

# Remote Cocking Mechanism

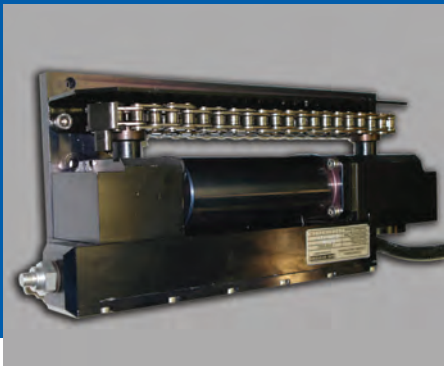


DENEL MECHATRONICS

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DENEL VEHICLE SYSTEMS



The Denel Mechatronics remotely operated .50 Browning machine gun cocking mechanism is an add-on solution mounted on the right hand side of the weapon, utilizing existing weapon interfaces, replacing the manually operated cocking mechanism.

The weapon can be operated in the breech open or close configuration.

The cocking mechanism can also act as a weapon safety mechanism, keeping the breech in the open (rear) position. Manual overriding of the electric cocking mechanism is possible by means of a crank handle. The override switch on the cocking mechanism allows the gunner to service the weapon. The mode selection is by serial interface (RS-422) or discreet signal input. A fire inhibit interlock and status feedback is provided.

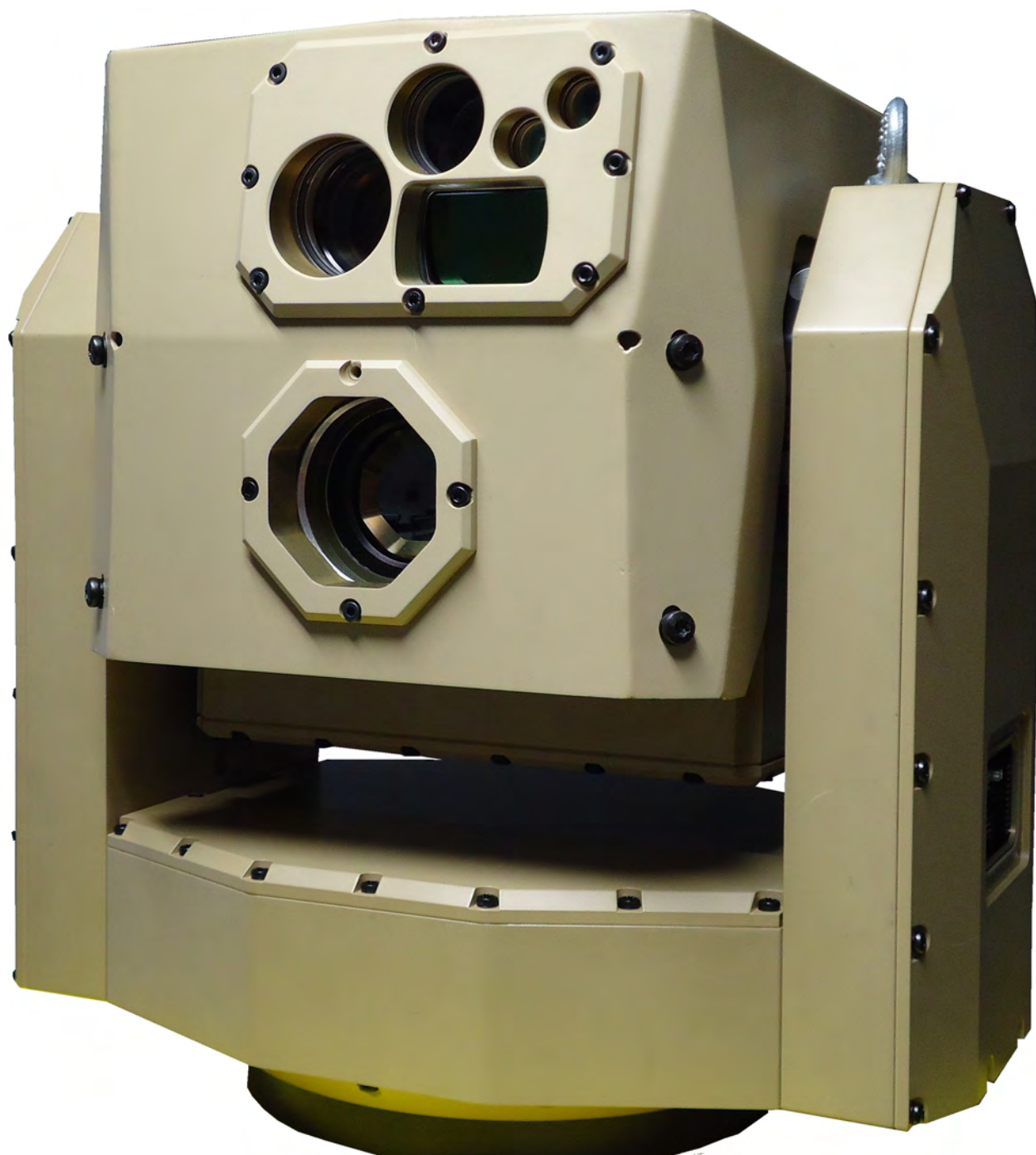
#### Specifications

Mass	2.7 kg
Power requirements	18 – 32 VDC
Cocking time	<3 seconds
Length	270mm
Height	113mm
Width	57mm
Operational modes	Cock Safe Override

#### Disclaimer

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# FIRE CONTROL SYSTEMS (FCS) BUILDING BLOCKS



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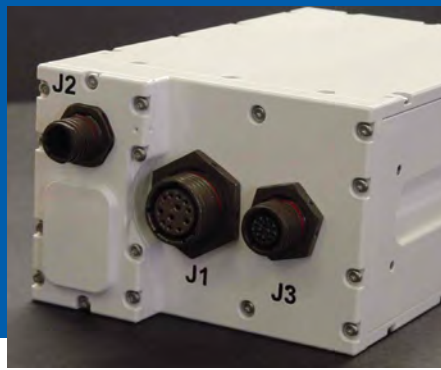
DENEL VEHICLE SYSTEMS



Denel Mechatronics has developed a suite of building blocks for Fire Control Systems ranging from MMI to Fire Control Computers and Sighting Systems.

These products are all developed, manufactured and maintained by Denel Mechatronics and can be adapted to comply with specific user requirements. These building blocks are used in several of the systems offered by the company in order to achieve maximum commonality and management of obsolescence.

Using these building blocks as part of the upgrades offered by Mechatronics, older equipment can compete with advanced systems in the digital battlefