and Disorientate the attacker, as well as Deprive them of the initiative.

Sound units are twice the decibel level of usual stun grenades and smoke spreads over a wide area within seconds.

Easily fitted to any car, the NIMBUS vehicle protection system consists of a series of covertly fitted pyrotechnic devices that are deployed from within the car with a touch of the button. The system is designed to work as simply as possible, as the driver has little time to think in an emergency. NIMBUS also does not have any negative impact on the function of vehicle and is, most importantly, a non-lethal deterrent.

Nimbus can also include an optional tracking system that can alert base within seconds, anywhere in the world, when Nimbus has been deployed.

The System was developed with the help of close-protection personnel that have experienced situations where they would have liked to have a unique system such as the NIMBUS in order get out of the danger zone as quickly and safely as possible.

Their experiences, as well as the long development process and reports of already existing customers, assures us that NIMBUS can make the difference, and will help to save lives.



NIMBUS non-lethal vehicle protection system

#### **4. BALLISTIC INSTRUMENTATION AND RANGE DESIGN**

We produce a wide range of highly-accurate instrumentation for testing weapons, ammunition and ballistic materials.

Many of the world's weapons and ammunition manufacturers use our equipment or test range, and we also supply Government test establishments and armed forces with the necessary systems for evaluating equipment prior to being brought into service.



Simple and Versatile Equipment

## 5. AUTOMATED FLIGHT FOLLOWER

The flight follower was designed for product development and testing, whilst meeting the high-speed imaging needs for modern ammunition designers. The fully automated flight follower system can follow and film supersonic projectile from the moment it leaves the barrel of the gun. All medium and large calibre projectiles as well as rockets can be recorded for 100 metres or more horizontal and angled firing.

Even projectiles travelling at more than 1700 miles/hour can be recorded; pin sharp enough to actually see the shockwaves produced by the projectile, as well as being able to clearly read the markings on the projectile.

The System can ensure better than 0.1% tracking accuracy and offers an over 90° scan as well as a mid-flight update for impact analysis. The flight follower will reduce time and costs of development and testing as it is able to identify problems quickly and easily and therefore avoid costly rounds of trial and error. The Flight Follower has been demonstrated and supplied to government test and development centres and research institutions all over the United States already and is has been highly appreciated due the results it helps to create.

The recent development of a mini flight follower is bringing the technology within reach of all test establishments.



Flight Follower allows the user to analyse a projectile in flight



## 6. BALLISTIC TESTING

With the help of MS Instruments equipment, any projectile can be tested, from the moment of firing to the moment of impact. However, we also have our own independent test facility that, enables us to test different aspects such as velocity, rate of fire, pressure or accuracy. These can be observed either during the day, at night, in controlled laboratory conditions or in the field where also the impact of weather and other environmental conditions can be taken into account. Moreover tests can be carried out on projectile-resistant materials and many other different types of kinds of ballistic resistant items.

With Wiltshire Ballistic Services being owned by the same group, we have access to our own live fire test facility which is the only such range in the UK quality and MoD approved to the highest national and international standards.

With vast experience and excellence in our work, our ballistic testing gives essential support to designers when developing outstanding products. It will also make the development process cheaper, faster and more effective.

Our Test Range in the UK is used by UK government and overseas customers for development and testing, to enhance the product and its saleability. All testing on our range is done using MS Instruments ballistic instrumentation, which is also used to provide training for UK and overseas customers.



Our Test Range in the UK is used by UK government and overseas customers for development and testing

## 7. FORENSIC TESTING

MS Instruments equipment can be used for forensic investigations to identify weapon or ammunition performance in forensic cases.

Our equipment can also be used to train officers in recognising shot patterns. We record the behaviour of the bullet on impact and its behaviour travelling through or inside the target. Due to many years of experience we can provide any support you need, or even do the testing for you.

Via ballistic gel analysis, the effect of a projectile on the body can be observed which then can be easily analysed with the provided software in order to obtain accurate analytical results.

We can provide velocity and weapon identification systems as well as specialised equipment like the strawboard imager for understanding the characterisations of fragment size, energy and distribution.

Our Shotgun Scatter Analyser can be used to inform forensic scientists about the spread that may be seen from different weapon types and firing distances.

Our forensic equipment is already used by police forces and forensic establishments throughout the UK, as well as many in Asia and elsewhere worldwide, who on our equipment to present the highest accuracy data, for support in court cases.



Universal Weapon Rest Type 681-600

# CHAPTER ONE - LIVE-FIRE GROUND TRAINING

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# 10A CHARGER

## TYPE 210



### HARDWARE/SOFTWARE

- Three modes: constant current, timed constant voltage, and continuous float.
- Three-Colour LED shows charge status.
- Low-leakage current allows the unit to be connected without mains input.

### 10A CHARGER TYPE 210

This is a highly efficient 3 stage charger for use with lead acid batteries.

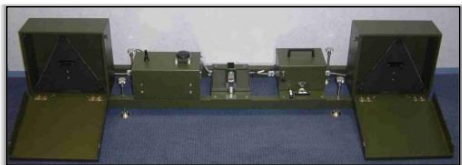
The three modes of operation give an optimized charging process and permit the charger to be left connected indefinitely. The unit, which is reverse-polarity and short circuit protected, has a high current rating. This ensures that this charger is available for the maximum amount of time.

## OPTIMIZED CHARGING PROCESS

### SPECIFICATION

HARDWARE	
Indicator	Multi-coloured LED
POWER/COMMS	
Power	110V-230V AC (50Hz-60Hz)
Bulk Charge	10A Orange
Balancing	14.7 Yellow
Float (Ready/Standby)	13.7V Green
ENVIRONMENT	
Operating Temperature	-10°C - +40°C [14 °F - 104 °F]
DIMENSIONS	
L x W x H	54mm x 171mm x 184mm [2.1in x 6.7in x 7.2in]
Weight	1.7kg [3.7lbs]

### USED WITH



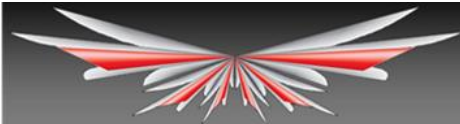
Acoustic Target Type 541



Optical Target Type 570



Strafe and Gunnery Target Type 590



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# BATTLE EFFECTS SIMULATOR (BATES) [NON-PYRO] TYPE 220-001



## BATTLE EFFECTS SIMULATOR (BATES) [NON-PYRO] TYPE 220-001

The MSI Non-Pyrotechnical Battles Effects Simulator realistically creates acoustical and visual battle effects for training purposes. BATES provides trainees and experiences shooters alike with a cost-effective and realistic training environment. The robust and weatherproof design ensures continuously reliable performance under difficult environmental conditions such as high snow and wind load.

The system operates as a standalone unit, and can also be interfaced with other targetry mechanisms. MSI design assures outstanding performance and usability, making BATES ideal for all training requirements.

## COST-EFFECTIVE AND REALISTIC

### HARDWARE

- **Acoustical impressions** of a tank, anti-tank weapon, or hostile fire weapon system.
- **Visual impression** of a hit or a kill is replicated by creating a cloud of smoke; several modes of discharge are available to suit the desired effect.
- **Impression of counter enemy fire** is created by discharging a loud main gun bang and gun smoke.
- **Smoke generated** by the system is a non-poisonous and non-pyrotechnical harmless fog to humans and the environment.
- **Control** is remote through the range control units.
- **Event triggers** based on engagement criteria.
- **No site preparation** is necessary or required to emplace the system, provided that the simulator is protected from direct fire and ricochets.
- **Location can be altered** without the need for infrastructure adaptations.

### SPECIFICATION

CONFIGURATIONS	
Installation	Fix-installed or Deployable
Power Supply	Hardwired or Battery-powered
Communication	Hardwired or Radio-controlled
Effects	Smoke, Sound
Sounds	Battle Tank Weapon & Anti-Tank Weapon
POWER	
Power	12 VDC or 110 VAC / 230 VAC, others on request
Power Supply	Hardwired, others on request
Max Output	70 dB to 130 dB at 1m
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	1000mm x 700mm x 440mm [39.4in x 27.6in x 17.3in]

### USED WITH



Location of Miss and Hit (LOMAH)  
Type 240 - 243



Stationary Advanced Target (SAT)  
Type 280 - 281



Stationary Infantry Target (SIT)  
Type 282 - 287



BATTLE EFFECTS  
SIMULATOR (BATES)  
TYPE 221-001



HARDWARE

- Various pyrotechnical cartridges provide battle effects similar to explosions, medium and large calibre gunfire, artillery, mortars, smoke, smoke signals, and star signals.
- Long lasting smoke effects in various colours are mainly used to simulate the hit on a hostile vehicle.
- Up to 25 cartridges in standard configuration, with other configurations available on request.
- Control is remote through range control units.
- Multiple BATES can be used in one location, as the system infrastructure has been built in a way that every unit can operate as a primary or as a secondary.
- No site preparation is necessary or required to emplace the system, provided that the simulator is protected from direct fire and ricochets.
- Location can be altered without the need for infrastructure adaptations.

BATTLE EFFECTS SIMULATOR (BATES) TYPE 221-001

The MSI Battle Effects Simulator (BATES) realistically creates the visual and acoustical impression of hostile fire and own hits on enemy targets.

BATES provides trainees and experienced shooters alike with a cost-effective and realistic training environment, and creates the stressful situations similar to the experience in battle. The robust and weatherproof design ensures continuously reliable performance under difficult environmental conditions such as high snow and wind load.

The system operates as a standalone unit, and can also be interfaced with other targetry mechanisms. MSI design assures outstanding performance and usability, making BATES ideal for all training requirements.

COST-EFFECTIVE AND REALISTIC

SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed or deployable
Power Supply	Hardwired or Battery-powered
Communication	Hardwired or Radio-controlled
Effects	Bang, Smoke, Star signals
Cartridges	L1a1, M20, M31 A1, DIFCUE
POWER	
Power	12 VDC or 110 VAC / 230 VAC
*Other voltages available on request	
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [13 °F – 161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W	350mm x 280mm [13.78in x 11.02in]

USED  
WITH



Location of Miss and Hit (LOMAH)  
Type 240 – 243



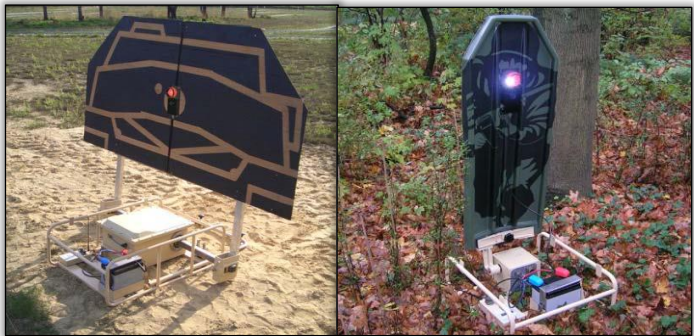
Stationary Armour Target (SAT)  
Type 280 – 281



Stationary Infantry Target (SIT)  
Type 282 - 287

# LASER ENGAGEMENT RECEIVER

## TYPE 222-001



### LASER ENGAGEMENT RECEIVER TYPE 222-001

The MSI Laser Engagement Receiver is a training sub-system providing realistic battlefield environment for soldiers involved in training exercises using eye safe lasers.

Laser transmitters are attached to each individual and vehicle weapon system, and accurately replicate actual ranges and lethality of the specific weapon systems. The receiver is an adapter to existing MSI targetry equipment, and has been developed to communicate and interact with laser engagement emitters such as MILES 2000, Saab BT 46, and alternative systems.

This system consists of a laser sensor unit (LSU) with a retro reflector and a laser decoder unit (LDU). According to the dimensions and armour of the equipped target various target templates can be chosen to allow appropriate reaction.

This versatile and realistic unit is a helpful addition to the range, bringing life-like precision to training scenarios.

### VERSATILE AND REALISTIC

#### THEORY OF OPERATION

- Individual information is transmitted in a laser beam and received by the Laser Engagement Receiver attached to a MSI target mechanism.
- Laser beam hits a detector, and the LDU records a kill or a near miss and its coordinates, depending on the type of weapon.
- MSI Laser Engagement Receivers are sensitive to the source of fire. For example, the laser beam simulating a soldier firing an M16 rifle will not register on a receiver mounted to a target silhouette of an armoured vehicle.

#### SPECIFICATION

POWER	
Power	9 – 36 VDC from Target Controller
Power Supply	Battery or Mains supply
Supported Systems	MILES 2000, OSAG Code (e.g. Saab BT 46), other instrumented laser target systems
ENVIRONMENT	
Operating Temperature	-20°C - +55°C [-4 °F - +131 °F]
Enclosure Type	IP 65
DIMENSIONS	
L x W x H (LSU)	235mm x 80mm x 80mm [9.25in x 3.15in x 3.15in]
L x W x H (LDU)	195mm x 120mm x 44mm [7.68in x 4.72in x 1.73in]

#### USED WITH



Battle Effects Simulator (BATES)  
Type 220 - 221



Stationary Armour Target (SAT)  
Type 280 – 281



Stationary Infantry Target (SIT)  
Type 282 – 287

# MUZZLE FLASH SIMULATOR

## TYPE 223-001



### MUZZLE FLASH SIMULATOR TYPE 223-001

The MSI Muzzle Simulator Type 223-001 is a target illumination device that realistically creates the visual effect of a firing weapon.

This versatile simulator not only imitates the retaliatory behaviour of targets, but can also be used to illuminate the target continuously to light up the silhouette at night. The adaptability of the simulator provides a heightened sense of reality to all situations, with one example being the event triggering, which discharges a light effect when desired, if an approaching unit fails to detect or engage enemy forces.

This robust and weatherproof design allows for long-lasting and consistent performance, making it a highly desirable component in any training scenario.

### LONG-LASTING AND CONSISTENT

#### HARDWARE

- Remote control is enabled once connected to the target lifter, allowing direct activation by the trainer.
- Event triggering based on engagement criteria enables a variety of training scenarios.
- Possible mounting includes direct mounting on a target lifter or, with a spike, plugging into loose ground in front of the lifter.
- Turning and swivelling of the simulator is possible.

#### SPECIFICATION

POWER/COMMS	
Power	Hardwired or Battery Powered
Wire	1m included
SUPPORTED EFFECTS	
Flash	Muzzle Flash
Illumination	White light, various colours available
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - 161.6 °F]
Enclosure Type	IP 68
DIMENSIONS	
Height x Diameter	320mm x 97mm [12.6in x 3.8in]

#### USED WITH



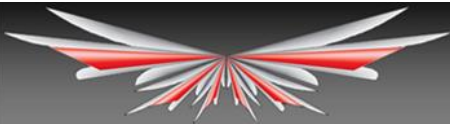
Battle Effects Simulator (BATES)  
Type 220-221



Location of Miss and Hit (LOMAH)  
Type 242 - 243



Stationary Infantry Target (SIT)  
Type 282 - 287



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# SOUND EFFECTS SIMULATOR

## TYPE 224-001

### SOUND EFFECTS SIMULATOR TYPE 224-001

The MSI Sound Effects Simulator (SES) Type 224-001 realistically creates the acoustical impression of battlefield effects. The system provides trainees and experienced shooters alike with a cost-effective and realistic training environment and creates the stressful situations similar to the experience in battle. SES is designed to play pre-corded sound files of 100 different sounds, though any user-desired sound can be implemented. This accommodating and robust device is easy to use and provides a smooth, tailored training environment.

### COST-EFFECTIVE AND REALISTIC

#### HARDWARE

- Sound files can be stored and/or modified utilizing a standard computer equipped with a Compact Flash Card (CFC).
- CFC comes pre-recorded upon shipment, installed inside a water and dust proof electronic unit.
- Any desired sound can be implemented by the vendor or by the user himself.
- Remotely controllable through the TACF/RCU.
- Stackable for safe transportation and storage.

#### SPECIFICATION

HARDWARE	
Power	Battery or Hardwired
Sounds	Pistol, Rifle, Machine Gun, Grande, User defined
Decodes	<ul style="list-style-type: none"><li>• MPEG 1 &amp; 2 audio layer III (MP3, CBR + VBR + ABR)</li><li>• WMA 4.0/4.1/7/8/9 all profiles (5-384kbit/s)</li><li>• WAV (PCM + IMA ADPCM)</li><li>• General MIDI / SP-MIDI files</li></ul>
Encodes	IMA ADPCM from microphone or line input
Streaming Support	MP3 and WAV
Max. Output	70 dB – 130 dB at 1m
ENVIRONMENT	
Operating Temperature	-25°C - +65°C [-13 °F - +149 °F]
DIMENSIONS	
L x W x H	752mm x 600mm x 248mm [29.6in x 23.62in x 9.76in]

#### USED WITH



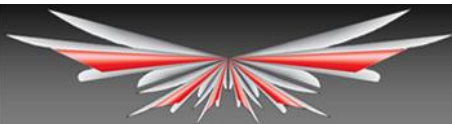
Battle Effects Simulator (BATES) Type 220 – 221



Muzzle Flash Simulator Type 223-001



Stationary Infantry Target (SIT) Type 282 - 287



## MS INSTRUMENTS Range Consultancy

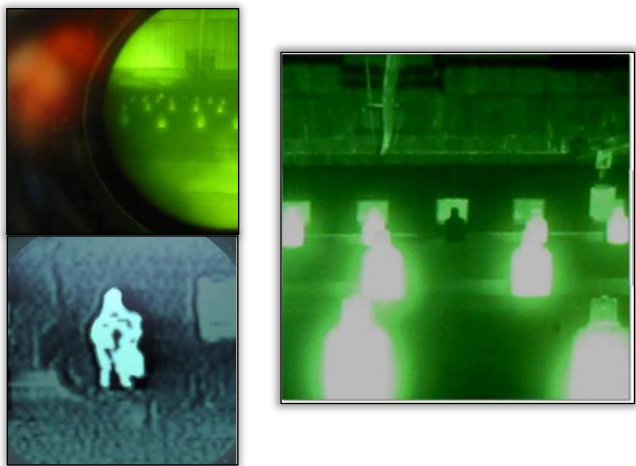
Precision, Expertise, Quality

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# THERMAL TARGET SYSTEM

## TYPE 225-001



### HARDWARE

- **Halogen spotlight** heats a target by emitting infrared light with short wavelengths between 780 and 1400 nm.
- **System is mounted** inside the target pit on a wall in front of the target.
- **Heater will be automatically activated** if a target is activated to rise.
- **Heater does not need to be preheated** as it reaches top temperatures immediately.
- **Maintenance free** system needs no service other than cleaning.

### THERMAL TARGET SYSTEM TYPE 225-001

The MSI Thermal Target System Type 225-001 is used to heat target silhouettes of infantry or armour targets. This realistically creates the visual effect of targets when viewed through a thermal night-vision device.

The outstanding feature of the halogen spotlight heater is mainly caused by the short-wave radiation that heats bodies and objects directly, with minimal heating of the ambient air.

Due to its design, the system can be used in outdoor environments in any weather condition, enabling target use whenever it is required.

## HALOGEN SPOTLIGHT HEATER

### SPECIFICATION

HARDWARE	
Power (Infantry Target)	800W
Power (Armour Target)	2000/w
Power Steps	16 adjustable power steps
Voltage	220 – 240 VAC (50Hz)
Wavelength	Infrared
Control	Protocol-based from target
Interface	1x Power, 1x Data
ENVIRONMENT	
Enclosure Type	IP 65
DIMENSIONS	
Size	Up to 6m <sup>2</sup>
Weight	5kg [11.0lbs]

### USED WITH



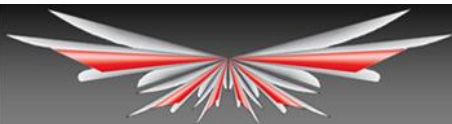
Sound Effects Simulator Type 224-001



Stationary Armour Target (SAT) Type 280 - 281



Stationary Infantry Target (SIT) type 282 - 287



## MS INSTRUMENTS Range Consultancy

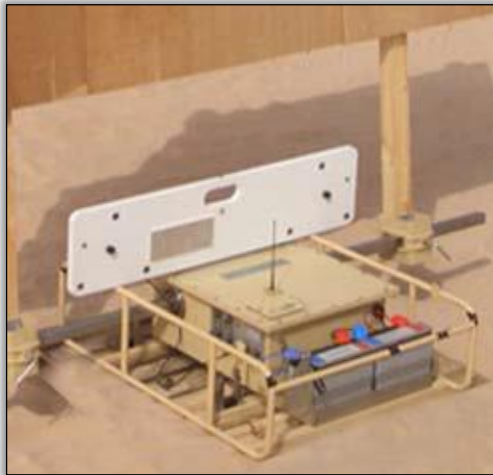
Precision, Expertise, Quality

- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards





# LOCATION OF MISS AND HIT (LOMAH) [STANDARD ARMOUR] TYPE 240-001



## LOCATION OF MISS AND HIT (LOMAH) - STANDARD ARMOUR TYPE 240-001

The LOMAH system is a training and zeroing system for precision shooting ranges. It provides immediate performance feedback for supersonic ammunition and specifies the positions of shots with exceptional accuracy.

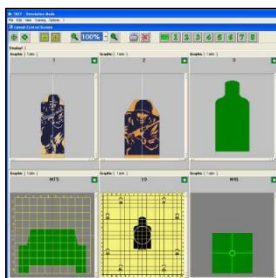
It is designed to register the location of hits on a target location or near misses beside the target.

The MSI LOMAH system can be installed on existing targets, and enables interaction with a target mechanism. The system is powered through the target appliance to which it is connected. Simultaneously robust and sleek, LOMAH is designed to save time and effort with efficient and safe scoring.

## ROBUST AND SLEEK

### Long-lasting and Robust Operation:

- Finest materials.
- Outstanding performance.
- Usable in difficult environmental conditions.

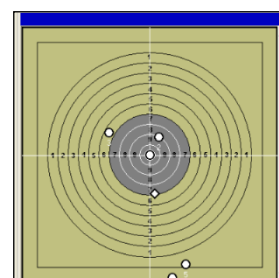


### Efficient and Safe Scoring:

- Eliminates data loss
- Reduces errors.
- Automated information retrieval.

### Time and Effort Saving:

- Trouble free functionality.
- Reduced required access to target area.
- Immediate performance feedback



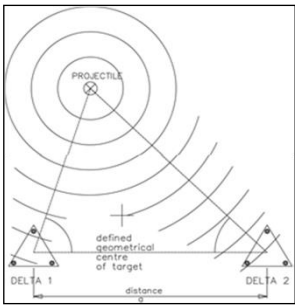
HARDWARE

- Automatic Scoring System reduces errors made by manual measurement and analysis of shots, omits the need for repeated access to the target area for information, and eliminates data loss from identically placed rounds.
- Hit registration is achieved by a registration unit in the target area installed in front of the target unit. Both units are protected against direct hits by a respective cover.
- Calculated position of the shot is transmitted to the range control (desktop, handheld controller, and shooter’s monitor).

SOFTWARE

- A Range Control System supplied by MSI controls LOMAH.
- Shots fired at the target system are displayed on the controller during firing, before the mean point of impact and extreme dispersion are recalculated.
- Registered hits or misses can be displayed graphically as well as in Cartesian coordinates in relation to the respective target silhouettes on the monitor of the central control console.

THEORY OF OPERATION



- Two Delta Sensor Arrays of the registration unit with three sensors each are installed close in front of the target and locate any projectile, passing with a speed of minimum Mach 1.3 by registering the supersonic shock wave.
- The projectile registration unit consists of the LOMAH sensor bar and the target electronics. The integrated software calculates the position of the projectile due to the sound wave of the projectile itself.
- Two groups of three sensors each are installed on the base plate (made from a special plastic material) by means of a sealant to ensure that only the supersonic shock wave that is coming through the air is registered.
- The sensors are installed in a triangular position with greatest accuracy, which is also true for the defined distance between the two arrays.

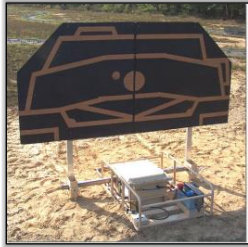
SPECIFICATION

CONFIGURATIONS	
Installation	Fix-installed in front of target device
Power Supply	Hardwired
Power	9 - 36 VDC from Target Controller
Communication	Hardwired
HIT SENSORING	
Type of Weapons	Machine Gun up to Main Battle Tank Gun
Projectile Velocity	At least 440 ms <sup>-1</sup> at the target
Hit Frequency	1200 rpm
Detecting Window (W x H)	15m x 7.5m [590.6in x 295.3in]
Calibre Type	Full Metal Jacket, Hollow Point 5.56mm to cal. 120mm
Supported Firing Modes	Single & Rapid Fire
Shooting Angle	<ul style="list-style-type: none"><li>Azimuth: ± 3°</li><li>Elevation: ± 5°</li></ul>
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Storage Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	1300mm x 68.5mm x 280mm [51.18in x 2.70in x 11.02in]
Weight	6.50kg [14.33lbs]

USED WITH



Mobile Tablet PC Type 274-001

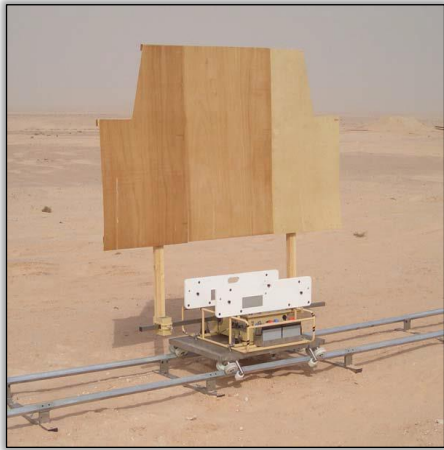


Stationary Advanced Target (SAT) Type 280 – Type 281



Shooters Monitor Type 292-001

# LOCATION OF MISS AND HIT (LOMAH) [ADVANCED ARMOUR] TYPE 241-001



## LOCATION OF MISS AND HIT (LOMAH) – ADVANCED ARMOUR TYPE 241-001

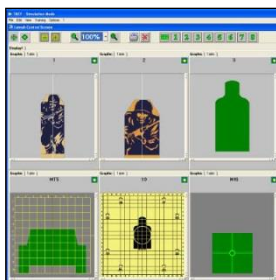
The Wide-Angle LOMAH system is a training and zeroing system for precision shooting ranges. It provides immediate performance feedback for supersonic ammunition and specifies the positions of shots with exceptional accuracy. It is designed to register the location of hits on a target location or near misses beside the target.

The MSI LOMAH system can be installed on existing targets, and enables interaction with a target mechanism. The system is powered through the target appliance to which it is connected. Simultaneously robust and sleek, LOMAH is designed to save time and effort with efficient and safe scoring.

## ROBUST AND SLEEK

### Long-lasting and Robust Operation:

- Finest materials.
- Outstanding, wide-angle performance.
- Usable in difficult environmental conditions.

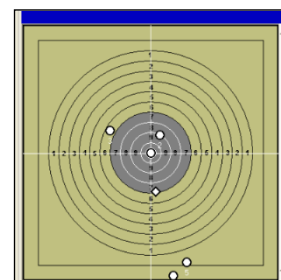


### Efficient and Safe Scoring:

- Eliminates data loss.
- Reduces errors.
- Automated information retrieval.

### Time and Effort Saving:

- Trouble free functionality.
- Reduced required access to target area.
- Immediate performance feedback.



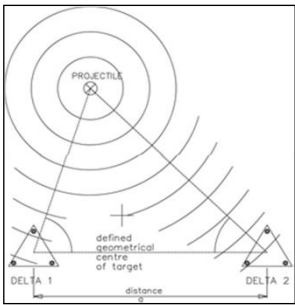
HARDWARE

- Automatic Scoring System reduces errors made by manual measurement and analysis of shots, omits the need for repeated access to the target area for information, and eliminates data loss from identically placed rounds.
- Hit registration is achieved by two registration units in the target area installed in front of the target unit. The use of two registration units enables a wide shooting angle up to 15 degrees. All units are protected against direct hits by a respective cover.
- Calculated position of the shot is transmitted to the range control (desktop, handheld controller, and shooter’s monitor).

SOFTWARE

- A Range Control System supplied by MSI controls LOMAH.
- Shots fired at the target system are displayed on the controller during firing, before the mean point of impact and extreme dispersion are recalculated.
- Registered hits or misses can be displayed graphically as well as in Cartesian coordinates in relation to the respective target silhouettes on the monitor of the central control console.

THEORY OF OPERATION



- Two Delta Sensor Arrays of the registration unit with three sensors each are installed close in front of the target and locate any projectile, passing with a speed of minimum Mach 1.3 by registering the supersonic shock wave.
- The projectile registration unit consists of the LOMAH sensor bar and the target electronics. The integrated software calculates the position of the projectile due to the sound wave of the projectile itself.
- Two groups of three sensors each are installed on the base plate (made from a special plastic material) by means of a sealant to ensure that only the supersonic shock wave that is coming through the air is registered.
- The sensors are installed in a triangular position with greatest accuracy, which is also true for the defined distance between the two arrays.

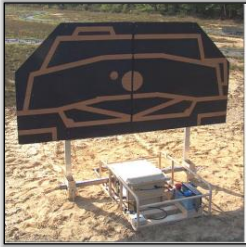
SPECIFICATION

CONFIGURATIONS	
Installation	2 fix-installed systems in front of target device
Power Supply	Hardwired
Power	9 - 36 VDC from Target Controller
Communication	Hardwired
HIT SENSING	
Type of Weapons	Machine Gun up to Main Battle Tank Gun
Projectile Velocity	At least 440 ms <sup>-1</sup> at the target
Hit Frequency	1200 rpm
Detecting Window (W x H)	3m x 2.5m [118.1in x 98.4in]
Calibre Type	Full Metal Jacket, Hollow Point 5.56mm to cal. 120mm
Supported Firing Modes	Single & Rapid Fire
Shooting Angle	<ul style="list-style-type: none"><li>Azimuth: ± 15°</li><li>Elevation: ± 5°</li></ul>
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Storage Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	1300mm x 68.5mm x 280mm [51.18in x 2.70in x 11.02in]
Weight	6.50kg [14.33lbs]

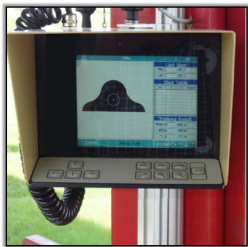
USED WITH



Mobile Tablet PC Type 274-001



Stationary Advanced Target (SIT) Type 280 – Type 281



Shooters Monitor Type 292-001



# LOCATION OF MISS AND HIT (LOMAH) [STANDARD INFANTRY] TYPE 242-001



## LOCATION OF MISS AND HIT (LOMAH) - STANDARD INFANTRY TYPE 242-001

The LOMAH system is a training and zeroing system for precision shooting ranges. It provides immediate performance feedback for supersonic ammunition and specifies the positions of shots with exceptional accuracy.

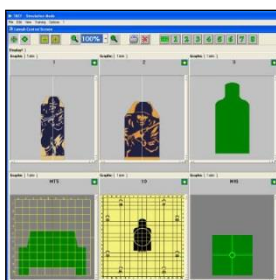
It is designed to register the location of hits on a target location or near misses beside the target.

The MSI LOMAH system can be installed on existing targets, and enables interaction with a target mechanism. The system is powered through the target appliance to which it is connected. Simultaneously robust and sleek, LOMAH is designed to save time and effort with efficient and safe scoring.

## ROBUST AND SLEEK

### Long-lasting and Robust Operation:

- Finest materials.
- Outstanding performance.
- Usable in difficult environmental conditions.



### Efficient and Safe Scoring:

- Eliminates data loss
- Reduces errors.
- Automated information retrieval.

### Time and Effort Saving:

- Trouble free functionality.
- Reduced required access to target area.
- Immediate performance feedback





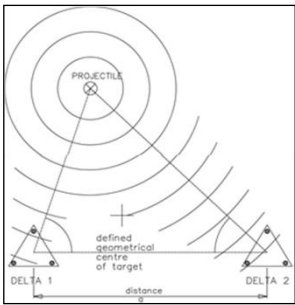
HARDWARE

- Automatic Scoring System reduces errors made by manual measurement and analysis of shots, omits the need for repeated access to the target area for information, and eliminates data loss from identically placed rounds.
- Hit registration is achieved by a registration unit in the target area installed in front of the target unit. Both units are protected against direct hits by a respective cover.
- Calculated position of the shot is transmitted to the range control (desktop, handheld controller, and shooter’s monitor).

SOFTWARE

- A Range Control System supplied by MSI controls LOMAH.
- Shots fired at the target system are displayed on the controller during firing, before the mean point of impact and extreme dispersion are recalculated.
- Registered hits or misses can be displayed graphically as well as in Cartesian coordinates in relation to the respective target silhouettes on the monitor of the central control console.

THEORY OF OPERATION



- Two Delta Sensor Arrays of the registration unit with three sensors each are installed close in front of the target and locate any projectile, passing with a speed of minimum Mach 1.3 by registering the supersonic shock wave.
- The projectile registration unit consists of the LOMAH sensor bar and the target electronics. The integrated software calculates the position of the projectile due to the sound wave of the projectile itself.
- Two groups of three sensors each are installed on the base plate (made from a special plastic material) by means of a sealant to ensure that only the supersonic shock wave that is coming through the air is registered.
- The sensors are installed in a triangular position with greatest accuracy, which is also true for the defined distance between the two arrays.

SPECIFICATION

CONFIGURATIONS	
Installation	Fix-installed in front of target device
Power Supply	Hardwired
Power	9 - 36 VDC from Target Controller
Communication	Hardwired
HIT SENSING	
Type of Weapons	<ul style="list-style-type: none"><li>• Rifle (Supersonic)</li><li>• Machine Gun</li></ul>
Projectile Velocity	At least 440 ms <sup>-1</sup> at the target
Hit Frequency	1200 rpm
Detecting Window (W x H)	3m x 2.5m [118.1in x 98.4in]
Calibre Type	Full Metal Jacket, Hollow Point 5.56mm to cal. 120mm
Supported Firing Modes	Single & Rapid Fire
Shooting Angle	<ul style="list-style-type: none"><li>• Azimuth: ± 3°</li><li>• Elevation: ± 5°</li></ul>
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Storage Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	760mm x 68.5mm x 165mm [29.92in x 2.70in x 6.5in]
Weight	4.30kg [9.48lbs]

USED WITH



Mobile Tablet PC Type 274-001



Stationary Infantry Target (SIT) Type 282 – Type 287



Shooters Monitor Type 292-001

## LOCATION OF MISS AND HIT (LOMAH) [ADVANCED INFANTRY] TYPE 243-001



### LOCATION OF MISS AND HIT (LOMAH) – ADVANCED INFANTRY TYPE 243-001

The 3D, Wide-Angle LOMAH system is a training and zeroing system for precision shooting ranges. It provides immediate performance feedback for supersonic ammunition and specifies the positions of shots with exceptional accuracy.

It is designed to register the location of hits on a target location or near misses beside the target.

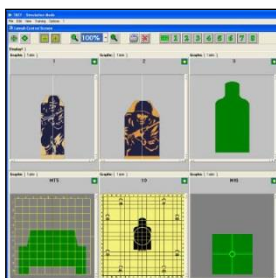
The MSI LOMAH system can be installed on existing targets, and enables interaction with a target mechanism. The system is powered through the target appliance to which it is connected.

Simultaneously robust and sleek, LOMAH is designed to save time and effort with efficient and safe scoring.

## ROBUST AND SLEEK

### Long-lasting and Robust Operation:

- Finest materials.
- Outstanding, wide-angle, 3D performance.
- Usable in difficult environmental conditions.



### Efficient and Safe Scoring:

- Eliminates data loss
- Reduces errors.
- Automated information retrieval.

### Time and Effort Saving:

- Trouble free functionality.
- Reduced required access to target area.
- Immediate performance feedback



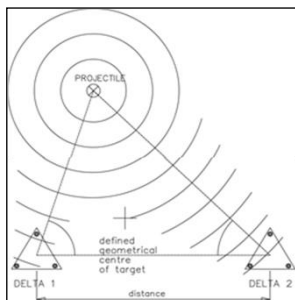
## HARDWARE

- **Automatic Scoring System** reduces errors made by manual measurement and analysis of shots, omits the need for repeated access to the target area for information, and eliminates data loss from identically placed rounds.
- **Hit registration** is achieved by two registration units in the target area installed in front of the target unit. All units are protected against direct hits by a respective cover.
- **Calculated position of the shot** is transmitted to the range control (desktop, handheld controller, and shooter's monitor).

## SOFTWARE

- **A Range Control System** supplied by MSI controls LOMAH.
- **Shots fired** at the target system are displayed on the controller during firing, before the mean point of impact and extreme dispersion are recalculated.
- **Registered hits or misses** can be displayed graphically as well as in Cartesian coordinates in relation to the respective target silhouettes on the monitor of the central control console.

## THEORY OF OPERATION



- The **registration unit** is installed close in front of the target and locate any projectile, passing with a speed of minimum Mach 1.3 by registering the supersonic shock wave.
- The **projectile registration unit** consists of the two LOMAH sensor bars and the target electronics. The integrated software calculates the position of the projectile due to the sound wave of the projectile itself.
- **3D LOMAH** uses **eight precision sensors** installed on the base plate (made from a special plastic material) by means of a sealant to ensure that only the supersonic shock wave that is coming through the air is registered.
- The **sensors are installed in a triangular position** with greatest accuracy, which is also true for the defined distance between the two arrays and the sensor bars.

## SPECIFICATION

CONFIGURATIONS	
Installation	Fix-installed/Portable
Power Supply	Hardwired/Battery-powered
Power	9 - 36 VDC from Target Controller
Communication	Hardwired via RS-232 interface or as required.
HIT SENSING	
Type of Weapons	<ul style="list-style-type: none"><li>• Rifle (Supersonic)</li><li>• Machine Gun</li></ul>
Projectile Velocity	At least 440 ms <sup>-1</sup> at the target
Hit Frequency	1200 rpm
Detecting Window (W x H)	3m x 2.5m [118.1in x 98.4in]
Calibre Type	Full Metal Jacket, Hollow Point 5.56mm to cal. 120mm
Supported Firing Modes	Single & Rapid Fire
Shooting Angle	<ul style="list-style-type: none"><li>• Azimuth: ± 30°</li><li>• Elevation: ± 10°</li></ul>
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Storage Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	760mm x 246mm x 172mm [29.92in x 9.68in x 6.77in]
Weight	7.40kg [16.31lbs]

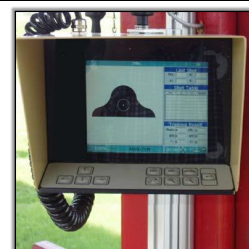
## USED WITH



Mobile Tablet PC Type 274-001



Stationary Infantry Target (SIT) Type 282 – Type 287



Shooters Monitor Type 292-001

# MOVING ARMOUR TARGET (PORTABLE POPUP)

## TYPE 250-601



### MOVING ARMOUR TARGET (PORTABLE POPUP) TYPE 250-601

The MSI Portable Popup Moving Armour Target is a multifunctional system that builds the awareness and responsiveness that is necessary in today's changing live-fire environment.

Since modern arms with computerized Gun Fire Control Systems require full size target silhouettes, this assembly is the

perfect choice for these types of live-fire engagements. With such a compact system that is so effortless to install, the rugged and durable characteristics are even more impressive than usual. Various target movements and speeds are possible, making the Moving Armour Target versatile as well as reliable. All of these features are accomplished with extraordinary energy efficiency and reliability, making it an essential component of any modern training facility.

## COMPACT AND DURABLE

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions



### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Minimal preparation time

### Time and Effort Saving:

- Trouble free functionality
- Modular concept
- Immediate performance feedback





HARDWARE

- **Modular concept** consists in its standard configuration of the drive unit and an armour target mechanism mounted on a rail-guided, cable-pulled target carriage.
- **Flexible construction** can accommodate curved set-up and elevation differences in the terrain.
- **Wind-resistant rail system** allows operation at high wind speeds without degradation or capsizing. Trouble free functionality is also guaranteed under difficult environmental conditions such as high snow.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Diversified scenarios** can be programmed to run, as the controller handles the operation of target appliances individually or in groups.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Docking station** provides the required network connection to the central control system and the connections to power / recharge the movers and associated equipment.
- **Power distribution** to all devices attached to, or located on, the mover carriage is provided by the moving target system.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a remote sensitivity adjustment to record hits of training ammunition.
- **Built-In-Test status identification**, an initial status information, and operational status feedback is provided to the central control console.
- **Audible warning indicator** signals impending movement. The devices have fail-safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power	As required
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	Up to 1200rpm
Firing Modes	Single / Burst
TARGET PRESENTATION	
Modes of Operation	Moving, Pop-up
Time to Expose*	5-7 s (adjustable)
Time to Retreat*	5-7 s (adjustable)
*May vary depending on customer requirements and target dimensions	
MOVING MECHANISM	
Speed	Up to 20kmph

Speed Control	Digital in stops of 1mph (or as required)
Track Length	Variable up to 300m
ENVIRONMENT	
Operating Temperature	-30°C - +72°C [-22 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H (Drive Unit)	1220mm x 1010mm x 520mm [48.0in x 39.8in x 20.5in]
L x W (Trolley)	1240mm x 1285mm [48.8in x 50.6in]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
- Muzzle Flash Simulator
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

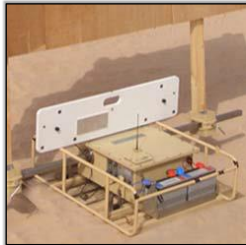
USED WITH



Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241

# MOVING ARMOUR TARGET (CABLE-PULLED POPUP) TYPE 250-602



## MOVING ARMOUR TARGET (CABLE-PULLED POPUP) TYPE 250-602

The MSI Portable Popup Moving Armour Target is a multifunctional system that builds the awareness and responsiveness that is necessary in today's changing live-fire environment.

Since modern arms with computerized Gun Fire Control Systems require full size target silhouettes, this assembly, with

the truck lifter system is the perfect choice for Tank and RPG training ranges. With such a compact system that is so effortless to install, the rugged and durable characteristics are even more impressive than usual. Various target movements and speeds are possible, making the Moving Armour Target versatile as well as reliable.

All of these features are accomplished with extraordinary energy efficiency and reliability, making it an essential component of any modern training facility.

## COMPACT AND DURABLE

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions



### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Minimal preparation time

### Time and Effort Saving:

- Trouble free functionality
- Modular concept
- Immediate performance feedback





HARDWARE

- **Modular concept** consists in its standard configuration of the drive unit and an armour target mechanism mounted on a rail-guided, cable-pulled target carriage.
- **Flexible construction** can accommodate curved set-up and elevation differences in the terrain.
- **Wind-resistant rail system** allows operation at high wind speeds without degradation or capsizing. Trouble free functionality is also guaranteed under difficult environmental conditions such as high snow.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Diversified scenarios** can be programmed to run, as the controller handles the operation of target appliances individually or in groups.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Docking station** provides the required network connection to the central control system and the connections to power / recharge the movers and associated equipment.
- **Power distribution** to all devices attached to, or located on, the mover carriage is provided by the moving target system.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a remote sensitivity adjustment to record hits of training ammunition.
- **Built-In-Test status identification**, an initial status information, and operational status feedback is provided to the central control console.
- **Audible warning indicator** signals impending movement. The devices have fail-safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power	24 V, others on request
Communication	Radio-controlled
HIT SENSING	
Hit Detection	Contact Hit Sensor
Hit Frequency	Up to 1200rpm
Firing Modes	Single / Burst
TARGET PRESENTATION	
Modes of Operation	Moving, Pop-up
Time to Expose*	5-7 s (adjustable)
Time to Retreat*	5-7 s (adjustable)
*May vary depending on customer requirements and target dimensions	
MOVING MECHANISM	
Speed	Up to 20kmph

Speed Control	Digital in steps in 1mph (or as required)
Track Length	Variable up to 300m
ENVIRONMENT	
Operating Temperature	-30°C - +72°C [-22 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H (Drive Unit)	1220mm x 1010mm x 520mm [48.0in x 39.8in x 20.5in]
L x W (Trolley)	1240mm x 1285mm [48.8in x 50.6in]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
- Muzzle Flash Simulator
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

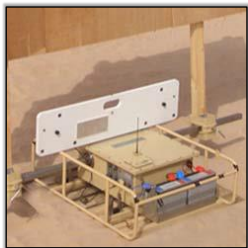
USED WITH



Battle Effects Simulator (BATES) Type 220-221



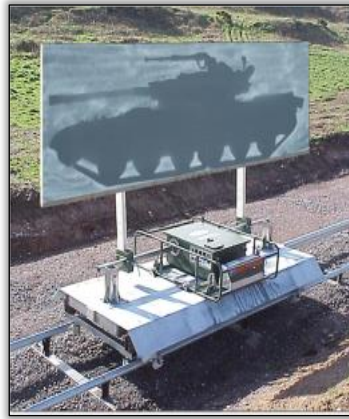
Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241

# MOVING ARMOUR TARGET (ADVANCED POPUP)

## TYPE 251-101



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### MOVING ARMOUR TARGET (ADVANCED POPUP) TYPE 251-101

The MSI Advanced Popup Moving Armour Target is a multifunctional system that builds the awareness and responsiveness that is necessary in today's changing live-fire environment.

Since modern arms with computerized Gun Fire Control Systems require full size target silhouettes, this assembly is the

perfect choice for these types of live-fire engagements. The rugged and durable characteristics of the system complement the advanced and powerful lifting mechanism. Various target movements and speeds are possible, whilst the system raises tank targets up to a 7m (23ft) x 3.5m (11.5ft), making the Moving Armour Target versatile as well as reliable.

All of these features are accomplished with extraordinary energy efficiency and reliability, making it an essential component of any modern training facility.

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## ADVANCED AND POWERFUL

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### Long-lasting and Robust Operation:

- Finest Materials
- Outstanding Performance
- Usable in difficult environmental conditions



### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Centrally-controlled speed

### Time and Effort Saving:

- Trouble free functionality
- Modular concept
- Immediate performance feedback



HARDWARE

- **Modular concept** consists in its standard configuration of the drive unit and an armour target mechanism mounted on a rail-guided, cable-pulled, or self-propelled target carriage.
- **Flexible construction** can accommodate curved set-up and elevation differences in the terrain.
- **Wind-resistant rail system** allows operation at high wind speeds up to 35mph without degradation or capsizing. Trouble free functionality is also guaranteed under difficult environmental conditions such as high snow.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Diversified scenarios** can be programmed to run, as the controller handles the operation of target appliances individually or in groups.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Docking station** provides the required network connection to the central control system and the connections to power / recharge the movers and associated equipment.
- **Power distribution** to all devices attached to, or located on, the mover carriage is provided by the moving target system.
- **Speed** is controlled via the central control system. The mover is capable of reaching each speed within 100m, and can be stopped at different firing distances from each speed within 20m.
- **Automatic parking brake** on the moving device holds the carrier in place.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a remote sensitivity adjustment to record hits of training ammunition.
- **Built-In-Test status identification**, an initial status information, and operational status feedback is provided to the central control console.
- **Audible warning indicator** signals impending movement. The devices have fail-safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal.

SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed or Portable
Power Supply	Landline-connected and/or Battery-powered
Power	As required
Communication	Hardwired or Radio-controlled
HIT SENSING	
Hit Detection	Contact Hit Sensor
Hit Frequency	Up to 1200rpm
Firing Modes	Single / Burst
TARGET PRESENTATION	
Modes of Operation	Moving, Pop-up
Time to Expose*	5-7 s (adjustable)
Time to Retreat*	5-7 s (adjustable)
*May vary depending on customer requirements and target dimensions	
MOVING MECHANISM	
Speed	Up to 30mph

Speed Control	Digital in steps in 1mph (or as required)
Track Length	Variable up to 300m
ENVIRONMENT	
Operating Temperature	-30°C - +72°C [-22 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H (Drive Unit)	2330mm x 1300mm x 980mm [91.7in x 52.4in x 38.6in]
L x W (Trolley)	3100mm x 1285mm [122.0in x 50.6in]

Additional Equipment

- **Ballistic Shield**
  - **Enemy Fire Simulators (Pyro & Non-Pyro)**
  - **LOMAH Sensor System**
- **Muzzle Flash Simulator**
  - **Solar Panels**
  - **Target Illumination Unit**
  - **Thermal Target Adaptor**

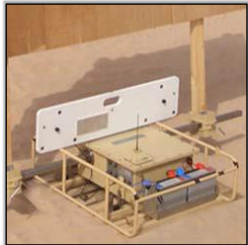
USED WITH



Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241



# MOVING ARMOUR TARGET (ADVANCED SELF-PROPELLED POPUP) TYPE 252-101



## MOVING ARMOUR TARGET (ADVANCED SELF-PROPELLED POPUP) TYPE 252-101

The MSI Advanced Self-Propelled Popup Moving Armour Target is a multifunctional system that builds the awareness and responsiveness that is necessary in today's changing live-fire environment.

Since modern arms with computerized Gun Fire Control Systems require full size target silhouettes, this assembly is the

perfect choice for these types of live-fire engagements. The rugged and durable characteristics of the system complement the advanced and powerful lifting mechanism. Various target movements and speeds are possible, whilst the system raises tank targets up to a 7m (23ft) x 3.5m (11.5ft), making the Moving Armour Target versatile as well as reliable.

All of these features are accomplished with extraordinary energy efficiency and reliability, making it an essential component of any modern training facility.

## ADVANCED AND POWERFUL

### Long-lasting and Robust Operation:

- Finest Materials
- Outstanding Performance
- Usable in difficult environmental conditions



### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Centrally-controlled speed

### Time and Effort Saving:

- Trouble free functionality
- Modular concept
- Immediate performance feedback





HARDWARE

- **Modular concept** consists in its standard configuration of the drive unit and an armour target mechanism mounted on a rail-guided and self-propelled target carriage.
- **Flexible construction** can accommodate curved set-up and elevation differences in the terrain.
- **Wind-resistant rail system** allows operation at high wind speeds up to 35mph without degradation or capsizing. Trouble free functionality is also guaranteed under difficult environmental conditions such as high snow.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Diversified scenarios** can be programmed to run, as the controller handles the operation of target appliances individually or in groups.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Docking station** provides the required network connection to the central control system and the connections to power / recharge the movers and associated equipment.
- **Power distribution** to all devices attached to, or located on, the mover carriage is provided by the moving target system.
- **Speed** is controlled via the central control system. The mover is capable of reaching each speed within 100m, and can be stopped at different firing distances from each speed within 20m.
- **Automatic parking brake** on the moving device holds the carrier in place.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a remote sensitivity adjustment to record hits of training ammunition.
- **Built-In-Test status identification**, an initial status information, and operational status feedback is provided to the central control console.
- **Audible warning indicator** signals impending movement. The devices have fail-safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal.

SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed or Portable
Power Supply	Landline-connected and/or Battery-powered
Power	As required
Communication	Hardwired or Radio-controlled
HIT SENSING	
Hit Detection	Contact Hit Sensor
Hit Frequency	Up to 1200rpm
Firing Modes	Single / Burst
TARGET PRESENTATION	
Modes of Operation	Moving, Pop-up
Time to Expose*	5-7 s (adjustable)
Time to Retreat*	5-7 s (adjustable)
*May vary depending on customer requirements and target dimensions	
MOVING MECHANISM	
Speed	Up to 30mph

Speed Control	Digital in steps in 1mph (or as required)
Track Length	Variable up to 300m
ENVIRONMENT	
Operating Temperature	-30 °C - +72 °C [-22 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W (Trolley)	3700mm x 1200mm [145.7in x 42.2in]
L x H (Target Silhouette)	7m x 3.05m [23ft x 10ft]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
- Muzzle Flash Simulator
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

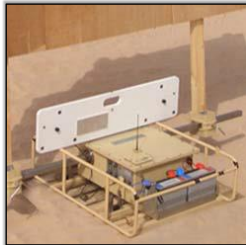
USED WITH



Battle Effects Simulator (BATES) Type 220-221



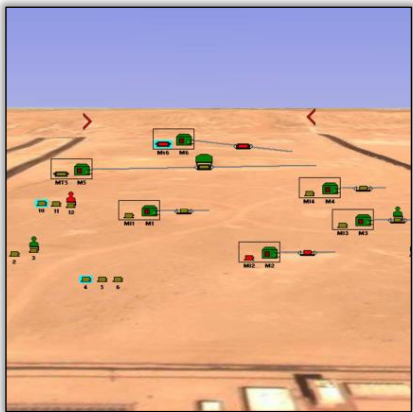
Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241

# TRAINING AREA CONTROL FACILITY (TACF) RANGE CONTROL SOFTWARE

## TYPE 272-001



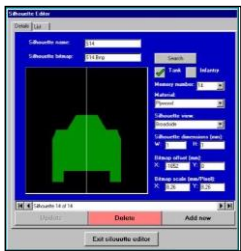
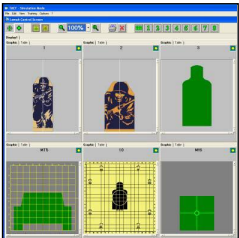
### TRAINING AREA CONTROL FACILITY (TACF) RANGE CONTROL SOFTWARE TYPE 272-001

The MSI TACF Software enables the control as well as the status monitoring of all target appliances on the shooting range. It displays the training area graphically on monitors and reports the hit data for each appliance. Tools and functions are clear and accessible, allowing for a smooth, flowing work environment. This intuitive software is easy to use and can be learnt quickly by any user, saving time and effort on all projects.

### CLEAR AND ACCESSIBLE

#### SOFTWARE

- **Windows Compatibility** of TACF means that it works with all state computers operating in this environment.
- **Communication** to the targets on the range can be hardwired via cable (RS-485, Ethernet) or wireless (WLAN, XBee, or customized radio).
  - Target & device control** of nearly all MSI range equipment is done by TACF. Presentation and movement, along with grouping capabilities, of target systems are key settings that TACF controls.
- **Three different, password-protected user levels** – Supervisor, Instructor, and Operator – keeps more complex and security relevant data separate from the day-to-day control operations. This separation allows the different skills required at each level to be learned more quickly.
- **Several Editors** allows for easy program adaptability. Range layout creation and manipulation is simply with this open type architecture.
- **Programmable Scenarios** such as preconfigured firing sessions can be controlled on a time base or by event, with the ability to be started, paused, and cancelled at any time. Learning a script language is not required.
- **Large Scenarios** can be split into engagements that can be started individually or in a linked list.
- **Simulation mode** allows training scenarios to be tested on the computer before running them on the range. This is particularly helpful in preventing equipment damage when training new TACF users, or briefing trainees.



- **Training review** is enabled by the recording of session data on an integrated software recorder. Scenarios can be played, paused, cancelled, and rewound, with all shooting results being stored in a database for a later evaluation or printout.
- **Built-in tests** are performed by TACF at start-up. Checks are performed on the communication and all components of the range. Diagnostic test results are reported and errors are stored in a log-file.

#### USED WITH



Location of Miss and Hit (LOMAH) Type 240 – Type 243



Mobile Tablet PC Type 274-001



Shooters Monitor Type 292-001

# MOBILE TABLET PC

## TYPE 274-001



### MOBILE TABLET PC TYPE 274-001

Designed for mobile use, this mobile tablet pc is a very rugged range control system, fully sealed to handle all outdoor situations. This slim, rugged, lightweight design has been ergonomically optimized with power-efficient, dual, hot-swappable batteries and a sunlight viewable display. The system is also built with an integrated handle and rubber hand strap.

This tablet PC, specifically designed for military use, can remotely operate a vast array of targeting and scoring systems, which MSI can also supply.

With a schematic display of all target systems and an integrated software recorder to store all training session data, this tablet is made to perform with consistently high standards and to be easy to use for all users.

## SLIM, RUGGED, LIGHTWEIGHT

### Ruggedized System:

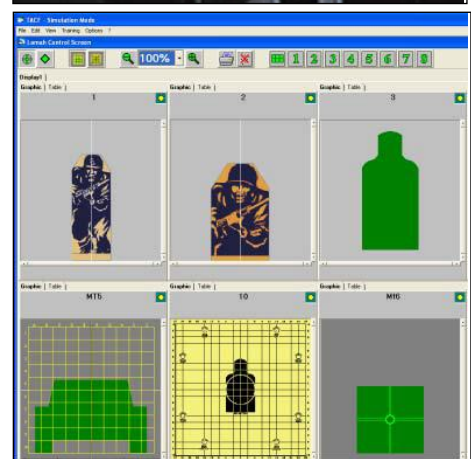
- Endures environmental and physical stress.
- Durable battery.
- For all training conduct.

### Several Editors:

- Open type architecture.
- Adaptable for each individual.
- Easily customisable range layouts.

### Easy to Use:

- User-friendly and intuitive handling.
- Fast to learn.
- Intelligent, accessible software.



## HARDWARE

- **10.4" touch display** with the slim, lightweight design and sunlight-viewable display is suitable for all situations and allows for great versatility.
- **Vehicle dock and vehicle power module** allows for mobile application of the tablet.
- **CPU, Memory, and Storage** are all specified to leave the user with smooth use and never be left wanting more.

## SOFTWARE (IF REQUIRED)

- **MSI Range Control Software** enables individual control of all target devices.
- **All live fire training range equipment** supplied by MSI can be controlled with this tablet.

## SPECIFICATION

CONFIGURATIONS	
Power Supply	Internal Lithium Polymer battery, 3800mAh, 7.4V
AC Adapter	AC 100 ~ 240 V, 50 ~ 60 Hz input; 19 VDC @ 3.42A (65W)
Battery Type	Hot swappable dual battery
Battery Life	Up to 8 hours
Communication	Wi-Fi IEEE 802.11 a/b/g/n and Bluetooth 4.0
HARDWARE	
CPU	Intel® Atom™ 1.6GHz Dual Core Processor
Memory	2GB DDR III
Storage	32GB SATA
Display	10.4-inch LED backlight screen
Display Resolution	1024 x 768 XGA
Display Brightness	350nits / optional 500nits for sunlight readable
Military Standard	MIL-STD-810G, MIL-STD-461F
SOFTWARE	
Operating System	Windows 7 Professional
Application Software	MSI TACF Range Control Software

ENVIRONMENT	
Operating Temperature	-20°C - +70°C [-4 °F - +158 °F]
Storage Temperature	-30°C - +70°C [-22 °F - +158 °F]
Humidity	5 – 95 % without condensation
Enclosure Type	IP 65
DIMENSIONS	
L a W x H	203.6mm x 275.4mm x 26.5mm [8.01in x 10.84in x 1.04in]
Weight	1.1kg [2.42lbs]

### Additional Accessories

- Desktop Dock
- Vehicle Dock
- Battery Charger
- External Battery
- Hand Strap
- Stylus
- GPS
- MBR
- Barcode Scanner

## USED WITH



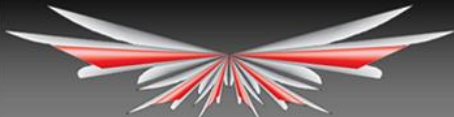
Location of Miss and Hit (LOMAH)  
Type 240 – Type 243



Training Area Control Facility (TACF)  
Range Control Software Type 272-001





Stationary Infantry Target (SIT)  
Type 282 – Type 285



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# STATIONARY ARMOUR TARGET (STANDARD POPUP) TYPE 280-101



## STATIONARY ARMOUR TARGET (STANDARD POPUP) TYPE 280-101

The MSI Standard Popup Stationary Armour Target simulates appearing and disappearing tank targets and serves typically on combined arms and multi-purpose ranges.

The lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability, and safe, easy handling.

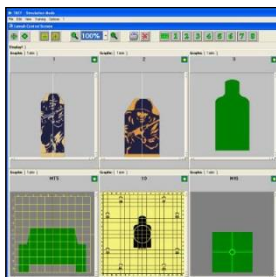
This fixed-installed solution outrivals competitive tank target lifters in lifting medium flank tank targets up to a size of 3m x 2m. The target system boasts trouble free functionality and also an adjustable hit sensor for most calibres and ammunition.

With such enormous lifting capacity, the extraordinary energy efficiency of this rugged and weather resistant design is just another reason with this is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

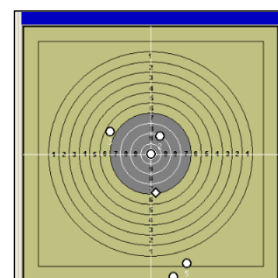


### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Enormous lifting capacity

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback



HARDWARE

- **Powerful hydraulic drive** endows the SAT with an enormous lifting capacity and a smooth and sturdy lifting process even with large target silhouettes.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.

SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed
Power Supply	Hardwired or Battery-powered
Power Supply (Target Mechanism)	Hardwired
Power	110 VAC. 230 VAC, others on request
Communication	Hardwired or Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	5-8 s (adjustable)
Time to Retreat*	5-8 s (adjustable)
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	1200Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W(with target arms) x H	660mm x 575(1558)mm x 306mm [26.0 in x 22.6(61.3)in x 12.0in]
Weight	60kg [132.3 lbs]
Max. Target Silhouette L x H	3m x 2m [3.28yd x 2.19yd]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
  - Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

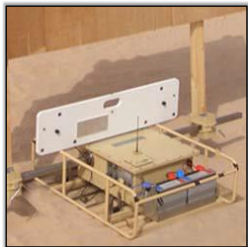
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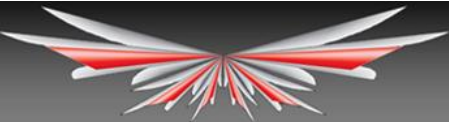
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241



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# STATIONARY ARMOUR TARGET (PORTABLE POPUP) TYPE 280-601



## STATIONARY ARMOUR TARGET (PORTABLE POPUP) TYPE 280-601

The MSI Portable Popup Stationary Armour Target simulates appearing and disappearing tank targets and serves typically on combined arms and multi-purpose ranges.

The lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability, and safe, easy handling.

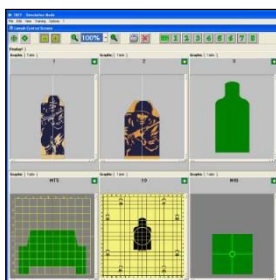
This compact and lightweight, portable system outrivals competitive tank target lifters in lifting medium flank tank targets up to a size of 3m x 2m. The target system requires no site preparation, and boasts trouble free functionality and also an adjustable hit sensor for most calibres and ammunition.

With such enormous lifting capacity, the extraordinary energy efficiency of this rugged and weather resistant design is just another reason with this is an essential component of any modern training facility.

## COMPACT AND LIGHTWEIGHT

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

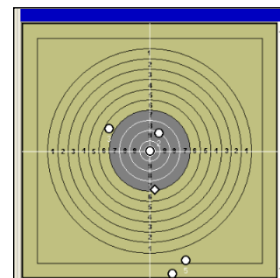


### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Enormous lifting capacity

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback





HARDWARE

- **Powerful hydraulic drive** endows the SAT with an enormous lifting capacity and a smooth and sturdy lifting process even with large target silhouettes. With this low energy consuming hydraulic drive, the target mechanism can perform up to 180 operational cycles before recharging is required.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Smooth-edged frame** accommodates all main components that require operation whilst offering easy and safe handling to service personnel. It can be easily carried by four men and hence repositioned to modify training scenarios.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply(Target Mechanism)	Battery / Solar Panel
Power	12 VDC or 24 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	5-8 s (adjustable)
Time to Retreat*	5-8 s (adjustable)
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	1200Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W(with target arms) x H	1195mm x 1558mm x 390mm [47.09 in x 61.3in x 15.35in]
Weight	84kg [185.19 lbs]
Weight with Battery	108kg [238.1 lbs]
Max. Target Silhouette L x H	3m x 2m [3.28yd x 2.19yd]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
  - Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

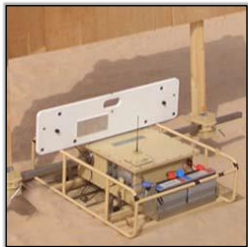
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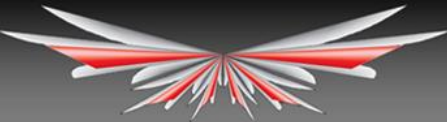
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241



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# STATIONARY ARMOUR TARGET (ADVANCED POPUP) TYPE 281-101



## STATIONARY ARMOUR TARGET (ADVANCED POPUP) TYPE 281-101

The MSI Advanced Popup Stationary Armour Target simulates appearing and disappearing tank targets and serves typically on combined arms and multi-purpose ranges.

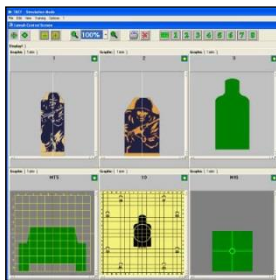
The lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability, and safe, easy handling.

This fixed-installed solution outrivals competitive tank target lifters in lifting full-scale flank tank targets up to a size of 7m x 2.5m. The target system boasts trouble free functionality and also an adjustable hit sensor for most calibres and ammunition. With such enormous lifting capacity, the extraordinary energy efficiency of this rugged and weather resistant design is just another reason with this is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

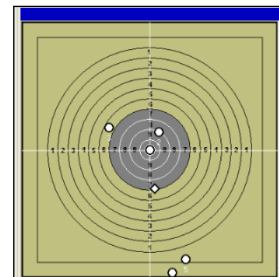


### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Enormous lifting capacity

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback



HARDWARE

- **Powerful hydraulic drive** endows the SAT with an enormous lifting capacity and a smooth and sturdy lifting process even with large target silhouettes.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.

SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed
Power Supply	Hardwired or Battery-powered
Power Supply (Target Mechanism)	Hardwired
Power	110 VAC. 230 VAC, others on request
Communication	Hardwired or Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	5-8 s (adjustable)
Time to Retreat*	5-8 s (adjustable)
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	2500Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W(with target arms) x H	1350mm x 633(2077)mm x 390mm [53.15 in x 24.9(81.77)in x 15.35in]
Weight	102kg [224 lbs]
Weight with Battery	160kg [353 lbs]
Max. Target Silhouette L x H	7m x 2.5m 7.66 yd x 2.74yd]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
  - Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

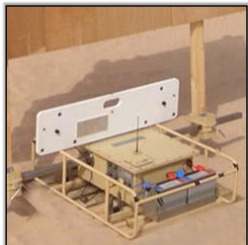
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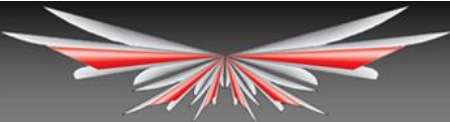
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241



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# STATIONARY ARMOUR TARGET (ADVANCED PORTABLE POPUP) TYPE 281-601



## STATIONARY ARMOUR TARGET (ADVANCED PORTABLE POPUP) TYPE 281-601

The MSI Advanced Portable Popup Stationary Armour Target simulates appearing and disappearing tank targets and serves typically on combined arms and multi-purpose ranges.

The lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability, and safe, easy handling.

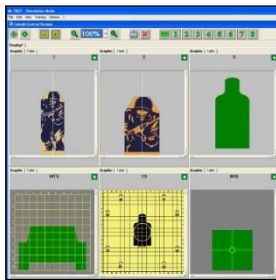
This conveniently portable system outtrivals competitive tank target lifters in lifting full-scale flank tank targets up to a size of 7m x 2.5m. The target system requires no site preparation, and boasts trouble free functionality and an adjustable hit sensor for most calibres and ammunition.

With such enormous lifting capacity, the extraordinary energy efficiency of this rugged and weather resistant design is just another reason with this is an essential component of any modern training facility.

## COMPACT AND LIGHTWEIGHT

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

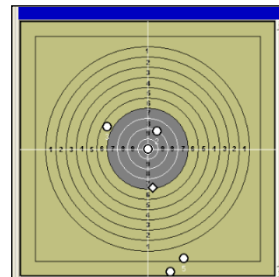


### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback

### Efficient and Optimised System:

- Energy efficient
- Optimal hit sensing
- Enormous lifting capacity





HARDWARE

- **Powerful hydraulic drive** endows the SAT with an enormous lifting capacity and a smooth and sturdy lifting process even with large target silhouettes. With this low energy consuming hydraulic drive, the target mechanism can perform up to 180 operational cycles before recharging is required.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Smooth-edged frame** accommodates all main components that require operation whilst offering easy and safe handling to service personnel. It can be easily carried by four men and hence repositioned to modify training scenarios.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	24 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	5-8 s (adjustable)
Time to Retreat*	5-8 s (adjustable)
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	2500Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13°F - +161.6°F]
Enclosure Type	IP 67
DIMENSIONS	
L x W(with target arms) x H	1350mm x 950(2077)mm x 390mm [53.15 in x 61.3(81.77)in x 15.35in]
Weight	102kg [224 lbs]
Weight with Battery	160kg [353 lbs]
Max. Target Silhouette L x H	7m x 2.5m [7.66yd x 2.74yd]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
  - Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

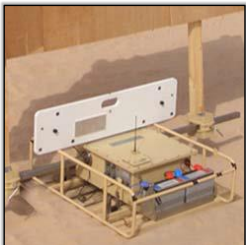
USED WITH



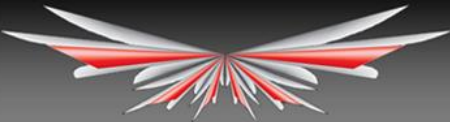
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 240-241



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# STATIONARY INFANTRY TARGET (BASIC POPUP)

## TYPE 282-101



### STATIONARY INFANTRY TARGET (BASIC POPUP) TYPE 282-001

The newly improved Basic Popup Stationary Infantry Target with its time-tested and continuously improved lifting mechanism was designed as a standard pop-up target on live-fire ranges.

The lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

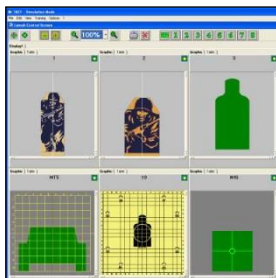
1. Hiding and exposing the target silhouette
2. Lowering the target after registration of a hit
3. Lowering the target after registration of a hit and automatically re-exposing the silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

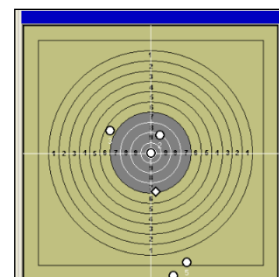


### Efficient and Optimised System:

- Powerful engine
- Optimal hit sensing
- No site preparation required

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback



HARDWARE

- Powerful electric engine with a robust gear easily lifts the full range of infantry targets.
- Contact hit sensor records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- Handheld controller can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- Range control system can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- Smooth-edged frame accommodates all main components that require operation whilst offering easy and safe handling to service personnel. It can be easily carried by two men and hence repositioned to modify training scenarios.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	1.2 s
Time to Retreat*	1.2 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	80 Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	750mm x 400mm x 350mm [29.53in x 15.75in x 13.78in]
Weight	17kg [37.48lbs]
Weight with Battery	23kg [50.71lbs]

Additional Equipment

- Ballistic Shield
  - Enemy Fire Simulators (Pyro & Non-Pyro)
  - LOMAH Sensor System
  - Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
  - Solar Panels
  - Target Illumination Unit
  - Thermal Target Adaptor

USED WITH



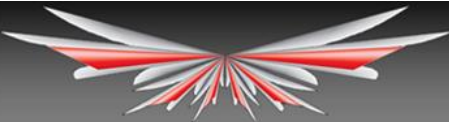
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



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STATIONARY INFANTRY TARGET (STANDARD POPUP)

## TYPE 283-001



### STATIONARY INFANTRY TARGET (STANDARD POPUP) TYPE 283-001

The Standard Popup Stationary Infantry Target with its time-tested and continuously improved lifting mechanism was designed as a standard pop-up target on live-fire ranges. The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

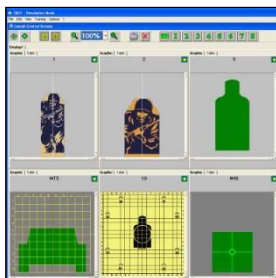
4. Hiding and exposing the target silhouette
5. Lowering the target after registration of a hit
6. Lowering the target after registration of a hit and automatically re-exposing the silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

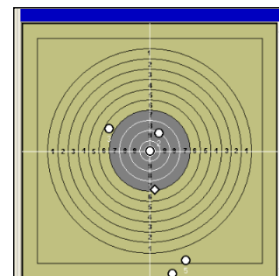


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality.
- Excellent reliability
- Immediate performance feedback



### HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Freely programmable target actions** are available to create interactive response to events in the field.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer's radio frequency and geographic conditions.



- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Smooth-edged frame** offers easy and safe handling to service personnel.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable or fix-installed
Power Supply	Battery-powered or Landline-connected
Power Supply (Target Mechanism)	Hardwired or Battery / Solar Panel (optional)
Power	240 VAC / 12 VDC or others on request
Communication	Radio-controlled or hardwired
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	0.8 s
Time to Retreat*	0.8 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	80 Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	650mm x 450mm x 250mm [25.59in x 17.72in x 9.84in]
Weight	25kg [55.12lbs]
Weight with Battery	32kg [70.55lbs]

Operational Settings

- System permanently communicates with the range controller
- Various settings to modify training scenarios e.g. *presentation time, hits to kill, hit counting mode*
- Built-In-Test status identification, an initial status information and operational feedback to the range controller

Additional Equipment

- Ballistic Shield
- Enemy Fire Simulators
- LOMAH Sensor System
- Muzzle Flash Simulator
- Rotary Pop-Up Adaptor
- Solar Panels
- Target Illumination Unit
- Thermal Target Adaptor

USED WITH



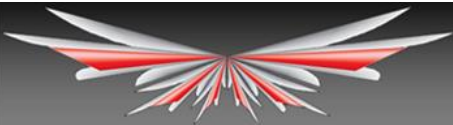
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



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# STATIONARY INFANTRY TARGET (PORTABLE POPUP)

## TYPE 283-601



### STATIONARY INFANTRY TARGET (PORTABLE POPUP) TYPE 283-601

The Portable Popup Stationary Infantry Target with its time-tested and continuously improved lifting mechanism was designed as a standard pop-up target on live-fire ranges.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

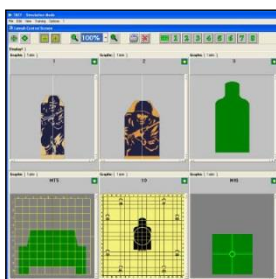
7. Hiding and exposing the target silhouette
8. Lowering the target after registration of a hit
9. Lowering the target after registration of a hit and automatically re-exposing the silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

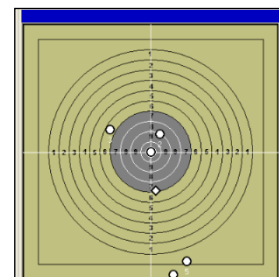


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality.
- Excellent reliability
- Immediate performance feedback



HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Stable, steadfast, and smooth-edged frame** offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- **Location can be altered** without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled or hardwired
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	0.8 s
Time to Retreat*	0.8 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	80 Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C[-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	650mm x 450mm x 250mm [25.59in x 17.72in x 9.84in]
Weight	25kg [55.12lbs]
Weight with Battery	32kg [70.55lbs]

Portability

- **No site preparation is necessary or required to emplace the system.**
- **Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.**

Additional Equipment

- **Ballistic Shield**
  - **Enemy Fire Simulators**
  - **LOMAH Sensor System**
  - **Muzzle Flash Simulator**
- **Rotary Pop-Up Adaptor**
  - **Solar Panels**
  - **Target Illumination Unit**
  - **Thermal Target Adaptor**

USED WITH



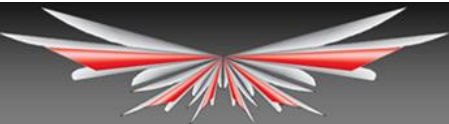
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



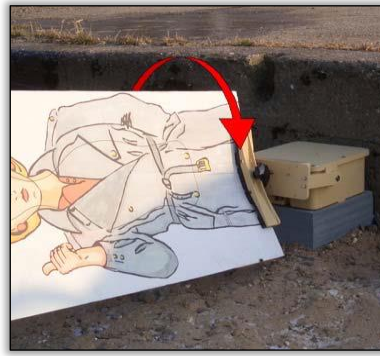
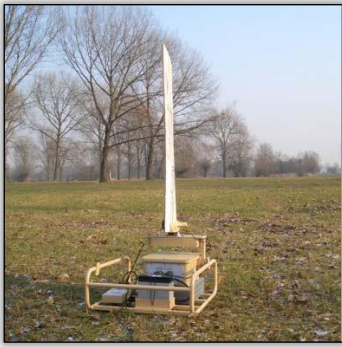
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# STATIONARY INFANTRY TARGET (TURNING POPUP) TYPE 283-611



## STATIONARY INFANTRY TARGET (TURNING POPUP) TYPE 283-611

The MSI Turning Popup Stationary Infantry Target combines the advantages of our Stationary Infantry Target with one of our Popup Turning Adaptor. This combination provides soldiers and trainers with a modular and highly flexible training tool to improve live-fire training skills along with vital friend/foe discrimination techniques.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

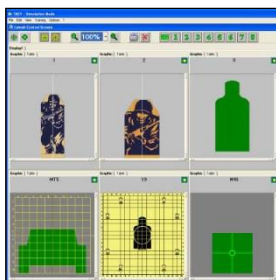
10. Hiding and exposing the target silhouette
11. Lowering the target after registration of a hit
12. Lowering the target after registration of a hit and automatically re-exposing the silhouette
13. Showing the Friend side of a target silhouette
14. Showing the Foe side of a target silhouette
15. Showing the Neutral side (Edge) of a target silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest Materials.
- Outstanding performance.
- Usable in difficult environmental conditions.

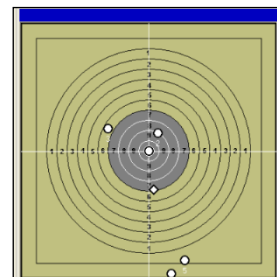


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback





HARDWARE

- Powerful electric engine with a robust gear easily lifts the full range of infantry targets.
- Popup Turning Adaptor turns a silhouette independently and enables the appearance of the front, back, and side of a friend/foe silhouette to train target discrimination and immediate reaction.
- Contact hit sensor records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- Handheld controller can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- Range control system can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- Stable, steadfast, and smooth-edged frame offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- Location can be altered without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up, Friendly/Foe, Pop-up Turning
Time to Expose*	0.8 s
Time to Retreat*	0.8 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable
Angles of Operation (Turner)	180°

Torque at Shaft	80Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	650mm x 450mm x 250mm [25.59in x 17.72in x 9.84in]
Weight	25kg [55.12lbs]
Weight with Battery	32kg [70.55lbs]

Portability

- No site preparation is necessary or required to emplace the system.
- Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.

Additional Equipment

- |                          |                            |
|--------------------------|----------------------------|
| - Ballistic Shield       | - Rotary Pop-Up Adaptor    |
| - Enemy Fire Simulators  | - Solar Panels             |
| - LOMAH Sensor System    | - Target Illumination Unit |
| - Muzzle Flash Simulator | - Thermal Target Adaptor   |

USED WITH



Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



# STATIONARY INFANTRY TARGET (DOUBLE PORTABLE POPUP) TYPE 284-601



## STATIONARY INFANTRY TARGET (DOUBLE PORTABLE POPUP) TYPE 284-601

The Double Portable Popup Stationary Infantry Target with its time-tested and continuously improved lifting mechanism was designed as a standard pop-up target on live-fire ranges.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

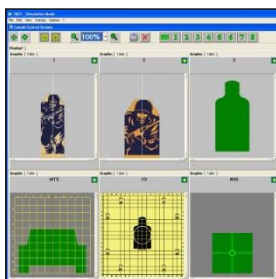
16. Hiding and exposing the target silhouette
17. Lowering the target after registration of a hit
18. Lowering the target after registration of a hit and automatically re-exposing the silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

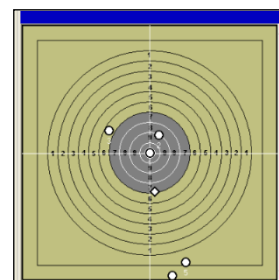


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback



HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Stable, steadfast, and smooth-edged frame** offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- **Location can be altered** without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	<2 s
Time to Retreat*	<2 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	50Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	800mm x 865mm x 255mm [31.5in x 34.1in 10.0in]
Weight	30kg [66.1lbs]

Portability

- **No site preparation is necessary or required to emplace the system.**
- **Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.**

Additional Equipment

- **Ballistic Shield**
  - **Enemy Fire Simulators**
  - **LOMAH Sensor System**
  - **Muzzle Flash Simulator**
- **Rotary Pop-Up Adaptor**
  - **Solar Panels**
  - **Target Illumination Unit**
  - **Thermal Target Adaptor**

USED WITH



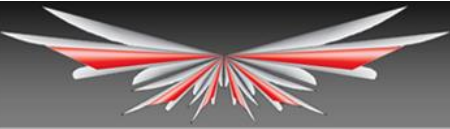
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001






Location of Miss and Hit (LOMAH) Type 242-243



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# STATIONARY INFANTRY TARGET (DOUBLE TURNING POPUP) TYPE 284-611



## STATIONARY INFANTRY TARGET (DOUBLE TURNING POPUP) TYPE 284-611

The MSI Double Turning Popup Stationary Infantry Target combines the advantages of our Stationary Infantry Target with one of our Popup Turning Adaptor. This combination provides soldiers and trainers with a modular and highly flexible training tool to improve live-fire training skills along with vital friend/foe discrimination techniques.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

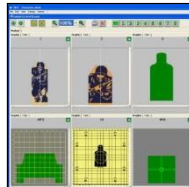
19. Turning the target while lifting and lowering the silhouette and in recessed position
20. Lifting and lowering the target without turning the silhouette
21. Turning the target to friend or foe view
22. Turning the target to neutral view
23. Random and automatic mode

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions



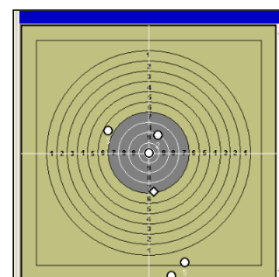
### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient



### Time and Effort Saving:

- Trouble free functionality
- Reduced required access to target area
- Immediate performance feedback



HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Popup Turning Adaptor** turns a silhouette independently and enables the appearance of the front, back, and side of a friend/foe silhouette to train target discrimination and immediate reaction.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Stable, steadfast, and smooth-edged frame** offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- **Location can be altered** without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up, Friendly/Foe, Pop-up Turning
Time to Expose*	<2 s
Time to Retreat*	<2 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable
Angles of Operation (Turner)	180°

Torque at Shaft	50Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	640mm x 1040mm x 450mm [25.2in x 40.9in x 17.7in]
Weight	48kg [106lbs]

Portability

- **No site preparation is necessary or required to emplace the system.**
- **Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.**

Additional Equipment

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| - <b>Ballistic Shield</b>       | - <b>Rotary Pop-Up Adaptor</b>    |
| - <b>Enemy Fire Simulators</b>  | - <b>Solar Panels</b>             |
| - <b>LOMAH Sensor System</b>    | - <b>Target Illumination Unit</b> |
| - <b>Muzzle Flash Simulator</b> | - <b>Thermal Target Adaptor</b>   |

USED WITH



Battle Effects Simulator (BATES) Type 220-221



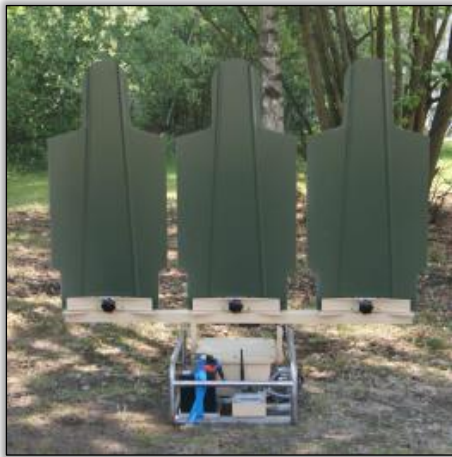
Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



# STATIONARY INFANTRY TARGET (TRIPLE PORTABLE POPUP) TYPE 285-601



## STATIONARY INFANTRY TARGET (TRIPLE PORTABLE POPUP) TYPE 285-601

The Triple Portable Popup Stationary Infantry Target with its time-tested and continuously improved lifting mechanism was designed as a standard pop-up target on live-fire ranges.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

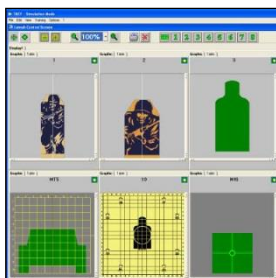
- 24. Hiding and exposing the target silhouette
- 25. Lowering the target after registration of a hit
- 26. Lowering the target after registration of a hit and automatically re-exposing the silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

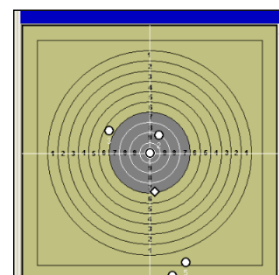


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality
- Reduced required access to target area
- Immediate performance feedback



HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Stable, steadfast, and smooth-edged frame** offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- **Location can be altered** without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up
Time to Expose*	<1 s
Time to Retreat*	<1 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

Torque at Shaft	50Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	800mm x 1365mm x 255mm [31.5in x 53.7in x 10.0in]
Weight	35kg [77.16lbs]

Portability

- No site preparation is necessary or required to emplace the system.
- Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.

Additional Equipment

- |                          |                            |
|--------------------------|----------------------------|
| - Ballistic Shield       | - Rotary Pop-Up Adaptor    |
| - Enemy Fire Simulators  | - Solar Panels             |
| - LOMAH Sensor System    | - Target Illumination Unit |
| - Muzzle Flash Simulator | - Thermal Target Adaptor   |

USED WITH



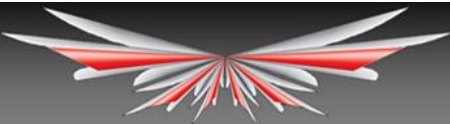
Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243



MS INSTRUMENTS Range Consultancy

Precision, Expertise, Quality

- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards



# STATIONARY INFANTRY TARGET (TRIPLE TURNING POPUP) TYPE 285-611



## STATIONARY INFANTRY TARGET (TRIPLE TURNING POPUP) TYPE 285-611

The MSI Turning Popup Stationary Infantry Target combines the advantages of our Stationary Infantry Target with one of our Popup Turning Adaptor. This combination provides soldiers and trainers with a modular and highly flexible training tool to improve live-fire training skills along with vital friend/foe discrimination techniques.

The extraordinarily energy efficient lifter with its configurable target controller and its target mechanism offers a unique combination of flexibility, excellent reliability and safe, easy handling.

The following target presentations are possible:

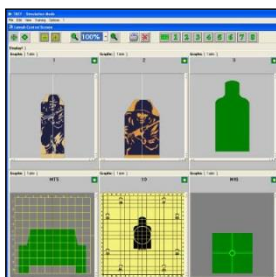
27. Hiding and exposing the target silhouette
28. Lowering the target after registration of a hit
29. Lowering the target after registration of a hit and automatically re-exposing the silhouette
30. Showing the Friend side of a target silhouette
31. Showing the Foe side of a target silhouette
32. Showing the Neutral side (Edge) of a target silhouette

This conveniently portable, rugged system, in the absence of wind, is capable of raising military standard target silhouettes in less than one second and is an essential component of any modern training facility.

## SAFE AND RUGGED

### Long-lasting and Robust Operation:

- Finest materials
- Outstanding performance
- Usable in difficult environmental conditions

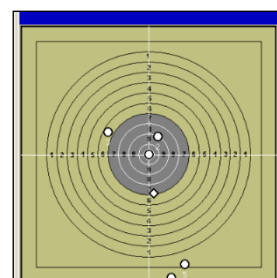


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality
- Excellent reliability
- Immediate performance feedback



HARDWARE

- **Powerful electric engine** with a robust gear easily lifts the full range of infantry targets.
- **Popup Turning Adaptor** turns a silhouette independently and enables the appearance of the front, back, and side of a friend/foe silhouette to train target discrimination and immediate reaction.
- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can also operate all target systems. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Stable, steadfast, and smooth-edged frame** offers easy and safe handling to service personnel and accommodates all main components needed to be operated.
- **Location can be altered** without the need for infrastructure adaptations.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable
Power Supply	Battery-powered
Power Supply (Target Mechanism)	Battery / Solar Panel
Power	12 VDC
Communication	Radio-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	1200rpm
TARGET PRESENTATION	
Modes of Operation	Pop-up, Friend/Foe, Pop-up Turning
Time to Expose*	<2 s
Time to Retreat*	<2 s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable
Angles of Operation (Turner)	180°

Torque at Shaft	50Nm
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	800mm x 1365mm x 450mm [31.5 in x 53.72in x 17.7in]
Weight	48kg [106 lbs]

Portability

- **No site preparation is necessary or required to emplace the system.**
- **Target can be conveniently carried by two men and hence repositioned to easily modify the training scenarios.**

Additional Equipment

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| - <b>Ballistic Shield</b>       | - <b>Rotary Pop-Up Adaptor</b>    |
| - <b>Enemy Fire Simulators</b>  | - <b>Solar Panels</b>             |
| - <b>LOMAH Sensor System</b>    | - <b>Target Illumination Unit</b> |
| - <b>Muzzle Flash Simulator</b> | - <b>Thermal Target Adaptor</b>   |

USED WITH



Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001

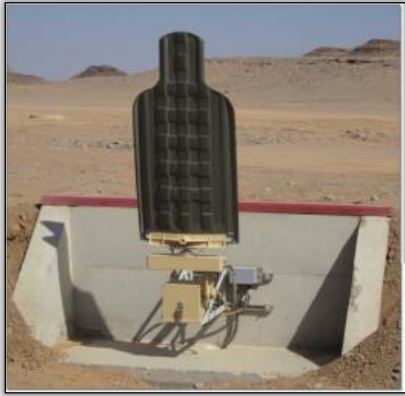


Location of Miss and Hit (LOMAH) Type 242-243



# STATIONARY INFANTRY TARGET (ADVANCED TURNING)

## TYPE 286-001



### STATIONARY INFANTRY TARGET (ADVANCED TURNING) TYPE 286-001

The Advanced Turning Stationary Infantry Target with its unique Target Cube® drive is designed as a multifunctional infantry target mechanism.

The target system with its stainless steel frame, configurable target controller, and powerful electric engine offers a unique combination of flexibility, excellent reliability, and safe, easy handling. In the standard configuration, the system lifts and lowers the full range of military target silhouettes.

The following target presentations are possible:

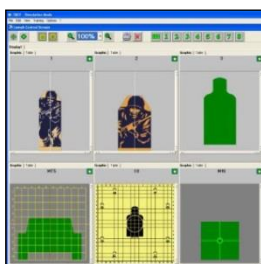
33. Turning the target while lifting and lowering the silhouette and in recessed position
34. Lifting and lowering the target without turning the silhouette
35. Turning the target to friend or foe view
36. Turning the target to neutral view
37. Random and automatic mode

With MSI adaptors, this device is easily convertible to carry out slashing, swivelling, turning, and popup turning actions.

## ROBUST AND SLEEK

### Long-lasting and Robust Operation:

- Finest Materials.
- Outstanding Performance.
- Usable in difficult environmental conditions.

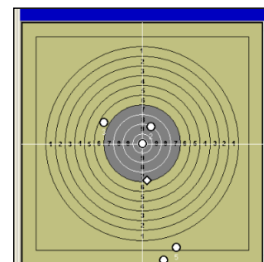


### Efficient and Safe Scoring:

- Powerful engine
- Optimal hit sensing
- Energy efficient

### Time and Effort Saving:

- Trouble free functionality.
- Excellent reliability
- Immediate Performance Feedback



HARDWARE

- **Contact hit sensor** records the hits of all calibres of live-fire ammunition. It has a sensitivity adjustment to record hits of training ammunition.
- **Freely programmable target actions** are available to create interactive response to events in the field.
- **Handheld controller** can be used to operate the system, enabling communication and immediate performance feedback over long distances depending on customer’s radio frequency and geographic conditions.
- **Range control system** can operate all target systems instead. This can be hardwired or radio linked, simultaneously providing details of each single target mechanism and a supreme overview of the whole scenario.
- **Smooth-edged frame** offers easy and safe handling to service personnel.

SPECIFICATION

CONFIGURATIONS	
Installation	Portable or fixed-installed
Power Supply	Battery-powered or hardwired
Power Supply (Target Mechanism)	Hardwired / Battery / Solar Panel (optional)
Power	240 VAC / 12 VDC, others on request
Communication	Remote-controlled or landline-controlled
HIT SENSORING	
Hit Detection	Contact Hit Sensor
Hit Frequency	Up to 1200rpm
Firing Modes	Single / Burst
TARGET PRESENTATION	
Modes of Operation	Popup Turning, Popup, Shearing
Available Adaptors	Turning, Slashing, Climbing, Sliding
Time to Expose*	0.8s
Time to Retreat*	0.8s
*May vary depending on customer requirements and target dimensions	
TARGET MECHANISM	
Angles of Operation (Lifter)	90°, end positions adjustable

ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - +161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	725mm x 400mm x 345mm [28.5 in x 15.7in x 13.6in]
Weight	21kg [46.3 lbs]
Weight (with battery)	28kg [61.7 lbs]

Operational Settings

- System permanently communicates with the range controller.
- Various settings to modify training scenarios e.g. *presentation time, hits to kill, hit counting mode*.
- Built-In-Test status identification, an initial status information and operational feedback to the range controller.

Additional Equipment

- Ballistic Shield
- Enemy Fire Simulators (Pyro & Non-Pyro)
- LOMAH Sensor System
- Muzzle Flash Simulator
- Target Illumination Unit
- Thermal Target Adaptor

USED WITH



Battle Effects Simulator (BATES) Type 220-221



Muzzle Flash Simulator Type 223-001



Location of Miss and Hit (LOMAH) Type 242-243

# SHOOTERS MONITOR

## TYPE 292-001



### SHOOTERS MONITOR TYPE 292-001

The MSI Shooters Monitor is a rugged, portable, menu-driven display and control unit.

The unit is used to display the shot position of a projectile fired over an automatic target. This monitor allows the firer to analyze their shots and to correct any misses or mistakes, the overall outcome being an improved performance.

This high-precision training and zeroing lane control system offers immediate performance feedback, with registered hits displayed graphically as well as in Cartesian coordinates.

With both fixed-installed and portable versions available, the MSI Shooters Monitor is a versatile piece of equipment that offers improved efficiency and precision to all ranges.

## HIGH-PRECISION

### HARDWARE

- **Flat panel monitor** is properly readable, both by daylight and at night.
- **Adjustable settings** such as brightness and colour.
- **Screen zoom** can be adjusted to focus to the centre of the target or to the mean point of impact.
- **Battery powered** and radio controlled deployable version available, allowing the shooter to shift their position freely. Alternatively available is a hardwired version for permanent installation.
- **Integrated** in centrally controlled precision live-fire ranges.
- **Simultaneous display** of results on a range control computer and the monitor.
- **Export** of shooting results via network connection or the USB port.
- **Keyboard port** for optionally available keyboards.
- **Windows CE 5.0 ®** based Shooters Monitor is a professional computer to display precise hit results, registered by an MSI Box Target or LOMAH Target

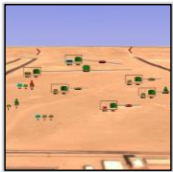
### SPECIFICATION

CONFIGURATIONS	
Installation	Fixed-installed or Deployable
Power Supply	Hardwired or Battery-Powered
Power	12 VDC (7.5 W)
Communication	Hardwired or Radio-controlled
HARDWARE	
CPU	ARM9
RAM	32MB
Program Memory	32MB Flash
Operating System	Windows CE
Display	8-inch LCD
Resolution	640 x 480
ENVIRONMENT	
Operating Temperature	-25°C - +65°C [-13 °F - 149 °F]
Enclosure Rating	IP 65
DIMENSIONS	
L x W x H	340mm x 265mm x 210mm [13.4in x 10.4in x 8.3in]
Weight	6kg [13.2lbs]

### USED WITH



Location of Miss and Hit (LOMAH)  
Type 240 – 243



Training Area Control Facility (TACF) Range  
Control Software Type 272-001



Lane Discriminator  
Type 293-001

# LANE DISCRIMINATOR

## TYPE 293-001



### LANE DISCRIMINATOR TYPE 293-001

The MSI Lane Discriminator can be supplied alongside the company's precision shooting systems to allow objective and faultless scoring.

The unit, comprising high-performing acoustic sensors has been developed to guarantee unimpeachable hit counting and to eliminate wrong scoring on multi-lane ranges in standing, prone-supported, prone-unsupported, and kneeling positions.

The shot sensor can be placed on the ground (unimproved terrain) at the front of the firing position and connected to the range supplied power and signal sources.

The rugged and weather resistant design guarantees trouble-free functionality under difficult environmental conditions. Delivering immediate feedback, the MSI Lane Discriminator is ideal for all modern ranges.

### THEORY OF OPERATION

- **Shot sensors** always detect that a round has been fired from the firing point thus signalling the system that a round has been shot in that lane.
- **Two high-performing acoustic sensors** register the muzzle bang of a fired weapon.
- **Acoustic signal** of both sensors is recorded, then evaluated, and finally transmitted with an event specific time stamp to the Range Controller.
- **Predefined, adjustable distance** between the muzzle and the Shot Sensors is assuring only shots fired from this specific shooting position are counted valid, and is avoiding the registration of weapons fired on neighbouring lanes.
- **Electronically registered hit or miss** on our non-contact LOMAH system is the next recorded and time stamped event.

### OBJECTIVE AND FAULTLESS SCORING

#### SPECIFICATION

CONFIGURATIONS	
Power Supply	Interface box at the firing position / Battery
Power	120 / 240 VAC or as required
ENVIRONMENT	
Operating Temperature	-25°C - +72°C [-13 °F - 161.6 °F]
Enclosure Type	IP 67
DIMENSIONS	
L x W x H	620mm x 190mm x 60mm [24.4in x 7.48in x 2.36in]
Weight	1kg [2.2lbs]

- **Shot recognized as valid** if both events were registered on the very same firing lane with a corresponding pair of time stamps.
- **On a lane where no shot was fired** at the shooting position, a registered hit of a target will be displayed and marked as invalid.

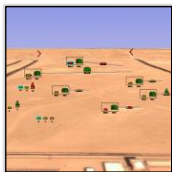
### USED WITH



Box Target  
Type 230-232



Location of Miss and Hit (LOMAH)  
Type 240 - 243



Training Area Control Facility (TACF) Range  
Control Software Type 272-001



# CHAMBER TARGET

## TYPE 519



### HARDWARE/SOFTWARE

- **Pair of sensor arrays**, mounted in a delta format with a set distance between them, sense the shockwave generated by the projectile.
- **Arrays are mounted** inside a wooden framed target.
- **Generated signals** are used to calculate the position of the shot with respect to the target.
- **Calculated position of the shot** is transmitted down the range cabling to the MSI Range Processor Type 663, from where it is also sent to the Shooters Monitor for display to the firer.
- **Comprehensive user-friendly software package** gives a graphical display of the shot locations and zeroing information.
- **Rubber** is positioned around the frame to give a zero-wind detection system for the automatic sensors. This allows the acoustic sensors to operate in the subsonic as well as supersonic regions.
- **Rubber panel** is the continuous and may be rotated to allow re-use.
- **More than 3500 rounds** can be fired at the target before the material needs replacing.

### CHAMBER TARGET TYPE 519

The MSI Chamber Target Type 519 provides trainee and experienced shooters alike with a cost-effective and accurate training system.

This precision target replaces traditional methods of measurement, and removes all the associated problems, thus saving time, reducing error, and increasing safety. Equally suitable for indoor and outdoor use, the systems require little maintenance once installed.

The MSI Chamber Target Type 519 is an easy piece of equipment with which to work, and makes weapons testing faster and better.

## SAVING TIME, REDUCING ERROR, AND INCREASING SAFETY

### SPECIFICATION

CONFIGURATIONS	
Power	12 VDC
Output Data	True XY Cartesian coordinate data
HIT SENSORING	
Projectile Velocity	Subsonic and supersonic projectiles
Hit Frequency	Up to 6000 rpm
Active Target Area	1.2m x 1.2m standard
Calibre Type	All small-arms calibres
Measurement Accuracy	±1mm
ENVIRONMENT	
Operating Temperature	-10°C - 50°C [14 °F - 122 °F]
Humidity	The unit is fully sealed against the ingress of moisture
Wind and Rain	The performance of the target is unaffected by normal ranges of wind and rain

- **Target can be configured** into systems with a single processor addressing 12 or more targets.
- **Visible target** is normally the user's target outline, for example 10-ring or figure 11 targets.

### USED WITH



Shooters Monitor Type 292-001

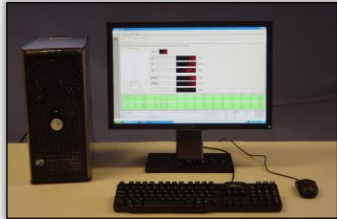


Remote-Control Transceiver Type 573



Range Processor Type 663

# RANGE PROCESSOR TYPE 663(N)



## RANGE PROCESSOR TYPE 663(N)

The Range Processor Type 663 is a high performance computer, which features the latest Windows Pro operating system and the latest Dual Core technology.

The 663 with ample memory and hard disk space for all modern Windows applications. Additional hardware is provided to interface with the MS Instruments equipment.

The desktop unit is supplied with a 21" LCD Monitor to provide a large, clear desktop display, enabling all results to be clearly seen as they are received. The 663N offers a portable solution. The range processor is the ideal machine from which to run range operations smoothly and efficiently.

## SMOOTH AND EFFICIENT

### SPECIFICATION - DESKTOP

INTERNAL HARDWARE (min)	
Processor	P-4 Dual core 3.0 GHz
Memory	4 GB
Hard Drive	512 GB
DVD ROM/RW	DVD/CD-RW Combo (8x8x8x24)
EXTERNAL HARDWARE	
Display	21" LCD
Printer	Colour Laserjet
UPS	500 VA
SOFTWARE	
Operating System	Windows 7 Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>
DIMENSIONS	
L x W x H (Desktop)	460mm x 630mm x 210mm [18.11in x 24.80in x 8.27mm]

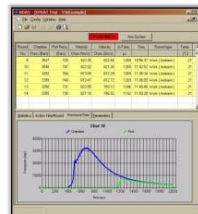
### SPECIFICATION - LAPTOP

INTERNAL HARDWARE (min)	
Processor	Intel Core i7 2.7 GHz
Memory	8 GB
Hard Drive	500 GB SSD
Video Outputs	HDMI/MiniDP
USB 3.0 Ports	2 (1 with PowerShare)
EXTERNAL HARDWARE	
Display	15" (1500 x 900)
Printer	HP Deskjet/Laserjet (Office Standard)
UPS	1000 VA+
Mouse	Built-in trackpad
SOFTWARE	
Operating System	Latest Windows Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>

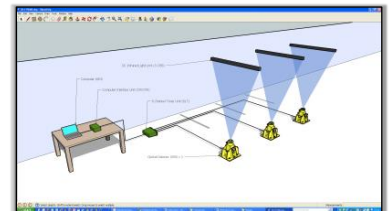
## USED WITH



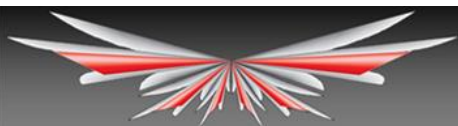
Acoustic Target  
Type 541



Ballistic DB Control Software  
Type 950-571



Projectile Velocity Measurement System  
(PVMS)



## MS INSTRUMENTS Range Consultancy

Precision, Expertise, Quality

- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards



# LIGHTNING PROTECTION

The single greatest cause of equipment malfunction and failure is due to the effect of lightning strike. Precautions against lightning strike damage are built into our equipment in the form of energy absorbing devices. However, in order to function correctly, these devices require an adequate low-resistance ( $\leq 0.01 \Omega$ ) earth and it is important that the installation is carried out to provide this. Even when there are no lightning strikes, the presence of an electrically charged cloud can give rise to unequal earth potentials over the range which in turn can cause equipment damage.

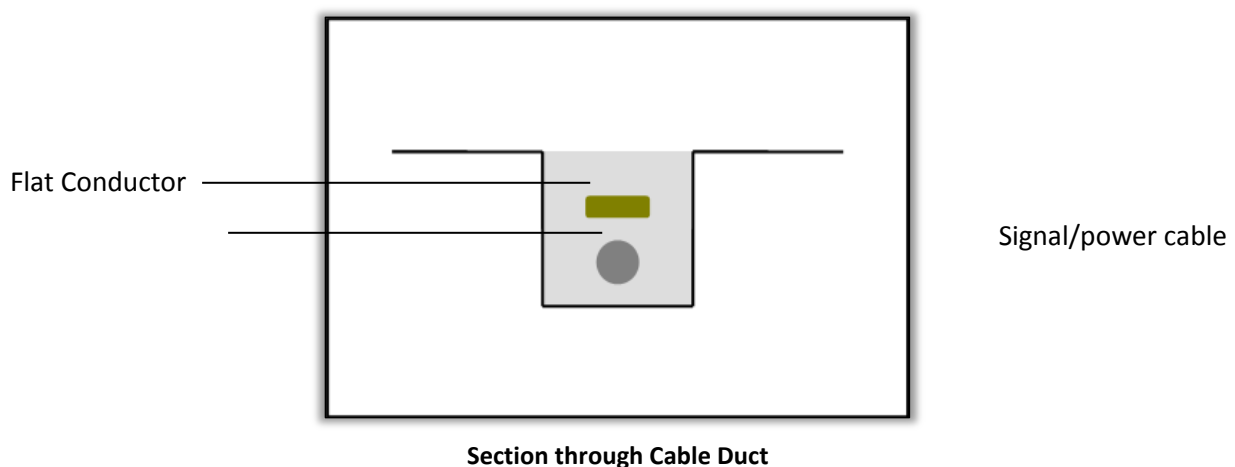
***At the outset, it must be stated that there is no adequate protection against a direct lightning strike.***

If lightning directly strikes any piece of equipment or cable then damage will be sustained, the severity of the damage depending on the path that the electrical discharge takes to earth. However a nearby lightning strike, say within 1 to 2 kilometres from the installation, will induce potentially damaging voltages in the signal and mains cabling; in these circumstances the cabling simply acts as an antenna of approximately 1.5Km in length. In order to protect the equipment against the induced voltage from a close lightning strike, the excess electrical energy has to be absorbed. Each electronic unit, for example, the head amplifier, contains protection circuits which limit the induced voltage to safe levels. A vital factor in the installation procedure is to ensure that the earth screens around the cables are continuous and are not damaged in the process of installation.

The essential points of good practice in installing a system that offers the greatest immunity to lightning strike are:

- Ensure that *low-resistance* local earth connections are made, either by the use of earth rods or by connection to a *low-resistance* conductor to earth, such as a metal water pipe. Use flat copper braid to connect to the earth. It is important to ensure that all cable earth screens are continuous and not damaged; any damaged cable must be replaced.
- Protect the circuit by absorbing the induced power at as many points as possible in order to ensure that the local power level that is dissipated is within the peak ratings of the protection devices.
- In order to minimise the induced voltage and, in addition, to equalise potentially damaging earth voltages, use a flat metal conductor laid above the main cable run (see diagram below).

This latter flat conductor minimises the induced voltage into the signal and mains cables by acting, electrically, as a shorted turn. In other words, the low impedance of the flat earth conductor substantially reduces the local field strength. In addition, the flat conductor equalises the general earth potential. In the absence of a lightning strike, a charged cloud in closer proximity to one end of the range to the other will cause large variations in local earth potential. The flat conductor equalises the earth potentials and reduces them to a safe level.



# CHAPTER TWO - AIR-TO-GROUND STRAFE AND BOMB SCORING SYSTEMS

## Contents

- 210-10Acharger
- 410-missdistanceindicator
- 573-remote-controltransceiver
- 590-strafeandgunnerytarget
- 650-bombscoringsystem
- 663\_n-rangeprocessor
- 740-hostilefireindicator
- 950-597-windowsair-to-groundcontrolsoftware
- airtoground-atog
- app01-lightningprotection
- mobile-rangecontroller



# 10A CHARGER

## TYPE 210



### HARDWARE/SOFTWARE

- **Three modes:** constant current, timed constant voltage, and continuous float.
- **Three-Colour LED** shows charge status.
- **Low-leakage current** allows the unit to be connected without mains input.

### 10A CHARGER TYPE 210

This is a highly efficient 3 stage charger for use with lead acid batteries.

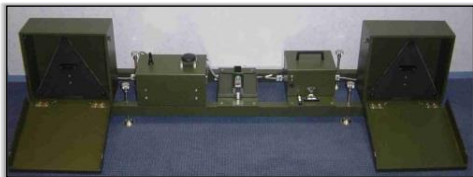
The three modes of operation give an optimized charging process and permit the charger to be left connected indefinitely. The unit, which is reverse-polarity and short circuit protected, has a high current rating. This ensures that this charger is available for the maximum amount of time.

## OPTIMIZED CHARGING PROCESS

### SPECIFICATION

HARDWARE	
Indicator	Multi-coloured LED
POWER/COMMS	
Power	110V-230V AC (50Hz-60Hz)
Bulk Charge	10A Orange
Balancing	14.7 Yellow
Float (Ready/Standby)	13.7V Green
ENVIRONMENT	
Operating Temperature	-10°C - +40°C [14 °F - 104 °F]
DIMENSIONS	
L x W x H	54mm x 171mm x 184mm [2.1in x 6.7in x 7.2in]
Weight	1.7kg [3.7lbs]

### USED WITH



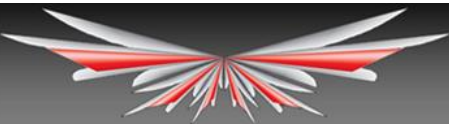
Acoustic Target Type 541



Optical Target Type 570



Strafe and Gunnery Target Type 590



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# MISS DISTANCE INDICATOR TYPE 410



## HARDWARE/SOFTWARE

- **Sensor Array** mounted in the front nose cone detects shock wave generated when a supersonic projectile passes through the sensing zone.
- **Airborne Processor** calculates the distance and sector information and transmits this data to the transceiver at the Ground Station.
- **Ground Station** decodes distance and sector information and sends it to the computer.
- **Computer** processes the data, then displays and records the information in an easy-to-understand interface.
- **Post-Firing Analysis** can be done on the print-outs. Missions can be recorded together with ballistic and any other data.

## MISS DISTANCE INDICATOR TYPE 410

The MS Instruments (MSI) airborne Miss Distance Indicator (MDI) Scoring System provides real-time assessment of live firings in the Air-to-Air and Ground-to-Air training environment.

The MDI is normally supplied as part of the MSAT-500/NG Aerial Target System. MSAT-500 is a reliable training tool assuring a solution to cost effective training budgets for air defence gunnery, missile firings and weapon operator training. Operational over both land and sea MSAT-500 can be utilised to simulate the threat of attacking enemy aircraft, missiles and RPVs/drones, bringing versatility to the training field.

## VERSATILITY TO THE TRAINING FIELD

### SPECIFICATION

HARDWARE	
Sensing Range (MDI)	10m-30m according to calibre (supersonic projectiles)
Sensor Type (Indicator)	Piezoelectric transducer
Computer	Laptop with proprietary software and operating system
POWER/COMMS	
Power (MDI)	Built in rechargeable battery 12V DC
Power (Ground Station)	110/230V AC
Antenna Type (MDI)	High gain whip
Antenna Type (Ground Station)	High gain dipole
Telemetry Frequency	450/900MHz UHF band (according to customer)
ENVIRONMENT	
Operating Temperature Of MDI	-10 - 50 °C14 – 122 °F
Humidity	100%
DIMENSIONS	
L x W x H (Indicator)	220mm x 120mm x 80mm[ 8.7Inc x 4.7Inc x 3.1Inc ]
L x W x H (Ground Station)	220mm x 120mm x 80mm [ 8.7Inc x 4.7Inc x 3.1Inc ]
Weight (MDI)	2.75kg [6.06lbs]
Weight (Ground Station)	2.2kg [4.85lbs]

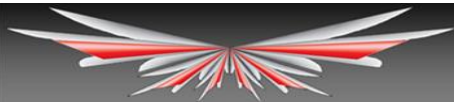
## USED WITH



Nimbus Type 155



Remote-Control Transceiver



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# REMOTE-CONTROL TRANSCEIVER

## TYPE 573



### REMOTE-CONTROL TRANSCEIVER TYPE 573

Created to be convenient and practical, the remote-control transceiver can be added to almost all MS Instruments training and ballistic data systems.

The transceiver is used when cabling is not viable, and can be provide as a standalone unit or integral to the other system components.

The unit has a standard distance of 3km from the firing point at which it can communicate with a target system. Made to suit a variety of operating environments, the unit offers a range of frequencies and power outputs, in order to be as user-friendly and helpful as possible.

### CONVENIENT AND PRACTICAL

### SPECIFICATION

RADIO FREQUENCY CHARACTERISTICS	
Frequency	902-928MHz
Channel Spacing	2.6MHz
Power Output	1mW/1W (Programmed)
POWER/COMMS	
Supply Voltage	10V-48V DC or 18-30V AC
Power	5VA max.

ENVIRONMENT	
Operating Temperature	-40°C - +85°C [-40°F - 185°F]
DIMENSIONS	
L x W x H	220mm x 120mm x 90mm [8.7in x 4.7in x 3.5in]
Weight	2kg [4.4lbs]

### USED WITH



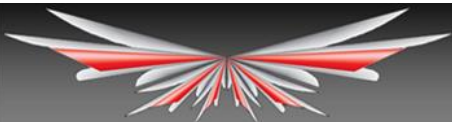
Acoustic Target Type 541



Meteorological Station Type 574



Range Processor Type 663



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# STRAFE AND GUNNERY TARGET TYPE 590



## STRAFE AND GUNNERY TARGET TYPE 590

The Strafe and Gunnery Target is an advanced acoustic shot scoring system. Designed for the training and evaluation of fixed wing and rotary aircraft gunnery, the real-time reporting of shot pattern and hits greatly enhances the gunner's training cycle.

The non-contact electronic shot detection technology ensures a low-cost system, with a greatly reduced frequency of target replacement. The rugged quality of the target adds a further assurance of product longevity, an essential requirement of any modern military equipment.

Since 1996, this has been a choice target used in UK RAF ranges. The latest target utilises cutting-edge technology to enhance accuracy and usability. The simplicity of the software, when added to the rapidity of the target's operational feedback, provides an unparalleled training experience. Pilots and gunners are made immediately aware of their score, greatly accelerating the improvement curve.

The Strafe Scoring target delivers instant, accurate shot scoring, with a support network at MS Instruments that guarantees the system is consistently the best.

## CUTTING-EDGE TECHNOLOGY ENHANCES ACCURACY AND USABILITY

### Versatile:

- All supersonic projectile types detected.
- Wide range of attack angles.
- Modular structure.

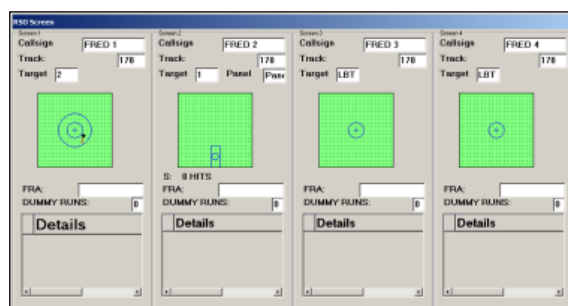


### Tough and Convenient:

- Robust folding design.
- Easy transportation.
- Reliable operation.

### Simple and Effective:

- Instant Feedback.
- Capacity for system expansion.
- Comprehensive report generation.



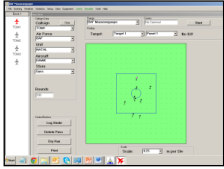




Acoustic Sensor



Full Target



Shot Pattern Display

## HARDWARE

- **Two acoustic sensor pods** measure the shock-cone generated by supersonic projectiles passing over the target. The projectile's location is then calculated.
- **The Radio Transceiver** sends this information to the Range Processor Type 663(n), where the shot pattern and score are clearly displayed. Wiring is available on request.
- **New Folding Frame** gives maximum pod separation, and hence detection area, whilst ensuring portability. The folding cover protects the target during transport and storage.
- **Modularity** ensures easy component replacement, minimising down-time in the event of shot damage. Combined with power-up tests, this ensures incomparable reliability.

## SOFTWARE

- **Shot Pattern and Score** displayed on operator and remote screen.
- **Communication** with the system allows performance analysis at any base location.
- **System Expansions** include multiple targets and bomb-scoring, with seamless software integration.
- **Comprehensive Report Generation** and summary statistics capability.

## SPECIFICATION

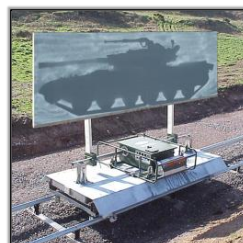
MEASUREMENT	
Active Target Area	7m x 7m [7.62mm cal]; 20m x 20m [30mm cal]
Shot Position Accuracy	500mm rms or better
Azimuth Range [typical]	±25°
Elevation Range [typical]	0-45°
PROJECTILES	
Projectile Velocity [at target]	Mach 1.3 to Mach 5
Projectile Calibre	All supersonic calibres
Rate of Fire	≤6000 rpm
POWER/COMMS	
Power	12V DC provided by sealed, lead, acid battery
Charging	110-240V AC (50-60 Hz)

Communications	900 MHz band UHF [Radio Transceiver Type 573]
Standard Radio Distance	3.0km [1.8mi]
Wired	Available on request
ENVIRONMENT	
IP Rating	IP67
Rain	Operates in light rain
Wind	Gusts affect nominal accuracy
Operating Temperature	-10°C to 50°C [14 °F to 122 °F]
DIMENSIONS	
L x W x H (Folded)	2.69m x 0.42m x 0.64m (1.59m x 0.42m x 0.68m) [106in x 17in x 26in (63in x 17in x 27in)]
Weight [excl. battery and cover]	39.0kg [86.0lbs]

## USED WITH



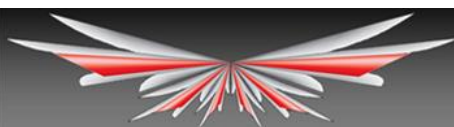
Battle Effects Simulator (BATES) Type 220-221



Moving Armour Target (MAT) Type 250-253



Bomb Scoring System Type 650



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# BOMB SCORING SYSTEM

## TYPE 650



### HARDWARE/SOFTWARE

- Two **Sighting Devices** are placed a known distance apart, giving separate bearings of the hit position. The calculated intersection gives the hit co-ordinate in relation to the aircraft approach track.
- Pivoting Arm** on which the sighting device is mounted connects to a sensor via a spindle.
- Electronic Sensor** is attached to the underside of the sighting frame. It converts the angular position of the pivoting arm into a bearing that is displayed on the Bomb-Court Control Unit. The Bearing is confirmed with a single button press.
- Strafing Range Processor** combines both bearings to calculate the position of impact.

### BOMB SCORING SYSTEM TYPE 650

The MS Instruments semi-automatic bomb scoring system is an advanced system that measures the bearing of a visible bomb or rocket strike. A rugged, compact system, the bomb scorer uses quick, intuitive technology to give rapid feedback to the user, reducing training time and costs. Instant and accurate, this bomb scoring system is a consistent performer.

## QUICK, INTUITIVE TECHNOLOGY

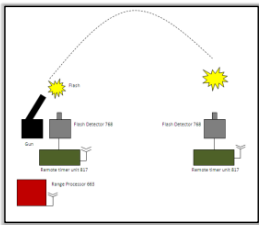
### SPECIFICATION

HARDWARE	
Bearing Resolution/Accuracy	0.01° (~0.5m at 2000m)
POWER/COMMS	
Power	12V DC
Communication	Cable or Wireless Link
Transceiver Range	Up to 5km
ENVIRONMENT	
Operating Temperature	0°C - 60°C [32 °F - 140 °F]
Humidity	95% non-condensing
Range	Governed by visibility – typically 5km
DIMENSIONS	
L x W x H (Control Unit)	120mm x 220mm x 140mm [4.7in x 8.7in x 5.5in]
Weight (Control Unit)	1.6kg [3.5lbs]
L x W x H (Transceiver without Antenna)	100mm x 210mm x 110mm [3.9in x 8.3in x 4.3in]
Weight (Transceiver)	1.5kg [3.3lbs]
L x W x H (Sighting Device)	200mm x 500mm x 400mm [7.9in x 19.7in x 15.7in]
Weight (Sighting Device)	6.4kg [14.1lbs]

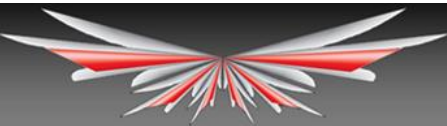
### USED WITH



Strafe and Gunnery Target Type 590



Burst Time Measurement Equipment



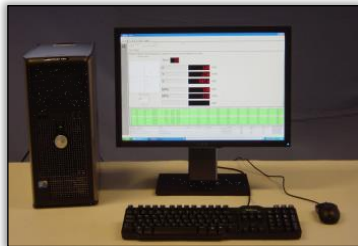
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# RANGE PROCESSOR TYPE 663(N)



## RANGE PROCESSOR TYPE 663(N)

The Range Processor Type 663 is a high performance computer, which features the latest Windows Pro operating system and the latest Dual Core technology.

The 663 with ample memory and hard disk space for all modern Windows applications. Additional hardware is provided to interface with the MS Instruments equipment.

The desktop unit is supplied with a 21" LCD Monitor to provide a large, clear desktop display, enabling all results to be clearly seen as they are received. The 663N offers a portable solution. The range processor is the ideal machine from which to run range operations smoothly and efficiently.

## SMOOTH AND EFFICIENT

### SPECIFICATION - DESKTOP

INTERNAL HARDWARE (min)	
Processor	P-4 Dual core 3.0 GHz
Memory	4 GB
Hard Drive	512 GB
DVD ROM/RW	DVD/CD-RW Combo (8x8x8x24)
EXTERNAL HARDWARE	
Display	21" LCD
Printer	Colour Laserjet
UPS	500 VA
SOFTWARE	
Operating System	Windows 7 Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>
DIMENSIONS	
L x W x H (Desktop)	460mm x 630mm x 210mm [18.11in x 24.80in x 8.27mm]

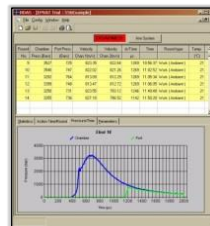
### SPECIFICATION - LAPTOP

INTERNAL HARDWARE (min)	
Processor	Intel Core i7 2.7 GHz
Memory	8 GB
Hard Drive	500 GB SSD
Video Outputs	HDMI/MiniDP
USB 3.0 Ports	2 (1 with PowerShare)
EXTERNAL HARDWARE	
Display	15" (1500 x 900)
Printer	HP Deskjet/Laserjet (Office Standard)
UPS	1000 VA+
Mouse	Built-in trackpad
SOFTWARE	
Operating System	Latest Windows Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>

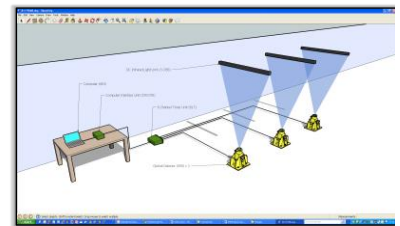
## USED WITH



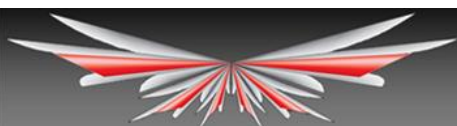
Acoustic Target  
Type 541



Ballistic DB Control Software  
Type 950-571



Projectile Velocity Measurement System  
(PVMS)



## MS INSTRUMENTS Range Consultancy

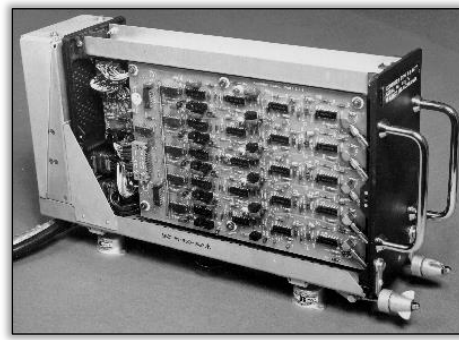
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# HOSTILE FIRE INDICATOR TYPE 740



## HOSTILE FIRE INDICATOR TYPE 740

The Hostile Fire Indicator [HFI] Type 740 is a device which gives a warning to the pilot of a rotary wing aircraft that they are under small arms fire, and indicates the general direction from which that fire originated.

The design of the equipment is based upon the detection of the shockwave front generated by a supersonic projectile. The system calculates the set of bullet velocity vectors which thus shows the direction of the source of the possible hostile fire. On receipt of an indication, the pilot would normally be able to

take avoiding action and minimise the danger of a subsequent direct hit, the exact pilot action being dependent on the operational conditions prevailing.

Although the standard unit is designed for rotary wing aircraft, there is a more compact unit for attachment to ground-based vehicles. The Vehicle Hostile Fire Indicator [VHFI] may be attached to VIP cars or armoured personnel carriers.

The VHFI system comprises the same basic units, however the sensor array is more compact and there may be multiple arrays fitted to vehicles with protruding parts e.g. turrets.

## MINIMISE THE DANGER

### Versatile:

- All small arms projectile types detected.
- Responsive to wide misses.
- Ground-based vehicle adaptability.

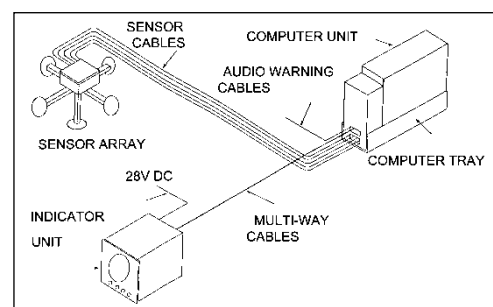


### Tough and Convenient:

- Compact design.
- Easy operation.
- Reliable operation.

### Simple and Effective:

- Instant feedback.
- Visual and audio warnings.
- Clear indication.





## HARDWARE

### Sensor Array

- Five sealed piezo-electric plate transducers are mounted at the ends of five mutually orthogonal tubes, four of which lie along the positive and negative horizontal axes, with the fifth mounted in the axis perpendicular to the other four.
- Anti-vibration mounts connect the transducers and support arms to a junction box.
- Five coaxial leads carry the transducer signals from the junction box to the computer.

### Computer Unit

- 3/8 ATR short case houses this unit.
- Five-channel amplifier converts the pre-processed transducer signals into a logic signal format.
- Logic circuitry determines the occurrence and spatial orientation of a valid shock wave front, and computes the possible sources of hostile fire which could have produced the shock wave.
- Information is visually displayed on the indicator unit.
- Audio warning signal in the form of a 1 second, 300Hz square wave tone is injected into the intercom system to give the pilot additional indication of a detected shock wave.

### Indicator Unit

- Standard 4ATI case situated in the aircraft instrument panel houses this unit.
- Red disc on the front of the unit is divided into eight, 45° segments, each one of which may be individually illuminated.
- In the event of hostile fire, 4 contiguous segments are illuminated for 5 seconds, producing a 180° arc which indicates the possible locations (relative to the helicopter axes) of the source of fire.
- Where an unambiguous indication cannot be given, the full 360° display is illuminated.

## SPECIFICATION

CONFIGURATIONS	
Power Supplies	28V ± 5V DC (22V emergency)
Power	30W + 35W display illuminated
Sensitivity	Responsive to supersonic projectiles with miss distances of up to 20m
Calibration	By means of special purpose Test equipment
Display	180° floating sector, illuminated for 5 seconds
Audio Warning	300Hz square wave, duration 1 second
Self-Test	B.I.T.E from amplifier inputs onwards is provided
CONTROLS	
Power ON/OFF Switch	Power on/off
RESET (Switch)	Cancels the current display and readies the system for new input
RESET (Switch)	Initiates an internal automatic test sequence producing an easy-to-follow sequence of displays lasting

	approximately 10 seconds. If the sequence of displays is completed, then the system has undergone a thorough self-testing procedure successfully
ENVIRONMENT	
Operating Temperature (Flight)	-10°C to 50°C [14°F to 122°F]
Operating Temperature (Ground)	-10°C to 50°C [14°F to 122°F]
DIMENSIONS	
L x W x H (Sensor)	305mm x 305mm x 195mm [12.0in x 12.0in x 7.7in]
L x W x H (Computer)	94mm x 41mm x 228mm [3.7in x 1.6in x 9.0in]
L x W x H (Indicator)	106mm x 106mm x 125mm [4.2in x 4.2in x 4.9in]
Weight (Sensor)	1.097kg [2.4lbs]
Weight (Computer)	3.95kg [8.7lbs]
Weight (Indicator)	1.25kg [2.8lbs]

USED  
WITH



Nimbus Type 155



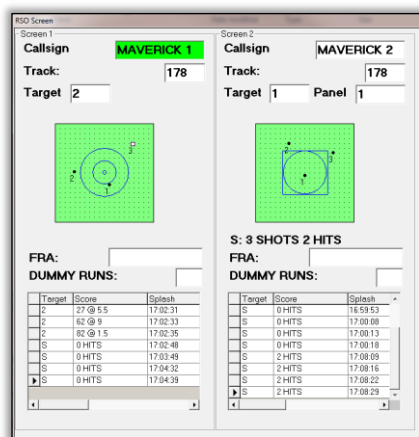
Strafe and Gunnery Target Type 590



Bomb Scoring System Type 650

# WINDOWS AIR-TO-GROUND (WINATOG) CONTROL SOFTWARE

## TYPE 950-597



## WINDOWS AIR-TO-GROUND (WINATOG) CONTROL SOFTWARE TYPE 950-597

The MSI WINATOG Software enables the control as well as the status monitoring of the Air-to-Ground Strafe and Bomb-Scoring systems provided by the company.

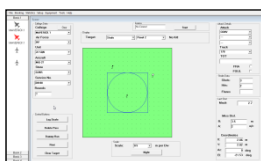
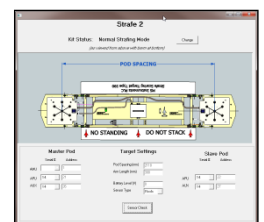
As well as providing complete diagnostic and configuration facilities for the system hardware, the software is designed to give results from all connected instruments in a simple and rapid manner.

This clear and accessible software is easy to use and enables smooth operation in all projects.

## SIMPLE AND RAPID

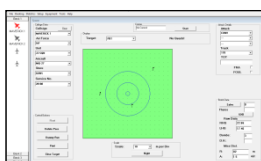
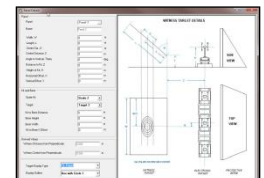
### SOFTWARE

- **Windows Compatibility** of WINATOG means that it works with all state computers operating in this environment.
- **Integral microprocessor** in all MSI measuring equipment enables the units to communicate digitally by cable, radio, or other telemetry link (UHF or Wifi) to the Range Processor.
- **Target & device control** allows the software running on the Strafing Range Processor to communicate with up to 12 strafing targets and 8 sighting quadrants as standard.



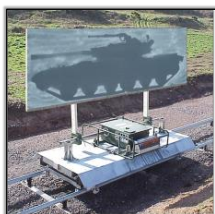
- **Shot or bomb-drop positions** are displayed on screen, and readings are also given of clock/distance, and Direct Hit/Hit/Miss information.
- **Range of displayed information** includes the Callsign, Aircraft Type, Store, Attack Profile etc.
- **Ability to log** First Run Attacks, Dry Runs, Bootlegs, and Fouls is provided.
- **Bootleg flights** are allowed without interrupting the system setup, or delaying data processing.

- **Two control screens** provided with the Range Processor allow one user screen and an additional unit for the air-traffic controller.
- **Air-Traffic Controller** maintains a complete overview of all aircraft in-circuit from the control screen.
- **"Night" mode** reduces the display contrast during night-time firing.



- **Data is combined** into daily and monthly statistical reports for further analysis.
- **Data may be stored to disk**, assembled into a summary report, and printed or faxed from the internal modem to the pilot's home base.
- **Software comes complete** with a Data-Warehousing suite and Rang Management module.
- **Range-booking** and usage functions assist in cost-effective utilization of available range resources.

## USED WITH



Moving Armour Target (MAT) Type 250 – 253



Strafe and Gunnery Target Type 590



Bomb Scoring System Type 650

**“ATOG is designed for rapid training and assessment of pilot performance in air to ground gunnery and**

- Up to 12 strafing targets and 8 sighting quadrants
- Shot/bomb-drop positions are displayed on screen
- Clock/Distance and Direct Hit/Hit/Miss info given
- Information displayed includes Callsign, Aircraft type, Store, Attack profile etc.
- Ability to log First Run Attacks, Dry Runs, Bootlegs, and Fouls
- Data combined into daily and monthly reports for further analysis



# LIGHTNING PROTECTION

The single greatest cause of equipment malfunction and failure is due to the effect of lightning strike. Precautions against lightning strike damage are built into our equipment in the form of energy absorbing devices. However, in order to function correctly, these devices require an adequate low-resistance ( $\leq 0.01 \Omega$ ) earth and it is important that the installation is carried out to provide this. Even when there are no lightning strikes, the presence of an electrically charged cloud can give rise to unequal earth potentials over the range which in turn can cause equipment damage.

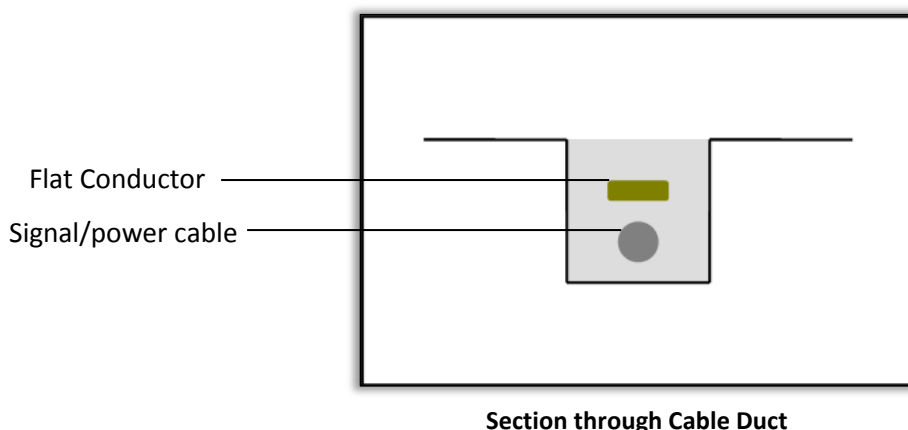
***At the outset, it must be stated that there is no adequate protection against a direct lightning strike.***

If lightning directly strikes any piece of equipment or cable then damage will be sustained, the severity of the damage depending on the path that the electrical discharge takes to earth. However a nearby lightning strike, say within 1 to 2 kilometres from the installation, will induce potentially damaging voltages in the signal and mains cabling; in these circumstances the cabling simply acts as an antenna of approximately 1.5Km in length. In order to protect the equipment against the induced voltage from a close lightning strike, the excess electrical energy has to be absorbed. Each electronic unit, for example, the head amplifier, contains protection circuits which limit the induced voltage to safe levels. A vital factor in the installation procedure is to ensure that the earth screens around the cables are continuous and are not damaged in the process of installation.

The essential points of good practice in installing a system that offers the greatest immunity to lightning strike are:

- Ensure that *low-resistance* local earth connections are made, either by the use of earth rods or by connection to a *low-resistance* conductor to earth, such as a metal water pipe. Use flat copper braid to connect to the earth. It is important to ensure that all cable earth screens are continuous and not damaged; any damaged cable must be replaced.
- Protect the circuit by absorbing the induced power at as many points as possible in order to ensure that the local power level that is dissipated is within the peak ratings of the protection devices.
- In order to minimise the induced voltage and, in addition, to equalise potentially damaging earth voltages, use a flat metal conductor laid above the main cable run (see diagram below).

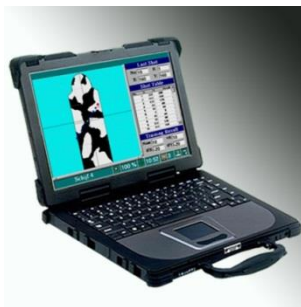
This latter flat conductor minimises the induced voltage into the signal and mains cables by acting, electrically, as a shorted turn. In other words, the low impedance of the flat earth conductor substantially reduces the local field strength. In addition, the flat conductor equalises the general earth potential. In the absence of a lightning strike, a charged cloud in closer proximity to one end of the range to the other will cause large variations in local earth potential. The flat conductor equalises the earth potentials and reduces them to a safe level.





# MOBILE RANGE CONTROL COMPUTER

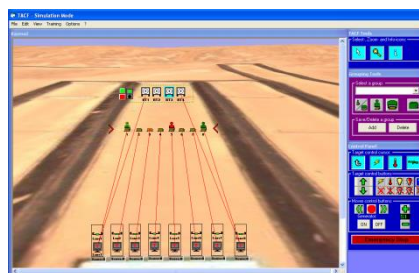
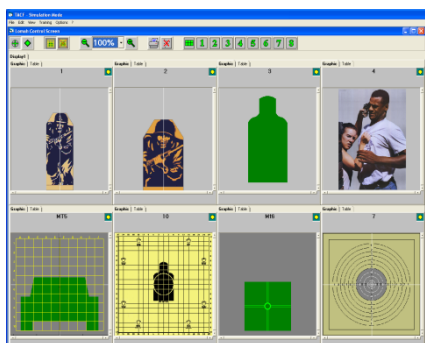
## RUGGEDIZED TACF



The mobile range control computer (Ruggedized TACF) is a multi-functional target control system specifically designed for military use.

The portable Training Area Control Facility (TACF) is a fully computerized controller for infantry and tank target mechanisms, moving target systems, enemy fire simulators and automatic scoring systems. The TACF displays graphically the whole training area and reports the number of hits for each target, the location of miss and hit (LOMAH), the position of both stationary and moving targets, and the status and errors for each appliance.

The ruggedized TACF Laptops are selected to withstand environmental and physical stress occurring on live-fire ranges including temperature extremes, drops to hard surfaces, and exposure to water and dust.



### SPECIFICATION

CPU	1.4 GHZ or higher	Display	14,1 TFT XGA (1024x 724)
RAM Memory	256 MB or more	Environmental & Safety/EMC	Mil-STD 810F, IP 54, CE, FCC part 15, Class 15
VGA Controller	Integrated, 64 MB shared	Dimensions	(w) 400 mm (D) 300 mm (H) 50 mm
Battery	~3 hour operation, second Battery and car adapter available	Weight	4 kg
I/O Ports	Serial port, USB, DC input	Operating System	MS Windows 7
Environmental Standard			
	Operational	Storage	
Temp (Min.)	0°C	-20°C	
Temp (Max.)	+55°C	+55°C	
Humidity	5% to 95% RH		
Altitude	15000ft	40000ft	
Shock	15g, 11ms	50g, 11ms	
Drop	3 feet height free drop		
Vibration	57.5~500 Hz/ 1.0 g	57.5~500 Hz/ 2.0 g	
Enclosure	IP 54 compliance		

# CHAPTER THREE - NIMBUS NON-LETHAL VEHICLE PROTECTION SYSTEM

## Contents

- 155-nimbus

# NIMBUS TYPE 155



## NIMBUS TYPE 155

The NIMBUS Virtual Armour is the latest in anti-terrorist weaponry. Covert, sophisticated, and easy-to-use, NIMBUS provides a non-lethal deterrent that secures the vehicle whilst minimising civilian casualties and collateral damage.

An array of desensitizing pyrotechnics, commanded from within the vehicle, serves to distract and disorientate the attacker, depriving them of any advantage.

Designed to defend against a wide range of attacks, NIMBUS provides additional protection to up-armoured vehicles, which are never truly “bulletproof”, as well as soft-skin.

The system is suitable for a multitude of clients, from military personnel to riot police and VIPs, with its operational versatility making it successful in all vehicular environments.

NIMBUS is designed to save lives. It is an essential component in the defensive arsenal of all high-risk vehicles.

## ‘DISTRACT, DISORIENTATE, DEPRIVE’

### Simple and Intelligent:

- Minimised collateral damage.
- Continuous self-diagnosis.
- Elimination of accidental firing.



### Covert:

- Complete in-car control.
- Customisable colour-scheme.
- Remote tracking.



### Universal and Versatile:

- Compatible with all vehicles.
- Deployable in all weather types.
- Successful at all speeds.





Firing Unit



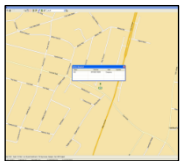
Pyrotechnic Devices



Tracking System Parts



Bracket Fitting



Tracker Street View

## HARDWARE

- The **Firing Unit** is designed with a simple, striking layout. Full choice of which units to deploy is given to the operator, allowing flexibility in all situations. Once fired, remaining units are automatically armed, giving the operator rapid ability to respond to any progression in the conflict.
- **Smoke, Air, and Multisound (SAM) Pyrotechnics** combine extreme amplitude and luminosity with dense cloud to disorientate the attackers and obscure their vision. These units can be detonated in any configuration, from a single unit to the entire system, according to the operator's requirements.
- A **State-of-the-Art Tracking System** is integrated with NIMBUS as an optional addition. The system uses live tracking from the control software, SMS, and GMS to pinpoint the exact position of the vehicle worldwide. Upon activation of NIMBUS, the T1 tracker sends an immediate signal to base, informing them of the vehicles location, and that NIMBUS has been deployed.

## SOFTWARE

- **Central Server** allows for tracking of multiple NIMBUS systems at once, with easy connection of the software to portable devices.
- **Third-Party Mapping Engines**, such as Google Earth, are supported.
- **Automatic Log Downloading** enables a quick turnaround from an incident occurring to being analysed.

## SCENARIO – SHARK ATTACK

- |                 |   |
|-----------------|---|
| <b>Attack</b>   | – <b>Road pursuit</b> with the client being attacked by gunmen in the car behind.                   |
|                 | – <b>Gunmen</b> leaning out of windows and sunroof, spraying the client's vehicle with ammo.        |
| <b>Response</b> | – <b>Rear Air Burst Units deployed.</b> Driver swerves and gunmen momentarily disengage.            |
|                 | – <b>Sound Units (both banks) deployed.</b> Deafened gunmen flinch and disengage.                   |
|                 | – <b>Smoke Units deployed.</b> Sheer volume and density of smoke cause attack vehicle to disengage. |

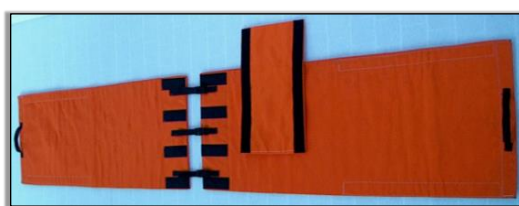
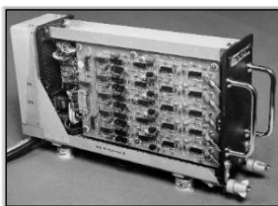
### Other Scenarios Include:

- 1) **Ambush**
- 2) **Car Jacking**
- 3) **Road Side IED**
- 4) **Aggressive Crowd**

## SPECIFICATION

FIRING UNIT	
Voltage	12V-36V
Current	2A [sequential firing]
SMOKE UNIT	
Time to Max. Output	4 secs
Toxicity	Ingestion Harmful
Gross Weight	134g [0.30lbs]
SOUND UNIT	
Time to Detonation	1-1.5 secs
Amplitude at 10m	150dB
Toxicity	Ingestion Harmful
Gross Weight	114g [0.25lbs]
AIRBURST UNIT	
Time to Detonation	0.5 secs
Toxicity	Ingestion Harmful
Gross Weight	168g [0.37lbs]
BRACKETS	
Attachment Method	• Spot Weld
	• Rivet
	• Screw
	• Glue
	• Cable-Tie
	• Magnet
GENERAL	
Installation Time	2-3 hours
Reload Time	Better than 5 mins
(NIMBUS is retrofit and can be transferred between vehicles)	

## USED WITH



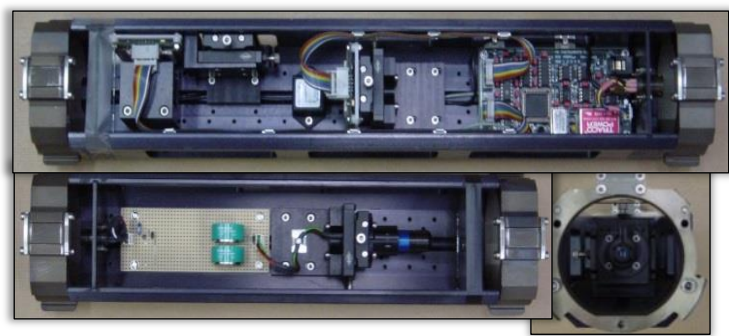


# CHAPTER FOUR - BALLISTIC INSTRUMENTATION AND RANGE DESIGN

## Contents

- 151-barrelstraightnessgauge
- 157-safetyfiringsystem
- 157-050-remotetriggerpull
- 210-10Acharger
- 340-largeareaopticaltarget
- 341-laotaimingmark
- 519-chambertarget
- 530-acoustictarget
- 531-050-popupaimingmark
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- 546-opticaltarget
- 570-070-computerinterfaceunit
- 570-opticaltarget
- 573-remote-controltransceiver
- 574-200-meteorologicalstation
- 574-meteorologicalstation
- 588-acousticdetector
- 598-indoorclimatemonitor
- 603-strawboardimager
- 616-shotpatternanalyser
- 630-320-multipletriggersystem
- 663\_n-rangeprocessor
- 680-ballisticdataacquisitionsystem
- 681-400-azimuthandelevationmount
- 681-550-universalweaponreststand
- 681-600-universalweaponrest
- 681-700-universalreceiver
- 681-800-x-ymount
- 681-900-universalreceiver-mediumcalibre
- 681-cc-coppercrusheradaptors
- 683-pressuremeasurementunit
- 684-remote-controlledliveammunitiondrilling machine
- 685-bullettraps
- 726-flashdetector
- 726-050-flashdetector
- 761-100-opticaldetectortestset
- 761-200-pvmstestset
- 768-100-infraredflashbeacon
- 768-flashdetector
- 769-variabledelayunit
- 775-solid-state-lightsupportframe
- 783-120-detectorpowerunit
- 788-intelligentinfraredlightsource
- 807-rate-of-firecomputer
- 817-triple-channelremotetimerunit
- 818-050-tracerignitionsystem
- 818-100-dual-channelgps-synchronizedtimer
- 818-250-tracerdetector
- 858-opticaldetector
- 859-velocityscreen
- 950-571-ballisticsdbcontrolsoftware
- app01-lightningprotection
- app02-calibrationofautomatictargets
- app03-opticaldetectoralignchecks
- app04-sampleballisticprintout
- app05-standardstatisticalanalyses
- app06-accuratevelocitymeasurement
- app07-windeffectonacoustictargets
- app08-pitchandyawmeasurement
- ballisticmeasuringinstrumentation
- bursttimemeasurementequipment-t-btme
- indoorvelocitymeasurementsystem-ivms
- pressurebarrel
- projectilevelocitymeasurementsystem-pvms

# BARREL STRAIGHTNESS GAUGE TYPE 151



## BARREL STRAIGHTNESS GAUGE TYPE 151

The MSI Barrel Straightness Gauge is, as the name suggests, a device used to measure the straightness of a barrel or tube at multiple positions along its length.

The system is easily calibrated by placing the target and laser assemblies in a reference tube. A simple procedure provides the helpful reference readings.

This sleek device is helpful and thorough, providing statistics and graphs to ensure optimised analysis.

## HELPFUL AND THOROUGH

### HARDWARE/SOFTWARE

- Low-power, eye-safe laser with integrated rechargeable battery is inserted into a collar matching the internal dimensions of the tube
- Laser is inserted into the barrel and positioned at the base of the barrel. Insertion and removal of the assembly is by simple screw-in rods.
- Target assembly is inserted into the barrel in a similar manner to the laser assembly, and may be moved along the length of the barrel to analyse the straightness along the length.
- Target rods have a simple scale to give an indication of the depth of the target assembly in the barrel.
- Readings may be entered into the Notebook PC allowing graphing of the barrel profile.

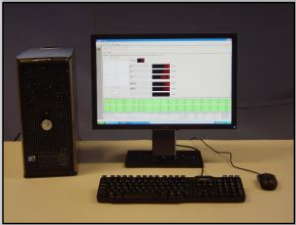
### SPECIFICATION

POWER/COMMS	
Power Supply	85 – 264 VAC or 12 VDC
Interface	RS232
CONFIGURATIONS	
Target Detection Area	20mm x 20mm
Target Resolution	0.02mm
Laser Wavelength	630nm
ENVIRONMENT	
Humidity	95% non-condensing
DIMENSIONS	
Length x Diameter [Target Assembly]	200mm x 80mm [7.87in x 3.15in]
Length x Diameter [Laser]	100mm x 40mm [3.94in x 3.15in]
Weight [Target Assembly]	0.5kg [1.1lbs]
Weight [Laser]	0.2kg [0.4lbs]

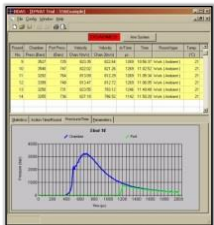
## USED WITH



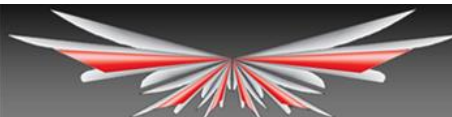
Acoustic Target Type 541



Range Processor Type 663



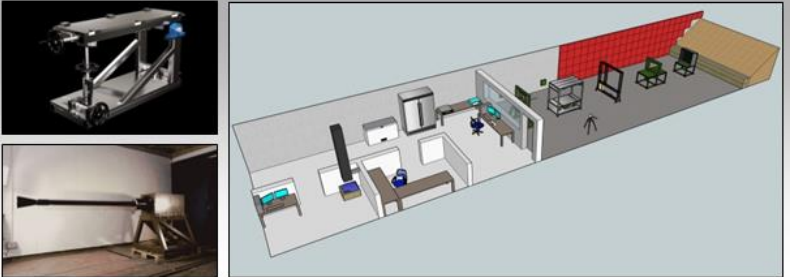
Ballistics DB Control Software Type 950-571



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- Only the Latest Standards



# SAFETY FIRING SYSTEM

## TYPE 157



### SAFETY FIRING SYSTEM TYPE 157

The Safety Firing System is an essential part of any successful ballistics range, bringing ease and sophistication to the testing process.

Designed for firing all weapon types the main objective of the system is to enable firing in the safest possible manner. Using a whole host of features, including door locks, sensors, and self-tests, it helps to remove risk to personnel and make the whole firing process smoother.

All of this ensures the most secure environment in which to fire.

## EASE AND SOPHISTICATION

### HARDWARE/SOFTWARE

- **Safe Key** must be removed when loading the gun, so that the gun can't be fired.
- **PIR** check that no personnel are in the firing room.
- **Door Sensor** checks that the firing room door is closed.
- **Strobe** indicates that the range is live.
- **Warning Sounder** alerts when the gun is about to fire.
- **Door Lock** ensures that no personnel can go into the firing room if in countdown to fire mode.
- **LCD Screen** displays *Misfired Count* and *Shot Count*.
- **Self-Test** performed at power on to check that gun can be fired.
- **Shot Misfired** door safety interlock. Door stays locked for programmable time.

### SPECIFICATION

POWER/COMMS	
Power	110V-240V AC (100W)
Connections	<ul style="list-style-type: none"><li>• 19-way socket to Range J/B.</li><li>• USB to PC.</li><li>• Mains Power.</li></ul>
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	Indoor Use only
DIMENSIONS	
L x W x H (Safety Firing Box)	280mm x 170mm x 90mm [11.0in x 6.7in x 3.5in]
Weight	4kg [8.8lb]
L x W x H (Remote Trigger)	260mm x 150mm x 100mm [11.0in x 5.0in x 4.0in]
Weight	4kg [8.8lb]

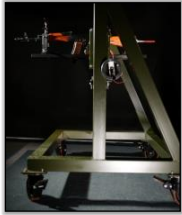
## USED WITH



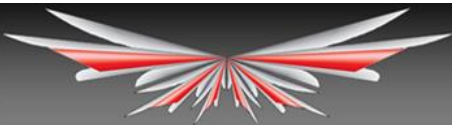
Universal Weapon Rest Type 681-600



Universal Receiver Type 681-700



X-Y Mount Type 681-800



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# REMOTE TRIGGER PULL

## TYPE 157 050



### REMOTE TRIGGER PULL TYPE 157 050

The Remote Trigger Pull has been designed to fire weapons remotely from the safety of the control room in conjunction with 157 001AS. The remote trigger pull has a programmable trigger pull distance and a trigger hold time set in a menu. The trigger hold time is used to fire a burst of rounds that have been loaded in to the weapon. There are two safety parts to the system: one is a flashing red strobe on the top of the unit to show that the system is live or safe, and the second is a safety key switch that you set to safe and remove key when loading the weapon.

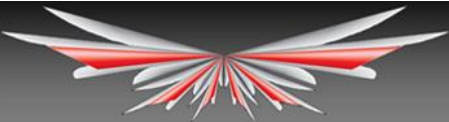
### HARDWARE

- **Safety**  
The 157 firing system is the safest way of firing weapons.
- **Weapons that can be fired**  
All weapons that have a trigger can be fired with this system. Rifles, Hand guns, 0.50" BMG A2

### COMPACT AND RELIABLE

### SPECIFICATION

HARDWARE	
Trigger Pull Distance	5mm – 50mm
Trigger Hold Time	1 – 5 Seconds
POWER/COMMS	
Power	110 – 240V ac $\pm 10\%$ @ 15W
ENVIRONMENT	
Operating Temperature	0°C - +50°C [-32 °F - +122 °F]
DIMENSIONS	
L x W x H	260mm x 150mm x 100mm [10.2in x 5.9in x 3.9in]
Weight	8.8kg [14.2lbs]



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# 10A CHARGER

## TYPE 210



### HARDWARE/SOFTWARE

- Three modes: constant current, timed constant voltage, and continuous float.
- Three-Colour LED shows charge status.
- Low-leakage current allows the unit to be connected without mains input.

### 10A CHARGER TYPE 210

This is a highly efficient 3 stage charger for use with lead acid batteries.

The three modes of operation give an optimized charging process and permit the charger to be left connected indefinitely. The unit, which is reverse-polarity and short circuit protected, has a high current rating. This ensures that this charger is available for the maximum amount of time.

## OPTIMIZED CHARGING PROCESS

### SPECIFICATION

HARDWARE	
Indicator	Multi-coloured LED
POWER/COMMS	
Power	110V-230V AC (50Hz-60Hz)
Bulk Charge	10A Orange
Balancing	14.7 Yellow
Float (Ready/Standby)	13.7V Green
ENVIRONMENT	
Operating Temperature	-10°C - +40°C [14 °F - 104 °F]
DIMENSIONS	
L x W x H	54mm x 171mm x 184mm [2.1in x 6.7in x 7.2in]
Weight	1.7kg [3.7lbs]

### USED WITH



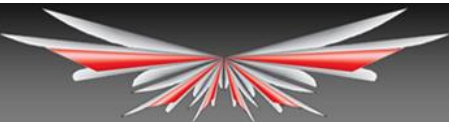
Acoustic Target Type 541



Optical Target Type 570



Strafe and Gunnery Target Type 590



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# LARGE AREA OPTICAL TARGET (LAOT) TYPE 340



## LARGE AREA OPTICAL TARGET (LAOT) TYPE 340

The MSI Optical Target Type 546 target provides developers, testers, and manufacturers with a highly accurate and cost-effective method of checking the performance of weapons and ammunition by measuring the coordinates of shots fired under test.

MSI's Optical Targets have been designed for the rapid testing of a wide range of calibre weapons, both new and repaired. The LAOT is a high precision instrument that provides a virtual

target plane with a large detection area, which is ideal for weapons with higher dispersion patterns, with the Optical Target Type 546 being preferable for smaller dispersions.

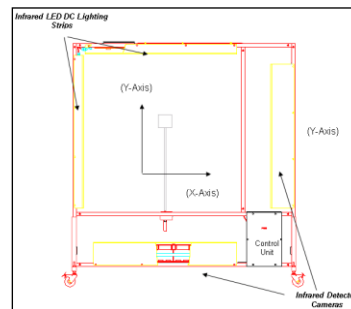
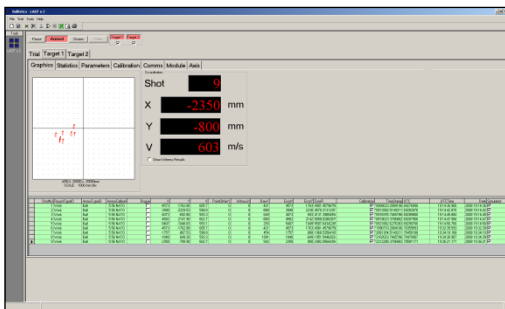
This precision electronic target replaces traditional methods of measurement, and removes all the associated problems, thus saving time, reducing error, and increasing safety.

The MSI Large Area Optical Target is an easy piece of equipment with which to work, and makes weapons testing faster and better.

## SAVING TIME, REDUCING ERROR, AND INCREASING SAFETY

### Simple and Versatile Equipment:

- Accommodates a variety of ammunition
- Designed primarily for indoor use
- Provides a range of possible calculations

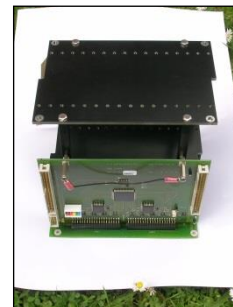


### Accurate and Easy Data Recording:

- Instant graphical representation of data
- Results can be stored and graphically printed
- Comprehensive, user-friendly software

### Time and Effort Saving:

- Simple calibration
- Requires little maintenance
- Fast Installation



## HARDWARE

- **Camera** consists of a linear metal housing of a length a few centimetres more than the detection area; the width and height is approximately 320mm and 250mm.
- **A number of detector modules** are located side by side and form a continuous line of photodetectors in the camera.
- **Line of detectors** is set up to view a linear light source, which is located on the opposite side of the target plane.
- **Sensing area** of each detector is restricted to an accurately defined fan. The fans overlap so that a projectile will be detected by a number of adjacent sensors.
- **Circuit associated with each sensor** is designed to detect only fast moving objects (rapid changes in light level) so that slow variations in the light level e.g. voltage variations or insect movement, will have no effect on the operation of the target.
- **Separate connector** provides power to the camera from the Control Unit.
- **Light source** s provide by a solid-state light source comprising a number of LEDs.
- **Control unit** has the X and Y cameras connected to it by two pairs of cables; one cable supplies the power to the camera, and the other is a 26-way cable, which provides the link for the digital signals controlling each camera. The control unit is an intelligent device that allows configuration of various target parameters e.g. lockout time and shot calculation algorithm.
- **X-Y coordinates** are obtained from camera signals, which can then be transmitted to the remote computer.
- **Mounting** either on a framework or to the walls, floor and ceiling in the case of larger units.

## SOFTWARE

- **Target interfaces** with a modern PC with our software, Ballistics DB, installed.
- **Ballistics DB** offers configuration of set-up parameters, and a wide range of diagnostic testing. The software also displays the shots on screen during firing and may provide printouts and store data to disk. In addition, a series of data analyses may be performed on all shot data.
- **Communication to the computer** is via a serial link, which may be an RS232, RS485, or MSI serial interface (compatible with other targets and the MSI Line Receiver Interface.).

## SPECIFICATION

POWER/COMMS	
Power	230 V $\pm 10\%$ (50/60Hz, 200VA per m, 5m x 5m approx. 2000VA)
HIT SENSING	
Projectile Velocity	10 – 2 000 ms <sup>-1</sup>
Hit Frequency	Up to 10 000 rpm
Active Target Area	From 1m x 1m to 5m x 5m as standard
Calibre Type	4mm – 150mm

Measurement Accuracy	$\pm 2.5\text{mm}$
ENVIRONMENT	
Operating Temperature	0°C - +50°C [+32 °F - +122 °F]
Humidity	95% non-condensing

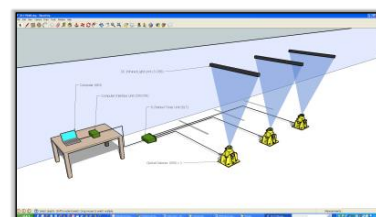
## USED WITH



Universal Weapon Rest Type 681-600

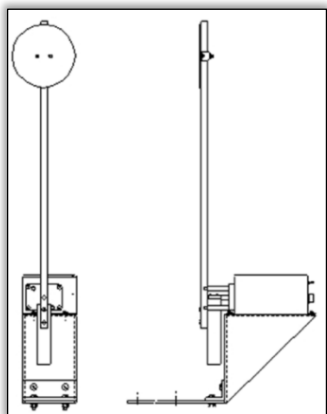


Universal Receiver Type 681-700



Projectile Velocity Measurement System (PVMS)

# LARGE AREA OPTICAL TARGET (LAOT) AIMING MARK TYPE 341



## LAOT AIMING MARK TYPE 341

The LAOT Aiming Mark is a small and convenient attachment to both the MSI Large Area Optical Target Type 340 and Optical Target Type 546.

Designed for easy use, this simple device is easily added to the target, and can sport a variety of target shapes, with a white disc being the most common.

Smart and affordable, the LAOT Aiming Mark is a helpful addition to any range.

## SMALL AND CONVENIENT

### HARDWARE/SOFTWARE

- **Swinging Actuator** moves the extender metal rod into or out of the target area under computer control.
- **A variety of aiming point indicators** can be attached to the actuator. The most common is a white disc with a set of cross hairs.
- **LAOT-powered supply.**
- **Remote Control** from the Range Processor controlling LAOT.
- **Automatic Control Software** disables when the aiming point is raised.

### SPECIFICATION

CONFIGURATIONS	
<b>Power</b>	Via LAOT
<b>Manual Mode Switch</b>	Raise/Lower
<b>Aiming Mark Height</b>	Adjustable

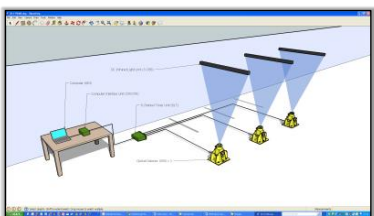
## USED WITH



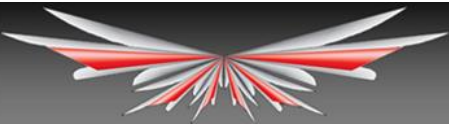
Large Area Optical Target  
(LAOT) Type 340



Universal Receiver  
Type 681-700



Projectile Velocity  
Measurement System



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# CHAMBER TARGET

## TYPE 519



### HARDWARE/SOFTWARE

- Pair of sensor arrays, mounted in a delta format with a set distance between them, sense the shockwave generated by the projectile.
- Arrays are mounted inside a wooden framed target.
- Generated signals are used to calculate the position of the shot with respect to the target.
- Calculated position of the shot is transmitted down the range cabling to the MSI Range Processor Type 663, from where it is also sent to the Shooters Monitor for display to the firer.
- Comprehensive user-friendly software package gives a graphical display of the shot locations and zeroing information.
- Rubber is positioned around the frame to give a zero-wind detection system for the automatic sensors. This allows the acoustic sensors to operate in the subsonic as well as supersonic regions.
- Rubber panel is the continuous and may be rotated to allow re-use.
- More than 3500 rounds can be fired at the target before the material needs replacing.

### CHAMBER TARGET TYPE 519

The MSI Chamber Target Type 519 provides trainee and experienced shooters alike with a cost-effective and accurate training system.

This precision target replaces traditional methods of measurement, and removes all the associated problems, thus saving time, reducing error, and increasing safety. Equally suitable for indoor and outdoor use, the systems require little maintenance once installed.

The MSI Chamber Target Type 519 is an easy piece of equipment with which to work, and makes weapons testing faster and better.

## SAVING TIME, REDUCING ERROR, AND INCREASING SAFETY

### SPECIFICATION

CONFIGURATIONS	
Power	12 VDC
Output Data	True XY Cartesian coordinate data
HIT SENSING	
Projectile Velocity	Subsonic and supersonic projectiles
Hit Frequency	Up to 6000 rpm
Active Target Area	1.2m x 1.2m standard
Calibre Type	All small-arms calibres
Measurement Accuracy	±1mm
ENVIRONMENT	
Operating Temperature	-10°C - 50°C [14 °F - 122 °F]
Humidity	The unit is fully sealed against the ingress of moisture
Wind and Rain	The performance of the target is unaffected by normal ranges of wind and rain

- Target can be configured into systems with a single processor addressing 12 or more targets.
- Visible target is normally the user's target outline, for example 10-ring or figure 11 targets.

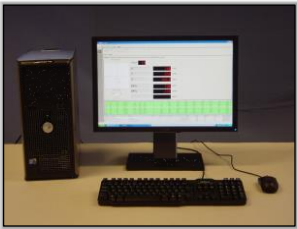
### USED WITH



Shooters Monitor Type 292-001



Remote-Control Transceiver Type 573



Range Processor Type 663

# ACOUSTIC TARGET TYPE 530



## ACOUSTIC TARGET TYPE 530

The MSI Acoustic Target Type 530 provides developers, manufacturers and testing organisations with an accurate means of checking the performance of weapons and ammunition outdoors by measuring the co-ordinates of shots passing through the target area.

This precision electronic target accommodates calibres from 4mm to 120mm, giving the capability of measuring the performance of the full range of weapons from small arms to tank guns.

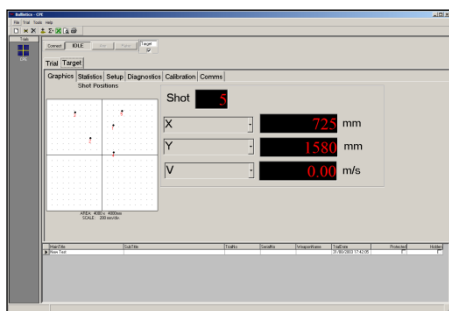
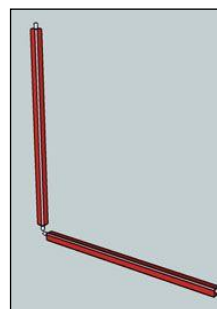
The system replaces paper, canvas, or wood witness targets, and thus removes many associated problems. As such, use of this target dramatically reduces the need for repeated access to the target area, the errors in manual measurement, and the loss of data due to measurement failure.

The elimination of these problems improves efficiency and safety, saves time and effort, and therefore saves money. The MSI Acoustic Target Type 530 is an easy piece of equipment with which to work, and makes weapons testing faster and better.

## IMPROVES EFFICIENCY AND SAFETY

### Simple and Versatile Equipment:

- Accommodates a variety of ammunition
- Suitable for both indoor and field trials
- Provides a range of possible calculations

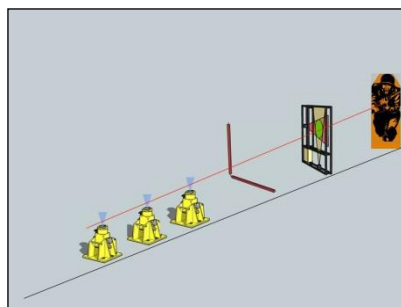


### Accurate and Easy Data Recording:

- Instant graphical representation of data
- Results can be stored and graphically printed
- Comprehensive, user-friendly software

### Time and Effort Saving:

- Automatic self-check every session
- Requires little maintenance
- Only one installation required



HARDWARE

- Two orthogonally mounted bars carrying sensors at their ends detect the shock wave generated by any supersonic projectile passing through the square area defined by the bars.
- Signals generated by the sensors are used to calculate the XY coordinates of the position of the projectile.
- Sensor bars are normally mounted on a stand; in the 1m and 2m options, the vertical bar can be folded down on to the horizontal sensor bar for ease of transport and stowage out of the line of fire.
- The bars may be mounted to a wall and to the floor or ceiling in suitable locations, with both cases reducing the possibility of accidental damage.
- Acoustic lining is advised in tunnel ranges when tests are carried out with automatic weapons, to eliminate false responses from echoes.

SOFTWARE

- Shot positions are instantaneously displayed on a graphical representation of the target area together with coordinate data and a running total of shots fired.
- Results can be stored on completion of each firing test.
- A graphical printout can be made for subsequent analysis.
- A comprehensive user-friendly software package gives a graphical display of the shot locations and provides a range of mathematical and statistical calculations that can be applied to shots.

SPECIFICATION

CONFIGURATIONS	
Mounting Arrangement	Wall-mounted or free-standing 1m and 2m targets
Power Supply	Via Processor Type 663 or Line Receiver Interface Type 565
Output Data	True XY Cartesian coordinate data
HIT SENSORING	
Projectile Velocity	Mach 1.3 minimum to Mach 5 at target
Hit Frequency	Up to 6000 rpm for 1m target
Active Target Area	1m x 1m, 2m x 2m, and 6m x 3m
Calibre Type	All supersonic natures
Measurement Accuracy	±5mm in still air conditions for 2m target

ENVIRONMENT	
Operating Temperature	-10°C - +60°C [+14 °F - +140 °F]
Humidity	The unit is fully sealed against the ingress of moisture
Rain	The system operates in light rain
Wind	Fluctuating wind at the target affects accuracy

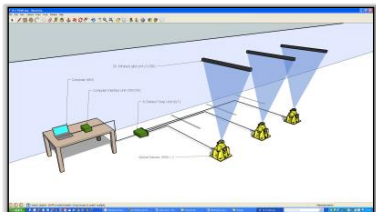
USED WITH



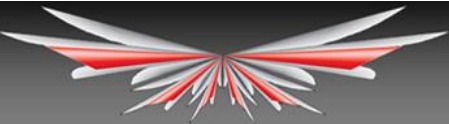
Remote-Control Transceiver Type 573



Range Processor Type 663



Projectile Velocity Measurement System



MS INSTRUMENTS Range Consultancy

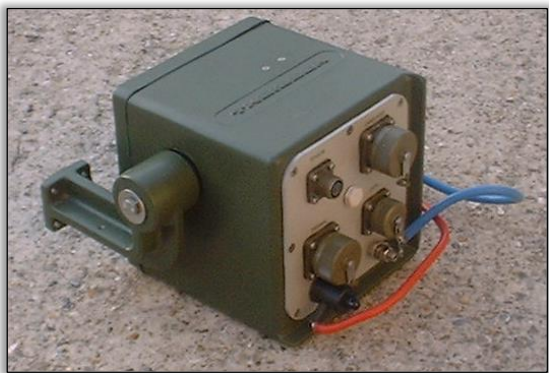
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# POPUP AIMING MARK

## TYPE 531-050



### POPUP AIMING MARK TYPE 531-050

The MSI Popup Aiming Mark is a small and convenient device that can be used with any target.

Simple and robust, the cube has an electro-drive actuator that lifts the aiming mark for use with stationary guns. Whilst useable with any target, the cube also has a dedicated location in the MSI Acoustic Target Type 541, such is its importance.

Useable in a versatile set of conditions, and with a long service life, the Popup Aiming Mark is a helpful and affordable addition to any range.

### HARDWARE

- Heavy-duty actuator swings an aiming point indicator (attached to an extender metal rod) into or out of the target area under computer control.
- Variety of aiming point indicators can be attached to the actuator. The most common is a white disc with a set of cross hairs.
- Mains operated power supply.

### SIMPLE AND ROBUST

### SPECIFICATION

ENVIRONMENT	
Operating Temperature	-25°C - +65°C [-13 °F - 149 °F]
Waterproof	IP67
Corrosion Protection	• Stainless Steel • Aluminium
Drop Test	1m on concrete ground
EMC Test	Class A
Sealing	Sand and dust tight
Service Life	10 years
DIMENSIONS	
L x W x H (H with popup holder up)	230mm x 180mm x 180mm (240mm) [9.1in x 7.1in x 7.1in (9.4in)]
Weight	10kg [22lbs]

### USED WITH



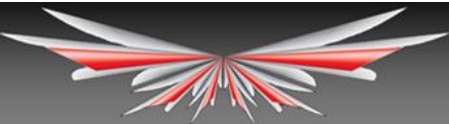
Large Area Optical Target  
(LAOT) Type 340



Acoustic Target  
Type 541



Universal Receiver  
Type 681-700



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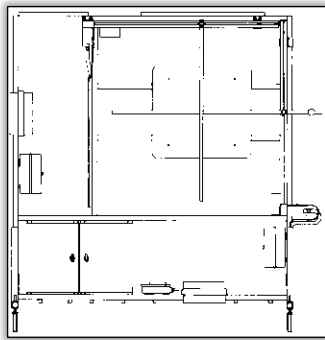
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# MOVING AIMING MARK TYPE 531-100



## HARDWARE/SOFTWARE

- 2 linear drive motors.
- Control and interface unit.
- Controlled by the computer system software.
- Two wooden aiming marks are initially in the 'home' position out of the line of fire.
- Single key press moves the two aiming marks to the centre of the target area or to the mean point of impact (MPI) of a previously fired group.
- System is configurable so that the aiming marks will move to the MPI of a group of shots as soon as the group has been fired.

## MOVING AIMING MARK TYPE 531-100

The MSI Moving Aiming Mark is an accessory to the Optical Target Type 546 which allows rapid and accurate zeroing of weapons in the manufacturing and test environments.

By reducing the number of rounds required for the zeroing process, considerable savings may be made in the cost of testing. The aiming mark allows considerable flexibility and ease of use, and is an ideal addition to the range.

## FLEXIBILITY AND EASE OF USE

### EXAMPLE OF USE

*When a weapon is tested for the first time, the sight is only approximately zeroed. The weapon is mounted in a weapon rest and the barrel is aligned to the centre of the target by using a bore-sight. Shots are then fired and the sights adjusted to the MPI of the group of shots. The weapon is then zeroed using the sights and a further group of shots is fired to check the zeroing.*

*By use of the Moving Aiming Mark (MAM), the final check is not required as the MAM is placed at the MPI of the first shot group and the sight is adjusted to it.*

*This has the dual benefit of a saving in ammunition cost and improved testing throughout.*

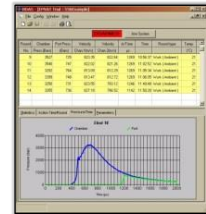
## USED WITH



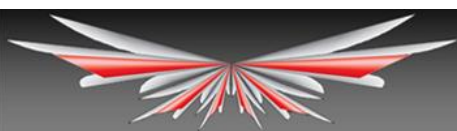
Optical Target Type 546



Universal Receiver Type 681-700



Ballistics DB Control Software Type 950-571



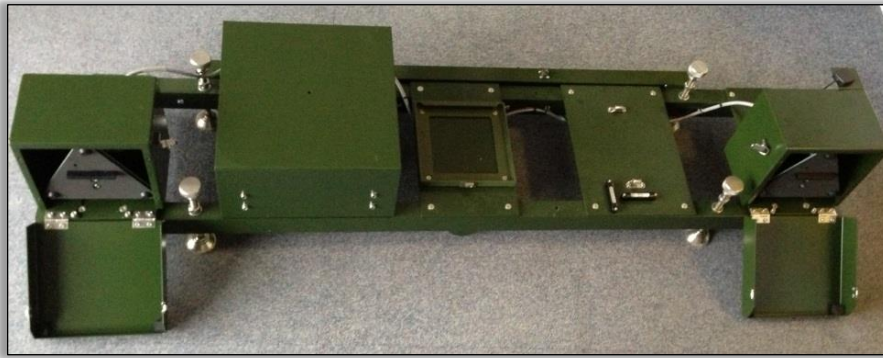
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# ACOUSTIC TARGET TYPE 541



## ACOUSTIC TARGET TYPE 541

The MSI Acoustic Target Type 541 provides developers, manufacturers and testing organisations with an accurate means of checking the performance of weapons and ammunition outdoors by measuring the co-ordinates of shots passing through the target area.

This precision electronic target accommodates calibres from 4mm to 150mm, giving the capability of measuring the performance of the full range of weapons from small arms to tank guns.

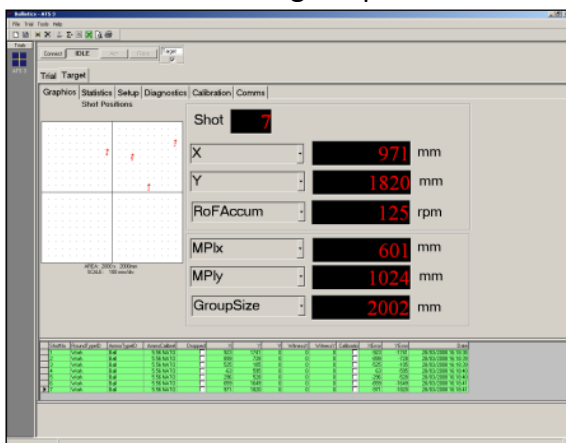
The system replaces paper, canvas, or wood witness targets, and thus removes many associated problems. As such, use of this target dramatically reduces the need for repeated access to the target area, the errors in manual measurement, and the loss of data due to measurement failure.

The elimination of these problems improves efficiency and safety, saves time and effort, and therefore saves money. The MSI Acoustic Target Type 541 is an easy piece of equipment with which to work and makes weapons testing faster and better.

## IMPROVES EFFICIENCY AND SAFETY

### Simple and Versatile Equipment:

- Suitable for both indoor and field trials
- Single and multi-shot evaluation
- Provides a range of possible calculations



### Time and Effort Saving:

- Automatic self-check every session
- Requires little maintenance
- Only one installation required



### Accurate and Easy Data Recording:

- Instant graphical representation of data
- Results can be stored and graphically printed
- Comprehensive, user-friendly software



HARDWARE

- Pair of sensor arrays in a delta format, mounted with a set distance between them, sense the shockwave generated by the projectile.
- Signals generated by these arrays are used to calculate the position of the shot with respect to the target.
- Arrays are mounted in a protective case with a flip-down lid and are installed relative to the witness target. The Delta Acoustic Target (DAT) should be protected from direct fire.
- DAT will detect all projectiles travelling in excess of Mach 1.3 at the target plane, at rates-of-fire of up to 6 000 rpm.
- Accurate location and evaluation of single or multi-shot impacts on targets removes need for marking personnel or other witness targets.
- Target can be configured into systems with a single processor.
- Processor Type 663 addresses up to 15 Type 541 targets via a 3km radio link operating at 868/900MHz.
- Radio link allows the trials officer to select the positions on the range that best suit the aim of the trial, rather than being confined to the location of cable access points.

SOFTWARE

- Shot positions are instantaneously displayed on a graphical representation of the target area together with coordinate data and a running total of shots fired.
- Results can be stored on completion of each firing test.
- A graphical printout can be made for subsequent analysis.
- A comprehensive user-friendly software package gives a graphical display of the shot locations and provides a range of mathematical and statistical calculations that can be applied to shots.

APPLICATIONS

Automatic Marking System (AMS) for Training

- Visible target which is normally the user’s target outline can, if mounted on a suitable mechanism, be caused to pop up and down under Range Processor or Shooters Monitor control.
- DAT can be portable whilst on a fixed range, the delta arrays may be mounted directly to the ground.
- Calculated shot position is transmitted down the range cabling to the Range Processor from where it is also sent to the Shooters Monitor for display to the firer.

Precision Target for Ballistic Analysis

- Substantially the same hardware as the AMS.
- Control software is considerably different from AMS such that the user may collect statistical data, and integrate with Pressure, Velocity, and Ballistic Analysis systems.

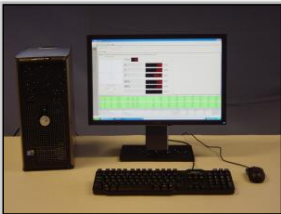
SPECIFICATION

CONFIGURATIONS	
Power	12 - 30 VDC
Output Data	True XY Cartesian coordinate data
HIT SENSING	
Projectile Velocity	Mach 1.3 minimum to Mach 5 at target
Hit Frequency	Up to 6000 rpm for 1m target
Active Target Area	Calibre dependent: <ul style="list-style-type: none"><li>• Up to 5m x 5m for 5.56mm.</li><li>• Up to 20m x 20m for 30mm.</li></ul>
Calibre Type	All supersonic natures
Measurement Accuracy	<ul style="list-style-type: none"><li>• ±5mm in still air conditions for 2m x 2m target</li><li>• ±20mm in still air conditions for 10m x 10m target</li></ul>
ENVIRONMENT	
Operating Temperature	-10°C - +60°C [+14 °F - +140 °F]
Humidity	The unit is fully sealed against the ingress of moisture
Rain	The system operates in light rain
Wind	Fluctuating wind at the target affects accuracy

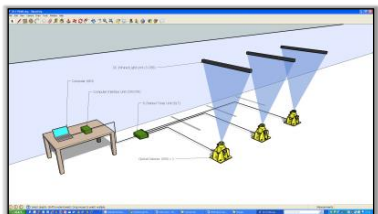
USED WITH



Remote-Control Transceiver Type 573

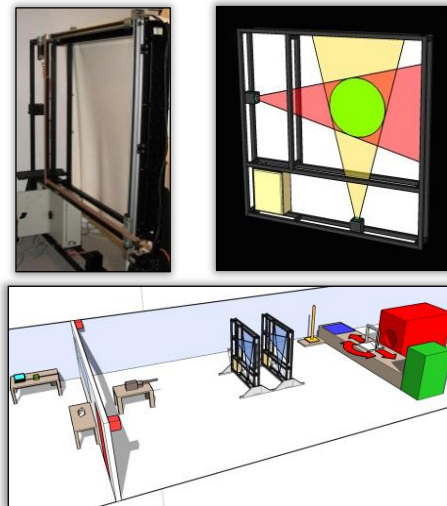


Range Processor Type 663



Projectile Velocity Measurement System

# OPTICAL TARGET TYPE 546



## OPTICAL TARGET TYPE 546

The MSI Optical Target Type 546 target provides developers, testers, and manufacturers with a highly accurate and cost-effective method of checking the performance of weapons and ammunition by measuring the coordinates of shots fired under test.

MSI's Optical Targets have been designed for the rapid testing of a wide range of calibre weapons, both new and repaired. The Type 546 target is a high precision instrument with a small

detection area, which is ideal for weapons with lower dispersion patterns, with the Large Area Optical Target (LAOT) being preferable for larger dispersions.

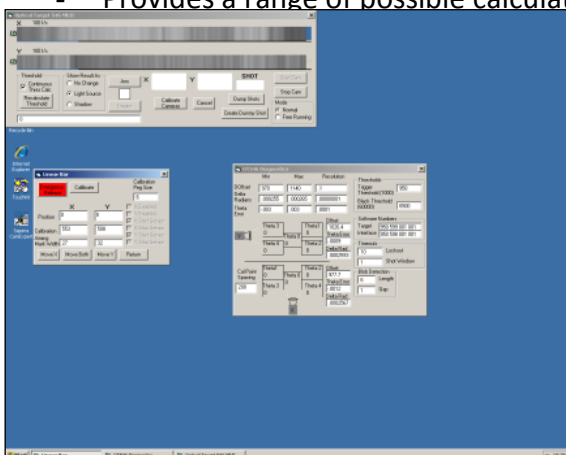
This precision electronic target replaces traditional methods of measurement, and removes all the associated problems, thus saving time, reducing error, and increasing safety.

The MSI Optical Target Type 546 is an easy piece of equipment with which to work, and makes weapons testing faster and better.

## SAVING TIME, REDUCING ERROR, AND INCREASING SAFETY

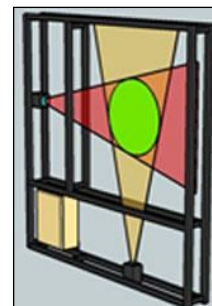
### Simple and Versatile Equipment:

- Accommodates a variety of ammunition
- Suitable for indoor and enclosed field trials
- Provides a range of possible calculations



### Time and Effort Saving:

- Simple calibration
- Requires little maintenance
- Easily transportable



### Accurate and Easy Data Recording:

- Instant graphical representation of data
- Results can be stored and graphically printed
- Comprehensive, user-friendly software





## HARDWARE

- **Rigid framework** can be easily dismantled for transportation.
- **Two industrial line scan cameras** are mounted at known angles to each other on the framework.
- **Each camera views a linear light source** and when a projectile enters the field of view of the cameras, it causes a change in light intensity that is detected by the cameras.
- **Industrial PC** is also fitted to the frame, and controls the cameras.
- **X and Y positions of the projectile** are related to the change in light intensity, which is then processed and converted in to true XY-coordinates by software running on the industrial PC.
- **Small LCD display** allows the user to quickly monitor the status of the target, and also helps the user to calibrate the target in a few easy steps.
- **Simple calibration device** allows regular absolute checking of the target performance, and is removed for firing.
- **Step-by-step instructions** guide the user through the calibration procedure.

## SOFTWARE

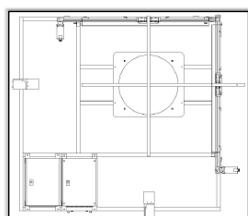
- **Target interfaces** with a modern PC with our software, Ballistics DB, installed.
- **Ballistics DB** offers the user a range of statistical calculations on trial results, and allows for full control of the target's operation.
- **Data is transmitted** from the Optical Target as a serial data stream, after being stored locally.
- **Communication** is established using either radio or cable link.

## SPECIFICATION

POWER/COMMS	
Power	110 or 230 VAC $\pm 10\%$ (50/60Hz, 300VA)
Communication	Radio link or cable link (RS232/RS485)
Output Data	True XY Cartesian coordinate data in ASCII code
HIT SENSING	
Projectile Velocity	10 – 2 000 ms <sup>-1</sup>
Hit Frequency	Up to 15 000 rpm
Active Target Area	600mm diameter circle
Calibre Type	4.5 – 50 mm

Measurement Accuracy	Better than $\pm 0.5\text{mm}$
ENVIRONMENT	
Operating Temperature	-10°C - +60°C [+14 °F - +122 °F]
DIMENSIONS	
L x W x (H range)	790mm x 1720mm x (1925 – 2175)mm [31.1in x 67.7in x (75.8 – 85.6)in]

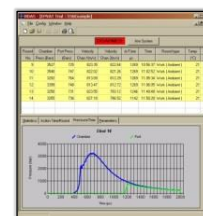
## USED WITH



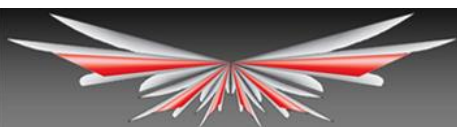
*Moving Aiming Mark Type 531-100*



*Universal Receiver Type 681-700*



*Ballistics DB Control Software Type 950-571*



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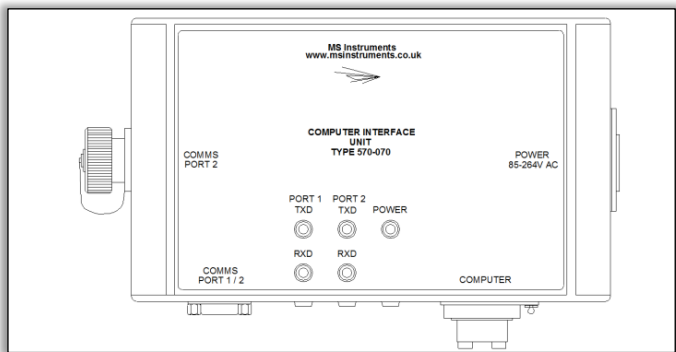
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# COMPUTER INTERFACE UNIT

## TYPE 570-070



### COMPUTER INTERFACE UNIT TYPE 570-070

The MS Instruments Computer Interface Unit allows USB connectivity to MS Instruments equipment. Simple and discreet interfacing between system and computer is brought by the clearly-indicated, robust ports. Further, the unit automatically powers off when the PC powers down, helping to save costs and energy. These touches all combine to create a neat, little unit that's ideal for computer interfacing.

### SIMPLE AND DISCREET

#### HARDWARE

- **Computer port** on the box connects to the USB port of a PC.
- **Port 1/2** is a 9-way D-type which has RS232 and RS485.
- **Port 2** has a 10-way that connects to the MSI Triple-Channel Remote Timer Unit Type 817 to provide power and communications.
- **Auto power off** when the PC is powered down.

#### SPECIFICATION

POWER/COMMS	
Power	85-264VAC (50W)
Connections	<ul style="list-style-type: none"><li>• 10-way socket to the 817 timer unit</li><li>• USB to PC</li><li>• 9-way D-type</li><li>• Mains power</li></ul>
LEDs	Shows transmit, receive, and power
ENVIRONMENT	
Operating Temperature	0°C - 50°C 32°F - 122°F
DIMENSIONS	
L x W x H	130mm x 220mm x 70mm 5.12in x 8.66in x 2.76in

#### USED WITH



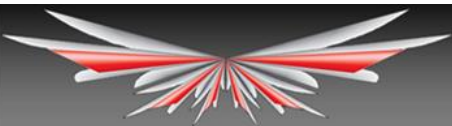
Acoustic Target Type 541



Optical Target Type 570



Triple-Channel Remote Timer Unit Type 817



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# OPTICAL TARGET TYPE 570



## HARDWARE/SOFTWARE

- Graphical representation of target area is displayed instantly/
- Two sets of three optical sensors generate the signals from the shots.
- Rigid metal framework provides mounting platform for arrays and the control unit.
- Permanent records of firing data can be stored on disk or printed for subsequent analysis.
- Wide range of calibres can be detected, with a similarly wide velocity range.
- Operational distances of up to 5km from the Processor are possible using a radio link.
- Optional GPS can be provided as integral part of the system, to give accurate target location and event time (using UTC).

## OPTICAL TARGET TYPE 570

This precision electronic target provides developers, manufacturers and testing organisations with an accurate means of checking the performance of weapons and ammunition outdoors by measuring the co-ordinates of shots passing through the target area.

Being an Optical Target, the Type 570 is unaffected by wind and thus gives a high degree of accuracy of half-calibre or better. The instantaneous accuracy of this target makes it greatly desirable for all outdoor firing.

## PRECISION ELECTRONIC TARGET

### SPECIFICATION

MEASUREMENT		
Active Target Area	<ul style="list-style-type: none"><li>2.5m x 2.5m for 5mm calibre</li></ul>	<ul style="list-style-type: none"><li>4m x 4m for 120mm calibre</li></ul>
Position Accuracy	<ul style="list-style-type: none"><li>5mm for 5mm calibre</li></ul>	<ul style="list-style-type: none"><li>10mm for 120mm calibre</li></ul>
Angular Accuracy	<ul style="list-style-type: none"><li>0.4° Elevation</li></ul>	<ul style="list-style-type: none"><li>1° Azimuth</li></ul>
Velocity Accuracy	0.2%	
PROJECTILES		
Projectile Velocity	50ms <sup>-1</sup> to 1500ms <sup>-1</sup> at target	
Projectile Calibre	5mm to 120mm	
Rate of Fire	<ul style="list-style-type: none"><li>1000rpm for 50ms<sup>-1</sup></li></ul>	<ul style="list-style-type: none"><li>12000rpm for 1500ms<sup>-1</sup></li></ul>
POWER/COMMS		
Power	12V DC	
ENVIRONMENT		
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]	
Humidity	The units are fully sealed	
Rain	The system operates in light rain	
Wind	Accuracy is not affected by wind	
DIMENSIONS		
L x W x H	300mm x 600mm x 2300mm [11.8in x 23.6in x 90.6in]	
Weight	50kg [110.2lbs]	

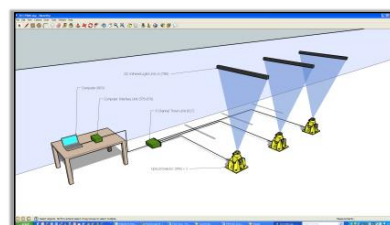
## USED WITH



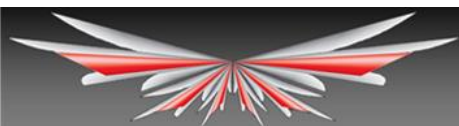
Meteorological Station Type 574



Universal Receiver Type 681-700



Projectile Velocity Measuring System



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# REMOTE-CONTROL TRANSCEIVER

## TYPE 573



### REMOTE-CONTROL TRANSCEIVER TYPE 573

Created to be convenient and practical, the remote-control transceiver can be added to almost all MS Instruments training and ballistic data systems.

The transceiver is used when cabling is not viable, and can be provide as a standalone unit or integral to the other system components.

The unit has a standard distance of 3km from the firing point at which it can communicate with a target system. Made to suit a variety of operating environments, the unit offers a range of frequencies and power outputs, in order to be as user-friendly and helpful as possible.

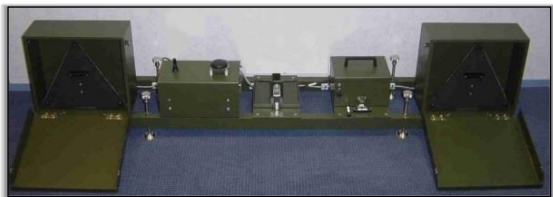
### CONVENIENT AND PRACTICAL

#### SPECIFICATION

RADIO FREQUENCY CHARACTERISTICS	
Frequency	902-928MHz
Channel Spacing	2.6MHz
Power Output	1mW/1W (Programmed)
POWER/COMMS	
Supply Voltage	10V-48V DC or 18-30V AC
Power	5VA max.

ENVIRONMENT	
Operating Temperature	-40°C - +85°C [-40°F - 185°F]
DIMENSIONS	
L x W x H	220mm x 120mm x 90mm [8.7in x 4.7in x 3.5in]
Weight	2kg [4.4lbs]

#### USED WITH



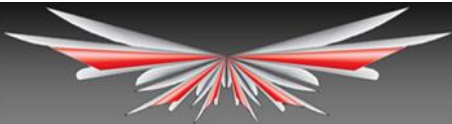
Acoustic Target Type 541



Meteorological Station Type 574



Range Processor Type 663



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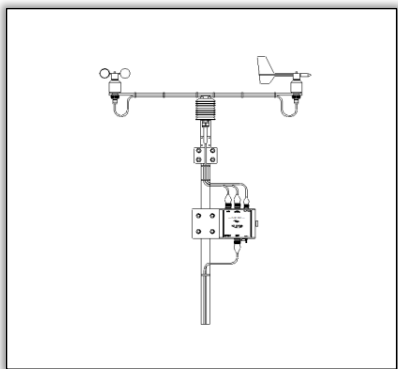
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# METEOROLOGICAL STATION

## TYPE 574-200



### HARDWARE/SOFTWARE

- **Sensors** measure wind speed and direction.
- **Built-In Heaters** protect sensors during cold and wet weather conditions, preventing freezing.
- **Central Range Computer** builds a detailed record of weather conditions for each firing event (if desired).
- **Transceiver Type 574** allows the unit to be placed almost anywhere on the range within 2km.

### METEOROLOGICAL STATION TYPE 574-200

The Meteorological Station Type 574-200 is an innovative system that incorporates an array of weather-measurement units.

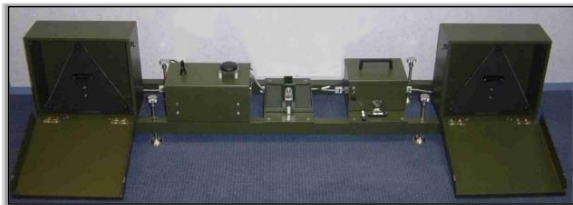
In modern firing for testing and training, being fully aware of all environmental conditions surrounding the trials is essential. By analysing the data retrieved from the station, the user can develop a complete understanding of how the shots have been affected, leading to more efficient and informative trials.

## EFFICIENT AND INFORMATIVE

### SPECIFICATION

MEASUREMENT	
Barometric Pressure Range	800-1100mbar
Humidity Range	0-100%
Temperature Range	-40°C - +60°C [-40 °F - 140 °F]
Wind Speed Range	0.5 to 50 m/s Spinning Cup
Wind Direction	0° to 360° with resolution of 11.25°
POWER/COMMS	
Power	24V DC (50W)
DIMENSIONS	
L x W x H	930 x 235 x 1180mm
Weight	10kg

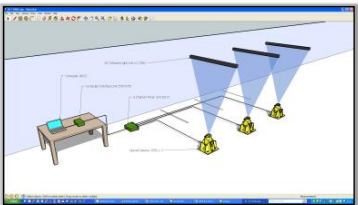
### USED WITH



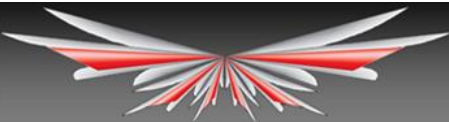
Acoustic Target Type 541



Range Processor Type 663



Projectile Velocity Measurement System



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# METEOROLOGICAL STATION

## TYPE 574



### HARDWARE/SOFTWARE

- **Precision Solid-State Anemometer** measures wind speed.
- **Accurate Electronic Compass** works in unison with the anemometer to provide wind direction readings
- **GPS** outputs positional and precision time data.
- **Central Range Computer** builds a detailed record of weather conditions for each firing event (if desired).
- **Transceiver Type 574** allows the unit to be placed almost anywhere on the range within 2km.
- **Two Stations** can be setup up to tally meteorological data with shot data from an automatic target, allowing the user to determine whether a rogue shot is due to gusting winds.

### METEOROLOGICAL STATION TYPE 574

The Meteorological Station Type 574 is an innovative system that incorporates an array of advanced weather-measurement units.

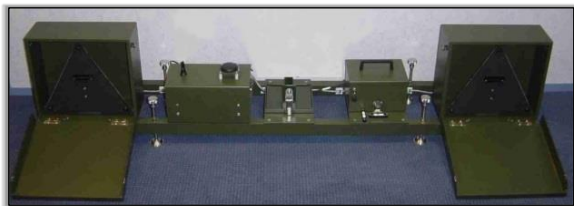
In modern firing for testing and training, being fully aware of all environmental conditions surrounding the trials is essential. By analysing the data retrieved from the station, the user can develop a complete understanding of how the shots have been affected, leading to more efficient and informative trials.

### EFFICIENT AND INFORMATIVE

### SPECIFICATION

MEASUREMENT	
Barometric Pressure Range	800 – 1100mbar
Humidity Range	0-100%
Temperature Range	-40°C - +60°C [-40 °F – 140 °F]
Brightness Range	0 – 100 Lux
Wind Speed Range	0 – 70 ms <sup>-1</sup> [0 – 156 mph]
Wind Direction	0° - 359°, with resolution of 1°
Anemometer Sensor	3-Axis Ultrasonic Meteorological
Derived Data	<ul style="list-style-type: none"><li>• Wind chill</li><li>• Dew Point</li></ul>
POWER/COMMS	
Power	12V DC (25VA)
Communications	RS485 Cable Link/Wireless
DIMENSIONS	
L x W x H	80 x 86 x 236 cm [31.5 x 33.9 x 93.0 in.]
Weight	34.0 kg

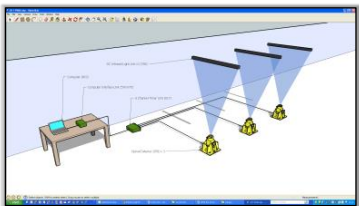
### USED WITH



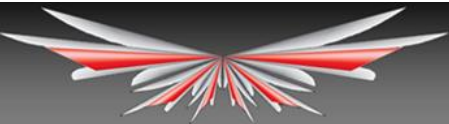
Acoustic Target Type 541



Range Processor Type 663



Projectile Velocity Measurement System



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# ACOUSTIC DETECTOR

## TYPE 588



### ACOUSTIC DETECTOR TYPE 588

The Acoustic Detector Type 588 is a solid and reliable unit that provides an output pulse in response to a large amplitude acoustic disturbance. The unit can therefore be used to detect muzzle blast, supersonic projectile shockwave or similar disturbances that enable the detector to trigger other events, measure rate of fire or measure projectile velocity using 817 timer units. The versatile unit has the facility for local and remote use up to 200m, as well as diagnostics, making it a useful addition to any ballistic environment.

### SOLID AND RELIABLE

### SPECIFICATION

CONFIGURATIONS	
Power	10 – 30VDC (250mA)
Power Supply	<ul style="list-style-type: none"><li>Detector Power Unit Type 783.</li><li>Multicore Cable</li></ul>
Pulse Output	<ul style="list-style-type: none"><li>Line driver to Detector Power Unit Type 783.</li><li>BNC Output: +ve 1ms TTL pulse.</li></ul>
Connectors	19-way combined power and signal
DETECTION	
Typical Detection Wave at 10m	Measured at maximum sensitivity using shockwave produced by a 7.62mm projectile at 800ms <sup>-1</sup>

Max. Rate of Fire	1500rpm (may be increased)
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - +122 °F]
Humidity	Seals unit with desiccator/indicator fitted
Enclosure Type	IP 67

### USED WITH



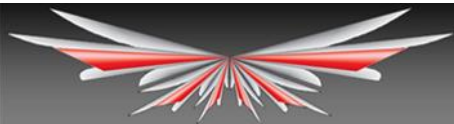
Ballistic Data Acquisition System Type 680



Pressure Measurement Unit Type 683



Rate-of-Fire Computer Type 807



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# INDOOR CLIMATE MONITOR

## TYPE 598



### HARDWARE

- **Measurements** are available for air temperature, barometric air pressure, and humidity.
- **8 analogue to digital inputs** can be used for additional data inputs.
- **Thermal sensors** typically occupy the additional data inputs in order to analyse temperature trends over a metallic surface e.g. a test barrel.
- **Optional interface units** are available.
- **All meteorological data** can be fed back to the central range computer for each shot during a trial, allowing a detailed record to be built of environmental conditions for each firing event.

### INDOOR CLIMATE MONITOR TYPE 598

The MSI Indoor Climate Monitor is an innovative system that incorporates an array of measurement units to determine air temperature, barometric air pressure, and humidity. The system is rugged and compact, whilst delivering measurements efficiently to a central computer for thorough analysis. Knowing the environmental conditions in any testing setup is essential, making this monitor an important addition to any facility.

## RUGGED AND COMPACT

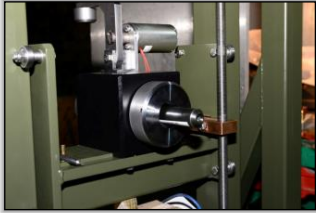
### SPECIFICATION

MEASUREMENT	
Barometric Pressure Range	800 to 1100mbar $\pm 0.2\%$
Humidity Range	5-100% $\pm 2.5\%$
Temperature Range	0°C - +60°C [32 °F - 140 °F]
POWER/COMMS	
Inputs	8x 10-Bit A/D

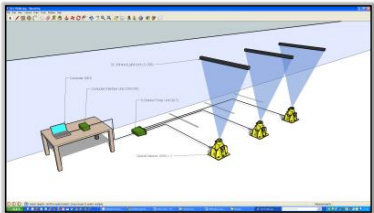
### USED WITH



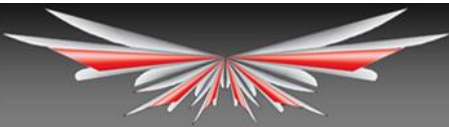
Ballistic Data Acquisition System (BDAS) Type 680



Universal Receiver Type 681-700



Projectile Velocity Measurement System (PVMS)



## MS INSTRUMENTS Range Consultancy

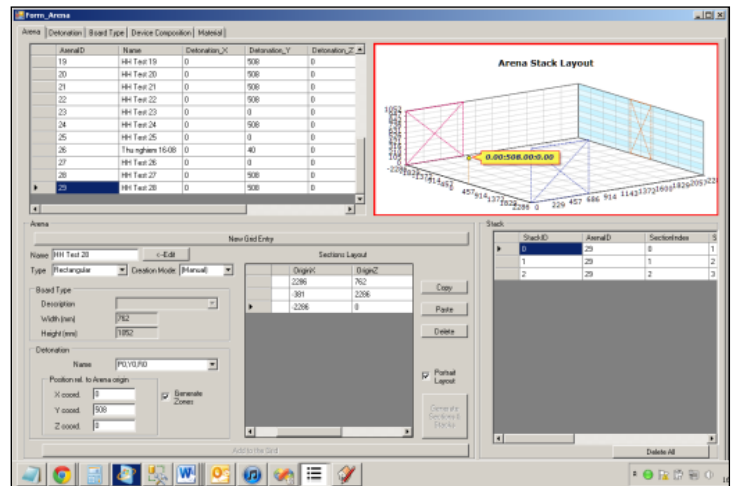
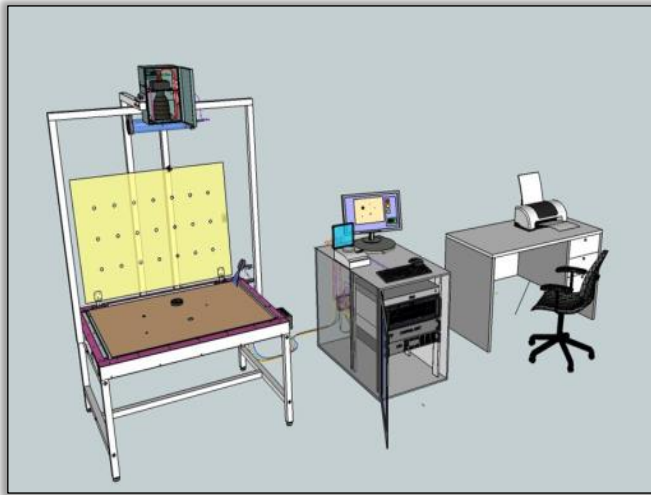
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# STRAWBOARD IMAGER TYPE 603



## STRAWBOARD IMAGER TYPE 603

The MS Instruments Strawboard Imager offers an easy and accurate means of fragment measurement which greatly reduces trial time costs. A clever integrated system removes all the problems associated with the large number of boards and larger number of fragments that is classically seen in strawboard trials; the result is a smoother, more accurate analysis of fragment distribution.

The system's capability can be extended by combining with fragment velocity measurement equipment to enable full evaluation of munitions lethality. Every aspect of the imager, down to the base processing algorithms, has been carefully reworked to ensure the most accurate recording of every hole. Hence, the MSI Strawboard Imager is a system of the highest quality that performs consistently, and provides easy, precise fragment analysis for every range in which it operates.

## SMOOTH AND ACCURATE ANALYSIS

### Clear and Thorough Analysis:

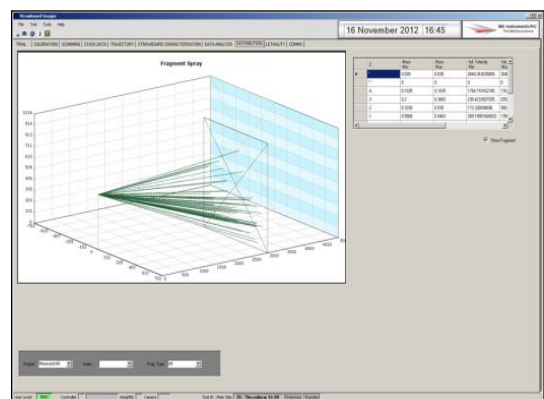
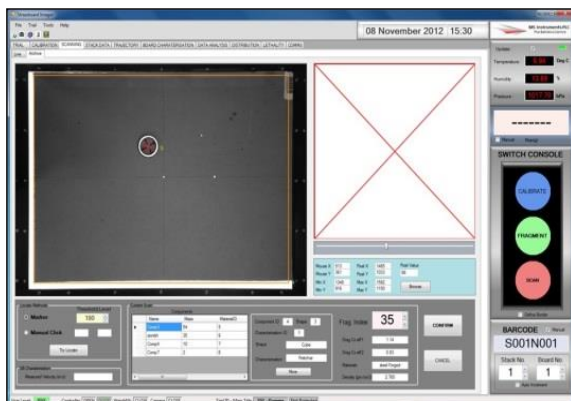
- High-resolution imager
- Configurable for any detonation
- Modular structure.

### Accurate and Easy Data Recording:

- Robust and ergonomic design
- Automated fragment analysis
- Comprehensive report generation.

### Intuitive Operation:

- Software wizard for easy set-up
- User-friendly graphical interface
- Data export in multiple formats



## HARDWARE

- **High resolution digital camera, optimised lens, and LED light panel** are used by the system's imager, enabling fast and accurate scanning of strawboards.
- **Calibration plate** is lowered after setup to give accurate hole measurement.
- **Robust, ergonomic function buttons** ensure the system can be used wearing gloves.
- **'Fragment' button** is pressed when the fragment is removed from the board and placed on the digital scales, to record the fragment mass and location.
- **Barcode labels** can be affixed to stacks when removing from the arena. These are automatically read during scanning to ensure location traceability.

## SOFTWARE

- **All trial setup parameters** (including strawboard arrangement, detonation device, time, date, officers etc.) are simply configured, stored, and recalled.
- **User-friendly graphical interface** helps the operator monitor scanning sequence, and ensures all data is correctly recorded.
- **All data** is automatically saved and can be recalled and exported as required.
- **Additional software functions** generate statistical data as listed in ITOP 4-2-813 (for example).
- **Stack penetration trajectory analysis** enables velocity/energy estimates for some fragment types.

## SPECIFICATION

POWER/COMMS	
Power	110 – 240 VAC (5A)
PC (MINIMUM)	
Processor	P-4 Dual core 3.0 GHz
Memory	2 GB
Hard Drive	500 GB
DVD ROM/RW	DVD/CD-RW Combo
Printer	HP Laserjet
Monitor	24in
UPS	2kVA
Operating System	Windows 7 Pro
Software	Application + Office Pro

IMAGER (MINIMUM)	
Pixels	2352 x 1728
L x W	1036mm x 782mm [40.8in x 30.8in]
Resolution	<0.5mm
DIMENSIONS	
L x W x H	0.95m x 1.25m x 2.15m [37.4in x 49.2in x 84.6in]

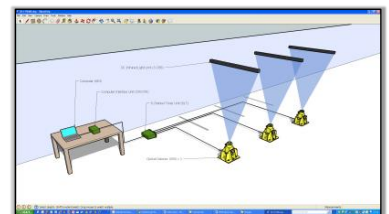
## USED WITH



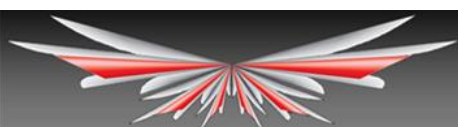
Universal Receiver Type 681-700



Triple-Channel Remote Timer Unit Type 817



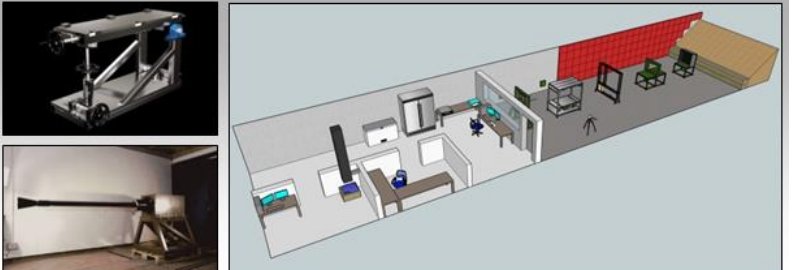
Projectile Velocity Measurement System



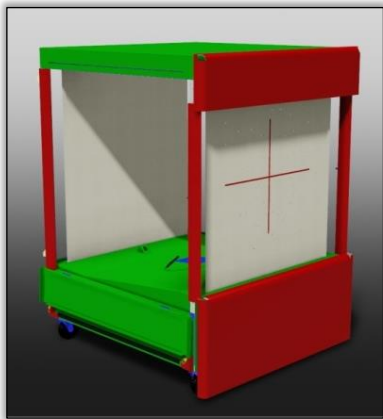
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# SHOT PATTERN ANALYSER TYPE 616



## HARDWARE

- **Camera and Lighting** technology ensures accurate shot position recording in all lighting conditions.
- **Protective Armour** prevents accidental shot damage and reduces ricochet risk.
- **Folding design** allows the target to be moved to multiple locations.

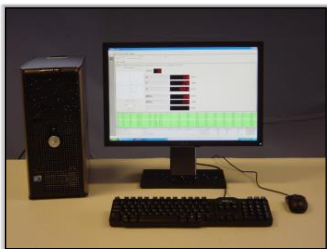
## SOFTWARE

- **BallisticsDB** software package designed specifically for trial management and hardware control.
- **Trial Statistics** are permanently stored in database for future reference.
- **User Configurable** reports and spreadsheet are automatically generated.

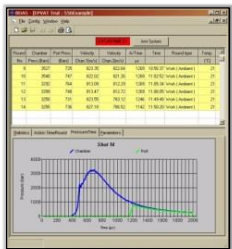
## USED WITH



Remote-Control Transceiver Type 573



Range Processor Type 663



Ballistics DB Control Software Type 950-571

## SHOT PATTERN ANALYSER TYPE 616

This paper based system offers an efficient and reliable method for shot pattern analysis. The digital scanning technology enables automated shot hole measurement with high accuracy over a large detection area. The shot pattern data is then transferred wirelessly to the control PC or laptop where trial statistics and user-customised reports are automatically generated. Its robust design comes with protective armour and is suitable for indoor and outdoor use, and has the added benefit of folding down for transportation.

## ROBUST AND VERSATILE

## SPECIFICATION

POWER/COMMS	
Power	100-240 VAC
Comms	2.4GHz Wifi
DETECTION	
Detection Area	120 x 120 cm
Measurement Time	30 secs.
Feature Size (min.)	1 mm
Scan Time	30 secs.
Set-Up Time	2 mins.
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32°F - 122°F]
Humidity	95% non-condensing
IP Rating	54
Shot Protection	Up to #0000 Buckshot, 3 ½ Mag. At 20m
DIMENSIONS	
L x W x H	1.4m x 1.4m x 2.1m [55in x 55in x 83in]
L x W x H (folded)	1.4m x 1.4m x 0.9m [55in x 55in x 35in]

# MULTIPLE TRIGGER SYSTEM

## TYPE 630-320



### HARDWARE

- Master Trigger Unit connects to the Flight-Follower.
- Flight-Follower supplies power.
- Chain of Trigger Interface Units have a BNC connector and will operate on make, break, or TTL inputs.
- Up to 32 Trigger Units can be connected to the master trigger unit.
- Power/Trigger LED turns on to show power, and flashes off to indicate a trigger.
- Polarity Switch to select rising or falling edge trigger options.

### MULTIPLE TRIGGER SYSTEM TYPE 630-320

Comprised of a Master Trigger Unit a chain of Trigger Interface Units, the Multiple Trigger System Type 630-320 is used to update the mirror position of the Flight-Follower to enable it to track unpredictable projectiles.

The rapid response time of less than 5 microseconds adds real finesse to the Flight-Follower, with even the most unusual flight-paths being successfully tracked. Saving time and costs on otherwise lengthy trials, this system is a useful addition to the Flight-Follower System.

### RAPID RESPONSE TIME

### SPECIFICATION

HARDWARE	
Number of Trigger Units	1-32
Polarity Selection	Selected by switch
Diagnostics	LED on Master Unit shows Power/Trigger
POWER/COMMS	
Power	24V DC
Power Supply	Flight Follower Type 630
ENVIRONMENT	
Operating Temperature	-10°C - 50°C [14 °F - 122 °F]
Humidity	100%
Enclosure	IP67
DIMENSIONS	
L x W x H	12cm x 9cm x 6cm [ 4.5in x 3.5in x 2.5in ]
Weight	0.5kg [1.1lbs]

### USED WITH



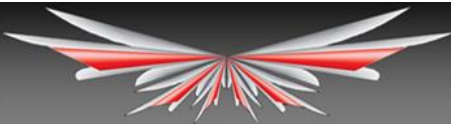
Flight-Follower Type 630



Automated Flight-Follower Type 631



Mini Flight-Follower Type 632



## MS INSTRUMENTS Range Consultancy

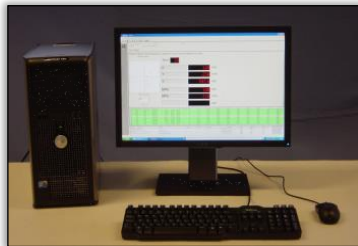
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# RANGE PROCESSOR TYPE 663(N)



## RANGE PROCESSOR TYPE 663(N)

The Range Processor Type 663 is a high performance computer, which features the latest Windows Pro operating system and the latest Dual Core technology.

The 663 with ample memory and hard disk space for all modern Windows applications. Additional hardware is provided to interface with the MS Instruments equipment.

The desktop unit is supplied with a 21" LCD Monitor to provide a large, clear desktop display, enabling all results to be clearly seen as they are received. The 663N offers a portable solution. The range processor is the ideal machine from which to run range operations smoothly and efficiently.

## SMOOTH AND EFFICIENT

### SPECIFICATION - DESKTOP

INTERNAL HARDWARE (min)	
Processor	P-4 Dual core 3.0 GHz
Memory	4 GB
Hard Drive	512 GB
DVD ROM/RW	DVD/CD-RW Combo (8x8x8x24)
EXTERNAL HARDWARE	
Display	21" LCD
Printer	Colour Laserjet
UPS	500 VA
SOFTWARE	
Operating System	Windows 7 Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>
DIMENSIONS	
L x W x H (Desktop)	460mm x 630mm x 210mm [18.11in x 24.80in x 8.27mm]

### SPECIFICATION - LAPTOP

INTERNAL HARDWARE (min)	
Processor	Intel Core i7 2.7 GHz
Memory	8 GB
Hard Drive	500 GB SSD
Video Outputs	HDMI/MiniDP
USB 3.0 Ports	2 (1 with PowerShare)
EXTERNAL HARDWARE	
Display	15" (1500 x 900)
Printer	HP Deskjet/Laserjet (Office Standard)
UPS	1000 VA+
Mouse	Built-in trackpad
SOFTWARE	
Operating System	Latest Windows Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>

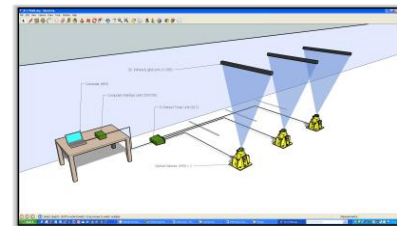
## USED WITH



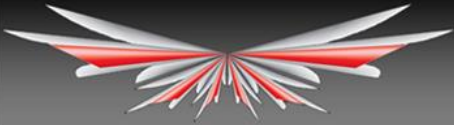
Acoustic Target  
Type 541



Ballistic DB Control Software  
Type 950-571






Projectile Velocity Measurement System  
(PVMS)



## MS INSTRUMENTS Range Consultancy

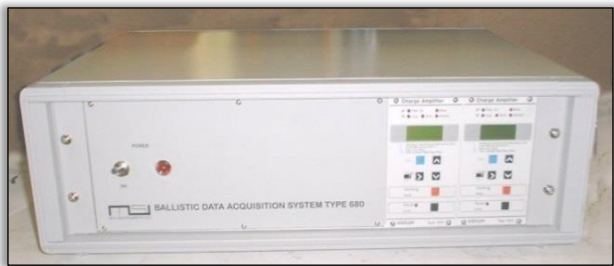
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## BALLISTIC DATA

# ACQUISITION SYSTEM (BDAS) TYPE 680



## BALLISTIC DATA ACQUISITION SYSTEM [BDAS] TYPE 680

Primarily used for Electronic Pressure Velocity and Action Time (EPVAT) measurement, BDAS is a precision, integrated unit that gathers data for complete ballistics analysis.

With a variety of possible configurations, this multipurpose unit has been developed to combine the many useful, individual properties of MSI instrumentation. The resulting sophisticated and versatile product can be utilised in the measurement of velocity and rate of fire of a projectile; port and chamber pressure within the weapon and the action time.

### HARDWARE/SOFTWARE

- **Ballistics DB** is a Windows program which, when run on the Range Processor, allows for simple data exchange and provides data in standard Excel/Access file formats.
- **Standard User Interface** typical in Windows gives a rapid familiarity with the software, reducing training requirements.
- **Self-Arming Software** allows for largely hands-free operation during use. All data is safely logged to disk after each round.
- **Two Digital Charge Amplifiers** are fitted to ensure that all instrument settings are set electronically and recorded with the data for optimum data integrity.

## SOPHISTICATED AND VERSATILE

### SPECIFICATION

POWER/COMMS	
Power	85-264V AC
A/D Card	2-Channel 10MHz 12-bit
Connections	<ul style="list-style-type: none"><li>• 6x 19-pin</li><li>• 10X TTL</li><li>• 2x AUX</li><li>• 2x BNC</li></ul>
FILTERS	
Butterworth	0-500kHz
ENVIRONMENT	
Operating Temperature	0°C - 60°C [32 °F - 140 °F]
Humidity	95% non-condensing
DIMENSIONS	
L x W x H	650mm x 500mm x 150mm [25.6in x 19.7in x 5.9in]
Weight	15kg [33.1lbs]

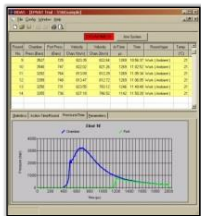
### USED WITH



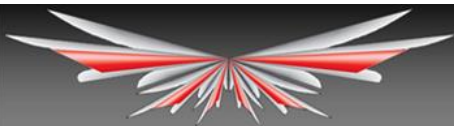
Universal Receiver Type 681-700



Optical Detector Type 858



Ballistics DB Control Software Type 950-571



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# UNIVERSAL RIFLE MOUNT STAND type 681-550 and Azimuth/Elevation Mount type 681-400



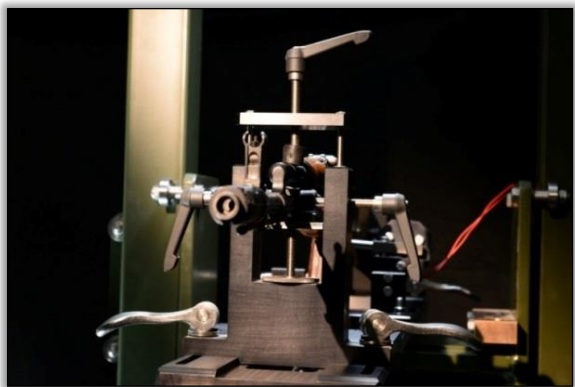
The Universal Rifle Mount Type 681-600 series is designed to clamp firmly a wide range of small arms for remote firing (see separate leaflet).  
If orthogonal firing is required for ballistics material testing, then it is mounted on the X/Y mount type 681-800, however it is more normally fitted to the Azimuth/Elevation Mount type 681-400 (see right-hand image above) which is secured to the Stand type 681-550 (see left-hand image above).

## SPECIFICATION

Unit	Calibre	Size	Movement	Weight
Stand Type 681-550	All calibres up to 40mm	Height: 670mm Width: 1040mm Depth: 1040mm		170kg
Azimuth/Elevation Mount Type 681-400	All calibres up to 12.7mm	Height: 595mm Width: 510mm Depth: 1180mm	5 degrees left-right 5 degrees up-down	175kg

# UNIVERSAL WEAPON REST

## TYPE 681-600



### HARDWARE/SOFTWARE

- Several Interchangeable components with Quick-Release Clamps ensure that the weapons mount can be adjusted quickly from one type of firearm to the next.
- Soft Mounts protect the weapons from damage wherever the gun is supported.
- Electronic or Manual firing

### UNIVERSAL WEAPON REST TYPE 681-600

The Universal Rifle Mount Type 681-600 series is designed to clamp firmly a wide range of small arms for remote firing. This versatile mount can securely house a comprehensive variety of rifles, sub machine guns and pistols using adjustable blocks at the front and rear of the firearm.

The care taken to cater for all users' requirements means this weapon rest brings quality to the range, and smoothness to the trials.

## QUALITY TO THE RANGE

### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 14.5mm
DIMENSIONS	
L x W x H	900 x 250 x 560mm [35.4in x 9.8in x 22.0in]
Weight	60kg [132.3lbs]

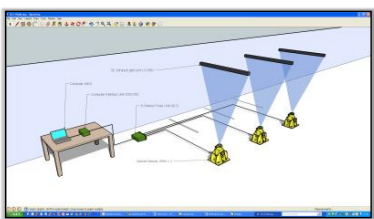
### USED WITH



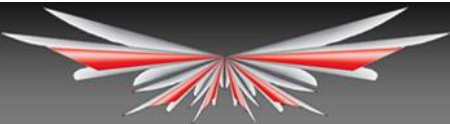
Safety Firing System Type 157



Optical Target Type 546



Projectile Velocity Measurement System



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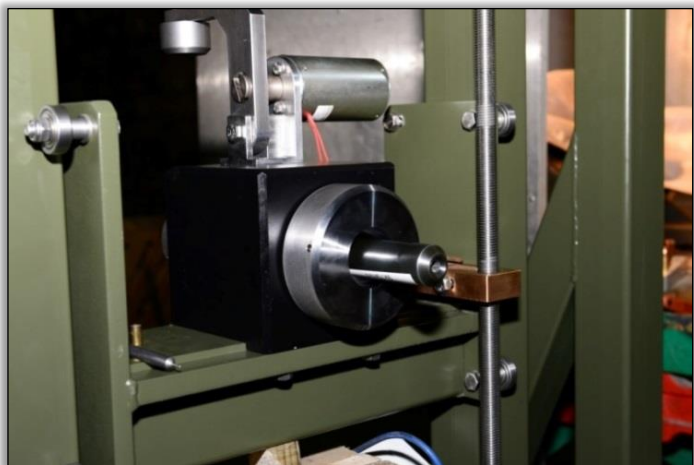
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# UNIVERSAL RECEIVER

## TYPE 681-700



### UNIVERSAL RECEIVER TYPE 681-700

The Universal Receiver is a breech/firing assembly that accepts a wide range of small arms barrels. Designed for accuracy, velocity and pressure test barrels, this is a versatile receiver, and can handle calibres up to 12.7mm. It can be used with a recoil mechanism if required, and may be mounted on an orthogonal X-Y firing mount or an azimuth and elevation rest.

An adaptable, helpful piece of equipment, this receiver is an affordable piece of a smooth-running range.

### TRULY A *UNIVERSAL* RECEIVER

#### HARDWARE

- **Universal Breech** accepts barrels of different calibres made to fit the receiver.
- **X/Y Mount Type 681-800** to which the Receiver is fitted enables firing always to be made perpendicular to the line of fire. This feature is especially important when testing ballistic material.
- **Electrical (Solenoid) Firing Unit** interfaces to the MSI Safety Firing System Type 157.

#### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 12.7mm
Movement	Depends on chosen mounting system
DIMENSIONS	
L x W x H	150mm x 250mm x 180mm [5.9in x 9.8in x 7.1in]
Weight	45kg [99.2lbs] with typical barrel (not including stand etc.)

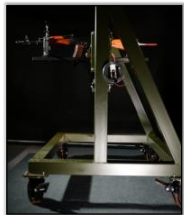
#### USED WITH



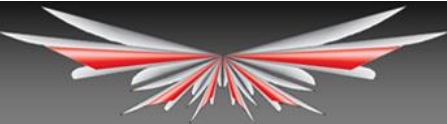
Azimuth/Elevation mount Type 681-400



Stand Type 681-550



X-Y Mount Type 681-800



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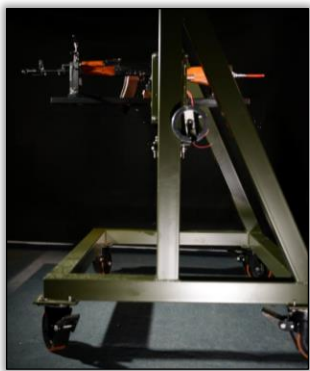
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# X-Y MOUNT

## TYPE 681-800



### HARDWARE/SOFTWARE

- Lockable Wheels allow easy deployment.
- Perpendicular Movement is particularly useful for ballistic materials testing, where orthogonal firing greatly increases the validity of the results.
- Jacking feet provide a stable firing platform ensuring consistent test results.

### X-Y MOUNT TYPE 681-800

The X-Y Mount Type 681-800 is a strong and durable frame designed to hold the Universal Weapon Rest Type 681-600 or Universal Receiver Type 681-700. Made for long-lasting use, the mount is easy to set up, and enables firing to be carried out swiftly and as predictably as possible.

## STRONG AND DURABLE

### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 14.5mm
Movement	<ul style="list-style-type: none"><li>• 400 mm left-right</li><li>• 720mm up-down</li></ul>
DIMENSIONS	
L x W x H	2090mm x 1040mm x 1325mm [82.3in x 40.9in x 52.2in]
Weight	220kg [485lbs]

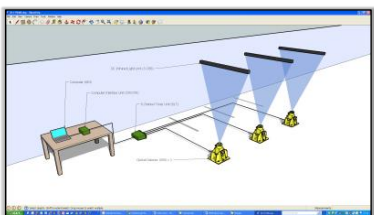
### USED WITH



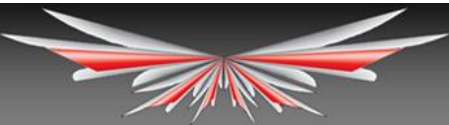
Universal Weapon Rest Type 681-600



Universal Receiver Type 681-700



Projectile Velocity Measurement System



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# UNIVERSAL RECEIVER

## (Medium Cal) TYPE 681-900

### UNIVERSAL RECEIVER TYPE 681-900

The Universal Receiver is a breech/firing assembly that accepts a wide range of small arms barrels. Designed for accuracy, velocity and pressure test barrels, this is a versatile receiver, and can handle calibres up to 30mm (40mm unit is type 681-500). It can be used with a recoil mechanism if required, and is mounted on a firing stand type 681-550.

## TRULY A UNIVERSAL RECEIVER

## HARDWARE

### HARDWARE

- Universal Breech accepts barrels of different calibres made to fit the receiver.
- Electrical (Solenoid) Firing Unit interfaces to the MSI Safety Firing System Type 157.

### SPECIFICATION

HARDWARE	
Calibre	All calibres from 50 Cal up to 30mm
Movement	Fixed on optional recoil mount
DIMENSIONS (of Receiver/firing mechanism only)	
L x W x H	500mm x 200mm x 200mm [19.7in x 7.9in x 7.9in]
Weight	60kg [132lbs] (not including barrel, stand etc.)

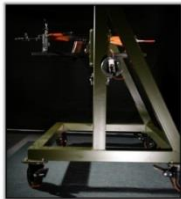
### USED WITH



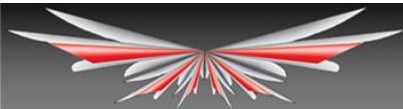
30mm Barrel (rifled/smooth/EPVAT)



Stand Type 681-550



X-Y Mount Type 681-800



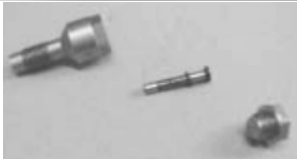
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# COPPER CRUSHER ADAPTORS



## HARDWARE

- **Kistler 6215 compatible** fits into standard M10 holes drilled and threaded into pressure barrels.
- **Various piston sizes** are available to cover different pressure ranges.

## Copper Crusher Adaptors

Before the development of the piezoelectric sensor and its use for the measurement of chamber and port pressure in small/medium calibre test systems, the copper crusher was used.

Whilst the piezo transducer provides a more convenient and accurate methodology, there are still existing facilities using the copper crusher approach. This adaptor set enables the use of suitable sized crushers in barrels drilled for 10mm diameter piezo sensors

## Compact and Convenient

## KEY FEATURES

HARDWARE	
Compatibility	Kistler 6215 compatible
	(avoids barrel re-working)
DIMENSIONS	
Hole diameter	10mm

## USED WITH



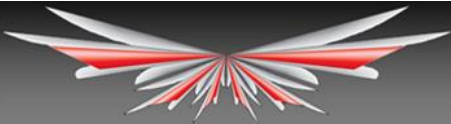
Universal Receiver Type 681-700



Azimuth/Elevation mount Type 681-400



Pressure Measurement Unit  
type 683



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# PRESSURE MEASUREMENT UNIT TYPE 683



## PRESSURE MEASUREMENT UNIT TYPE 683

Primarily used for Electronic Pressure Velocity and Action Time (EPVAT) measurement, the Pressure Measurement Unit Type 683 is a compact, sealed unit that gathers data for complete ballistics analysis.

With a variety of possible configurations, this multipurpose unit has been developed to combine the many useful, individual properties of MSI instrumentation. The resulting sophisticated and versatile product can be utilised in the measurement of velocity and rate of fire of a projectile; port and chamber pressure within the weapon and the action time.

## SOPHISTICATED AND VERSATILE

### SPECIFICATION

POWER/COMMS	
Power	24V DC
Power Supply	Computer Interface Unit Type 570-070
A/D Card	2-Channel 10MHz 12-bit
Connections	<ul style="list-style-type: none"><li>1x 19-pin</li><li>1x 2-pin power</li><li>2x TTL</li><li>2x AUX</li><li>2x BNC</li></ul>
FILTERS	
Butterworth	0-500kHz
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
Humidity	The unit is sealed
DIMENSIONS	
L x W x H	350mm x 140mm x 280mm [13.0in x 5.5in x 11.0in]
Weight	9kg [19.8lbs]

### HARDWARE/SOFTWARE

- BallisticsDB is a Windows program which, when run on the Range Processor, allows for simple data exchange and provides data in standard Excel/Access file formats.
- Standard User Interface typical in Windows gives a rapid familiarity with the software, reducing training requirements.
- Self-Arming Software allows for largely hands-free operation during use. All data is safely logged to disk after each round.
- Two Digital Charge Amplifiers are fitted to ensure that all instrument settings are set electronically and recorded with the data for optimum data integrity.

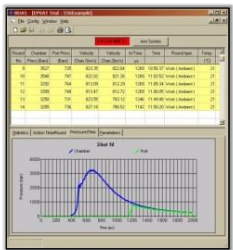
### USED WITH



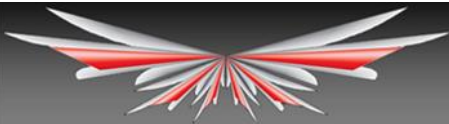
Universal Receiver  
Type 681-700



Triple-Channel Remote  
Timer Unit Type 817



Ballistics DB Control Software  
Type 950-571



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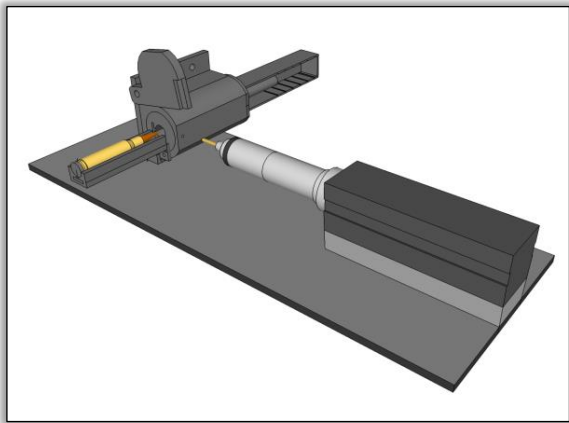
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# REMOTE-CONTROLLED LIVE AMMUNITION DRILLING MACHINE

## TYPE 684



### REMOTE-CONTROLLED LIVE AMMUNITION DRILLING MACHINE TYPE 684

The MSI Remote-Controlled Live Ammunition Drilling Machine is an all-air-drive machine that requires no electric circuits. The system promotes safety and efficiency in operation, allowing the procedure to flow smoothly and effectively. Additionally, MSI can supply all the required peripheral equipment, making this a true turn-key solution. This compact and precise system is a quality piece of equipment that performs to the highest standard, and is first choice for all ammunition drilling tasks.

### COMPACT AND PRECISE

#### HARDWARE/SOFTWARE

- **Air-cooling of the jig**, together with the variable drill speed, prevents localised overheating of the cartridge.
- **Incorporated serviceable bullet trap** prevents damage or harm in event that a round is ignited.
- **Individual rounds** are clamped horizontally in the appropriate calibre drill.
- **Each jig** is designed to allow a flow of compressed air over the drilling area, reducing heat build-up and clearing swarf from the area.
- **Limit stop** is set to the appropriate case wall thickness.
- **Operator can retire to a safe area**, start the drill, and advance the feed ram to the stop. The drill is then shut off and the ram retracted to allow the round to be removed.

#### SPECIFICATION

POWER/COMMS	
Power Supply	Standard compressed air supply
CONFIGURATIONS	
Action	Horizontal, bench mounted, or vertical
Drill Capacity	1.5mm – 10mm
Drill Type	Variable speed air-powered drill
Jigs	Hardened individual drill jigs to suit calibre
Pneumatic Ram	Variable stroke depth to max 50mm*
*Alternatives can be offered, subject to requirements	

#### USED WITH



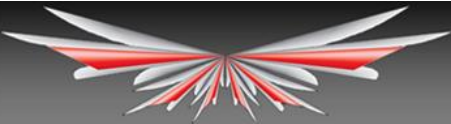
Ballistic Data Acquisition System Type 680



Universal Receiver Type 681-700



Pressure Measurement Unit Type 683



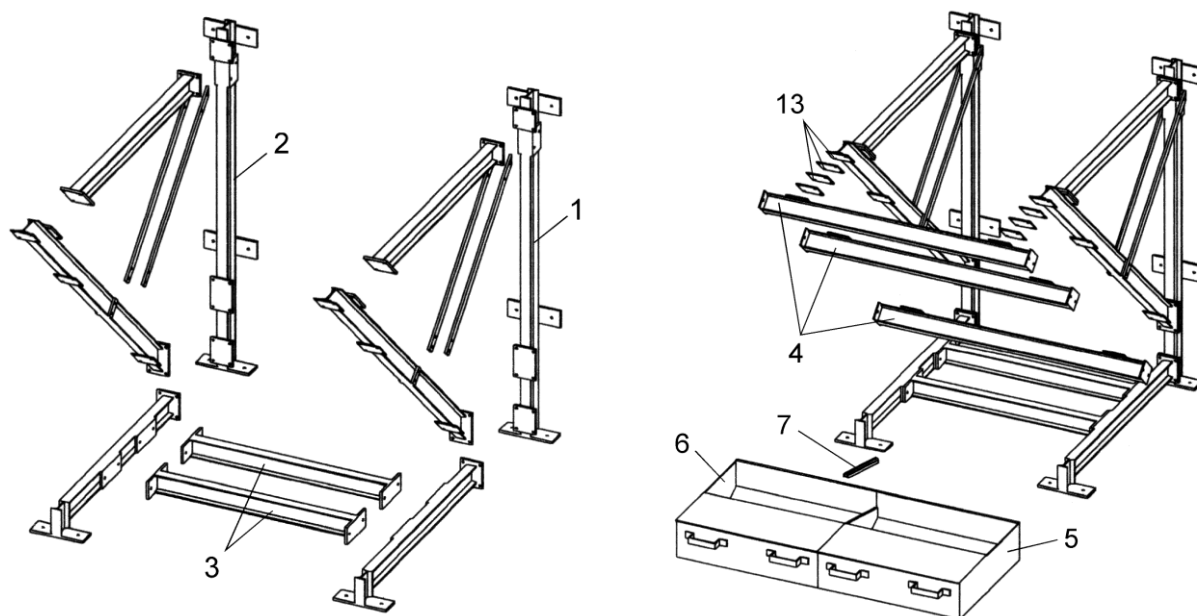
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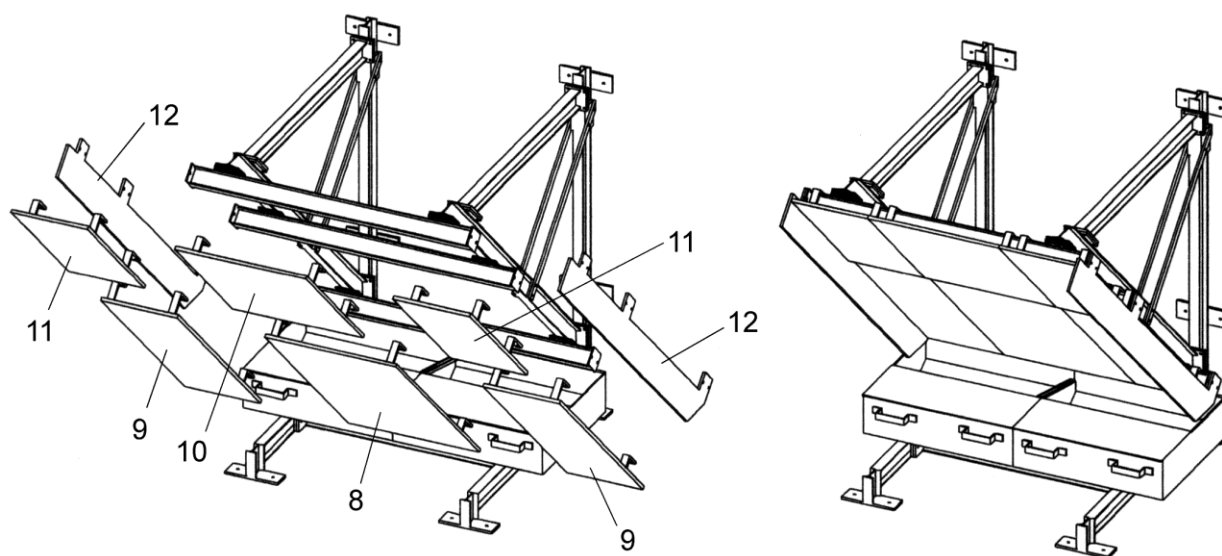


## BULLET TRAPS



The company provides various different bullet trap designs, depending on the specific range needs. In some cases, it is necessary to collect the fired projectile, whereas in others, safe trapping and diverting is required.

These images show the standard diverting type, which collects the debris into drawers that can be readily emptied and cleaned.



# FLASH DETECTOR

## TYPE 726



### HARDWARE/SOFTWARE

- **Detector** provides an output signal in response to a brief light pulse in a broad field of view.
- **BNC Connector** can trigger other events or equipment like a camera or x-ray by providing a TTL output.
- **Detector Power Unit Type 783-120** provides the detector with power and allows adjustment of sensitivity.
- **Event Distinction** means the system ignores slow events, such as flicker from fluorescent lighting.
- **Built-In Test Facility** allows system function to be checked prior to operation.

### FLASH DETECTOR TYPE 726

For the detection of muzzle flash, explosion, or other similarly brief event, the Flash Detector Type 726 is an ideal unit. From this, projectile exit time, time of flight to target, and other parameters can be measured.

Low-cost and unobtrusive, this compact and reliable unit is perfect for firing trials.

## COMPACT AND RELIABLE

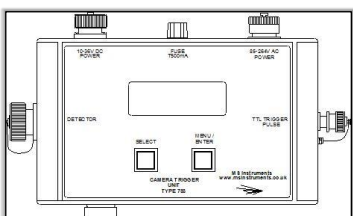
### SPECIFICATION

HARDWARE	
Wavelength Spectral Range	770nm to 1100nm
Peak Spectral Response	900nm
Field of View	20°
Min. Flash Rise Time	1500 candela/m <sup>2</sup> per second
Min. Detectable Flash Luminance at 5m	15 candela/m <sup>2</sup>
Min. Detectable Flash Duration	3µs
POWER/COMMS	
Power	10-30V DC
Power Supply	Detector Power Unit Type 783-120
BNC Output	TTL (5V) Rising edge 1ms pulse
ENVIRONMENT	
Operating Temperature	-25°C - +60°C [-13 °F - +140 °F]
Humidity	The unit is sealed
DIMENSIONS	
L x W x H	150mm x 290mm x 105mm [5.9in x 11.4in x 4.1in]
Weight	1kg [2.2lbs]

### USED WITH



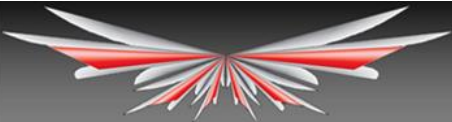
Universal Weapon Rest Type 681-600



Detector Power Unit Type 783-120



Rate-of-Fire Computer Type 807



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# FLASH DETECTOR

## TYPE 726 050



### HARDWARE/SOFTWARE

- **Detector** provides an output signal in response to a brief increase in light.
- **BNC Connector** can be used to trigger equipment like a camera or x-ray by providing a TTL output.
- **Detector Power Unit Type 783-120** provides the detector with power and allows adjustment of sensitivity.

### FLASH DETECTOR TYPE 726 050

For the detection of muzzle flash, explosion, or other similarly brief event, the Flash Detector Type 726 050 is an ideal unit. From this, projectile exit time, time of flight to target, and other parameters can be measured.

The advantage of this flash detector is an interchangeable lens to satisfy all requirements from close to far away flash events.

### COMPACT AND RELIABLE

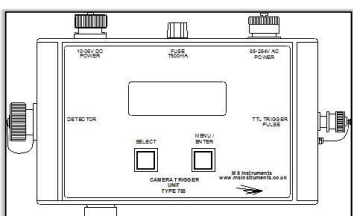
### SPECIFICATION

HARDWARE	
Wavelength Spectral Range	430nm to 1064nm
Peak Spectral Response	780 - 950nm
Field of View	Depends on lens fitted
Min. Flash Rise Time	1500 candela/m <sup>2</sup> per second
Min. Detectable Flash Luminance at 5m	15 candela/m <sup>2</sup>
Min. Detectable Flash Duration	3µs
POWER/COMMS	
Power	10-36V DC
Power Supply	Power cable 726 030AS DC Power supply 588 080AS Detector power unit 783 120AS
BNC Output	TTL (5V) Rising edge 1ms pulse
ENVIRONMENT	
Operating Temperature	-10°C - +60°C [-13 °F - +140 °F]
Humidity	The unit is not sealed because of lens
DIMENSIONS	
L x W x H	150mm x 290mm x105mm [5.9in x 11.4in x 4.1in]
Weight	1kg [2.2lbs]

### USED WITH



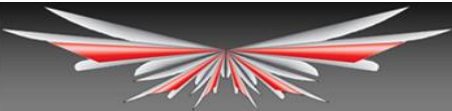
Universal Weapon Rest Type 681-600



Detector Power Unit Type 783-120



Rate-of-Fire Computer Type 807



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# OPTICAL DETECTOR TEST SET

## TYPE 761-100



### HARDWARE/SOFTWARE

- **LED Transmitter Units** are used in place of the lenses in the Optical Detector units of the PVMS. They are connected to the Test Set by means of a 3m BNC Lead
- **Background Lighting Conditions** are simulated by the DC component of the LED current.
- **Projectile Passage** is simulated by decreasing the standing LED current.

### OPTICAL DETECTOR TEST SET TYPE 761-100

The Optical Detector Test Set Type 761-100 has been designed as an aid to testing and servicing the Optical Detector Type 758/858, as used in the Projectile Velocity Measurement System (PVMS), under laboratory conditions.

With the Test Set, it is possible to simulate the passage of various projectiles over the Optical Detectors under a variety of background lighting conditions, ensuring consistent success in trials and leading to a faster, more cost-effective testing process.

## CONSISTENT SUCCESS

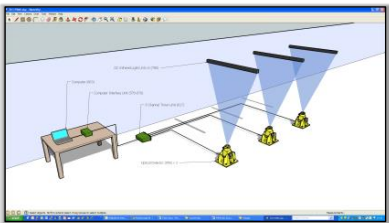
### SPECIFICATION

POWER/COMMS	
Power	9 VDC Battery
CONTROLS	
Front Panel Rotary Switch	Light level (select LED standing current – variable positions)
Front Panel Push Buttons	<ul style="list-style-type: none"><li>• Power on/off</li><li>• Trigger</li></ul>
Indicators	<ul style="list-style-type: none"><li>• Low Battery</li><li>• Power/Trigger</li></ul>
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	95% non-condensing
DIMENSIONS	
L x W (LED Assembly)	60mm x 45mm [2.36in x 1.77in]
L x W x H	80mm x 180mm x 60mm [3.15in x 7.09in x 2.36in]
Weight	0.75kg [1.65lbs]

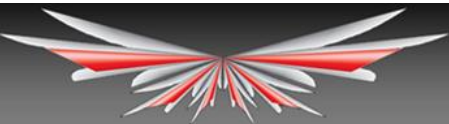
## USED WITH



Optical Detector Type 858



Project Velocity Measurement System



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# PVMS TEST SET

## TYPE 761-200



### HARDWARE/SOFTWARE

- **LED Transmitter Units** are used in place of the lenses in the Optical Detector units of the PVMS.
- **Illumination and Triggering** of an Optical Detector is simulated by radiation emitted when a current passes through the LED.
- **Background Lighting Conditions** are simulated by the DC component of the LED current.
- **Projectile Passage** is simulated by decreasing the standing LED current.
- **Current Pulses** simulate the time interval between pulses on the start and stop channels.

### PVMS TEST SET TYPE 761-200

The PVMS Test Set Type 761-200 has been designed as an aid to testing and servicing the Projectile Velocity Measurement System (PVMS) under laboratory conditions. With the Test Set, it is possible to simulate the passage of various projectiles over the Optical Detectors under a variety of background lighting conditions, ensuring consistent success when the PVMS is used in trials and leading to a faster, more cost-effective testing process.

## CONSISTENT SUCCESS

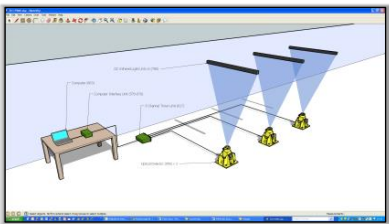
### SPECIFICATION

TESTS	
Timer Test	Up to 3 velocity pairs
System Test	1x start-and-stop pair
POWER/COMMS	
Power	110V-240V
Connections	<ul style="list-style-type: none"><li>• 6x 19-way Timer Test</li><li>• 2x BNC LED Emitters</li></ul>
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	Indoor Use Only
DIMENSIONS	
L x W x H	250mm x 250mm x 120mm [9.8in x 9.8in x 4.7in]

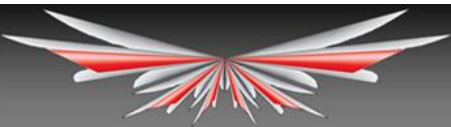
### USED WITH



Optical Detector Type 858



Project Velocity Measurement System



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# INFRARED FLASH BEACON TYPE 768-100



## HARDWARE

- **Two modes:** continuous flashing and manual.
- **External trigger** can be used to provide a system self-test function.

## INFRARED FLASH BEACON TYPE 768-100

The Infrared Flash Beacon Type 768-100 provides a high-power flash in the infrared region for the purpose of testing and aligning MSI Flash Detectors. The unit is in a weather-proof housing and can be mounted on a tripod, providing a rugged and compact operation.

## RUGGED AND COMPACT

## SPECIFICATION

POWER/COMMS	
Power Supply	Battery (IEC 3R12)
Power	9V

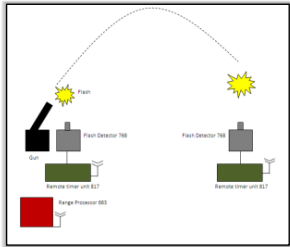
## USED WITH



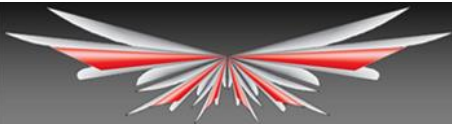
Flash Detector Type 726



Flash Detector Type 768



Burst Time Measurement Equipment (BTME)



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# FLASH DETECTOR

## TYPE 768



### HARDWARE/SOFTWARE

- **Detector** provides an output signal in response to a brief light pulse.
- **Trigger** can start other events or equipment like a camera or x-ray.
- **Detector Power Unit Type 783-120** provides the detector with power and allows adjustment of sensitivity.
- **Event Distinction** means the system ignores slow events, such as flicker from fluorescent lighting.
- **Built-In Test Facility** allows system function to be checked prior to operation.
- **Infrared Flash Beacon Type 768-100** is an option that may be used to assist in alignment and testing of the unit.

### FLASH DETECTOR TYPE 768

For the detection of muzzle flash, explosion, or other similarly brief event, the Flash Detector Type 768 is an ideal unit. From this, projectile exit time, time of flight to target, and other parameters can be measured.

The system comprises a detector mounted on a photographic tripod – its narrow field of view allows for further detection distance. This is an advanced and reliable flash detector that is certain to perform consistently.

## ADVANCED AND RELIABLE

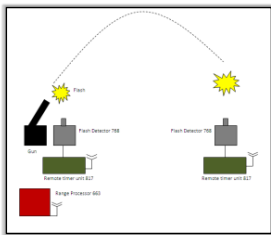
### SPECIFICATION

HARDWARE	
Wavelength Spectral Range	430nm to 1064nm
Peak Spectral Response	900nm
Field of View	6° with 50mm lens
Min. Flash Rise Time	1500 candela/m <sup>2</sup> per second
Min. Detectable Flash Luminance at 5m	15 candela/m <sup>2</sup>
Min. Detectable Flash Duration	4µs
POWER/COMMS	
Power	10V-30V DC
Power Supply	Detector Power Unit Type 783-120
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
Humidity	The unit is sealed
DIMENSIONS	
Length x Diameter	290mm x 152mm [11.4in x 6.0in]
Weight with tripod	9.8kg [21.6lbs]
Weight without tripod	5.8kg [12.8lbs]

### USED WITH



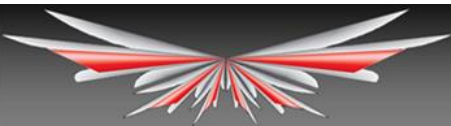
Automated Flight-Follower Type 631



Burst Time Measurement Equipment



High Speed Video Camera



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# VARIABLE DELAY UNIT

## TYPE 769



### HARDWARE

- **TTL positive output pulse** generated when the projectile is predicted to have reached the measurement plane.
- **Accurate projectile velocity calculations**
- **Transistor open-drain (contact-closure) output** can also be provided to trigger a variety of devices.
- **Simple programming requirements** are just distances and expected velocities.
- **Stored data** does not have to be re-entered.
- **Accurate photographs** can be taken even given variation of projectile velocity.

### VARIABLE DELAY UNIT TYPE 769

The Variable Delay Unit type 769 is designed to provide a precise distance delay between a desired measurement plane and a reference point.

This unit has a variety of configurations and outputs, as well as the ability to trigger a range of devices. Equipped with impeccable software, the 769 delivers consistent accuracy in every aspect of its performance.

## CONSISTENT ACCURACY

### SPECIFICATION

HARDWARE	
Delay Time	50µs-65535µs in 1µs Increments
Inputs	4 inputs for optical detectors
Outputs	TTL +ve rising edge pulse
POWER/COMMS	
Power	10-30V DC (12W)
Power Supply	Computer Interface Unit Type 570-070
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14°F - 122°F]
Humidity	The unit is sealed
DIMENSIONS	
L x W x H	350mm x 140mm x 280mm [13.8in x 5.5in x 11.0in]
Weight	4.6kg [10.1lbs]

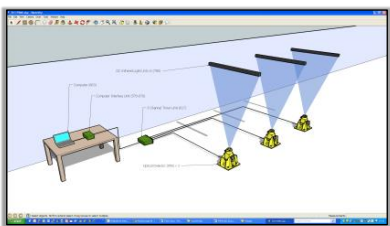
### USED WITH



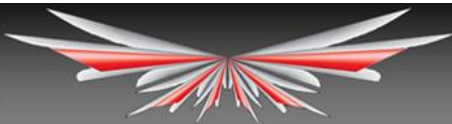
Optical Detector Type 858



High Speed Video Camera



Projectile Velocity Measurement System



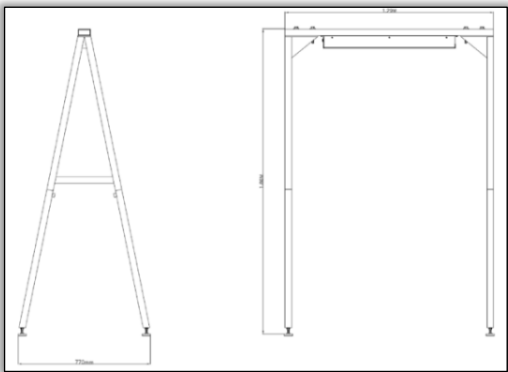
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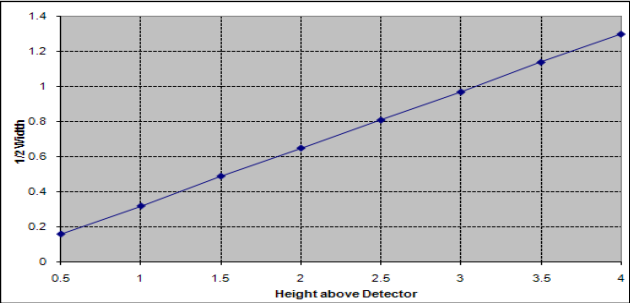
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# SOLID-STATE-LIGHT SUPPORT FRAME TYPE 775



½ WIDTH OF SLOT FOR OPTICAL DETECTOR



## SOLID-STATE-LIGHT SUPPORT FRAME TYPE 775

The MSI Solid-State-Light Support Frame is designed specifically for use with Solid-State Light Source Type 788, where ceiling mounting of lights is not a practical option.

The support frame suspends solid-state lights above the Type 858 Optical Detectors when indoor use is required. This setup is constructed of rugged material and provides stability and optimum lighting during operation, ensuring accurate results in a variety of firing applications.

## PROVIDES STABILITY

### SPECIFICATION

DIMENSIONS								
Base Depth x W x H		770mm x 1290mm x 1860mm [30.3in x 50.8in x 73.2in]						
DETECTION FAN WIDTH								
Lens Angle [°]	6	6	6	6	6	6	6	6
Lens ½ Angle [°]	8	8	8	8	8	8	8	8
Height [m]	.5		.5		.5		.5	
½ Width [m]	.16	.32	.49	.64	.81	.97	.14	.3
Width [m]	.32	.64	.98	.3	.62	.94	.28	.6
Min projectile (1/500) [mm]	.64	.28	.96	.6	.24	.88	.56	.2

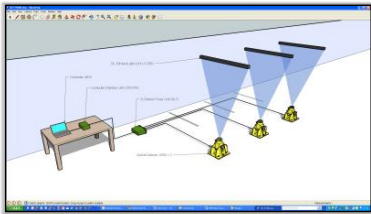
## USED WITH



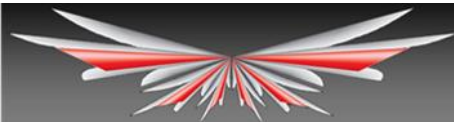
Intelligent Infrared Light Source Type 788



Optical Detector Type 858



Projectile Velocity Measurement System



## MS INSTRUMENTS Range Consultancy

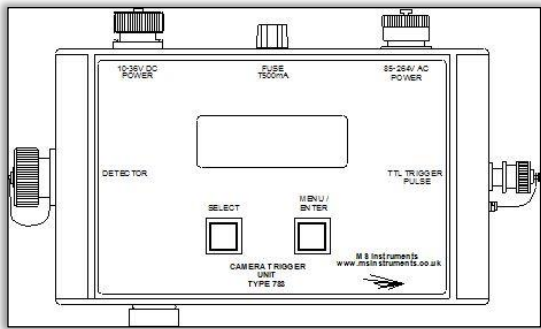
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# DETECTOR POWER UNIT

## TYPE 783-120



### HARDWARE/SOFTWARE

- **Lighting Condition** is shown on LCD Display as “Good/Bad Lighting”.
- **Shot Count** is shown on LCD Display. Max is 200.
- **Sensitivity** is set by Menu 1-10 (min-max).
- **TTL Trigger** can be set to rising/falling edge trigger.
- **Self-Test** runs on power on, and checks the optical detector for working operation.

### DETECTOR POWER UNIT TYPE 783-120

The Detector Power Unit Type 783-120 is a simple and efficient device that provides the power supplies necessary for the operation of Acoustic, Optical, and Flash Detectors.

The unit receives and processes the pulse generated by the detector and converts it to a positive/negative going pulse to trigger high-speed or x-ray cameras.

Removing the difficulties of powering devices, with the added pulse feature, this device is a helpful and reliable tool for all MS Instruments detectors.

## HELPFUL AND RELIABLE

### SPECIFICATION

POWER/COMMS	
Power	10V-36V DC or 85V-264V AC (6W)
Connections	<ul style="list-style-type: none"><li>• 19-way socket power to detector</li><li>• 2-way plug DC power in</li><li>• 3-way plug mains in</li><li>• BNC TTL output</li></ul>
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32°F - 122°F]
Humidity	95% Non-condensing
DIMENSIONS	
L x W x H	220mm x 130mm x 70mm [8.7in x 5.1in x 2.8in]
Weight	1.6 kg [3.5]

### USED WITH



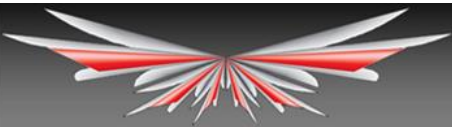
Acoustic Detector Type 588



Flash Detector Types 726 and 768



Optical Detector Type 858



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INTELLIGENT INFRARED  
LIGHT SOURCE  
TYPE 788



HARDWARE/SOFTWARE

- Three Printed Circuit Boards mounted end on in an aluminium channel form a single light. Each board consists of 80 infrared-emitting diodes.
- A Diffuser produces a uniform strip of infrared radiation from the individual diodes.
- A Universal-Input-Voltage Power Supply provides the 30V DC power for two lights.
- Computer Control is an option that allows each light to be controlled individually and remotely. Features include: Fault Report, Brightness Control, Energy Saving, Arm/Disarm Ability, Temperature-Limitation, and Others.

INTELLIGENT INFRARED LIGHT SOURCE TYPE 788

Whenever there is insufficient natural light, for example in an indoor range, these infrared lights are an essential piece of equipment.

The units are of rugged construction and, as of February 2011, they have the facility for computer control. With computer control comes a whole host of advantages that help save energy, costs, and time.

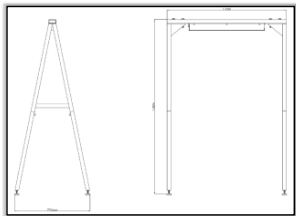
Designed for use with MS Instruments’ Projectile Velocity Measurement System (PVMS), these sleek lights are useful in many circumstances, helping improve the functionality of the range.

SAVE ENERGY, COSTS, AND TIME

SPECIFICATION

POWER/COMMS	
Power	90V-260V AC
Current	0.6A
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	95% non-condensing
DIMENSIONS	
L x W x H	783mm x 80mm x 77mm [30.8in x 3.1in x 3.0in]
Weight	2.6kg [5.7lbs]

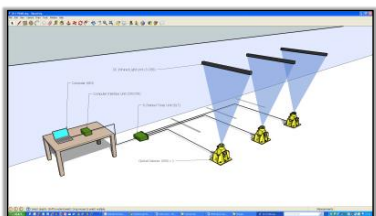
USED WITH



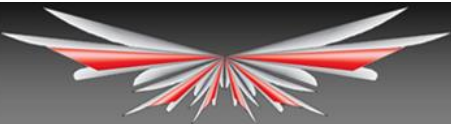
Solid-State-Light Support Frame Type 775



Optical Detector Type 858



Projectile Velocity Measurement System



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# RATE-OF-FIRE COMPUTER TYPE 807



## HARDWARE/SOFTWARE

- **Echo Rejection** is achieved by setting the maximum rate of fire – retaining the validity of the results.
- **Sensitivity** of the acoustic trigger can be set to allow for blanks and large calibre.
- **Built-in Battery** comes with a fast charger, and allows for portability.

## RATE-OF-FIRE COMPUTER TYPE 807

The Rate-of-Fire Computer Type 807 is a compact and rugged unit that measures the rate of fire of automatic weapons. The unit can be used with live rounds or blanks, and every aspect of the design is made to improve the ease with which firing can be measured.

## COMPACT AND RUGGED

## SPECIFICATION

HARDWARE	
Display Information	<ul style="list-style-type: none"><li>• Round Count</li><li>• Rate of Fire</li><li>• Battery Status</li></ul>
Rate of Fire	500-10 000 rpm
POWER/COMMS	
Power	100V-240V AC (30VA)
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
DIMENSIONS	
L x W x H	220mm x 130mm x 90mm [8.7in x 5.1in x 3.5in]

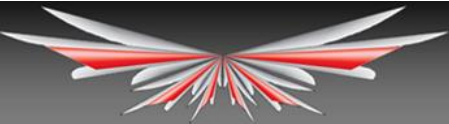
## USED WITH



Acoustic Detector Type 588



Universal Weapon Rest Type 681-600



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TRIPLE-CHANNEL  
REMOTE TIMER UNIT  
TYPE 817



HARDWARE/SOFTWARE

- Crystal-controlled chronometer channels each have a time resolution of 100 nanoseconds, producing high accuracy velocity measurements.
- Three Independent Chronometer Channels can each provide velocity or time-of-flight and rate-of-fire.
- Integrate Software Package is available, providing accuracy velocity, rate of fire, and pressure data.
- Software allows for remote control of the unit, and retrieval of all data, which may be stored to disk and printed out.
- Muzzle Velocity and intermediate velocities are all calculable using the Ballistic Coefficient, when more than two detectors are used.

TRIPLE-CHANNEL REMOTE TIMER UNIT TYPE 817

The Triple-Channel Remote Timer Unit Type 817 is a precise, microprocessor-based instrument, which provides direct measurement of projectile velocity and rate of fire. Using crystal-controlled chronometer channels, this unit provides highly accurate and reliable measurements which, when combined with the software package, produces impressive ballistic analysis potential.

HIGHLY ACCURATE AND RELIABLE

SPECIFICATION

HARDWARE	
Frequency Standard	<ul style="list-style-type: none"><li>10MHz crystal oscillator</li><li>Stability of 0.0025% over temp range -20°C - +80°C</li><li>Long term stability 10 ppm per year</li></ul>
Store Capacity	<ul style="list-style-type: none"><li>256 Velocity/Time measurements</li><li>257 Rate of Fire measurements</li></ul>
Rate of Fire	30,000 rpm max.
POWER/COMMS	
Power	10V-36V DC
Connections	<ul style="list-style-type: none"><li>Up to six Optical Detectors Type 858</li><li>Data connection to processor</li></ul>
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
DIMENSIONS	
L x W x H	350mm x 140mm x 280mm [13.8in x 5.5 in x 11.0in]
Weight	5kg [11.0lbs]

USED WITH



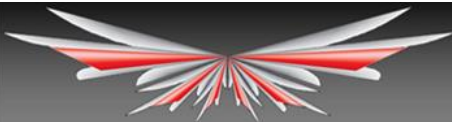
Acoustic Detector Type 588



Flash Detector Type 768



Optical Detector Type 858



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# TRACER IGNITION SYSTEM

## TYPE 818-050



Tracer Ignition Detector  
Type 818 050



GPS Synchronized Timer  
Unit  
Type 818 100



Power Supply Unit  
Type 818 150



Computer Interface Unit  
Type 818 200

### HARDWARE/SOFTWARE

- **Crystal-controlled chronometer channels** each have a time resolution of 100 nanoseconds from channel to channel, producing high accuracy time measurements.
- **Two Independent Chronometer Channels** Is used for the use of two lane firing.
- **Integrate Software Package** is available, providing accuracy velocity, rate of fire, accuracy.
- **Software** allows for remote control of the unit, and retrieval of all data, which may be stored to disk and printed out.

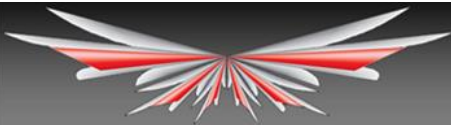
### TRACER IGNITION SYSTEM TYPE 818-050

The system is used for the detection of tracer ignition and burn distance. The equipment is set out on stands at Pass/Fail intervals down a range with a tracer ignition detector, GPS synchronized timer unit and a power supply at each stand. The tracer ignition detector is mounted on a stand with the detector field of view facing down to the ground so the sun will not cause any problems of not detecting or false triggering. All sensors are connected to a single wire that runs down the range to give power and communication to all timer units. The system can be used to measure the average velocity of the tracer round between two stands. This then gives you the velocity profile of the projectile as it is burning the tracer compound and losing mass down range. It also confirms whether the tracer was still burning as it passed each stand. All systems connect back to the control room and results are shown on the control PC along with data analysis.

## HIGHLY ACCURATE AND RELIABLE

### SPECIFICATION

HARDWARE	
Frequency Standard	<ul style="list-style-type: none"> <li>10MHz crystal oscillator</li> <li>Stability of 0.0025% over temp range -20°C - +80°C</li> <li>Long term stability ±0.5ppm Stability.</li> <li>Ageing of ±1ppm per year</li> </ul>
Store Capacity	<ul style="list-style-type: none"> <li>256 Time measurements</li> </ul>
POWER/COMMS	
Power	110 – 240V ac ±10%
Connections	<ul style="list-style-type: none"> <li>Up to two Detectors Type 818</li> <li>Data connection to processor</li> <li>GPS Antenna</li> </ul>
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
DIMENSIONS/Weight	
See individual Data sheets for more information	



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DUAL-CHANNEL  
GPS-SYNCHRONIZED TIMER  
TYPE 818-100



HARDWARE/SOFTWARE

- **Crystal-controlled chronometer channels** each have a time resolution of 100 nanoseconds from channel to channel, producing high accuracy time measurements.
- **Two Independent Chronometer Channels** each provide velocity or time-of-flight and rate-of-fire.
- **Integrated Software Package** is available, providing accuracy, velocity, rate of fire.
- **Software** allows for remote control of the unit, and retrieval of all data, which may be stored to disk and printed out.
- **Muzzle Velocity** and intermediate velocities are all calculable using the Ballistic Coefficient, where known.

DUAL-CHANNEL GPS SYNCHRONIZED TIMER TYPE 818-100

The Dual-Channel GPS Synchronized Timer Unit Type 818-100 is a precise, ARM based Processing instrument, which provides GPS time synchronized measurement of events. A typical application is Burst Time measurement.

The timer crystal has  $\pm 5\text{ppm}$  accuracy and the GPS unit is time-synchronized to better than 300ns to UTC for all timing channels. This unit provides highly accurate and reliable measurements, which enable detailed ballistic analysis to be undertaken in the software.

HIGHLY ACCURATE AND RELIABLE

SPECIFICATION

HARDWARE	
Frequency Standard	<ul style="list-style-type: none"><li>• 10MHz crystal oscillator</li><li>• Stability of 0.0025% over temp range -20°C - +80°C</li><li>• Long term stability <math>\pm 0.5\text{ppm}</math> Stability.</li><li>• Ageing of <math>\pm 1\text{ppm}</math> per year</li></ul>
Store Capacity	<ul style="list-style-type: none"><li>• 256 Velocity/Time measurements</li><li>• 257 Rate of Fire measurements</li></ul>
Rate of Fire	30,000 rpm max.
POWER/COMMS	
Power	10V-36V DC
Connections	<ul style="list-style-type: none"><li>• Up to two Detectors Type 858/726/768/588/818</li><li>• TTL and Make/Break</li><li>• Data connection to processor</li><li>• GPS Antenna</li></ul>
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
DIMENSIONS	
L x W x H	260mm x 150mm x 90mm [10.2in x 5.9 in x 3.5in]
Weight	2.1kg [4.6lbs]

USED WITH



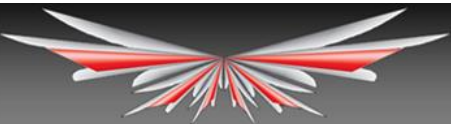
Acoustic Detector Type 588



Flash Detector Type 768



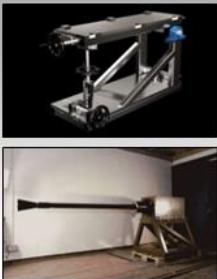
Optical Detector Type 858



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# TRACER DETECTOR

## TYPE 818-250



### HARDWARE/SOFTWARE

- **Detector** provides an output signal in response to a brief light pulse in a broad field of view.
- **GPS Synchronized Unit Type 818-100** provides the detector with power and allows adjustment of sensitivity.
- **Event Distinction** means the system ignores slow events, such as flicker from fluorescent lighting.
- **Built-In Test Facility** allows system function to be checked prior to operation.

### TRACER DETECTOR TYPE 818-250

For the detection of tracer ignition and burn distance, the Tracer Detector Type 818-250 is an ideal unit. This unit is set out on stands at Pass/Fail intervals down a range and is used with the 818-100 GPS Synchronized Timer Unit to measure the timing of tracer illumination. This then can be used to calculate the average velocity between sensors so that a velocity trend can be seen as a projectile loses mass of burnt tracer compound.

## COMPACT AND RELIABLE

### SPECIFICATION

HARDWARE	
Wavelength Spectral Range	450nm to 700nm
Peak Spectral Response	700nm
Field of View	20°
Min. Detectable Flash Duration	3µs
POWER/COMMS	
Power	10-30V DC
Power Supply	GPS Synchronized Unit 818-100
ENVIRONMENT	
Operating Temperature	-25°C - +60°C [-13 °F - +140 °F]
Humidity	The unit is sealed
DIMENSIONS	
L x W x H	120mm x 120mm x 100mm [4.7in x 4.7in x 3.9in]
Weight	1.85kg [4.1lbs]

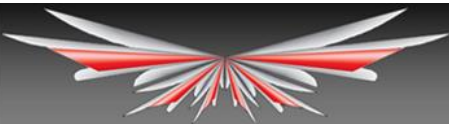
### USED WITH



GPS Synchronized Timer Unit Type 818 100



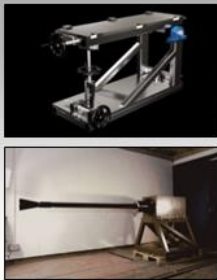
6 Channel Timer Unit Type 817



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# OPTICAL DETECTOR

## TYPE 858



### HARDWARE/SOFTWARE

- **Start and Stop Detectors** identify a small change in illumination when a projectile passes through the field of view, and translate this into an output pulse.
- **BNC Connector** provides a TTL output pulse, which may be used to trigger other equipment, such as a high-speed camera.
- **Light Alloy Plinths** on which the detectors are mounted allow for permanent range installation, or wall-mounting.
- **Automatic Gain Control System** compensates for ambient light changes.
- **Tracer Shield** can easily be fitted to enable velocity measurement on tracer rounds.
- **Fixed-Spacing Cradles** can be supplied for forensic applications.

### OPTICAL DETECTOR TYPE 858

The Optical Detector Type 858 is an integral component of MS Instruments' Range Equipment, most commonly used as part of the Projectile Velocity Measurement System (PVMS).

This brand new design has been meticulously created to yield a rugged and sophisticated system that will operate successfully on both outdoor and indoor ranges, for all users.

## METICULOUSLY CREATED

### SPECIFICATION

HARDWARE	
Lens	50mm Focal Length Camera lens at full aperture
Field of View	36° x 0.17° for 50mm lens
Projected Slit Width at 1m	1.5mm for 50mm lens
Slit Position	Defined by two bosses brought out on plinth
Vertical Alignment	0.3mrad
Pre-Set Elevation Angle	0°, 15°, 30°, and 45°
Sensitivity	Will respond to <0.1% change in ambient light level
PROJECTILES	
Projectile Calibre	2mm to 155mm and above
Projectile Velocity	10ms <sup>-1</sup> to >5000ms <sup>-1</sup>
POWER/COMMS	
Power Supply	Remote Unit via multicore cable
Pulse Output	Fed by line driver to 817, BDAS or other
Monitor Outputs	Illumination level monitoring in terms of DC voltage at BNC
ENVIRONMENT	
Operating Temperature	0°C - 50°C 32°F - 122°F
Operating Brightness	15cfm <sup>2</sup> to >1500cfm <sup>2</sup> at source colour temperature of 2780K
Humidity	Units are sealed against moisture
DIMENSIONS	
L x W x H	324mm x 280mm x 365mm 12.8in x 11.0in x 14.4in
Weight	14kg [30.9lbs] each

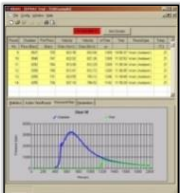
### USED WITH



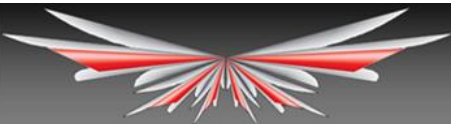
Automated Flight Follower Type 631



Triple-Channel Remote Unit Type 817



Ballistics DB Control Software Type 950-571



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# VELOCITY SCREEN

## TYPE 859



### HARDWARE/SOFTWARE

- **Start and stop detectors** identify a small change in illumination when a projectile passes through the detection area, and translate this into an output pulse.
- **BNC connectors** provide a TTL/12V output pulse, which may be used to trigger other equipment, such as a high-speed camera.
- **Automatic gain control** system compensates for dust and dirt on sensor windows.
- **Built-in diagnostics** report if light has been damaged by the means of a LED and sounder.

### VELOCITY SCREEN TYPE 859

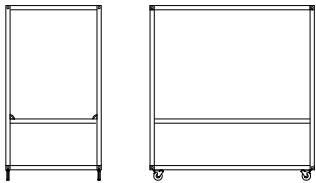
The MSI Velocity Screen Type 859 is an integral component of MS Instruments' Range Equipment, most commonly used as part of the Projectile Velocity Measurement System (PVMS). The Velocity screen can be used with all nature of projectiles including tracer. They are fitted to a trolley for ease of use at a sensor separation of 1m but can be supplied on larger sensor separation if required. This design has been created to bring a larger detection area and ease of use at a competitive price.

## EASY AND AFFORDABLE

### SPECIFICATION

HARDWARE	
Active Area	1m x 1m
Safe Clear Passage	990mm x 990mm
PROJECTILES	
Projectile Calibre	5.56mm to 14.5mm
Projectile Velocity	50ms <sup>-1</sup> to >3000ms <sup>-1</sup>
POWER/COMMS	
Power Supply	Remote Unit via multicore cable
Trigger Pulse	Fed by line driver to timer unit
BNC Trigger Outputs	50Ω TTL Can be preconfigured for rising/falling edges 50Ω 12V Can be preconfigured for rising/falling edges
ENVIRONMENT	
Operating Temperature	0°C - 50°C 32°F - 122°F
Humidity	95% non-condensing
DIMENSIONS	
H x W x L	1320mm x 1090mm x 50mm 52.0in x 43.0in x 2.0in
Weight	10kg [22.0lbs] each

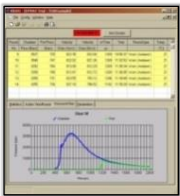
### USED WITH



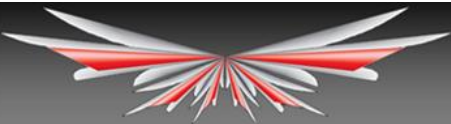
Velocity Trolley Type 859 250AS



Triple-Channel Remote Unit Type 817



Ballistics DB Control Software Type 950-571



## MS INSTRUMENTS Range Consultancy

Precision, Expertise, Quality

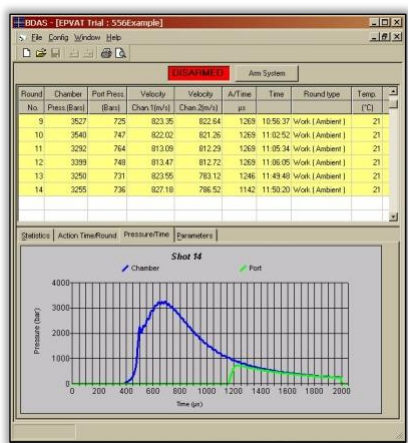
- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards





# BALLISTICS DB CONTROL SOFTWARE

## TYPE 950-571



### BALLISTICS DB CONTROL SOFTWARE TYPE 950-571

Ballistics DB is the most important control software in the MSI range. This sleek, yet functional interface is the front end of all MSI test range instrumentation, adapting to each system with ease, being customized prior to each shipment.

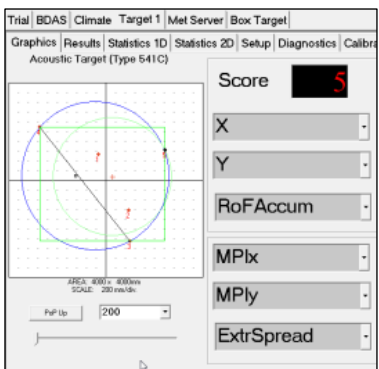
The software can be set up and operated with ease, for all in-house sensor systems. It provides statistical analysis and printouts, whilst allowing calibration functions to be applied.

Simple and helpful, the ergonomic design allows effortless operation. Ballistics DB Control Software is the essential core of all our sensor systems, and brings universal control to the range.

### EFFORTLESS OPERATION

#### SOFTWARE

- **Windows Compatibility** of Ballistics DB means that it works with all types of computers operating in this environment.
- **Integral microprocessor** in all MSI measuring equipment enables the units to communicate digitally by cable, radio, or other telemetry link (UHF or Wifi) to the Range Processor.
- **Control** of nearly all MSI range equipment is done by Ballistics DB. The software is developed in-house for operation with all sensor systems produced by the company.

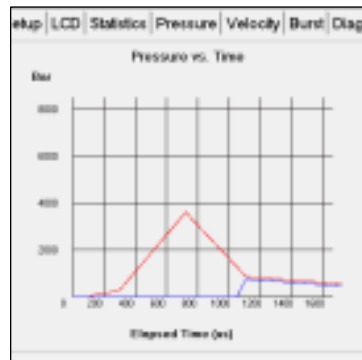


- **Three different, password-protected user levels** – Supervisor, Instructor, and Operator – keeps more complex and security relevant data separate from the day-to-day control operations. This separation allows the different skills required at each level to be learned more quickly.
- **Customisation** prior to shipment provides an integrated 'Trial' Tab specific to customer requirements. Each system has its own associated control tab on which the unit's setup parameters can be configured.

Configure Grid Columns			
Column	Visible	Printout	Width
Extreme Spread (mm)	<input type="checkbox"/>	<input type="checkbox"/>	900
Group Size (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1065
Mean Radius (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1380
Mean Radius (mils)	<input type="checkbox"/>	<input type="checkbox"/>	930
R 50% (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1170
R 100% (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1125
Group SD (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1545
Group SD (mils)	<input type="checkbox"/>	<input type="checkbox"/>	1545
Group Circle (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1545
C-X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	900
C-Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	825
Dev X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1035
Dev Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1020
Mid X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	885
Mid Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	960

- **All possible data** is recorded automatically as each shot is fired, ensuring minimal risk of transcription error. Data fields in the trial table can be switched on and off for the purposes of simplifying screen displays and printouts.
- **Common data format**, typically Microsoft Excel or Access, allows the user to undertake 'desktop' trials on historical data, thus reducing the need for costly and time-consuming live-firing trials.

**Meteorological and environmental data** relevant to the trial may be recorded using MSI's range of solid-state monitoring systems. Data from these units are recorded on a shot-by-shot basis.

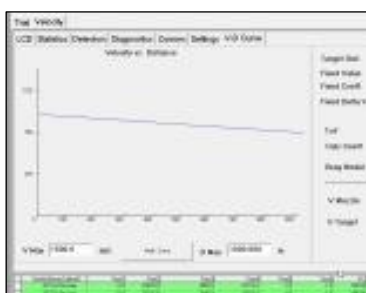


- **Every event is synchronised** to improve the integrity of the data by eliminating false triggers.
- **Built-in tests** are performed by Ballistics DB at start-up on the communication, and all components of the range. Diagnostic test results are reported and errors are displayed.
- **Wide range of data analysis functions** is provided as standard, and additional functions are available as options. The statistical functions may be sub-divided according to various groupings and analysed separately, e.g. with different colours on the graphic display

Trial Flight Fol.	
3D Wizard	Setup 3D Setup Mirror Trace Triggers Times
<b>Calculation Mode</b> <input type="radio"/> Defined Track Distance <input checked="" type="radio"/> Defined Flight Follower Position <span>Move APT</span>	
Firing Angle	35.00 deg
Start Tracking	0.00 m After Start Trig
Trunnion Height	0.00 m
Barrel Length	0.00 m
Scan Start Angle	-50.00 deg
Scan Stop Angle	50.00 deg
Scan Rot. Offset	11.13 deg
Track Distance	133.15 m
<b>Flight Follower Position</b> <input type="radio"/> Left of Firing Line <input checked="" type="radio"/> Right of Firing Line	
<b>Perpendicular Ground Distances</b> Along Path 50.00 m Away from Path 41.95 m	
Track Standoff	50.82 m
Mirror Down	40.96 m
Tripod Rotation	0.00 deg
Swing (Yaw)	10.43 deg
Roll	28.26 deg
Elevation (Pitch)	39.84 deg

**KINETIC** is a special version of the Ballistics DB software that is typically used by forensic and ballistic material test establishments.

- It measures velocity
- Provides a range of ballistics models
- Analysis of velocity and rate-of-fire profiles



Settings	V-D Curve
	625.4 m/s
	2727.27 rpm
	781.9 m/s

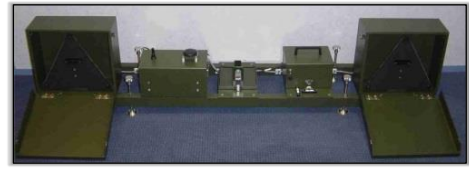
LCD	Statistics	Detectors	Diagnostics	Comms	S
Shot	2	V12			
		RoFAccum			
		V56			

# USED WITH

## Acoustic Targets



Acoustic Target Type 530

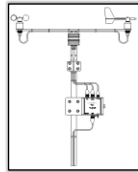


Acoustic Target Type 541

## Atmospheric Instrumentation



Meteorological  
Station Type 574



Meteorological  
Station Type 574-200



Indoor Climate Monitor  
Type 598



Intelligent Infrared Light Source  
Type 788

## Data Processors



Remote-Control Transceiver  
Type 573



Range Processor Type 663



Ballistic Data Acquisition System (BDAS)  
Type 680



Pressure Measurement Unit Type 683



Variable Delay Unit Type 769

## Optical Targets



Large Area Optical Target (LAOT)  
Type 340



Optical Target  
Type 546



Optical Target Type 570

## Projectile Analysis



Safety Firing System Type 157



Shot Pattern  
Analyser Type 616



Automated Flight-  
Follower Type 631



Mini Flight-Follower  
Type 632

# LIGHTNING PROTECTION

The single greatest cause of equipment malfunction and failure is due to the effect of lightning strike. Precautions against lightning strike damage are built into our equipment in the form of energy absorbing devices. However, in order to function correctly, these devices require an adequate low-resistance ( $\leq 0.01 \Omega$ ) earth and it is important that the installation is carried out to provide this. Even when there are no lightning strikes, the presence of an electrically charged cloud can give rise to unequal earth potentials over the range which in turn can cause equipment damage.

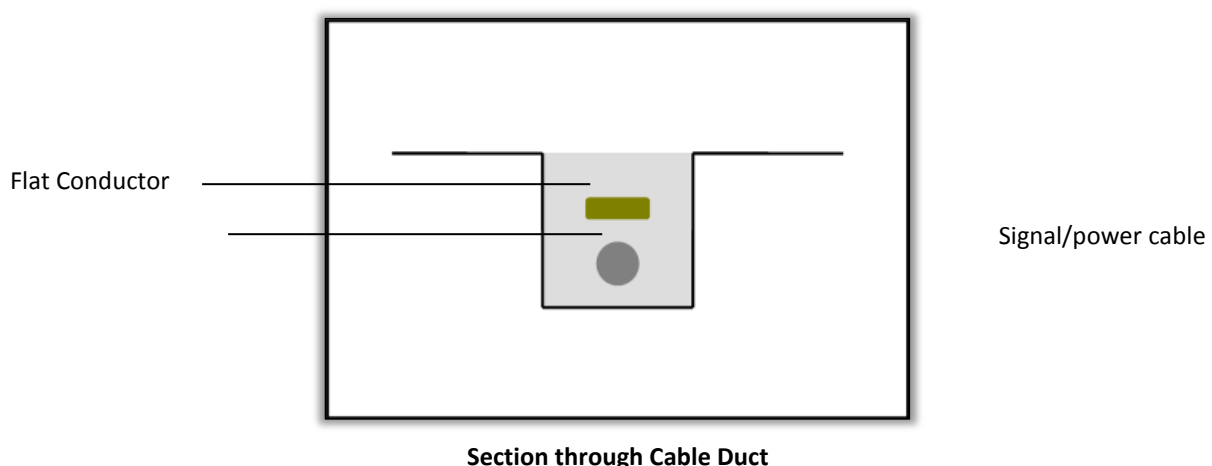
***At the outset, it must be stated that there is no adequate protection against a direct lightning strike.***

If lightning directly strikes any piece of equipment or cable then damage will be sustained, the severity of the damage depending on the path that the electrical discharge takes to earth. However a nearby lightning strike, say within 1 to 2 kilometres from the installation, will induce potentially damaging voltages in the signal and mains cabling; in these circumstances the cabling simply acts as an antenna of approximately 1.5Km in length. In order to protect the equipment against the induced voltage from a close lightning strike, the excess electrical energy has to be absorbed. Each electronic unit, for example, the head amplifier, contains protection circuits which limit the induced voltage to safe levels. A vital factor in the installation procedure is to ensure that the earth screens around the cables are continuous and are not damaged in the process of installation.

The essential points of good practice in installing a system that offers the greatest immunity to lightning strike are:

- Ensure that *low-resistance* local earth connections are made, either by the use of earth rods or by connection to a *low-resistance* conductor to earth, such as a metal water pipe. Use flat copper braid to connect to the earth. It is important to ensure that all cable earth screens are continuous and not damaged; any damaged cable must be replaced.
- Protect the circuit by absorbing the induced power at as many points as possible in order to ensure that the local power level that is dissipated is within the peak ratings of the protection devices.
- In order to minimise the induced voltage and, in addition, to equalise potentially damaging earth voltages, use a flat metal conductor laid above the main cable run (see diagram below).

This latter flat conductor minimises the induced voltage into the signal and mains cables by acting, electrically, as a shorted turn. In other words, the low impedance of the flat earth conductor substantially reduces the local field strength. In addition, the flat conductor equalises the general earth potential. In the absence of a lightning strike, a charged cloud in closer proximity to one end of the range to the other will cause large variations in local earth potential. The flat conductor equalises the earth potentials and reduces them to a safe level.





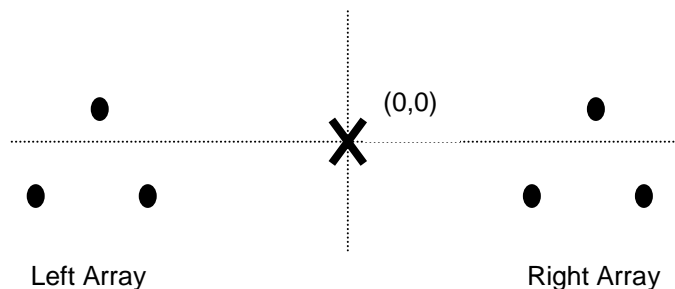
# CALIBRATION OF AUTOMATIC TARGETS

When using a virtual target system, it is often necessary to relate the “target” area of the virtual target to a physical witness for the purposes of calibration or verification. The computer software allows the user to calibrate the target in a variety of different ways

For acoustic targets, four calibration constants are usually calculated and programmed into the System. These may be easily checked and re-programmed if required.

Where four calibration constants are used, there are two for the “X” dimension and two for the “Y” dimension. The constants for each dimension comprise an offset term ( $C_x$  and  $C_y$ ) and a multiplication factor ( $M_x$  and  $M_y$ ).

If no calibration constants have been set, the centre of the virtual target (0,0), is the point mid-way between the two arrays in the x (horizontal) direction and a line that is drawn between the centre of the left and right arrays in the y (vertical) dimension. See Figure below.



So, if a shot is fired at point X, with no calibration constants set, then the virtual target will report a coordinate of (0,0). DO NOT DO THIS, however, as there is a serious risk of damage to the target if firing is done at this level.

If no constants are set, then shots will only appear in the top half of the target display in the software. For this reason,  $C_y$  will normally need to be set to a large negative number to make a correction.

If the target planes of the virtual target system and the physical witness are coplanar and perfectly aligned, the multiplication factor in X and Y will be 1.000 and the offset will be 0.0.

If the target planes are parallel in all dimensions but are offset in the X or Y dimension, the multiplication factors will be 1.000 and the offsets will be simply the distance that the physical witness target centre is offset from the virtual witness target centre.

For example, if the centre of the physical witness is 10mm to the right and 1000mm above the centre of the virtual target, the offset values will be set to  $X = -10\text{mm}$  and  $Y = -1000\text{mm}$ ; thus a shot fired at the centre of the witness target will be recorded on the physical witness at 0,0 and will now be shown on the target computer at 0,0.

If this is the only source of error, then these offsets can be manually entered into the “Surveyed Target Position” offset positions.

Do NOT use offset AND calibration constants at the same time, as this leads to confusion.

If the virtual target plane and the physical witness are not parallel and one leans away or towards the other, a simple offset is insufficient for correction. The multiplication factor is used to take account of this and operates on the original co-ordinate calculated by the target system as a multiple. For example, if the physical witness is perfectly upright and the virtual target is leaning towards it, a hole on the physical witness could be at a height of (say) 100mm above the centre and yet be recorded on the virtual target at 102mm; a Y dimension multiplication factor of 0.9804 when applied to the calculated virtual target value would correct to read 100mm. A similar factor can be used in the X dimension. If there is additionally a simple offset, this term would also be applied as above.

The four constant method does not correct for rotational effects. The accuracy will be affected if the virtual target or the physical witness is not level. Six or greater constants may be used if required, although they are not normally provided as such gross errors are usually a symptom of poor setup.

## *Number of calibration constants*

In the BallisticsDB software, there is a calibration tab for the target. On this tab, there is a choice of 0, 2, 4 or 6 constants.

Select “0 Consts” to remove all multipliers and offsets. The target will record shots as noted in the diagram above.

Select “2 Consts” to calculate the simple offset in x and y. No multiplier terms are calculated.

Select "4 Consts" to calculate a combination of the best offset and best multipliers in x and y.

Select "6 Consts" to take account additionally of any rotational errors between the physical and virtual target.

### ***Application of calibration constants***

**(In the following explanation, note that some versions of the software show RawX as X-row and RawY as Y-row)**

**The automatic target calculates the basic coordinates RawX, RawY.**

The relationship between X and RawX and between Y and RawY is shown on the calibration Tab, and is as follows:

$$X = (M_x \times \text{RawX}) + (M_{xy} \times \text{RawY}) + (C_x \times 1000)$$

$$Y = (M_{yx} \times \text{RawX}) + (M_y \times \text{RawY}) + (C_y \times 1000)$$

These are the equations when 6 calibration constants are used.

For a 4 constant calculation,  $M_{xy}$  and  $M_{yx}$  are both zero, which simplifies the equations to:

$$X = (M_x \times \text{RawX}) + (C_x \times 1000)$$

$$Y = (M_y \times \text{RawY}) + (C_y \times 1000)$$

If "0 Consts" is selected, then the X and Y coordinates shown on the Graphical display, and in the Shot list, will be the same as RawX, RawY.

### ***Method of Calibration***

Ensure that the shot grid is displaying, as a minimum, the following columns:

Shot No., RawX, RawY, X, Y, WitnessX, WitnessY, Calibration, XError, YError, RError.

(Refer to manual for instructions on how to switch columns on and off).

1) Place a witness target of the required dimensions in a convenient position behind the virtual target, taking care to ensure that the targets are parallel and level and that there is a minimal possibility of the two targets interfering. The physical target should normally be placed around 2m behind the virtual target.

2) Set up the controlling computer so that it is ready for live firing (check operators manual for details). The calibration constants should be set to their base values i.e. 1.000 for the multiplication factors and 0.0 for the offsets and any additional constants.

This is done in BallisticsDB by selecting "0 Consts".

3) For best results, the shots should be scattered about the target area with a minimum of one shot in the centre and one in each of the four corners. Please note that at least 5 shots must be fired for the "4 or 6 Consts" calculation to be made, although it is advised that one or two extra shots are fired in case of corruption or shots registering off target.

4) When firing has finished, measure the witnessed results taking great care to ensure that the axes drawn on the witness target are orthogonal.

5) Type these values into the "WitnessX" and "WitnessY" locations on the shot grid, taking care to ensure that the witnessed results relate to their relevant virtual target results.

6) Tick the "Calibration" box for each shot being used for the calculation.

7) Select "2, 4 or 6 Consts" as appropriate. The calibration constants are then calculated by the program and displayed on the screen. If the targets are accurately aligned, you should see multiplication factors of approximately 0.90 to 1.1 and small offsets in X and Y relating to the actual offsets of the target centres. If the results are very different, or the calibration is rejected (this is done automatically if the multiplication factors are less than 0.8 or greater than 1.2) check that the witness results have been correctly measured and re-enter the values.

8) Take a printout of the results and calculated calibration constants for future reference.

If the constants are already known, these may be entered manually. This method can be used to effect an approximate calibration without the trouble of a live firing, by accurately measuring the differences between the two target centres and entering these manually as offsets and setting the multiplication factors to 1.000.

A worked example is given below:

- a) Set "0 Consts" and fire 5 shots. RawX, RawY and X, Y should be the same.

Graphics

Statistics

Setup

Diagnostics

Calibration

Comms

Acoustic Target Calibration Constants

$$X = 1.000 * X\text{-raw} + 0.000 * Y\text{-raw} + 0.000 * 1000$$

$$Y = 0.000 * X\text{-raw} + 1.000 * Y\text{-raw} + 0.000 * 1000$$

6 Consts.

4 Consts.

2 Consts.

0 Consts.

Surveyed Target Position

Distance From Muzzle (m)

600

Horizontal Offset (m)

0

Vertical Offset (m)

0

☐ Show Witness Results

AREA: 10000 x 10000mm

SCALE: 500 mm/div.

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError	UTCTime
	1	-597	1712	-597	1712	0	0	<input type="checkbox"/>	597	-1712	1813	13:03:34.448
	2	-231	2396	-231	2396	0	0	<input type="checkbox"/>	231	-2396	2407	13:04:14.306
	3	-587	2998	-587	2998	0	0	<input type="checkbox"/>	587	-2998	3055	13:04:17.606
	4	-729	2215	-729	2215	0	0	<input type="checkbox"/>	729	-2215	2332	13:04:20.826
	5	-728	2991	-728	2991	0	0	<input type="checkbox"/>	728	-2991	3078	13:04:23.968

- b) Enter witness results, tick calibration boxes and select the appropriate number of Consts.

"2 Consts"

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1712	-595	1710	<input checked="" type="checkbox"/>	2	-2	3
	2	-231	2396	-231	2396	-233	2399	<input checked="" type="checkbox"/>	-2	3	4
	3	-587	2998	-587	2998	-585	2996	<input checked="" type="checkbox"/>	2	-2	3
	4	-729	2215	-729	2215	-730	2219	<input checked="" type="checkbox"/>	-1	4	4
	5	-728	2991	-728	2991	-730	2988	<input checked="" type="checkbox"/>	-2	-3	4

"4 Consts"

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1713	-595	1710	<input checked="" type="checkbox"/>	2	-3	4
	2	-231	2396	-232	2396	-233	2399	<input checked="" type="checkbox"/>	-1	3	3
	3	-587	2998	-587	2997	-585	2996	<input checked="" type="checkbox"/>	2	-1	3
	4	-729	2215	-729	2216	-730	2219	<input checked="" type="checkbox"/>	-1	3	4
	5	-728	2991	-728	2990	-730	2988	<input checked="" type="checkbox"/>	-2	-2	3

**"6 Consts"**

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1713	-595	1710	<input checked="" type="checkbox"/>	2	-3	3
	2	-231	2396	-232	2398	-233	2399	<input checked="" type="checkbox"/>	-1	1	2
	3	-587	2998	-588	2997	-585	2996	<input checked="" type="checkbox"/>	3	-1	3
	4	-729	2215	-728	2215	-730	2219	<input checked="" type="checkbox"/>	-2	4	4
	5	-728	2991	-728	2989	-730	2988	<input checked="" type="checkbox"/>	-2	-1	2

XError, YError shows the difference between the shot positions on the physical and virtual targets. RError is the radial distance between (X, Y) and (WitnessX, WitnessY)

Note that for this particular shot pattern, there is little difference in accuracy between the 3 methods. This shows that the target was set up accurately and simple offsets only are required.

As the virtual target is always installed in front of the physical target, there will always be a parallax error. When firing at long distances, this is fairly small, however at shorter distances, the 4 or 6 const calibration methods are used to correct for this factor.

The calculation may be repeated at any time and as the constants operate on the Raw values, the calibration may even be done after firing.

Once the appropriate number of constants has been selected, the constants will be calculated and shown on the calibration tab. These constants will be used for all subsequent firings.



# OPTICAL DETECTOR ALIGNMENT AND SETUP CHECKS

The Optical Detector method of projectile detection is by far the most accurate technique and offers many advantages over acoustic and other sensor types. The system enables a measurement accuracy of up to 0.01%, however, care must be taken in the setup of the system in order to achieve these high levels of accuracy.

In the first instance, reference should be made to the setup instructions in the manuals provided with the system. If a problem persists, check through the information given below.

*A typical system comprises the following:*

- Two Optical Detectors type 858, sometimes known as Sky Screens, (or an earlier version is type 758).
- Velocity Computer (sometimes known as a Chronograph) which will be connected to a PC.
- D.C. lights (for indoor use only)

## **The Optical Detector type 758/858**

The 858 utilises a linear cell placed under a 6/1000" slit. This model may be clearly identified as a bright yellow unit whereas earlier models (pre-1982) were grey. The old units used a single photocell with a fibre-optic fan.

The advantage of the newer units is that they are more sensitive and don't suffer from the 'blind-spots' sometimes observed when projectiles are fired high above the earlier units.

The detection area above the 858 is a 36-degree fan (with the standard lens) which is 0.17 degrees thick. The projectile must occupy approximately 1/500 of the fan width in order to trigger the unit.

e.g. at 1m above the detector, the fan is about 536mm wide, thus a projectile of just over 1mm could be detected.

This sensitivity should be remembered particularly when firing indoors as burnt powder and other fragments can trigger the detector before the real projectile passes overhead.

It is ESSENTIAL that the genuine projectile is detected first. Either the sensitivity must be adjusted using the gain setting in the BallisticsDB control software or the detectors must be placed a sufficient distance from the muzzle to ensure that the projectile is the first detection.

The projectile signal may be observed by connecting an oscilloscope to the BNC connector on the base of the Detector. This connector also provides a D.C. level which may be used to align the detectors under the D.C. lights when the system is set up indoors.

## **The Velocity Computer is the type 817 (an earlier versions are the 708/808 814/815)**

The 817 provides power to the 758/858 and also takes the projectile signal and converts to a TTL (5v) 1µs pulse which is fed to the timing circuitry.

The unit is controlled from the PC using the BallisticsDB software.

Great care must be taken when setting Lockout and False Reading Reject (FRR). If single shots are being fired, lockout should be set to at least 500ms. This should be reduced only in rapid firing modes.

FRR is used to reset the system if, for example, an insect triggers the START but not the STOP. It should be set a time significantly greater than the time taken for a genuine projectile to pass between the two detectors; 1000ms is a typical value.

## **Solid state lights type 788 (an earlier version was D.C. Lights type 760)**

These units are normally suspended from the ceiling or a framework. The optical detectors must be aligned carefully beneath them and this is normally done by connecting a digital voltmeter to the BNC connector on the base of the detector. The D.C. voltage reading should be approximately 8-9v when properly aligned, although very new designs may be 10-11v. Gently slide the detector back and forth under the light to obtain a maximum.

It is important to note that the detection 'fan' of the 758/858 may be wider than the lamp (depending on the height of the lamp above the detector); this means that any extraneous light outside the ends of the D.C. light assembly may be seen. Overhead fluorescent lights are a particular problem as they emit A.C. light which can give rise to a continuous triggering of the detectors. A blackened board above the assembly can remove the problem.

*Typical readings:*

If the readings are lower than expected, this suggests that the START detector has received a signal early, i.e. before the real projectile has been seen, and the STOP detector has seen the projectile. The most common reasons for this are as follows:

- Pre-triggering due to burning powder or other debris arriving at the START detector before the bullet. Fire further back or through a piece of card with a small hole to 'strip' debris.
- Pre-triggering due to movement of the D.C. light from the shot blast; this is particularly pronounced when the detectors are aligned badly under the lights. If the detection 'fan' is directed at the edge of the lamp, a small movement in the lamp can cause a large light change.
- Pre-triggering due to movement of the 758. This is normally seen only with larger calibre firings. Place sandbags or similar sound absorbent material between the 758 and the weapon.


If the readings are higher than expected, this suggests that both detectors have received a signal early. The most common reason for this is that the shot blast is triggering both detectors directly. Place sandbags or similar sound absorbent material between the 758 and the weapon.

# SAMPLE BALLISTIC PRINTOUT

The MS Instruments LTD Ballistic Instrumentation Systems provide a printout with a full range of data. The configuration of the printout varies according to the data available.

Some data is entered manually and is recorded for records purposes only whereas some parameters are actively used in calculations and data analysis. Meteorological and other 'condition' data may be collected from automatic stations provided by the company.

The computer software may be configured to display various headers and data in many different forms; typical printouts from an Automatic Target and a Velocity Measuring System are shown below.

M. S. Instruments PLC - EPVAT 2

09/01/2009 16:15:20

**Trial**  
Title  
Sub Title  
Trial No.

Test 1

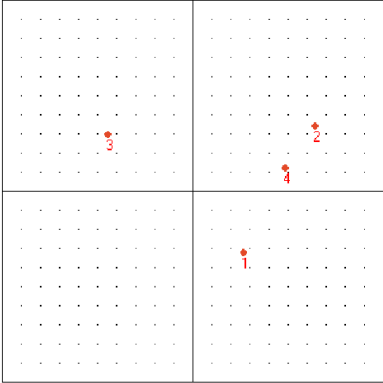
Date  
Serial No.  
Range Name

18/08/2008 12:09:18

**Statistics**  
Round Type  
Ammo Type  
Rounds


Work  
Ball  
4

	X	Y
MPI (mm)	238.1	102.4
Group Rectangle (mm)	1089.2	665.7
Std. Deviation (mm)	481.9	303.8
Std. Deviation (mils)	4.9	3.1
A plus B (mm)	1754.9	
Group Size (mm)	1276.5	
Extreme Spread (mm)	1090.2	
Group Circle (mm)	1113.2	
Mean Radius (mm)	465.4	
Mean Radius (mils)	4.7	
Groud S.D. (mm)	402.8	
Groud S.D. (mils)	4.1	



AREA: 2000 mm x 2000 mm

Page 1

M. S. Instruments PLC - KINETIC

09/01/2009 16:18:03

**Trial Data**

Title	SW Test NBIS	Date	26/03/2008 12:13:26
Sub Title		Serial No.	
Trial No.		Range Name	

**Shot Table**

ShotNo	RoundTypeID	AmmoTypeID	KE_UKAS	V1
1	Work	Ball	13.549	608.384
2	Work	Ball	135.948	957.488
3	Work	Ball	135.688	956.572
4	Work	Ball	135.948	957.488
5	Work	Ball	135.688	956.572

**Statistics**

Value	Rounds	Min	Max	Spread	Mean	SD	SDn	Prob95	Prob90	
KE_UKAS	5	13.5	135.9	122.4	111.4	54.7	48.9	341.6	297.8	
V1	5	608.4	957.5	349.1	887.3	155.9	139.5	1543.7	1419.0	
E1	5	13.6	136.6	123.0	111.9	55.0	49.2	343.3	299.3	

Page 1

# STANDARD STATISTICAL ANALYSES

In MS Instruments LTD software, a range of statistical functions are provided as standard and additional ones may be specified. The list below gives an explanation of the standard definitions. Enclosing Circle (sometimes known as Group Circle) is the diameter of the smallest circle that encloses all shots.

In the following explanations, the shot data is referred to in the equations as  $X_i, Y_i$  where  $X_i$  and  $Y_i$  are the co-ordinates of shot number  $i$ .  $N$  is the total number of shots.

---

## MEAN POINT OF IMPACT (MPI): $X_m$ and $Y_m$

This generates the mean value of all shots in the X and Y direction where:

$$X_m = \frac{1}{n} \sum_{i=1}^n X_i$$

$$Y_m = \frac{1}{n} \sum_{i=1}^n Y_i$$

---

## GROUP RECTANGLE

This gives the dimensions of the rectangle which encloses all shots. The sides of the rectangle are parallel to the X and Y axes. The sides are found by:

$$Side_x = \max\{X_i\} - \min\{X_i\}$$

$$Side_y = \max\{Y_i\} - \min\{Y_i\}$$

---

## STANDARD DEVIATION: $SD_x$ and $SD_y$

This produces the sample standard deviation for all X co-ordinates and all Y co-ordinates.

$$SD_x = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - X_m)^2}$$

$$SD_y = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (Y_i - Y_m)^2}$$

---

## STANDARD DEVIATION in mils: $SD_x(m)$ and $SD_y(m)$

The angular values of Standard Deviation (Distance from firing point to target = R)

$$SD_x(m) = 1018.59 \tan^{-1} \left( \frac{SD_x}{R} \right) \quad SD_y(m) = 1018.59 \tan^{-1} \left( \frac{SD_y}{R} \right)$$

---

## EXTREME SPREAD (ES)

This is the largest distance between any two shots.

Shot spacing between shots  $i$  and  $j$  is given by:

$$ES = \max \left\{ \sqrt{(X_i - X_j)^2 + (Y_i - Y_j)^2} \right\}$$

---

## MEAN RADIUS (MR)

This is the average distance of all shots from the mean point of impact, and is given by:

$$MR = \frac{1}{n} \sum_{i=1}^n \sqrt{(X_i - X_m)^2 + (Y_i - Y_m)^2}$$

---

## MEAN RADIUS in mils: $MR(m)$

The angular value of MEAN RADIUS

(Distance from firing point to target = R)

$$MR(m) = 1018.59 \tan^{-1} \left( \frac{MR}{R} \right)$$

---

## GROUP S.D.: GSD

This generates a single value from the standard deviation for X and Y, given by:

$$GSD = \sqrt{\frac{(SD_x)^2 + (SD_y)^2}{2}}$$

---

## GROUP S.D. in mils: $GSD(m)$

The angular value of the GROUP S.D.

(Distance from firing point to target = R)

$$GSD(m) = 1018.59 \tan^{-1} \left( \frac{GSD}{R} \right)$$

---

N.B. 1018.59 is the conversion factor from Radians to mils:

$$6400 \text{ mils} = 2\pi \times 1000 \text{ mRads} = 360 \text{ degrees, or } 1 \text{ mRad} = 1.01859 \text{ mils.}$$



# ACCURATE VELOCITY MEASUREMENT

## AIM

The aim of this application note is to guide the user through the steps required to achieve high precision velocity measurement using the Projectile Velocity Measuring System (PVMS) type 858 system. The principles of measurement are essentially straightforward: detect the crossing times of the projectile on each vertical optical screen and then calculate the velocity from the known separation divided by the time difference.

From this short description it is already apparent that in order to achieve high precision we need to measure the crossing times to great accuracy; we need to know the separation between the sky screen cradles accurately and we need to ensure that the optical screens are indeed vertical. In addition, it is assumed that the projectile flight path is horizontal and it is essential to ensure that there is little elevation present.

The electronic detectors measure the crossing times to the very high precision of 0.1 microseconds, so the accuracy of the system is then governed by the accuracy with which we can perform the set-up. In the next two sections, we discuss how best to set up the system so that it meets its specification of 0.1% accuracy in the measurement of velocity. There are two phases to the set-up: first choose an sky screen separation appropriate to the projectile velocity and the firing height above the optics in the cradles. Both of these factors affect the final accuracy achievable. Choosing the separation is simply a question of looking up its value in a table or getting it from one of the menus in the software. Once the choice has been made we then have to actually position and align the cradles; we will discuss these first and then return to the question of selecting the separation - usually two metres or more.

## POSITIONING THE CRADLES

The sky screen cradles should be placed under the projectile flight path at the required separation, and oriented so that the cradles are parallel to each other. The following diagrams illustrate the aimed for set up and show what is to be avoided.

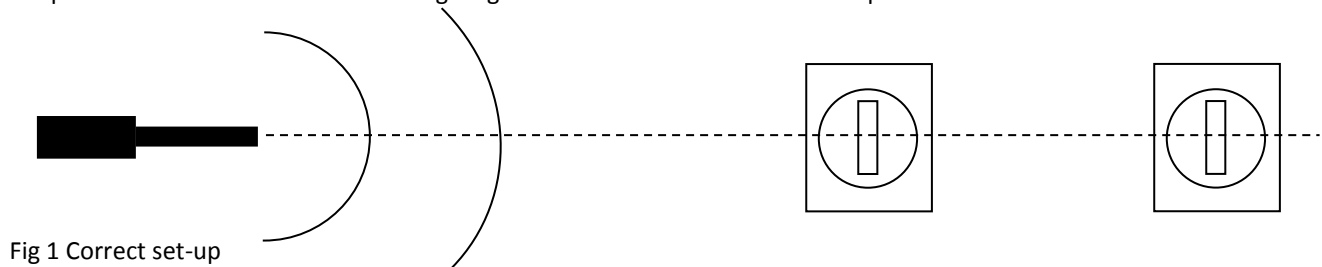


Fig 1 Correct set-up

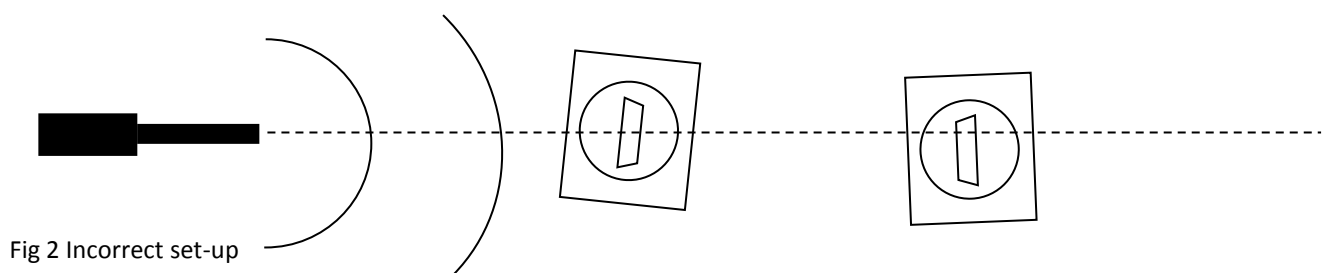


Fig 2 Incorrect set-up

Fig. 1 shows the correctly set up system: the cradles are parallel to each other and lie directly under the projectile flight path.

Fig. 2 shows an incorrectly set up system with the major types of error:

*The cradles are twisted relative to each other*

The angle of twist will affect the crossing times of the projectile through each optical screen. It is possible to see this relative twist for quite a large range of cradle spacing from 1m to 10m. Move to a position where you can line up the two lens hoods by eye. Now look carefully at the flanges on the sides of the cradles. Any asymmetry here indicates that the cradles are misaligned. One or both may need to be rotated into the proper position.

*The cradles are not aligned along the flight path*

The angular deviation between the flight path and the line joining the cradles will adversely affect the crossing times. The flight path will need to be identified via some aiming mark. It is then necessary to ensure that the muzzle, the cradles, and the aiming mark all line up visually.

*The first screen is too close to the muzzle*

The muzzle blast can create microphonics noise in the equipment if the screen is too close to the muzzle. Also, the muzzle ejects debris, which is initially ahead of the projectile, and this can lead to false triggers in the system. As a rule of thumb, the distance from the first screen to the muzzle should be at least 3 metres for 556 and 5m for 12mm ammunition.

In the light of the above discussion, the main steps in positioning the cradles should be carried out in the following order:

- A. Establish a visual aiming mark so that you can identify the flight path from muzzle to aiming mark.
- B. Place the first screen at the correct distance from the muzzle along the flight path.
- C. Place the second screen approximately at the recommended distance from the first screen.
- D. Using the aiming mark, adjust the cradles to lie on the flight path. In some systems, you can use the supplied aiming telescope to aid this procedure.
- E. By sighting along the cradles check that they are parallel.
- F. Now approximately level each cradle using the attached spirit levels.

Any movement in the cradles may affect the positioning carried out in the previous step. It is better to cycle through D, E, and F rather than trying to perfect each on its own. You are now ready to set the separation between the cradles.

### SETTING THE CRADLE SEPARATION

In some systems, you will be supplied with a 2m steel setting bar containing two holes. Slip the bar holes over the pegs on the side of the cradles. With two bars, you can also ensure that the cradles are parallel to each other when both bars are located in their pegs but without strain on any peg.

If you do not have setting bars, you will need to measure the distance between pegs from cradle to cradle and on *both* sides of the cradles. The difference in distances obtained should be less than a half millimetre – anything more than this indicates a relative twist in the cradles. You will need to record this information for input into the computer system.

If any position adjustments have been made you will need to ensure that you have not now moved either cradle off the flight path.

### VERTICAL ALIGNMENT OF THE CRADLES

All PVMS systems are supplied with a pair of crossed spirit levels either attached to the cradle or to the lens mount. Three adjustable feet are attached to the base of the cradle. Choose the left foot as the pivot and tighten its locknut softly. Now adjust the right-hand foot until the spirit level parallel to the line joining the left and right feet shows level. Once level has been achieved, adjust the back foot until the other spirit shows level. Repeat the cycle until both bubbles show level accurately centred between the marks. Once both levels are set, tighten the locknuts on each leg firmly, and re-check the level accuracy.

If there has been significant movement during this process it may be necessary to reset or re-measure the separation between the cradles. If so, the vertical alignment process will need to be repeated.

### CHOOSING THE DETECTOR SEPARATION

The required detector separation depends on the projectile velocity and the height of firing above the detectors. The following is an approximation that can be used to find the minimum detector separation needed to achieve the precision in measurement of velocity:

$$S = (2V\delta t + 2H\delta\psi + \delta S)/v$$

In this expression:

$\delta t$	Error in the measurement of the crossing time (nominally $0.1 \times 10^{-6}$ second)
$\delta\psi$	Error in the vertical alignment (nominally 1 minute of arc = 0.000291 radians)
$\delta S$	Error in the separation (nominally 1mm = 0.001 m)
$v$	Relative error in the measurement of velocity (0.1% = 0.001)
$V$	Nominal projectile velocity (m/s)
$H$	Height of flight path above lens hood (m)
$S$	Spacing (m) required to achieve the specified relative error $v$

Using the above nominal values, the formula specialises to

$$S = 0.582H + 0.0002V + 0.5$$

For a velocity of 1000 m/s and a projectile height of 2m, the required distance is

$$S = 1.164 + 0.2 + 0.5 = 1.864 \text{ (m)}$$

This means that a separation of 2 m will ensure that the 0.1% accuracy specification is indeed achievable.

## MEASUREMENT OF DELTA V

By setting up three detectors  $P_1, P_2, P_3$  along the flight path, we can measure the velocities  $V_{12}, V_{23}$  across successive detector pairs, and then the retardation in the projectile can be measured. The retardation can be represented in terms of the rate of change of velocity with distance i.e.  $R = \frac{dV}{dS}$ , and this quantity can be measured by the ratio  $R = \frac{V_{12} - V_{23}}{S_{mid}}$ . Here  $S_{mid}$  is the distance between the *mid points* of each detector pair.

The absolute error in  $R$  is given by the formula:

$$\delta R \leq (2\delta V + R\delta S_{mid}) / S_{mid}$$

Since the retardation  $R$  is usually small, the relative error  $\delta R / R$  in retardation is likely to be huge, and it makes more sense to work directly with the absolute error in retardation as expressed above.

# THE EFFECT OF WIND ON ACOUSTIC TARGET SYSTEMS

The problem with the wind is that it is not usually constant, It gusts and changes direction. If there is a constant crosswind across a target while a group of shots is fired over the target the shots will be displaced to one side but the group size will be substantially the same as if there were no wind.

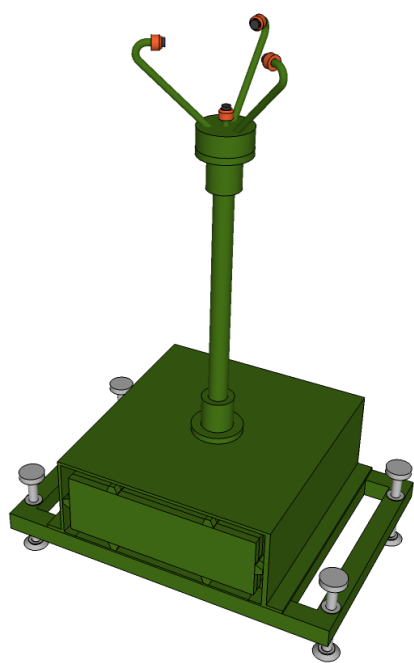
We have a formula we have developed by experience over 25 years as a result of trials conducted over a 2 by 2 metre target:

$$E = W \times 2.5 + 5$$

Where E is the mean radial error of a group of 30 rounds in mm, W is the average wind speed in m/s.  
However, the higher the shot over the target the greater the effect the crosswind will have on the shock wave from the projectile. So a tight group of shots will be less affected than a wide dispersed group of shots in terms of group size.

Crosswind (m/s)	Error (mm)
1	7.5
2	10
3	12.5
4	15
5	17.5
10	30

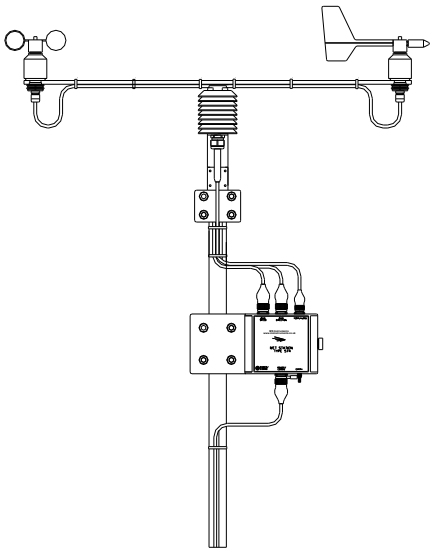
While the accuracy of the MSI acoustic targets can be up to 2mm indoors, outdoors the wind has a significant effect. This effect can be reduced by measuring the crosswind at the target and performing a correction for each shot based on the wind at the time of arrival of the shot cone. To do this the system requires the addition of one or more wind measuring device such as those shown below.



Type 574 D



Type 574 B



Type 574 C



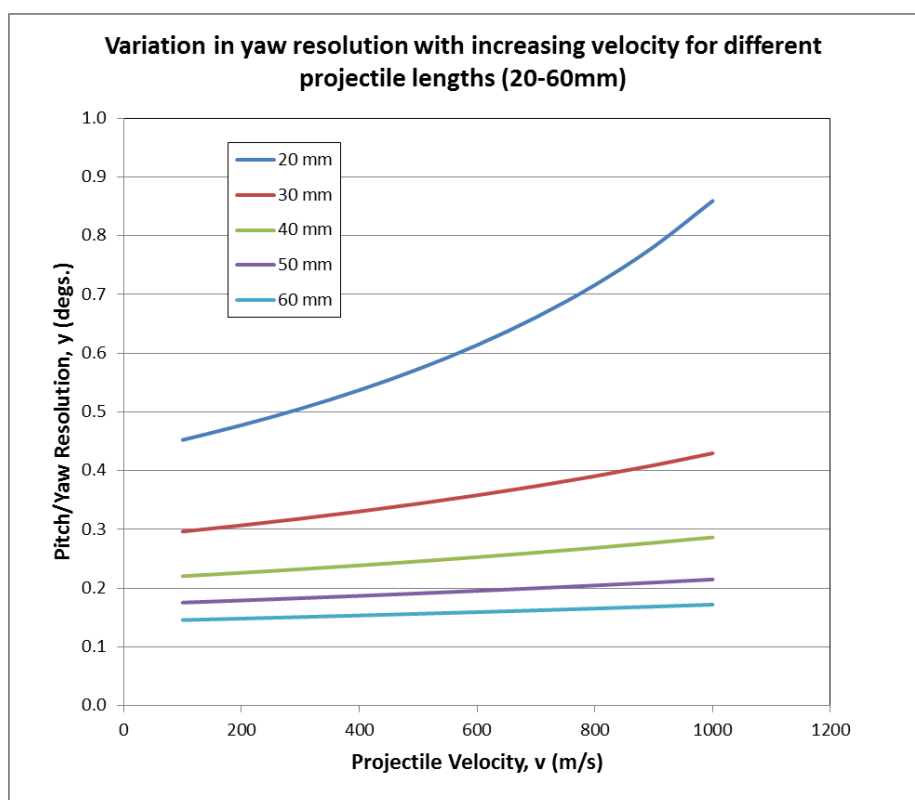
# THE MEASUREMENT OF PROJECTILE PITCH AND YAW

The High-Precision Optical Target type 546 designed and manufactured by MS Instruments LTD, employs two high-resolution line scan cameras that detect the shadow cast by a projectile passing in front of an infrared light strip. The cameras are arranged orthogonally, which enables accurate measurement of the projectile location as it passes through the target plane by finding the shadow's centre.

Note: All calculations below are based on 546 Optical Target with 4k pixel camera and frame rate of 100kHz. We have also assumed that the projectile is near the centre of the typical target detection area (of diameter = 600mm).

Where the camera frame rate is fast enough to capture multiple frames as the projectile passes then it is possible to estimate the YAW by measuring frame by frame shift in the shadow offset for a projectile of known velocity. The projectile velocity can be accurately measured using other MS Instruments products, or by using inter-target arrival times if multiple targets are available. This is typically the case in Aeroballistic Ranges, where the Optical Target type 546 is installed at multiple positions to enable the tracking of change in pitch in YAW over distance.

Using the above method, the high frame rate and high positional accuracy of the Optical Target type 546 allows pitch and YAW measurement for a range of projectiles of different length and velocity. As a general rule, the YAW resolution improves for longer, slower, projectiles. This trend is illustrated in the figure below, where we can see the resolution approaches  $1^\circ$  for a 20mm projectile beyond 1000m/s.



# BALLISTIC MEASURING INSTRUMENTATION



## Optical Target Type 340

- Variety of ammunition
- Primarily indoor use
- Instant graphical representation of data



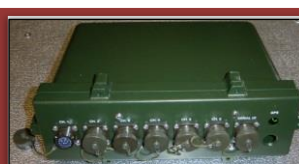
## Meteorological Station Type 574

- Pressure, Humidity, Temperature, and Brightness,
- Solid-state anemometer measures wind speed
- GPS and electronic compass provides wind direction data



## Ballistic Data Acquisition System Type 680

- Electronic Pressure Velocity and Action Time (EPVAT) measurement
- Variety of configurations
- Complete ballistic analysis



## Triple-Channel Remote Timer Unit Type 817

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Ballistic Coefficient use with multiple detectors



## Optical Detector

- Start and stop detectors identify projectile
- Ambient light compensation and versatile installation
- Tracer and forensic applications

S  
E  
N  
S  
O  
R



Flash Detector



Flash Detector

Type 726



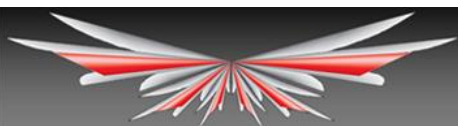
Acoustic Detector

Type 588



Ignition Detector  
Type 818

Type 726



## MS INSTRUMENTS Range Consultancy

*Precision, Expertise, Quality*

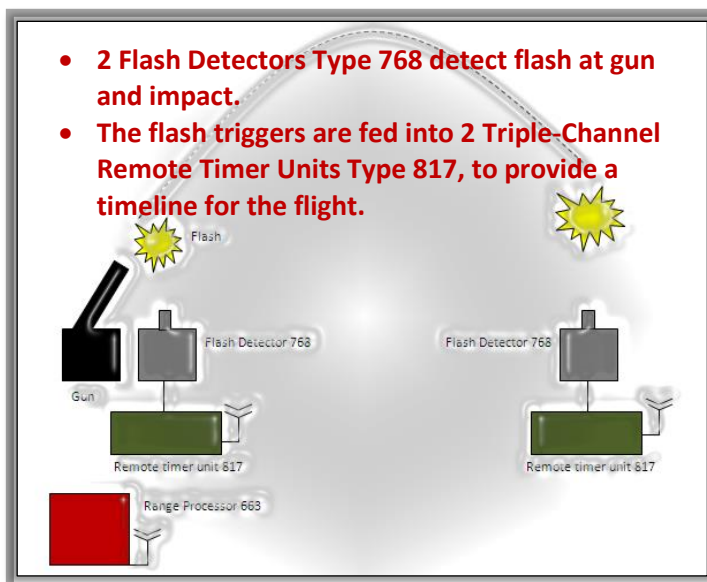
- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards



## BURST TIME MEASUREMENT EQUIPMENT (BTME)

**“The BTME System accurately measures the flight time of a projectile over a distance of 25km or**

..



### Infrared Flash Beacon

#### Type 768-100

- High-power flash in the infrared region
- Used at the target end for accurate alignment of the detector
- Continuous flashing mode or manual mode

### Ballistics DB Control

#### Software Type 950-571

- Time of flight and rate of fire
- Remotely control 817 and retrieve all data for storing and/or printing

### Flash Detector Type 768

- Can be triggered externally to provide a system self-test
- Weather-proof housing and tripod mounting

### Triple-Channel Remote Timer Unit Type 817

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Equipped with GPS

## MS INSTRUMENTS Range Consultancy

*Precision, Expertise, Quality*

- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards



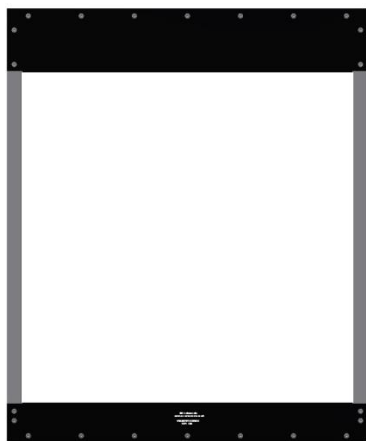
# INDOOR VELOCITY MEASURING SYSTEM (IVMS)

Typical Range Layout



**Computer Interface Unit  
Type 570-070**

- USB connectivity to MSI equipment
- Automatic power off of velocity system when PC is turned off
- LED indication of communication and power



**Velocity Screen  
Type 859**

- Built in light source
- Built in diagnostic test of light source
- Can be used with non MS Instruments timer units
- Large area detection 990mm x 990mm (39"x 39")

**"The IVMS combines the Type 859 Velocity Screens with the Type 818 Timer Unit controlled by the KINETIC option of the Ballistics DB Software all at a competitive price."**



**Range Processor  
Type 663(n)**

- High performance laptop/desktop computer
- Latest Windows Pro operating system
- Ample memory and hard disk space



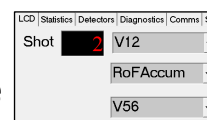
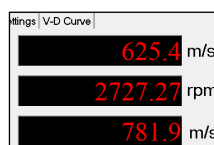
**GPS Synchronised  
Timer Unit  
Type 818**

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Ballistic Coefficient use with multiple detectors



**Ballistics DB  
Control Software  
Type 950-571**

- Velocity and rate-of-fire measurement
- Retrieve all data for storing and/or printing





## BARRELS for PRESSURE TESTING (EPVAT)



For ammunition proofing, a standard range of test barrels is normally specified. This is to ensure that the impact of the test environment on the ammunition under test is negligible.

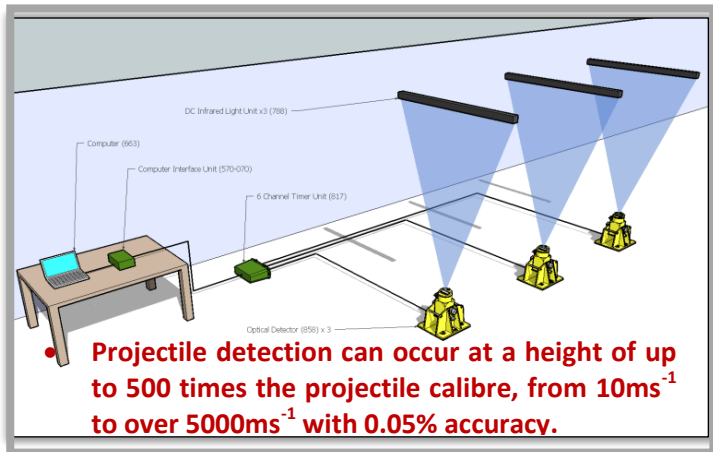
The barrels are fitted to a Universal Receiver, which includes a breech and firing unit.

Standard calibres are 5.56, 7.62 and shotgun type 12/70 and 12/76.

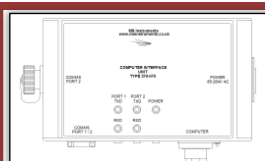
However there are a number of test standards worldwide and barrels can be made to specific requirements.

The barrels in the left-hand image are accuracy barrels. In the right-hand image, the pressure variant is shown with holes drilled to fit piezo transducers for the measurement of chamber and port pressure.

## PROJECTILE VELOCITY MEASUREMENT SYSTEM (PVMS)



**“The PVMS combines the extraordinary accuracy of MSI’s Type 858 Optical Detectors with the sophisticated KINETIC variation of the ubiquitous Ballistics DB Software.”**



**Computer Interface Unit**  
**Type 570-070**

- USB connectivity to MSI equipment
- Cost and energy saving automatic power off
- Clearly indicated, robust ports



## Range Processor

- High performance computer
- Latest Windows Pro operating system
- Ample memory and hard disk space



## Intelligent Infrared Light Source Type 788

- 240 infrared-emitting diodes.
- Diffuser produces uniform radiation
- Optional computer control



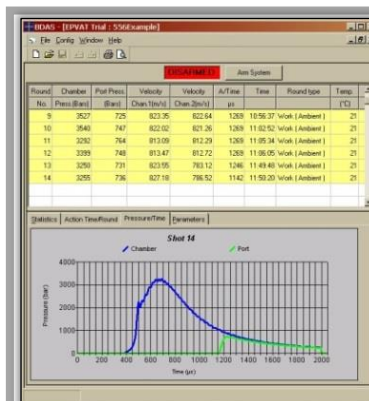
## Triple-Channel Remote Timer Unit Type 817

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Ballistic Coefficient use with multiple detectors



## Optical Detector

- Start and stop detectors identify projectile
- Ambient light compensation and versatile installation
- Tracer and forensic applications



**Ballistics DB  
Control Software  
Type 950-571**

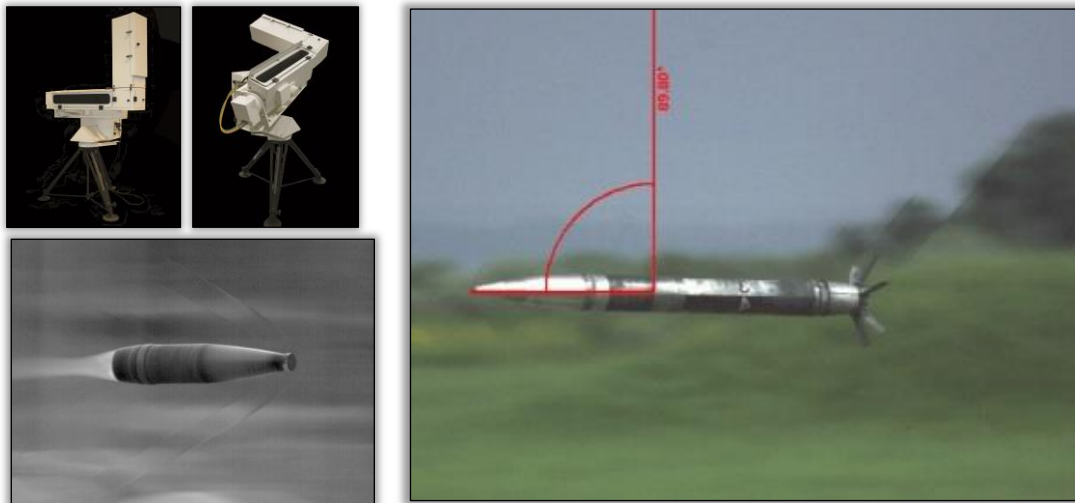
- Velocity and rate-of-fire measurement
- Retrieve all data for storing and/or printing

# CHAPTER FIVE - AUTOMATED FLIGHT FOLLOWER

## Contents

- 631-automatedflight-follower
- 632-miniflight-follower
- 663\_n-rangeprocessor

# AUTOMATED FLIGHT-FOLLOWER TYPE 631



## AUTOMATED FLIGHT-FOLLOWER TYPE 631

The Flight-Follower has been developed to meet the high-speed-imaging needs of modern ammunition designers. The system consists of a computer controlled triggered rotating mirror positioned in front of a High Speed Video camera. The mirror is programmed to rotate at the correct speed, such that the camera will “follow” the projectile.

Typically, the system will track the trajectory for 100m or more as the mirror scans a 90° arc, providing high quality images of the projectile in flight.

This latest design offers much improved performance whilst eliminating the need for calibration. The combined functionality of the hardware and software greatly simplifies system operation without limiting flexibility.

## HIGH QUALITY IMAGING

### Simple and Versatile Equipment:

- Simplified range surveying
- Accommodates a variety of cameras
- High mechanical stability

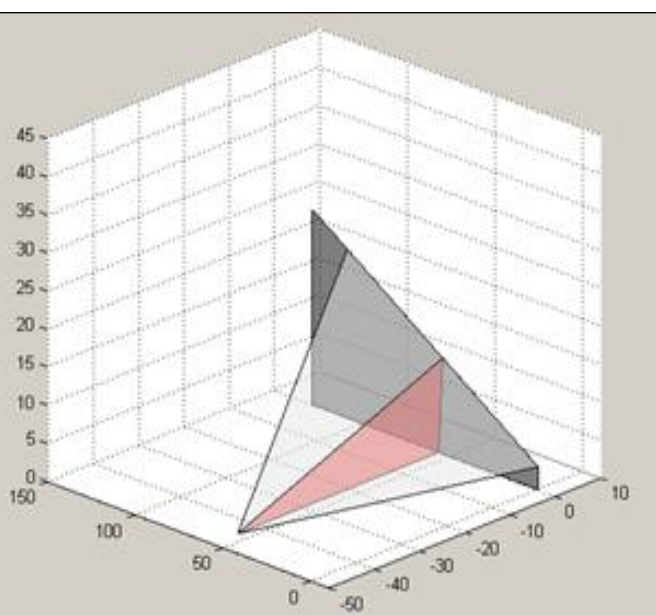
### Time and Effort Saving:

- Easy, quick set up
- Remote operation
- Automatic adjustment to data entries

### Efficient and Optimised System:

- Software wizards
- In-built instrumentation
- Real-time mirror position control

Firing Angle	10.0	Scanner Start Angle	50.0
Muzzle Height Above FF	3.0	Scanner Stop Angle	-50.0
Start Distance	0.0	Scanner Rotation	10.0
Track Distance	110.0	<button>Edit Trigger Parameters</button>	
Flight Follower Position			
<input checked="" type="radio"/> Left of Firing Line <input type="radio"/> Right of Firing Line			
Positioning Mode			
<input type="radio"/> Fixed Flight Follower Position			
<input type="radio"/> Fixed Path Tracking Distance			
<input type="radio"/> Advanced (free all parameters)			
<b>ORIENTATION PARAMETERS</b>			
FF to Track	42.78	Tilt	9.8
Muzzle to max w	35.90	Twist	1.2
		Skew	0.1





## HARDWARE

- **Velocity profile modes** (*Fixed, Measured, Multiple Update* or *User-defined*) with multiple trigger inputs (up to 256) and built-in trigger delay.
- **Housing** accommodates most High Speed Video cameras, and allows camera focusing without obscuring the flight path.
- **Mirror Halt function** stops the mirror in mid-flight for impact analysis.
- **High optical throughput** due to large mirror, angled optical axis, and optical components optimised for visible or infrared applications.
- **High mechanical stability** with benefit of remote/automated tilt, skew, and twist.
- **Double axis or extended trajectory analysis** using two or more synchronised units.

## SOFTWARE

- **Remote Operation via dedicated MS Windows software** (with set-up wizards) ensures optimised set-up for all geometries including *Horizontal, Inclined, and Skewed*.
- **Real-time (10MHz) mirror position control** enables in-flight velocity and acceleration correction.
- **Video analysis software** supplied if required.

## SPECIFICATION

CONFIGURATIONS	
Operation Modes	<ul style="list-style-type: none"> <li>• Measure/Fixed/Multiple Update or User-defined velocity profile</li> <li>• 3 x TTL</li> <li>• 3 x Skyscreen</li> <li>• 1 x Multi-trigger (up to 256 inputs)</li> </ul>
Power	100 – 240V, 50 – 60Hz
Trigger Output	<ul style="list-style-type: none"> <li>• 1 x +5V TTL in synchronism with the start of the mirror scan</li> <li>• 2 x TTL stand-alone (for 3-D scan etc.)</li> </ul>
Communication	RS 232/RS485/GBit Ethernet/Fibre Optic/Wireless LAN
HOUSING	
Rotation Range (about mirror axis)	<ul style="list-style-type: none"> <li>• Pitch: -17° - +90°</li> <li>• Roll: ±45°</li> <li>• Yaw: ±12°</li> </ul>
Rotation Measurement	±0.1°

MIRROR	
Scan Ratio* (highest)	0.1 - 100
Tracking Angle	100° total, 90° tracking
Angular Tracking Accuracy	Better than 0.1°
Flatness	¼ Wave
*Scan Ratio = Projectile Velocity ÷ Stand-off Distance	
ENVIRONMENT	
Operating Temperature	0°C - +40°C [+32°F - +104°F]
DIMENSIONS	
L x W x H (mirror)	3mm x 133mm x 88mm [0.12 in x 5.24in x 3.46in]
OPTIONS	
Dual AFF System	Linked systems with 3-D view and 3-D software analysis

## USED WITH



Multiple Trigger System Type 630-320



Flash Detector Type 768



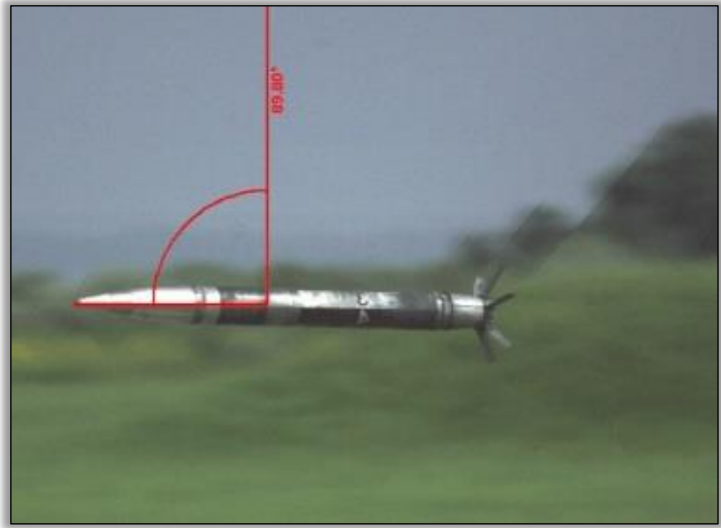
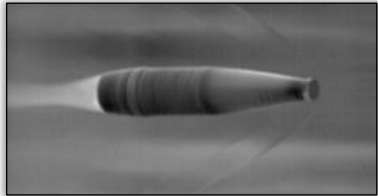
Optical Detector Type 858

# MS INSTRUMENTS Range Consultancy

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- State-of-the-Art Product Rendering
- Only the Latest Standards

# MINI FLIGHT-FOLLOWER TYPE 632



## MINI FLIGHT-FOLLOWER TYPE 632

The Mini Flight-Follower has been developed to meet the high-speed-imaging needs of modern ammunition designers, extending MSI's range of unique, specialised imaging solutions. The system is a complete Turn Key system that consists of a computer controlled triggered rotating mirror positioned in front of a High Speed Video camera. The mirror is programmed to rotate at the correct speed, such that the

camera will "follow" the projectile.

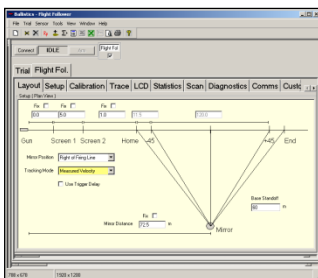
Typically, the system will track the trajectory for 100m or more as the mirror scans a 90° arc, providing high quality images of the projectile in flight.

This new, compact design is a complete package that gives high performance along with its convenience. The combined functionality of the hardware and software greatly simplifies system operation without limiting flexibility.

## HIGH QUALITY IMAGING

### Simple and Versatile Equipment:

- Simplified range surveying
- Accommodates a variety of cameras
- High mechanical stability



### Efficient and Optimised System:

- Software wizards
- In-built instrumentation
- Real-time mirror position control

### Time and Effort Saving:

- Easy, quick set up
- Remote operation
- Automatic adjustment to data entries



## HARDWARE


- **Velocity profile modes** (*Predicted or Measured*) with single or dual trigger inputs and built-in trigger delay.
- **Integrated high speed camera.**
- **Mirror Halt** function stops the mirror in mid-flight for impact analysis.
- **Trackable projectiles** include practically anything that is travelling too fast to observe.

## SOFTWARE

- **Remote Operation via dedicated MS Windows software** (with set-up wizards) ensures optimised set-up.
- **Optional Xcitex software** provides the user with an assortment of post analysis measurements and calculations to track and study the phenomena.
- **Low cost integrated Turn Key System.**

## SPECIFICATION

CONFIGURATIONS	
Operation Modes	<ul style="list-style-type: none"> <li>• Predicted or Measured velocity modes</li> <li>• Flash detector (standard) or 2 x Skyscreen (optional)</li> <li>• 1 x Multi-trigger (up to 256 inputs)</li> </ul>
Power	100 – 240V, 50 – 60Hz
Trigger Output	<ul style="list-style-type: none"> <li>• 1 x +5V TTL in synchronism with the start of the mirror scan</li> </ul>
Communication	GigE/Wireless LAN (optional)
Camera	
Resolution	1024 x 1024 (pixels)
Frames Per Second	Up to 6400 frames per second at full resolution
Memory	8GB (up to 16GB optional)
MIRROR	
Scan Ratio	0.1 - 100

Tracking Angle	100° total, 90° tracking
Angular Tracking Accuracy	Better than 0.1°
Flatness	¼ Wave
<i>*Scan Ratio = Projectile Velocity ÷ Stand-off Distance</i>	
ENVIRONMENT	
Operating Temperature	0°C - 40°C [32F - 104 F]
DIMENSIONS	
L x W x H (mirror)	135mm x 100mm
L x W x H (housing)	745mm x 335mm x 300mm [29.5in x13.5 in x12in]
Weight	26kg [57lbs]
SOFTWARE	
Standard	Ballistics DB
Option	Post analysis 

## USED WITH



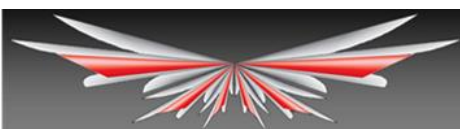
Multiple Trigger System Type 630-320



Flash Detector Type 768



Optical Detector Type 858



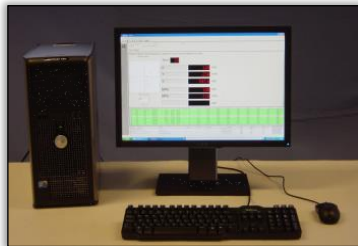
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# RANGE PROCESSOR TYPE 663(N)



## RANGE PROCESSOR TYPE 663(N)

The Range Processor Type 663 is a high performance computer, which features the latest Windows Pro operating system and the latest Dual Core technology.

The 663 with ample memory and hard disk space for all modern Windows applications. Additional hardware is provided to interface with the MS Instruments equipment.

The desktop unit is supplied with a 21" LCD Monitor to provide a large, clear desktop display, enabling all results to be clearly seen as they are received. The 663N offers a portable solution. The range processor is the ideal machine from which to run range operations smoothly and efficiently.

## SMOOTH AND EFFICIENT

### SPECIFICATION - DESKTOP

INTERNAL HARDWARE (min)	
Processor	P-4 Dual core 3.0 GHz
Memory	4 GB
Hard Drive	512 GB
DVD ROM/RW	DVD/CD-RW Combo (8x8x8x24)
EXTERNAL HARDWARE	
Display	21" LCD
Printer	Colour Laserjet
UPS	500 VA
SOFTWARE	
Operating System	Windows 7 Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>
DIMENSIONS	
L x W x H (Desktop)	460mm x 630mm x 210mm [18.11in x 24.80in x 8.27mm]

### SPECIFICATION - LAPTOP

INTERNAL HARDWARE (min)	
Processor	Intel Core i7 2.7 GHz
Memory	8 GB
Hard Drive	500 GB SSD
Video Outputs	HDMI/MiniDP
USB 3.0 Ports	2 (1 with PowerShare)
EXTERNAL HARDWARE	
Display	15" (1500 x 900)
Printer	HP Deskjet/Laserjet (Office Standard)
UPS	1000 VA+
Mouse	Built-in trackpad
SOFTWARE	
Operating System	Latest Windows Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>

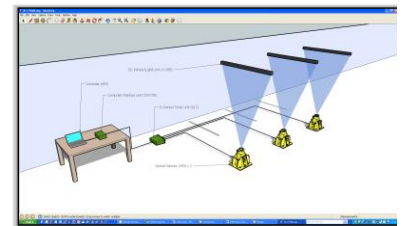
## USED WITH



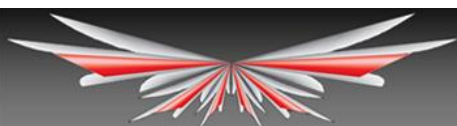
Acoustic Target  
Type 541



Ballistic DB Control Software  
Type 950-571



Projectile Velocity Measurement System  
(PVMS)



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# CHAPTER SIX - BALLISTIC TESTING

## Content

- wbs-leaflet



## **Wiltshire Ballistic Services Ltd**

The Ranges, Station Road, Devizes,

Wiltshire SN10 1BZ, England.

Tel: +44 (0)1380 721644 Fax: +44(0)1380 721421

<http://www.wiltshireballistics.co.uk>



Wiltshire Ballistic Services Ltd (WBS) offers secure, indoor firing ranges in Devizes, Wiltshire as well as ballistic testing on outdoor ranges

Independent from any weapon or armour manufacturers, quality approved to ISO 9001, certified to ISO 17025 and MOD Approved, WBS offers a range of testing to full international standards including the following:

- EN1063, EN1522 and EN1523
- MIL-STD-662F, UK/SC5449 and Def Stan 08-42, V50 and V0 evaluations.
- NIJ Standard 0101.06
- 
- NIJ Standard 0108.01
- Stab Testing to HOSDB requirements, Publication 7/03/C.
- Shield testing to HOSDB Publication 34/04.

The company's independence guarantees impartial results. Whatever the result, confidentiality is assured.

With the guidance and proactive assistance of experts who have a wide base of experience, you can have confidence in dealing with a true centre of excellence which represents the best opportunity to develop a product for your own market or customer – and quickly.

We are a commercial operation, who makes progress by delivering excellent service. We understand both your technical and commercial needs.

### **Full range of test facilities**

**There is a full range of instrumented test facilities available:**

- Separate stab testing room
- Live fire demonstration facility
- 0.15" to 20mm capability indoors
- 30 & 40mm outdoors
- Various range distances available 10,20,30,50,60,70,80 & 100 m
- 3 universal breech firing mechanisms
- 3 sets of velocity measurement systems
- Automatic electronic targets
- Various jigs & fixtures to handle many different types of impact testing
- Various weapons mounts to fire remotely the majority of small arms

**Our services include:**

- Ballistic testing
- Body armour trials facility
- Armoured Vehicle component and accessory testing
- Opaque armour testing
- Transparent armour testing
- Ammunition proofing and evaluation
- Ballistics training
- Weapon function testing
- Overpressure testing
- Fragment attack
- Grenade and high explosive attack

We can provide a bespoke service to supply all ballistic testing equipment including weapons, universal mounts, sample holders and instrumentation, for all natures of ammunition from 9mm to 40mm.

We can test all samples, vehicles and building materials against small arms, cannon, bomb and IED attack.

We can provide an unbiased verification and validation assessment of weapons, ammunition for supply to the MoD and Police and other services.

The company is also approved to handle classified material.

The company has and can also provide a wide variety of weapons mounts to use for testing of various weapons.

More details of these services are available on our website - please do visit us there, or in person for more technical information.

**Your visit will be not only effective, but also comfortable**

The facility is underground and secure, yet close to local facilities. Prolonged testing is easy and may be done without disturbance to the local population.

Meetings can be held for product development discussions, as we have a conference room and kitchen facilities on site.

Network, modem and presentation facilities are built in and display facilities are available.

Your development team can meet to progress the project in a confidential environment.

There is convenient, no hassle parking next to the range, with the Restaurant and Hotel facilities of Devizes within easy walking distance. With this relaxing post work environment close by:

- Early start or elongated late test periods can easily be handled with the minimum of inconvenience to customers
- Your own guests can be shown test demonstrations with excellent local hospitality

**Wiltshire Ballistics: A true centre of excellence**

The full range of test facilities, unparalleled in the UK, accessible whatever the weather, and using the most up to date and sophisticated instrumentation available is operated by a service-oriented team who have a wide-range of practical experience in the field.

# CHAPTER SEVEN - FORENSIC TESTING

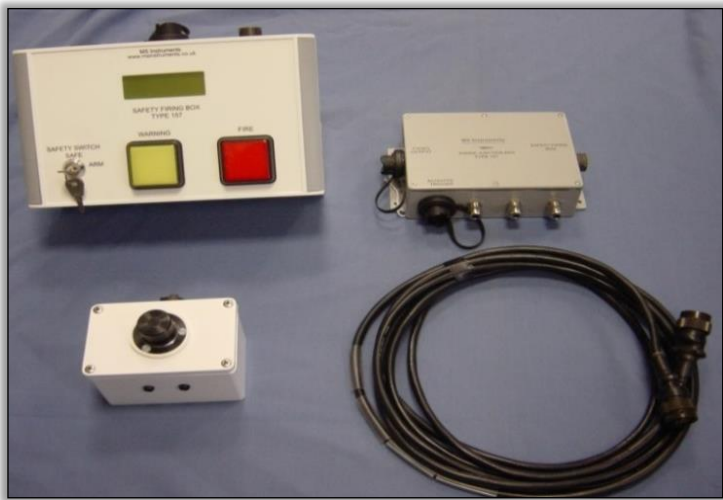
## Contents

- 157-safetyfiringsystem
- 157-050-remotetriggerpull
- 588-acousticdetector
- 598-indoorclimatemonitor
- 663\_n-rangeprocessor
- 681-400-azimuthandelelevationmount
- 681-550-universalweaponreststand
- 681-600-universalweaponrest
- 681-700-universalreceiver
- 681-800-x-ymount
- 726-flashdetector
- 775-solid-state-lightsupportframe
- 788-intelligentinfraredlightsource
- 817-triple-channelremotetimerunit
- 818-100-dual-channelgps-synchronizedtimer
- 858-opticaldetector
- 859-velocityscreen
- 950-571-ballisticsdbcontrolsoftware
- app02-calibrationofautomatictargets
- app04-sampleballisticprintout
- app05-standardstatisticalanalyses
- app06-accuratevelocitymeasurement
- ballisticmeasuringinstrumentation
- indoorvelocitymeasurementsystem-ivms



# SAFETY FIRING SYSTEM

## TYPE 157



### SAFETY FIRING SYSTEM TYPE 157

The Safety Firing System is an essential part of any successful ballistics range, bringing ease and sophistication to the testing process.

Designed for firing all weapon types the main objective of the system is to enable firing in the safest possible manner. Using a whole host of features, including door locks, sensors, and self-tests, it helps to remove risk to personnel and make the whole firing process smoother.

All of this ensures the most secure environment in which to fire.

### EASE AND SOPHISTICATION

#### HARDWARE/SOFTWARE

- **Safe Key** must be removed when loading the gun, so that the gun can't be fired.
- **PIR** check that no personnel are in the firing room.
- **Door Sensor** checks that the firing room door is closed.
- **Strobe** indicates that the range is live.
- **Warning Sounder** alerts when the gun is about to fire.
- **Door Lock** ensures that no personnel can go into the firing room if in countdown to fire mode.
- **LCD Screen** displays *Misfired Count* and *Shot Count*.
- **Self-Test** performed at power on to check that gun can be fired.
- **Shot Misfired** door safety interlock. Door stays locked for programmable time.

#### SPECIFICATION

POWER/COMMS	
Power	110V-240V AC (100W)
Connections	<ul style="list-style-type: none"><li>• 19-way socket to Range J/B.</li><li>• USB to PC.</li><li>• Mains Power.</li></ul>
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	Indoor Use only
DIMENSIONS	
L x W x H (Safety Firing Box)	280mm x 170mm x 90mm [11.0in x 6.7in x 3.5in]
Weight	4kg [8.8lb]
L x W x H (Remote Trigger)	260mm x 150mm x 100mm [11.0in x 5.0in x 4.0in]
Weight	4kg [8.8lb]

#### USED WITH



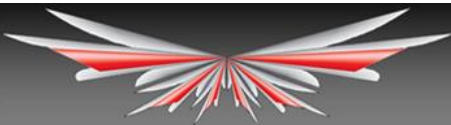
Universal Weapon Rest Type 681-600



Universal Receiver Type 681-700



X-Y Mount Type 681-800



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# REMOTE TRIGGER PULL TYPE 157 050



## HARDWARE

- **Safety**  
The 157 firing system is the safest way of firing weapons.
- **Weapons that can be fired**  
All weapons that have a trigger can be fired with this system. Rifles, Hand guns, 0.50" BMG A2

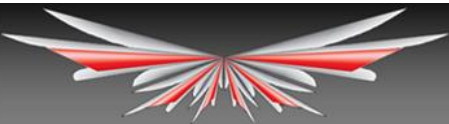
## REMOTE TRIGGER PULL TYPE 157 050

The Remote Trigger Pull has been designed to fire weapons remotely from the safety of the control room in conjunction with 157 001AS. The remote trigger pull has a programmable trigger pull distance and a trigger hold time set in a menu. The trigger hold time is used to fire a burst of rounds that have been loaded in to the weapon. There are two safety parts to the system: one is a flashing red strobe on the top of the unit to show that the system is live or safe, and the second is a safety key switch that you set to safe and remove key when loading the weapon.

## COMPACT AND RELIABLE

## SPECIFICATION

HARDWARE	
Trigger Pull Distance	5mm – 50mm
Trigger Hold Time	1 – 5 Seconds
POWER/COMMS	
Power	110 – 240V ac $\pm$ 10% @ 15W
ENVIRONMENT	
Operating Temperature	0°C - +50°C [-32 °F - +122 °F]
DIMENSIONS	
L x W x H	260mm x 150mm x 100mm [10.2in x 5.9in x 3.9in]
Weight	8.8kg [14.2lbs]



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# ACOUSTIC DETECTOR

## TYPE 588



### ACOUSTIC DETECTOR TYPE 588

The Acoustic Detector Type 588 is a solid and reliable unit that provides an output pulse in response to a large amplitude acoustic disturbance. The unit can therefore be used to detect muzzle blast, supersonic projectile shockwave or similar disturbances that enable the detector to trigger other events, measure rate of fire or measure projectile velocity using 817 timer units. The versatile unit has the facility for local and remote use up to 200m, as well as diagnostics, making it a useful addition to any ballistic environment.

### SOLID AND RELIABLE

### SPECIFICATION

CONFIGURATIONS	
Power	10 – 30VDC (250mA)
Power Supply	<ul style="list-style-type: none"><li>Detector Power Unit Type 783.</li><li>Multicore Cable</li></ul>
Pulse Output	<ul style="list-style-type: none"><li>Line driver to Detector Power Unit Type 783.</li><li>BNC Output: +ve 1ms TTL pulse.</li></ul>
Connectors	19-way combined power and signal
DETECTION	
Typical Detection Wave at 10m	Measured at maximum sensitivity using shockwave produced by a 7.62mm projectile at 800ms <sup>-1</sup>

Max. Rate of Fire	1500rpm (may be increased)
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14°F - +122°F]
Humidity	Seals unit with desiccator/indicator fitted
Enclosure Type	IP 67

### USED WITH



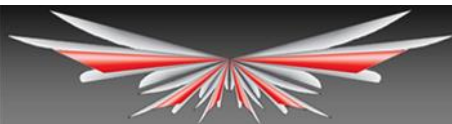
Ballistic Data Acquisition System Type 680



Pressure Measurement Unit Type 683



Rate-of-Fire Computer Type 807



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# INDOOR CLIMATE MONITOR

## TYPE 598



### INDOOR CLIMATE MONITOR TYPE 598

The MSI Indoor Climate Monitor is an innovative system that incorporates an array of measurement units to determine air temperature, barometric air pressure, and humidity. The system is rugged and compact, whilst delivering measurements efficiently to a central computer for thorough analysis. Knowing the environmental conditions in any testing setup is essential, making this monitor an important addition to any facility.

### RUGGED AND COMPACT

### HARDWARE

- **Measurements** are available for air temperature, barometric air pressure, and humidity.
- **8 analogue to digital inputs** can be used for additional data inputs.
- **Thermal sensors** typically occupy the additional data inputs in order to analyse temperature trends over a metallic surface e.g. a test barrel.
- **Optional interface units** are available.
- **All meteorological data** can be fed back to the central range computer for each shot during a trial, allowing a detailed record to be built of environmental conditions for each firing event.

### SPECIFICATION

MEASUREMENT	
Barometric Pressure Range	800 to 1100mbar $\pm 0.2\%$
Humidity Range	5-100% $\pm 2.5\%$
Temperature Range	0°C - +60°C [32 °F - 140 °F]
POWER/COMMS	
Inputs	8x 10-Bit A/D

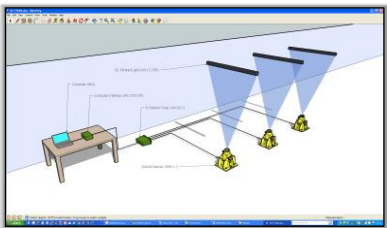
### USED WITH



Ballistic Data Acquisition System  
(BDAS) Type 680



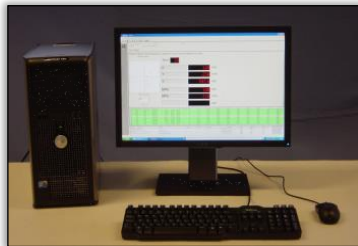
Universal Receiver  
Type 681-700



Projectile Velocity Measurement System  
(PVMS)



# RANGE PROCESSOR TYPE 663(N)



## RANGE PROCESSOR TYPE 663(N)

The Range Processor Type 663 is a high performance computer, which features the latest Windows Pro operating system and the latest Dual Core technology.

The 663 with ample memory and hard disk space for all modern Windows applications. Additional hardware is provided to interface with the MS Instruments equipment.

The desktop unit is supplied with a 21" LCD Monitor to provide a large, clear desktop display, enabling all results to be clearly seen as they are received. The 663N offers a portable solution. The range processor is the ideal machine from which to run range operations smoothly and efficiently.

## SMOOTH AND EFFICIENT

### SPECIFICATION - DESKTOP

INTERNAL HARDWARE (min)	
Processor	P-4 Dual core 3.0 GHz
Memory	4 GB
Hard Drive	512 GB
DVD ROM/RW	DVD/CD-RW Combo (8x8x8x24)
EXTERNAL HARDWARE	
Display	21" LCD
Printer	Colour Laserjet
UPS	500 VA
SOFTWARE	
Operating System	Windows 7 Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>
DIMENSIONS	
L x W x H (Desktop)	460mm x 630mm x 210mm [18.11in x 24.80in x 8.27mm]

### SPECIFICATION - LAPTOP

INTERNAL HARDWARE (min)	
Processor	Intel Core i7 2.7 GHz
Memory	8 GB
Hard Drive	500 GB SSD
Video Outputs	HDMI/MiniDP
USB 3.0 Ports	2 (1 with PowerShare)
EXTERNAL HARDWARE	
Display	15" (1500 x 900)
Printer	HP Deskjet/Laserjet (Office Standard)
UPS	1000 VA+
Mouse	Built-in trackpad
SOFTWARE	
Operating System	Latest Windows Pro
Application	<ul style="list-style-type: none"> <li>BallisticsDB Software</li> <li>MS Office Pro</li> </ul>

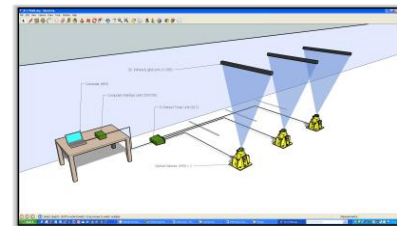
## USED WITH



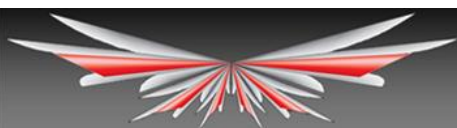
Acoustic Target  
Type 541



Ballistic DB Control Software  
Type 950-571



Projectile Velocity Measurement System  
(PVMS)



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# UNIVERSAL RIFLE MOUNT STAND type 681-550 and Azimuth/Elevation Mount type 681-400



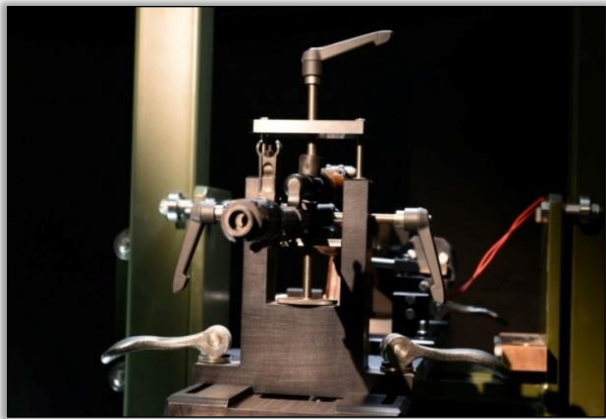
The Universal Rifle Mount Type 681-600 series is designed to clamp firmly a wide range of small arms for remote firing (see separate leaflet).  
If orthogonal firing is required for ballistics material testing, then it is mounted on the X/Y mount type 681-800, however it is more normally fitted to the Azimuth/Elevation Mount type 681-400 (see right-hand image above) which is secured to the Stand type 681-550 (see left-hand image above).

## SPECIFICATION

Unit	Calibre	Size	Movement	Weight
Stand Type 681-550	All calibres up to 40mm	Height: 670mm Width: 1040mm Depth: 1040mm		170kg
Azimuth/Elevation Mount Type 681-400	All calibres up to 12.7mm	Height: 595mm Width: 510mm Depth: 1180mm	5 degrees left-right 5 degrees up-down	175kg

# UNIVERSAL WEAPON REST

## TYPE 681-600



### UNIVERSAL WEAPON REST TYPE 681-600

The Universal Rifle Mount Type 681-600 series is designed to clamp firmly a wide range of small arms for remote firing. This versatile mount can securely house a comprehensive variety of rifles, sub machine guns and pistols using adjustable blocks at the front and rear of the firearm.

The care taken to cater for all users' requirements means this weapon rest brings quality to the range, and smoothness to the trials.

### QUALITY TO THE RANGE

#### HARDWARE/SOFTWARE

- Several Interchangeable components with Quick-Release Clamps ensure that the weapons mount can be adjusted quickly from one type of firearm to the next.
- Soft Mounts protect the weapons from damage wherever the gun is supported.
- Electronic or Manual firing

#### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 14.5mm
DIMENSIONS	
L x W x H	900 x 250 x 560mm [35.4in x 9.8in x 22.0in]
Weight	60kg [132.3lbs]

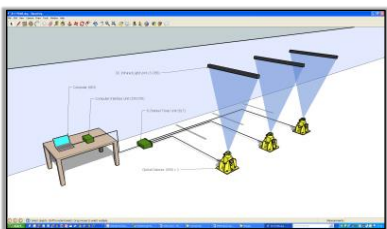
#### USED WITH



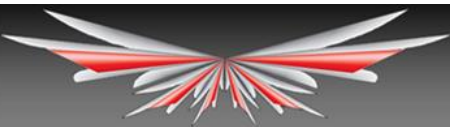
Safety Firing System Type 157



Optical Target Type 546



Projectile Velocity Measurement System



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# UNIVERSAL RECEIVER

## TYPE 681-700



### UNIVERSAL RECEIVER TYPE 681-700

The Universal Receiver is a breech/firing assembly that accepts a wide range of small arms barrels. Designed for accuracy, velocity and pressure test barrels, this is a versatile receiver, and can handle calibres up to 12.7mm. It can be used with a recoil mechanism if required, and may be mounted on an orthogonal X-Y firing mount or an azimuth and elevation rest. An adaptable, helpful piece of equipment, this receiver is an affordable piece of a smooth-running range.

### TRULY A UNIVERSAL RECEIVER

#### HARDWARE

- **Universal Breech** accepts barrels of different calibres made to fit the receiver.
- **X/Y Mount Type 681-800** to which the Receiver is fitted enables firing always to be made perpendicular to the line of fire. This feature is especially important when testing ballistic material.
- **Electrical (Solenoid) Firing Unit** interfaces to the MSI Safety Firing System Type 157.

#### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 12.7mm
Movement	Depends on chosen mounting system
DIMENSIONS	
L x W x H	150mm x 250mm x 180mm [5.9in x 9.8in x 7.1in]
Weight	45kg [99.2lbs] with typical barrel (not including stand etc.)

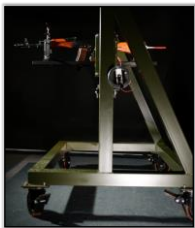
#### USED WITH



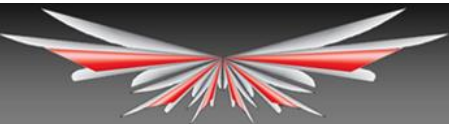
Azimuth/Elevation mount Type 681-400



Stand Type 681-550



X-Y Mount Type 681-800



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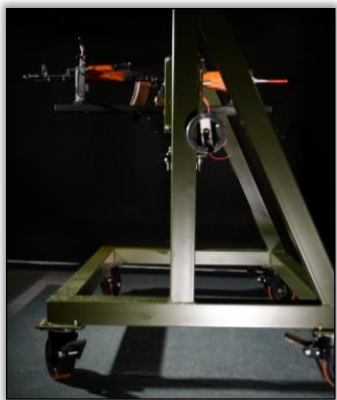
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# X-Y MOUNT

## TYPE 681-800



### HARDWARE/SOFTWARE

- Lockable Wheels allow easy deployment.
- Perpendicular Movement is particularly useful for ballistic materials testing, where orthogonal firing greatly increases the validity of the results.
- Jacking feet provide a stable firing platform ensuring consistent test results.

### X-Y MOUNT TYPE 681-800

The X-Y Mount Type 681-800 is a strong and durable frame designed to hold the Universal Weapon Rest Type 681-600 or Universal Receiver Type 681-700. Made for long-lasting use, the mount is easy to set up, and enables firing to be carried out swiftly and as predictably as possible.

## STRONG AND DURABLE

### SPECIFICATION

HARDWARE	
Calibre	All calibres up to 14.5mm
Movement	<ul style="list-style-type: none"><li>• 400 mm left-right</li><li>• 720mm up-down</li></ul>
DIMENSIONS	
L x W x H	2090mm x 1040mm x 1325mm [82.3in x 40.9in x 52.2in]
Weight	220kg [485lbs]

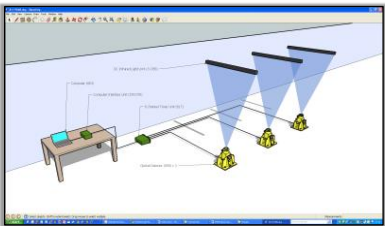
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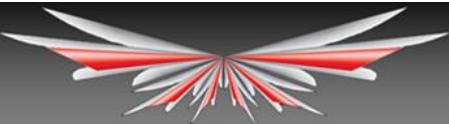
Universal Weapon Rest Type 681-600



Universal Receiver Type 681-700



Projectile Velocity Measurement System



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# FLASH DETECTOR

## TYPE 726



### HARDWARE/SOFTWARE

- **Detector** provides an output signal in response to a brief light pulse in a broad field of view.
- **BNC Connector** can trigger other events or equipment like a camera or x-ray by providing a TTL output.
- **Detector Power Unit Type 783-120** provides the detector with power and allows adjustment of sensitivity.
- **Event Distinction** means the system ignores slow events, such as flicker from fluorescent lighting.
- **Built-In Test Facility** allows system function to be checked prior to operation.

### FLASH DETECTOR TYPE 726

For the detection of muzzle flash, explosion, or other similarly brief event, the Flash Detector Type 726 is an ideal unit. From this, projectile exit time, time of flight to target, and other parameters can be measured.

Low-cost and unobtrusive, this compact and reliable unit is perfect for firing trials.

### COMPACT AND RELIABLE

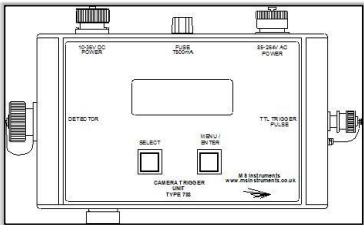
### SPECIFICATION

HARDWARE	
Wavelength Spectral Range	770nm to 1100nm
Peak Spectral Response	900nm
Field of View	20°
Min. Flash Rise Time	1500 candela/m <sup>2</sup> per second
Min. Detectable Flash Luminance at 5m	15 candela/m <sup>2</sup>
Min. Detectable Flash Duration	3µs
POWER/COMMS	
Power	10-30V DC
Power Supply	Detector Power Unit Type 783-120
BNC Output	TTL (5V) Rising edge 1ms pulse
ENVIRONMENT	
Operating Temperature	-25°C - +60°C [-13 °F - +140 °F]
Humidity	The unit is sealed
DIMENSIONS	
L x W x H	150mm x 290mm x 105mm [5.9in x 11.4in x 4.1in]
Weight	1kg [2.2lbs]

### USED WITH



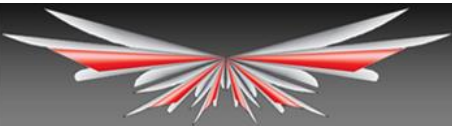
Universal Weapon Rest Type 681-600



Detector Power Unit Type 783-120



Rate-of-Fire Computer Type 807



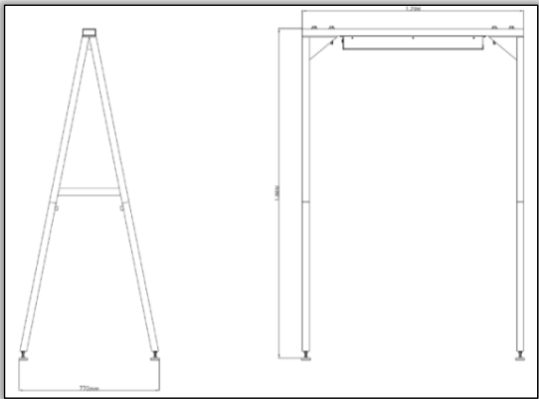
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# SOLID-STATE-LIGHT SUPPORT FRAME TYPE 775



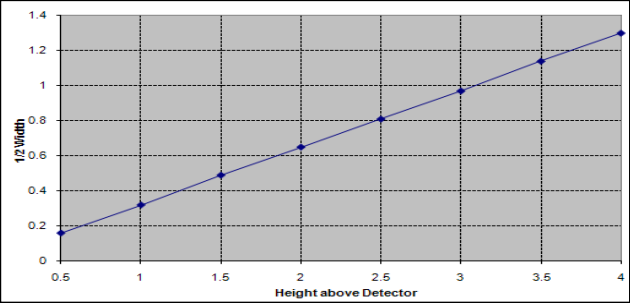
## SOLID-STATE-LIGHT SUPPORT FRAME TYPE 775

The MSI Solid-State-Light Support Frame is designed specifically for use with Solid-State Light Source Type 788, where ceiling mounting of lights is not a practical option.

The support frame suspends solid-state lights above the Type 858 Optical Detectors when indoor use is required. This setup is constructed of rugged material and provides stability and optimum lighting during operation, ensuring accurate results in a variety of firing applications.

## PROVIDES STABILITY

### ½ WIDTH OF SLOT FOR OPTICAL DETECTOR



### SPECIFICATION

DIMENSIONS								
Base Depth x W x H		770mm x 1290mm x 1860mm [30.3in x 50.8in x 73.2in]						
DETECTION FAN WIDTH								
Lens Angle [°]	6	6	6	6	6	6	6	6
Lens ½ Angle [°]	8	8	8	8	8	8	8	8
Height [m]	.5		.5		.5		.5	
½ Width [m]	.16	.32	.49	.64	.81	.97	.14	.3
Width [m]	.32	.64	.98	.3	.62	.94	.28	.6
Min projectile (1/500) [mm]	.64	.28	.96	.6	.24	.88	.56	.2

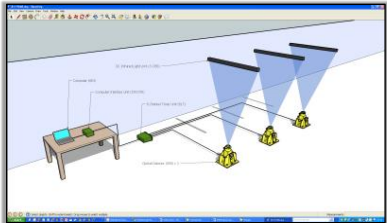
## USED WITH



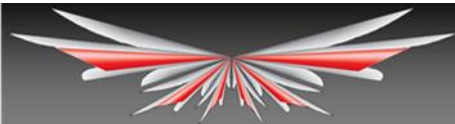
Intelligent Infrared Light Source Type 788



Optical Detector Type 858



Projectile Velocity Measurement System



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INTELLIGENT INFRARED  
LIGHT SOURCE  
TYPE 788



HARDWARE/SOFTWARE

- Three Printed Circuit Boards mounted end on in an aluminium channel form a single light. Each board consists of 80 infrared-emitting diodes.
- A Diffuser produces a uniform strip of infrared radiation from the individual diodes.
- A Universal-Input-Voltage Power Supply provides the 30V DC power for two lights.
- Computer Control is an option that allows each light to be controlled individually and remotely. Features include: Fault Report, Brightness Control, Energy Saving, Arm/Disarm Ability, Temperature-Limitation, and Others.

INTELLIGENT INFRARED LIGHT SOURCE TYPE 788

Whenever there is insufficient natural light, for example in an indoor range, these infrared lights are an essential piece of equipment.

The units are of rugged construction and, as of February 2011, they have the facility for computer control. With computer control comes a whole host of advantages that help save energy, costs, and time.

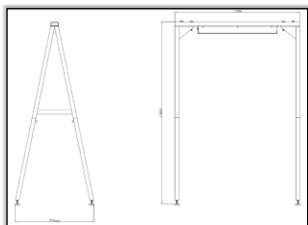
Designed for use with MS Instruments' Projectile Velocity Measurement System (PVMS), these sleek lights are useful in many circumstances, helping improve the functionality of the range.

SAVE ENERGY, COSTS, AND TIME

SPECIFICATION

POWER/COMMS	
Power	90V-260V AC
Current	0.6A
ENVIRONMENT	
Operating Temperature	0°C - 50°C [32 °F - 122 °F]
Humidity	95% non-condensing
DIMENSIONS	
L x W x H	783mm x 80mm x 77mm [30.8in x 3.1in x 3.0in]
Weight	2.6kg [5.7lbs]

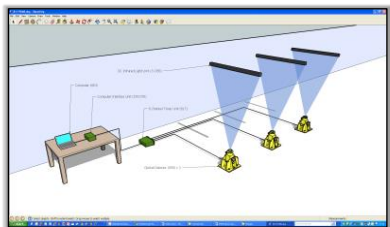
USED WITH



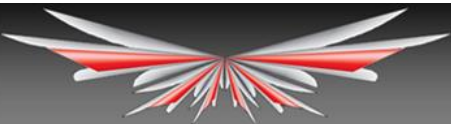
Solid-State-Light Support Frame Type 775



Optical Detector Type 858



Projectile Velocity Measurement System



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TRIPLE-CHANNEL  
REMOTE TIMER UNIT  
TYPE 817



TRIPLE-CHANNEL REMOTE TIMER UNIT TYPE 817

The Triple-Channel Remote Timer Unit Type 817 is a precise, microprocessor-based instrument, which provides direct measurement of projectile velocity and rate of fire. Using crystal-controlled chronometer channels, this unit provides highly accurate and reliable measurements which, when combined with the software package, produces impressive ballistic analysis potential.

HIGHLY ACCURATE AND RELIABLE

HARDWARE/SOFTWARE

- Crystal-controlled chronometer channels each have a time resolution of 100 nanoseconds, producing high accuracy velocity measurements.
- Three Independent Chronometer Channels can each provide velocity or time-of-flight and rate-of-fire.
- Integrate Software Package is available, providing accuracy velocity, rate of fire, and pressure data.
- Software allows for remote control of the unit, and retrieval of all data, which may be stored to disk and printed out.
- Muzzle Velocity and intermediate velocities are all calculable using the Ballistic Coefficient, when more than two detectors are used.

SPECIFICATION

HARDWARE	
Frequency Standard	<ul style="list-style-type: none"><li>10MHz crystal oscillator</li><li>Stability of 0.0025% over temp range -20°C - +80°C</li><li>Long term stability 10 ppm per year</li></ul>
Store Capacity	<ul style="list-style-type: none"><li>256 Velocity/Time measurements</li><li>257 Rate of Fire measurements</li></ul>
Rate of Fire	30,000 rpm max.
POWER/COMMS	
Power	10V-36V DC
Connections	<ul style="list-style-type: none"><li>Up to six Optical Detectors Type 858</li><li>Data connection to processor</li></ul>
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
DIMENSIONS	
L x W x H	350mm x 140mm x 280mm [13.8in x 5.5 in x 11.0in]
Weight	5kg [11.0lbs]

USED WITH



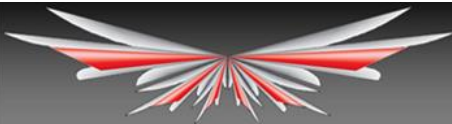
Acoustic Detector Type 588



Flash Detector Type 768



Optical Detector Type 858



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# DUAL-CHANNEL GPS-SYNCHRONIZED TIMER TYPE 818-100



## HARDWARE/SOFTWARE

- **Crystal-controlled chronometer channels** each have a time resolution of 100 nanoseconds from channel to channel, producing high accuracy time measurements.
- **Two Independent Chronometer Channels** each provide velocity or time-of-flight and rate-of-fire.
- **Integrated Software Package** is available, providing accuracy, velocity, rate of fire.
- **Software** allows for remote control of the unit, and retrieval of all data, which may be stored to disk and printed out.
- **Muzzle Velocity** and intermediate velocities are all calculable using the Ballistic Coefficient, where known.

## DUAL-CHANNEL GPS SYNCHRONIZED TIMER TYPE 818-100

The Dual-Channel GPS Synchronized Timer Unit Type 818-100 is a precise, ARM based Processing instrument, which provides GPS time synchronized measurement of events. A typical application is Burst Time measurement.

The timer crystal has  $\pm 5\text{ppm}$  accuracy and the GPS unit is time-synchronized to better than 300ns to UTC for all timing channels. This unit provides highly accurate and reliable measurements, which enable detailed ballistic analysis to be undertaken in the software.

## HIGHLY ACCURATE AND RELIABLE

## SPECIFICATION

HARDWARE	
Frequency Standard	<ul style="list-style-type: none"><li>• 10MHz crystal oscillator</li><li>• Stability of 0.0025% over temp range -20°C - +80°C</li><li>• Long term stability <math>\pm 0.5\text{ppm}</math> Stability.</li><li>• Ageing of <math>\pm 1\text{ppm}</math> per year</li></ul>
Store Capacity	<ul style="list-style-type: none"><li>• 256 Velocity/Time measurements</li><li>• 257 Rate of Fire measurements</li></ul>
Rate of Fire	30,000 rpm max.
POWER/COMMS	
Power	10V-36V DC
Connections	<ul style="list-style-type: none"><li>• Up to two Detectors Type 858/726/768/588/818</li><li>• TTL and Make/Break</li><li>• Data connection to processor</li><li>• GPS Antenna</li></ul>
ENVIRONMENT	
Operating Temperature	-10°C - +50°C [14 °F - 122 °F]
DIMENSIONS	
L x W x H	260mm x 150mm x 90mm [10.2in x 5.9 in x 3.5in]
Weight	2.1kg [4.6lbs]

## USED WITH



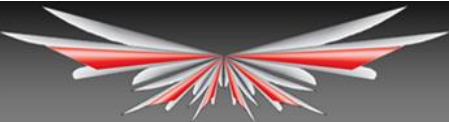
Acoustic Detector Type 588



Flash Detector Type 768



Optical Detector Type 858



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# OPTICAL DETECTOR TYPE 858



## HARDWARE/SOFTWARE

- **Start and Stop Detectors** identify a small change in illumination when a projectile passes through the field of view, and translate this into an output pulse.
- **BNC Connector** provides a TTL output pulse, which may be used to trigger other equipment, such as a high-speed camera.
- **Light Alloy Plinths** on which the detectors are mounted allow for permanent range installation, or wall-mounting.
- **Automatic Gain Control System** compensates for ambient light changes.
- **Tracer Shield** can easily be fitted to enable velocity measurement on tracer rounds.
- **Fixed-Spacing Cradles** can be supplied for forensic applications.

## OPTICAL DETECTOR TYPE 858

The Optical Detector Type 858 is an integral component of MS Instruments' Range Equipment, most commonly used as part of the Projectile Velocity Measurement System (PVMS).

This brand new design has been meticulously created to yield a rugged and sophisticated system that will operate successfully on both outdoor and indoor ranges, for all users.

## METICULOUSLY CREATED

## SPECIFICATION

HARDWARE	
<b>Lens</b>	50mm Focal Length Camera lens at full aperture
<b>Field of View</b>	36° x 0.17° for 50mm lens
<b>Projected Slit Width at 1m</b>	1.5mm for 50mm lens
<b>Slit Position</b>	Defined by two bosses brought out on plinth
<b>Vertical Alignment</b>	0.3mrad
<b>Pre-Set Elevation Angle</b>	0°, 15°, 30°, and 45°
<b>Sensitivity</b>	Will respond to <0.1% change in ambient light level
PROJECTILES	
<b>Projectile Calibre</b>	2mm to 155mm and above
<b>Projectile Velocity</b>	10ms <sup>-1</sup> to >5000ms <sup>-1</sup>
POWER/COMMS	
<b>Power Supply</b>	Remote Unit via multicore cable
<b>Pulse Output</b>	Fed by line driver to 817, BDAS or other
<b>Monitor Outputs</b>	Illumination level monitoring in terms of DC voltage at BNC
ENVIRONMENT	
<b>Operating Temperature</b>	0°C - 50°C 32°F - 122°F
<b>Operating Brightness</b>	15cfm <sup>-2</sup> to >1500cfm <sup>-2</sup> at source colour temperature of 2780K
<b>Humidity</b>	Units are sealed against moisture
DIMENSIONS	
<b>L x W x H</b>	324mm x 280mm x 365mm 12.8in x 11.0in x 14.4in
<b>Weight</b>	14kg [30.9lbs] each

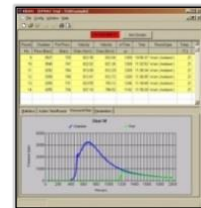
## USED WITH



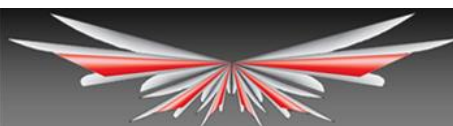
Automated Flight Follower Type 631



Triple-Channel Remote Unit Type 817



Ballistics DB Control Software Type 950-571



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# VELOCITY SCREEN

## TYPE 859



### HARDWARE/SOFTWARE

- **Start and stop detectors** identify a small change in illumination when a projectile passes through the detection area, and translate this into an output pulse.
- **BNC connectors** provide a TTL/12V output pulse, which may be used to trigger other equipment, such as a high-speed camera.
- **Automatic gain control** system compensates for dust and dirt on sensor windows.
- **Built-in diagnostics** report if light has been damaged by the means of a LED and sounder.

### VELOCITY SCREEN TYPE 859

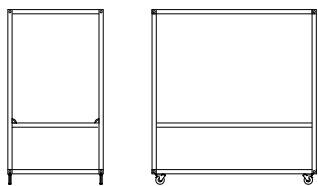
The MSI Velocity Screen Type 859 is an integral component of MS Instruments' Range Equipment, most commonly used as part of the Projectile Velocity Measurement System (PVMS). The Velocity screen can be used with all nature of projectiles including tracer. They are fitted to a trolley for ease of use at a sensor separation of 1m but can be supplied on larger sensor separation if required. This design has been created to bring a larger detection area and ease of use at a competitive price.

## EASY AND AFFORDABLE

### SPECIFICATION

HARDWARE	
Active Area	1m x 1m
Safe Clear Passage	990mm x 990mm
PROJECTILES	
Projectile Calibre	5.56mm to 14.5mm
Projectile Velocity	50ms <sup>-1</sup> to >3000ms <sup>-1</sup>
POWER/COMMS	
Power Supply	Remote Unit via multicore cable
Trigger Pulse	Fed by line driver to timer unit
BNC Trigger Outputs	50Ω TTL Can be preconfigured for rising/falling edges 50Ω 12V Can be preconfigured for rising/falling edges
ENVIRONMENT	
Operating Temperature	0°C - 50°C 32°F - 122°F
Humidity	95% non-condensing
DIMENSIONS	
H x W x L	1320mm x 1090mm x 50mm 52.0in x 43.0in x 2.0in
Weight	10kg [22.0lbs] each

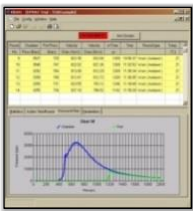
### USED WITH



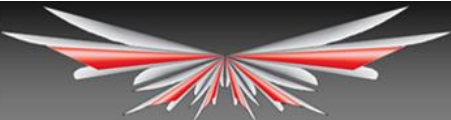
Velocity Trolley Type 859 250AS



Triple-Channel Remote Unit Type 817



Ballistics DB Control Software Type 950-571



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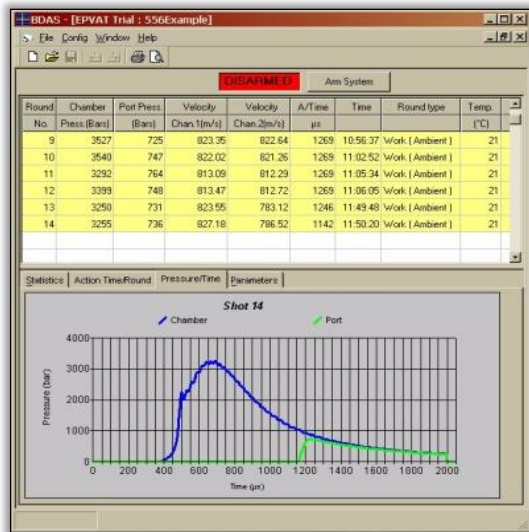
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# BALLISTICS DB CONTROL SOFTWARE

## TYPE 950-571



### BALLISTICS DB CONTROL SOFTWARE TYPE 950-571

Ballistics DB is the most important control software in the MSI range. This sleek, yet functional interface is the front end of all MSI test range instrumentation, adapting to each system with ease, being customized prior to each shipment.

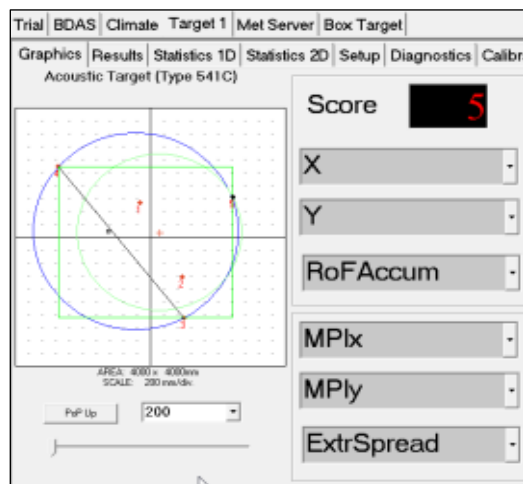
The software can be set up and operated with ease, for all in-house sensor systems. It provides statistical analysis and printouts, whilst allowing calibration functions to be applied.

Simple and helpful, the ergonomic design allows effortless operation. Ballistics DB Control Software is the essential core of all our sensor systems, and brings universal control to the range.

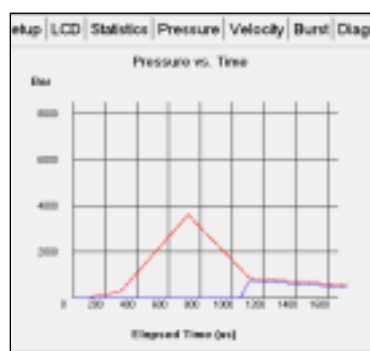
## EFFORTLESS OPERATION

### SOFTWARE

- **Windows Compatibility** of Ballistics DB means that it works with all types of computers operating in this environment.
- **Integral microprocessor** in all MSI measuring equipment enables the units to communicate digitally by cable, radio, or other telemetry link (UHF or Wifi) to the Range Processor.
- **Control** of nearly all MSI range equipment is done by Ballistics DB. The software is developed in-house for operation with all sensor systems produced by the company.



- **Three different, password-protected user levels** – Supervisor, Instructor, and Operator – keeps more complex and security relevant data separate from the day-to-day control operations. This separation allows the different skills required at each level to be learned more quickly.
- **Customisation** prior to shipment provides an integrated 'Trial' Tab specific to customer requirements. Each system has its own associated control tab on which the unit's setup parameters can be configured.



- **All possible data** is recorded automatically as each shot is fired, ensuring minimal risk of transcription error. Data fields in the trial table can be switched on and off for the purposes of simplifying screen displays and printouts.
- **Common data format**, typically Microsoft Excel or Access, allows the user to undertake 'desktop' trials on historical data, thus reducing the need for costly and time-consuming live-firing trials.
- **Meteorological and environmental data** relevant to the trial may be recorded using MSI's range of solid-state monitoring systems. Data from these units are recorded on a shot-by-shot basis.

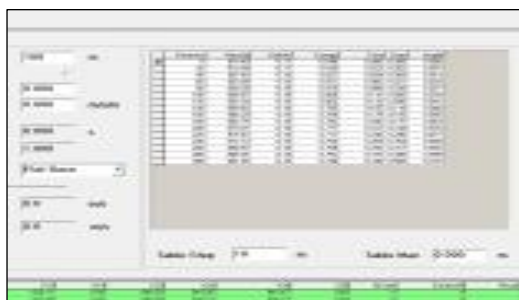
Configure Grid Columns			
Column	Visible	Printout	Width
Extreme Spread (mm)	<input type="checkbox"/>	<input type="checkbox"/>	900
Group Size (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1065
Mean Radius (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1380
Mean Radius (mils)	<input type="checkbox"/>	<input type="checkbox"/>	930
R 50% (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1170
R 100% (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1125
Group SD (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1545
Group SD (mils)	<input type="checkbox"/>	<input type="checkbox"/>	1545
Group Circle (mm)	<input type="checkbox"/>	<input type="checkbox"/>	1545
C-X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	900
C-Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	825
Dev X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1035
Dev Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1020
Mid X (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	885
Mid Y (mm)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	960

- **Every event is synchronised** to improve the integrity of the data by eliminating false triggers.
- **Built-in tests** are performed by Ballistics DB at start-up on the communication, and all components of the range. Diagnostic test results are reported and errors are displayed.
- **Wide range of data analysis functions** is provided as standard, and additional functions are available as options. The statistical functions may be sub-divided according to various groupings and analysed separately, e.g. with different colours on the graphic display.

Trial		Flight Fol.	
3D Wizard	Setup	3D Setup	Mirror
Trace	Triggers	Times	
Calculation Mode			
<input type="checkbox"/> Defined Track Distance		<input checked="" type="checkbox"/> Defined Flight Follower Position	
		Move OFF	
Firing Angle	35.00 deg	Scan Start Angle	50.00 deg
Start Tracking	0.00 m	After Start Trig	Scan Stop Angle
Trunnion Height	0.00 m		Scan Rot. Offset
Barrel Length	0.00 m		Track Distance
		133.15 m	
Flight Follower Position			
<input type="checkbox"/> Left of Firing Line		<input checked="" type="checkbox"/> Right of Firing Line	
Perpendicular Ground Distances			
Along Path	50.00 m	Away from Path	41.95 m
Track Standoff	50.02 m	Swing (Yaw)	10.43 deg
Mirror Down	40.96 m	Roll	28.26 deg
Tripod Rotation	0.00 deg	Elevation (Pitch)	39.84 deg

**KINETIC** is a special version of the Ballistics DB software that is typically used by forensic and ballistic material test establishments.

- It measures velocity
- Provides a range of ballistics models
- Analysis of velocity and rate-of-fire profiles



LCD	Statistics	Detectors	Diagnostics	Comms	S
Shot	2	V12			
		RoFAccum			
		V56			

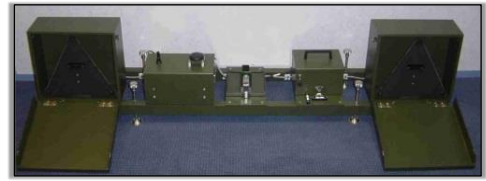
Settings	V-D Curve
	625.4 m/s
	2727.27 rpm
	781.9 m/s

# USED WITH

## Acoustic Targets



Acoustic Target Type 530

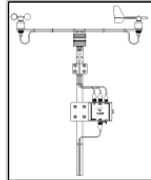


Acoustic Target Type 541

## Atmospheric Instrumentation



Meteorological  
Station Type 574



Meteorological  
Station Type 574-200



Indoor Climate Monitor  
Type 598



Intelligent Infrared Light Source  
Type 788

## Data Processors



Remote-Control Transceiver  
Type 573



Range Processor Type 663



Ballistic Data Acquisition System (BDAS)  
Type 680



Pressure Measurement Unit Type 683



Variable Delay Unit Type 769

## Optical Targets



Large Area Optical Target (LAOT)  
Type 340



Optical Target  
Type 546



Optical Target Type 570

## Projectile Analysis



Safety Firing System Type 157



Shot Pattern  
Analyser Type 616



Automated Flight-  
Follower Type 631



Mini Flight-Follower  
Type 632

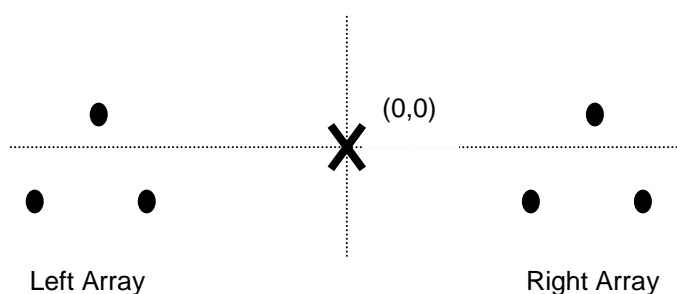
# CALIBRATION OF AUTOMATIC TARGETS

When using a virtual target system, it is often necessary to relate the “target” area of the virtual target to a physical witness for the purposes of calibration or verification. The computer software allows the user to calibrate the target in a variety of different ways

For acoustic targets, four calibration constants are usually calculated and programmed into the System. These may be easily checked and re-programmed if required.

Where four calibration constants are used, there are two for the “X” dimension and two for the “Y” dimension. The constants for each dimension comprise an offset term ( $C_x$  and  $C_y$ ) and a multiplication factor ( $M_x$  and  $M_y$ ).

If no calibration constants have been set, the centre of the virtual target (0,0), is the point mid-way between the two arrays in the x (horizontal) direction and a line that is drawn between the centre of the left and right arrays in the y (vertical) dimension. See Figure below.



So, if a shot is fired at point X, with no calibration constants set, then the virtual target will report a coordinate of (0,0). DO NOT DO THIS, however, as there is a serious risk of damage to the target if firing is done at this level.

If no constants are set, then shots will only appear in the top half of the target display in the software. For this reason,  $C_y$  will normally need to be set to a large negative number to make a correction.

If the target planes of the virtual target system and the physical witness are coplanar and perfectly aligned, the multiplication factor in X and Y will be 1.000 and the offset will be 0.0.

If the target planes are parallel in all dimensions but are offset in the X or Y dimension, the multiplication factors will be 1.000 and the offsets will be simply the distance that the physical witness target centre is offset from the virtual witness target centre.

For example, if the centre of the physical witness is 10mm to the right and 1000mm above the centre of the virtual target, the offset values will be set to  $X = -10\text{mm}$  and  $Y = -1000\text{mm}$ ; thus a shot fired at the centre of the witness target will be recorded on the physical witness at 0,0 and will now be shown on the target computer at 0,0.

If this is the only source of error, then these offsets can be manually entered into the “Surveyed Target Position” offset positions.

Do NOT use offset AND calibration constants at the same time, as this leads to confusion.

If the virtual target plane and the physical witness are not parallel and one leans away or towards the other, a simple offset is insufficient for correction. The multiplication factor is used to take account of this and operates on the original co-ordinate calculated by the target system as a multiple. For example, if the physical witness is perfectly upright and the virtual target is leaning towards it, a hole on the physical witness could be at a height of (say) 100mm above the centre and yet be recorded on the virtual target at 102mm; a Y dimension multiplication factor of 0.9804 when applied to the calculated virtual target value would correct to read 100mm. A similar factor can be used in the X dimension. If there is additionally a simple offset, this term would also be applied as above.

The four constant method does not correct for rotational effects. The accuracy will be affected if the virtual target or the physical witness is not level. Six or greater constants may be used if required, although they are not normally provided as such gross errors are usually a symptom of poor setup.

## *Number of calibration constants*

In the BallisticsDB software, there is a calibration tab for the target. On this tab, there is a choice of 0, 2, 4 or 6 constants.

Select “0 Consts” to remove all multipliers and offsets. The target will record shots as noted in the diagram above.

Select “2 Consts” to calculate the simple offset in x and y. No multiplier terms are calculated.

Select “4 Consts” to calculate a combination of the best offset and best multipliers in x and y.



Select “6 Consts” to take account additionally of any rotational errors between the physical and virtual target.

### ***Application of calibration constants***

**(In the following explanation, note that some versions of the software show RawX as X-row and RawY as Y-row)**

**The automatic target calculates the basic coordinates RawX, RawY.**

The relationship between X and RawX and between Y and RawY is shown on the calibration Tab, and is as follows:

$$X = (M_x \times \text{RawX}) + (M_{xy} \times \text{RawY}) + (C_x \times 1000)$$

$$Y = (M_{yx} \times \text{RawX}) + (M_y \times \text{RawY}) + (C_y \times 1000)$$

These are the equations when 6 calibration constants are used.

For a 4 constant calculation,  $M_{xy}$  and  $M_{yx}$  are both zero, which simplifies the equations to:

$$X = (M_x \times \text{RawX}) + (C_x \times 1000)$$

$$Y = (M_y \times \text{RawY}) + (C_y \times 1000)$$

If “0 Consts” is selected, then the X and Y coordinates shown on the Graphical display, and in the Shot list, will be the same as RawX, RawY.

### ***Method of Calibration***

Ensure that the shot grid is displaying, as a minimum, the following columns:

Shot No., RawX, RawY, X, Y, WitnessX, WitnessY, Calibration, XError, YError, RError.

(Refer to manual for instructions on how to switch columns on and off).

1) Place a witness target of the required dimensions in a convenient position behind the virtual target, taking care to ensure that the targets are parallel and level and that there is a minimal possibility of the two targets interfering. The physical target should normally be placed around 2m behind the virtual target.

2) Set up the controlling computer so that it is ready for live firing (check operators manual for details). The calibration constants should be set to their base values i.e. 1.000 for the multiplication factors and 0.0 for the offsets and any additional constants.

This is done in BallisticsDB by selecting “0 Consts”.

3) For best results, the shots should be scattered about the target area with a minimum of one shot in the centre and one in each of the four corners. Please note that at least 5 shots must be fired for the “4 or 6 Consts” calculation to be made, although it is advised that one or two extra shots are fired in case of corruption or shots registering off target.

4) When firing has finished, measure the witnessed results taking great care to ensure that the axes drawn on the witness target are orthogonal.

5) Type these values into the “WitnessX” and “WitnessY” locations on the shot grid, taking care to ensure that the witnessed results relate to their relevant virtual target results.

6) Tick the “Calibration” box for each shot being used for the calculation.

7) Select “2, 4 or 6 Consts” as appropriate. The calibration constants are then calculated by the program and displayed on the screen. If the targets are accurately aligned, you should see multiplication factors of approximately 0.90 to 1.1 and small offsets in X and Y relating to the actual offsets of the target centres. If the results are very different, or the calibration is rejected (this is done automatically if the multiplication factors are less than 0.8 or greater than 1.2) check that the witness results have been correctly measured and re-enter the values.

8) Take a printout of the results and calculated calibration constants for future reference.

If the constants are already known, these may be entered manually. This method can be used to effect an approximate calibration without the trouble of a live firing, by accurately measuring the differences between the two target centres and entering these manually as offsets and setting the multiplication factors to 1.000.

A worked example is given below:

- c) Set "0 Consts" and fire 5 shots. RawX, RawY and X, Y should be the same.

Graphics

Statistics

Setup

Diagnostics

Calibration

Comms

Acoustic Target Calibration Constants

$X = 1.000 * X\text{-raw} + 0.000 * Y\text{-raw} + 0.000 * 1000$   
 $Y = 0.000 * X\text{-raw} + 1.000 * Y\text{-raw} + 0.000 * 1000$

6 Consts.

4 Consts.

2 Consts.

0 Consts.

Surveyed Target Position

Distance From Muzzle (m)

600

Horizontal Offset (m)

0

Vertical Offset (m)

0

☐ Show Witness Results

AREA: 10000 x 10000mm

SCALE: 500 mm/div.

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError	UTCTime
	1	-597	1712	-597	1712	0	0	<input type="checkbox"/>	597	-1712	1813	13:03:34.448
	2	-231	2396	-231	2396	0	0	<input type="checkbox"/>	231	-2396	2407	13:04:14.306
	3	-587	2998	-587	2998	0	0	<input type="checkbox"/>	587	-2998	3055	13:04:17.606
	4	-729	2215	-729	2215	0	0	<input type="checkbox"/>	729	-2215	2332	13:04:20.826
	5	-728	2991	-728	2991	0	0	<input type="checkbox"/>	728	-2991	3078	13:04:23.968

- d) Enter witness results, tick calibration boxes and select the appropriate number of Consts.

"2 Consts"

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1712	-595	1710	<input checked="" type="checkbox"/>	2	-2	3
	2	-231	2396	-231	2396	-233	2399	<input checked="" type="checkbox"/>	-2	3	4
	3	-587	2998	-587	2998	-585	2996	<input checked="" type="checkbox"/>	2	-2	3
	4	-729	2215	-729	2215	-730	2219	<input checked="" type="checkbox"/>	-1	4	4
	5	-728	2991	-728	2991	-730	2988	<input checked="" type="checkbox"/>	-2	-3	4

"4 Consts"

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1713	-595	1710	<input checked="" type="checkbox"/>	2	-3	4
	2	-231	2396	-232	2396	-233	2399	<input checked="" type="checkbox"/>	-1	3	3
	3	-587	2998	-587	2997	-585	2996	<input checked="" type="checkbox"/>	2	-1	3
	4	-729	2215	-729	2216	-730	2219	<input checked="" type="checkbox"/>	-1	3	4
	5	-728	2991	-728	2990	-730	2988	<input checked="" type="checkbox"/>	-2	-2	3

### "6 Consts"

	ShotNo	RawX	RawY	X	Y	WitnessX	WitnessY	Calibration	XError	YError	RError
	1	-597	1712	-597	1713	-595	1710	<input checked="" type="checkbox"/>	2	-3	3
	2	-231	2396	-232	2398	-233	2399	<input checked="" type="checkbox"/>	-1	1	2
	3	-587	2998	-588	2997	-585	2996	<input checked="" type="checkbox"/>	3	-1	3
	4	-729	2215	-728	2215	-730	2219	<input checked="" type="checkbox"/>	-2	4	4
	5	-728	2991	-728	2989	-730	2988	<input checked="" type="checkbox"/>	-2	-1	2

XError, YError shows the difference between the shot positions on the physical and virtual targets. RError is the radial distance between (X, Y) and (WitnessX, WitnessY)

Note that for this particular shot pattern, there is little difference in accuracy between the 3 methods. This shows that the target was set up accurately and simple offsets only are required.

As the virtual target is always installed in front of the physical target, there will always be a parallax error. When firing at long distances, this is fairly small, however at shorter distances, the 4 or 6 const calibration methods are used to correct for this factor.

The calculation may be repeated at any time and as the constants operate on the Raw values, the calibration may even be done after firing.


Once the appropriate number of constants has been selected, the constants will be calculated and shown on the calibration tab. These constants will be used for all subsequent firings.

# SAMPLE BALLISTIC PRINTOUT

The MS Instruments LTD Ballistic Instrumentation Systems provide a printout with a full range of data. The configuration of the printout varies according to the data available.

Some data is entered manually and is recorded for records purposes only whereas some parameters are actively used in calculations and data analysis. Meteorological and other 'condition' data may be collected from automatic stations provided by the company.

The computer software may be configured to display various headers and data in many different forms; typical printouts from an Automatic Target and a Velocity Measuring System are shown below.



M. S. Instruments PLC - EPVAT 2

09/01/2009 16:15:20

Trial

Title

Test 1

Date

18/08/2008 12:09:18

Sub Title

Serial No.

Trial No.

Range Name

Statistics

Round Type

Work

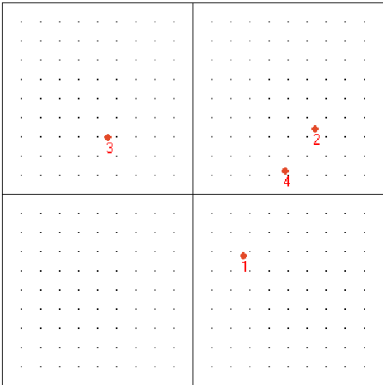
Ammo Type

Ball

Rounds


4

	X	Y
MPI (mm)	238.1	102.4
Group Rectangle (mm)	1089.2	665.7
Std. Deviation (mm)	481.9	303.8
Std. Deviation (mils)	4.9	3.1
A plus B (mm)	1754.9	
Group Size (mm)	1276.5	
Extreme Spread (mm)	1090.2	
Group Circle (mm)	1113.2	
Mean Radius (mm)	465.4	
Mean Radius (mils)	4.7	
Group S.D. (mm)	402.8	
Group S.D. (mils)	4.1	



AREA: 2000 mm x 2000 mm

Page 1


M.S. Instruments PLC - KINETIC

09/01/2009 16:18:03

Trial Data

Title	SW Test NBIS	Date	26/03/2008 12:13:26
Sub Title		Serial No.	
Trial No.		Range Name	

Shot Table

ShotNo	RoundTypeID	AmmoTypeID	KE_UKAS	V1
1	Work	Ball	13.549	608.384
2	Work	Ball	135.948	957.488
3	Work	Ball	135.688	956.572
4	Work	Ball	135.948	957.488
5	Work	Ball	135.688	956.572

Statistics

Value	Rounds	Min	Max	Spread	Mean	SD	SDn	Prob95	Prob90	
KE_UKAS	5	13.5	135.9	122.4	111.4	54.7	48.9	341.6	297.8	
V1	5	608.4	957.5	349.1	887.3	155.9	139.5	1543.7	1419.0	
E1	5	13.6	136.6	123.0	111.9	55.0	49.2	343.3	299.3	

Page 1



# STANDARD STATISTICAL ANALYSES

In MS Instruments LTD software, a range of statistical functions are provided as standard and additional ones may be specified. The list below gives an explanation of the standard definitions. Enclosing Circle (sometimes known as Group Circle) is the diameter of the smallest circle that encloses all shots.

In the following explanations, the shot data is referred to in the equations as  $X_i$ ,  $Y_i$  where  $X_i$  and  $Y_i$  are the co-ordinates of shot number  $i$ .  $N$  is the total number of shots.

---

## MEAN POINT OF IMPACT (MPI): $X_m$ and $Y_m$

This generates the mean value of all shots in the X and Y direction where:

$$X_m = \frac{1}{n} \sum_{i=1}^n X_i$$

$$Y_m = \frac{1}{n} \sum_{i=1}^n Y_i$$

---

## GROUP RECTANGLE

This gives the dimensions of the rectangle which encloses all shots. The sides of the rectangle are parallel to the X and Y axes. The sides are found by:

$$Side_x = \max\{X_i\} - \min\{X_i\}$$

$$Side_y = \max\{Y_i\} - \min\{Y_i\}$$

---

## STANDARD DEVIATION: $SD_x$ and $SD_y$

This produces the sample standard deviation for all X co-ordinates and all Y co-ordinates.

$$SD_x = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - X_m)^2}$$

$$SD_y = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (Y_i - Y_m)^2}$$

---

## STANDARD DEVIATION in mils: $SD_x(m)$ and $SD_y(m)$

The angular values of Standard Deviation (Distance from firing point to target = R)

$$SD_x(m) = 1018.59 \tan^{-1} \left( \frac{SD_x}{R} \right) \quad SD_y(m) = 1018.59 \tan^{-1} \left( \frac{SD_y}{R} \right)$$

---

## EXTREME SPREAD (ES)

This is the largest distance between any two shots.

Shot spacing between shots  $i$  and  $j$  is given by:

$$ES = \max \left\{ \sqrt{(X_i - X_j)^2 + (Y_i - Y_j)^2} \right\}$$

---

## MEAN RADIUS (MR)

This is the average distance of all shots from the mean point of impact, and is given by:

$$MR = \frac{1}{n} \sum_{i=1}^n \sqrt{(X_i - X_m)^2 + (Y_i - Y_m)^2}$$

---

## MEAN RADIUS in mils: $MR(m)$

The angular value of MEAN RADIUS

(Distance from firing point to target = R)

$$MR(m) = 1018.59 \tan^{-1} \left( \frac{MR}{R} \right)$$

---

## GROUP S.D.: GSD

This generates a single value from the standard deviation for X and Y, given by:

$$GSD = \sqrt{\frac{(SD_x)^2 + (SD_y)^2}{2}}$$

---

## GROUP S.D. in mils: $GSD(m)$

The angular value of the GROUP S.D.

(Distance from firing point to target = R)

$$GSD(m) = 1018.59 \tan^{-1} \left( \frac{GSD}{R} \right)$$

---

N.B. 1018.59 is the conversion factor from Radians to mils:

6400 mils =  $2\pi \times 1000\text{mRads}$  = 360 degrees, or 1mRad = 1.01859 mils.

# ACCURATE VELOCITY MEASUREMENT

## AIM

The aim of this application note is to guide the user through the steps required to achieve high precision velocity measurement using the Projectile Velocity Measuring System (PVMS) type 858 system. The principles of measurement are essentially straightforward: detect the crossing times of the projectile on each vertical optical screen and then calculate the velocity from the known separation divided by the time difference.

From this short description it is already apparent that in order to achieve high precision we need to measure the crossing times to great accuracy; we need to know the separation between the sky screen cradles accurately and we need to ensure that the optical screens are indeed vertical. In addition, it is assumed that the projectile flight path is horizontal and it is essential to ensure that there is little elevation present.

The electronic detectors measure the crossing times to the very high precision of 0.1 microseconds, so the accuracy of the system is then governed by the accuracy with which we can perform the set-up. In the next two sections, we discuss how best to set up the system so that it meets its specification of 0.1% accuracy in the measurement of velocity. There are two phases to the set-up: first choose an sky screen separation appropriate to the projectile velocity and the firing height above the optics in the cradles. Both of these factors affect the final accuracy achievable. Choosing the separation is simply a question of looking up its value in a table or getting it from one of the menus in the software. Once the choice has been made we then have to actually position and align the cradles; we will discuss these first and then return to the question of selecting the separation - usually two metres or more.

## POSITIONING THE CRADLES

The sky screen cradles should be placed under the projectile flight path at the required separation, and oriented so that the cradles are parallel to each other. The following diagrams illustrate the aimed for set up and show what is to be avoided.

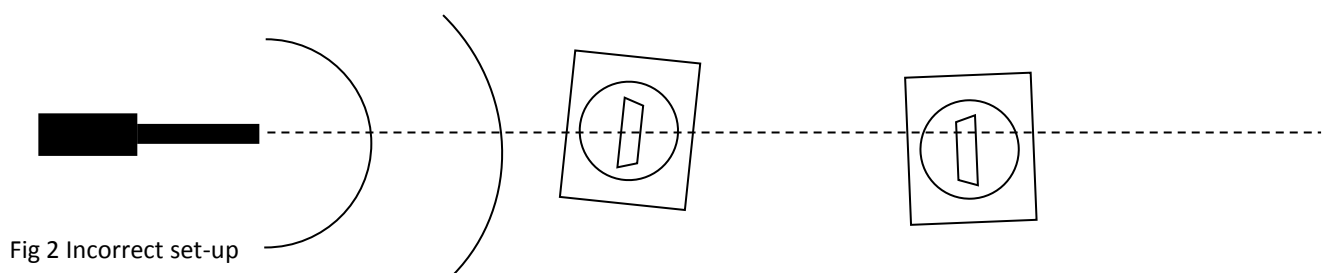
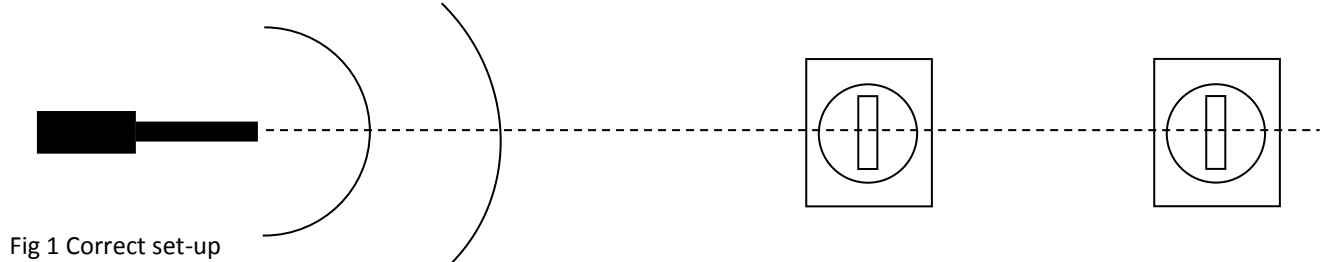


Fig. 1 shows the correctly set up system: the cradles are parallel to each other and lie directly under the projectile flight path.

Fig. 2 shows an incorrectly set up system with the major types of error:

*The cradles are twisted relative to each other*

The angle of twist will affect the crossing times of the projectile through each optical screen. It is possible to see this relative twist for quite a large range of cradle spacing from 1m to 10m. Move to a position where you can line up the two lens hoods by eye. Now look carefully at the flanges on the sides of the cradles. Any asymmetry here indicates that the cradles are misaligned. One or both may need to be rotated into the proper position.

*The cradles are not aligned along the flight path*

The angular deviation between the flight path and the line joining the cradles will adversely affect the crossing times. The flight path will need to be identified via some aiming mark. It is then necessary to ensure that the muzzle, the cradles, and the aiming mark all line up visually.

*The first screen is too close to the muzzle*

The muzzle blast can create microphonics noise in the equipment if the screen is too close to the muzzle. Also, the muzzle ejects debris, which is initially ahead of the projectile, and this can lead to false triggers in the system. As a rule of thumb, the distance from the first screen to the muzzle should be at least 3 metres for 556 and 5m for 12mm ammunition.

In the light of the above discussion, the main steps in positioning the cradles should be carried out in the following order:

- G. Establish a visual aiming mark so that you can identify the flight path from muzzle to aiming mark.
- H. Place the first screen at the correct distance from the muzzle along the flight path.
- I. Place the second screen approximately at the recommended distance from the first screen.
- J. Using the aiming mark, adjust the cradles to lie on the flight path. In some systems, you can use the supplied aiming telescope to aid this procedure.
- K. By sighting along the cradles check that they are parallel.
- L. Now approximately level each cradle using the attached spirit levels.

Any movement in the cradles may affect the positioning carried out in the previous step. It is better to cycle through D, E, and F rather than trying to perfect each on its own. You are now ready to set the separation between the cradles.

### SETTING THE CRADLE SEPARATION

In some systems, you will be supplied with a 2m steel setting bar containing two holes. Slip the bar holes over the pegs on the side of the cradles. With two bars, you can also ensure that the cradles are parallel to each other when both bars are located in their pegs but without strain on any peg.

If you do not have setting bars, you will need to measure the distance between pegs from cradle to cradle and on *both* sides of the cradles. The difference in distances obtained should be less than a half millimetre – anything more than this indicates a relative twist in the cradles. You will need to record this information for input into the computer system.

If any position adjustments have been made you will need to ensure that you have not now moved either cradle off the flight path.

### VERTICAL ALIGNMENT OF THE CRADLES

All PVMS systems are supplied with a pair of crossed spirit levels either attached to the cradle or to the lens mount. Three adjustable feet are attached to the base of the cradle. Choose the left foot as the pivot and tighten its locknut softly. Now adjust the right-hand foot until the spirit level parallel to the line joining the left and right feet shows level. Once level has been achieved, adjust the back foot until the other spirit shows level. Repeat the cycle until both bubbles show level accurately centred between the marks. Once both levels are set, tighten the locknuts on each leg firmly, and re-check the level accuracy.

If there has been significant movement during this process it may be necessary to reset or re-measure the separation between the cradles. If so, the vertical alignment process will need to be repeated.

### CHOOSING THE DETECTOR SEPARATION

The required detector separation depends on the projectile velocity and the height of firing above the detectors. The following is an approximation that can be used to find the minimum detector separation needed to achieve the precision in measurement of velocity:

$$S = (2V\delta t + 2H\delta\psi + \delta S)/v$$

In this expression:

$\delta t$	Error in the measurement of the crossing time (nominally $0.1 \times 10^{-6}$ second)
$\delta\psi$	Error in the vertical alignment (nominally 1 minute of arc = 0.000291 radians)
$\delta S$	Error in the separation (nominally 1mm = 0.001 m)
$v$	Relative error in the measurement of velocity (0.1% = 0.001)
$V$	Nominal projectile velocity (m/s)
$H$	Height of flight path above lens hood (m)
$S$	Spacing (m) required to achieve the specified relative error $v$

Using the above nominal values, the formula specialises to

$$S = 0.582H + 0.0002V + 0.5$$

For a velocity of 1000 m/s and a projectile height of 2m, the required distance is

$$S = 1.164 + 0.2 + 0.5 = 1.864 \text{ (m)}$$

This means that a separation of 2 m will ensure that the 0.1% accuracy specification is indeed achievable.

## MEASUREMENT OF DELTA V

By setting up three detectors  $P_1, P_2, P_3$  along the flight path, we can measure the velocities  $V_{12}, V_{23}$  across successive detector pairs, and then the retardation in the projectile can be measured. The retardation can be represented in terms of the rate of change of velocity with distance i.e.  $R = \frac{dV}{dS}$ , and this quantity can be measured by the ratio  $R = \frac{V_{12} - V_{23}}{S_{mid}}$ . Here  $S_{mid}$  is the distance between the *mid points* of each detector pair.

The absolute error in  $R$  is given by the formula:

$$\delta R \leq (2\delta V + R\delta S_{mid}) / S_{mid}$$

Since the retardation  $R$  is usually small, the relative error  $\delta R / R$  in retardation is likely to be huge, and it makes more sense to work directly with the absolute error in retardation as expressed above.



# BALLISTIC MEASURING INSTRUMENTATION



## Optical Target Type 340

- Variety of ammunition
- Primarily indoor use
- Instant graphical representation of data



## Meteorological Station Type 574

- Pressure, Humidity, Temperature, and Brightness,
- Solid-state anemometer measures wind speed
- GPS and electronic compass provides wind direction data



## Ballistic Data Acquisition System Type 680

- Electronic Pressure Velocity and Action Time (EPVAT) measurement
- Variety of configurations
- Complete ballistic analysis



## Triple-Channel Remote Timer Unit Type 817

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Ballistic Coefficient use with multiple detectors



## Optical Detector

- Start and stop detectors identify projectile
- Ambient light compensation and versatile installation
- Tracer and forensic applications

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Flash Detector



Flash Detector

Type 726

Ignition  
Detector  
Type 818



Acoustic Detector

Type 588



Type 768

## MS INSTRUMENTS Range Consultancy

*Precision, Expertise, Quality*

- Professional Bespoke Range Designs
- State-of-the-Art Product Rendering
- Only the Latest Standards



# INDOOR VELOCITY MEASURING SYSTEM (IVMS)

Typical Range Layout



**Computer Interface Unit  
Type 570-070**

- USB connectivity to MSI equipment
- Automatic power off of velocity system when PC is turned off
- LED indication of communication and power



**Velocity Screen  
Type 859**

- Built in light source
- Built in diagnostic test of light source
- Can be used with non MS Instruments timer units
- Large area detection 990mm x 990mm (39"x 39")

**"The IVMS combines the Type 859 Velocity Screens with the Type 818 Timer Unit controlled by the KINETIC option of the Ballistics DB Software all at a competitive price."**



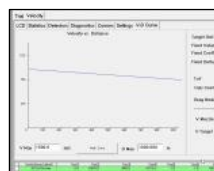
**Range Processor  
Type 663(n)**

- High performance laptop/desktop computer
- Latest Windows Pro operating system
- Ample memory and hard disk space



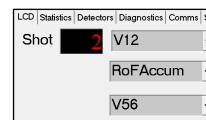
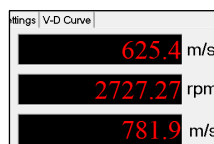
**GPS Synchronised  
Timer Unit  
Type 818**

- Direct measurement of velocity and rate of fire
- Crystal-controlled chronometer channels
- Ballistic Coefficient use with multiple detectors



**Ballistics DB  
Control Software  
Type 950-571**

- Velocity and rate-of-fire measurement
- Retrieve all data for storing and/or printing



# Wiltshire Ballistic Services



Wiltshire Ballistic Services have been testing weapons, ammunition and bullet-resistant materials for over 40 years. We test to both national and international standards, and the equipment used at the range is of the highest quality and accuracy, testing both small and medium calibres as well as large projectiles and rockets. The company's independence guarantees impartial results; whatever the result, confidentiality is assured. With the guidance and proactive assistance of experts who have a wide base of experience, you can have confidence in dealing with a true centre of excellence, which represents the best opportunity to develop a product for your own market or customer – and quickly. We have testing facilities from 10m to 80m and can batch, proof-test, all bullet-resistant materials including armour plate, shields, vests, glass, bomb disposal suits, bank counters, doors, civilian safes, cockpit doors and much more, up to 20mm indoors and larger calibres at an outdoor facility. As the pressure to make lighter, better fitting, high standard protective materials increases, Wiltshire Ballistic Services strive to test to the highest standards, while helping customers develop their products by testing new materials and compositions. WBS can test your products quickly and efficiently and work with complete customer confidentiality.

## Contact:

Sharon Pflieger-Taylor - [Sharon@wiltshireballistics.co.uk](mailto:Sharon@wiltshireballistics.co.uk)  
The Ranges, Station Road, Devizes, Wiltshire SN10 1BZ. Tel:  
01380 721644

Paul Everington  
Director, Wiltshire Ballistic Services Ltd ([www.wiltshireballistics.co.uk](http://www.wiltshireballistics.co.uk))  
Managing Director, MS Instruments Ltd ([www.msinstruments.co.uk](http://www.msinstruments.co.uk))



## The Ballistic ToolKit

The Ballistic ToolKit is a group of small and medium-sized UK companies brought together to network their skills and pool their resources in order to provide the best, and most cost-effective, solution for the customer.

The strength of this cooperative is that they can provide turn-key and highly specific solutions to their clients. Small companies are known for their expertise in research and development, thus creating bespoke products. To ensure maximum customer convenience, one member company acts as a single contracting point, while others act as subcontractors, keeping the whole process simple and tailored to customer requirements and satisfaction.



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Member-companies of the Ballistic ToolKit

It's a relationship that works extremely well and has the benefit of HMG support. But what does HMG support actually mean? Clearly, like all other companies and interest groups, Ballistic ToolKit companies apply for their F680s/Export Licenses and Exhibition Clearances like anyone else; but ensuring that HMG has a clear understanding of the current make-up and equipment the Ballistic ToolKit has, is key to our communicating that value overseas.

There are many ways we talk to HMG and these key engagements are called BTK Desk.

BTK Desk is where member-companies visit the Ministry of Defence in Bristol, MoD and DSO in London and the Export Support Team (British Army specialists) in Larkhill, to educate them about their goods and services.





The Ballistic ToolKit host their own events to the Armed Forces, Defence Attaches and other official foreign dignitaries, as depicted here at Larkhill

BTK Desk has even been completed overseas, namely in the United States, where the group visited the US Army exhibition and Conference (AUSA) in Washington DC to present to them (2011) and the Foreign Comparative Test (FCT) specialists across the US Armed Forces.

The Ballistic ToolKit has the ability to stretch far and wide because not all of their companies need to participate. Because we know each other very well, several companies can speak on behalf of the collective, while the collective shares the cost, thus creating incredible value for money opportunities for all members. By quality partnering, the Ballistic ToolKit goes from strength to strength, something we call Really Smart Procurement!

## Contacting BTK

<http://www.ballistictoolkit.org/>



## Contacting MS Instruments

MS Instruments Ltd  
Unit 4 Ravensquay Business centre  
Cray Avenue  
Orpington  
Kent  
BR5 4BQ  
Tel: 01689 883020  
Fax: 01689 871392  
Email: [sales@msinstruments.co.uk](mailto:sales@msinstruments.co.uk)  
[www.msinstruments.co.uk](http://www.msinstruments.co.uk)



CERTIFICATE NUMBER: 980010

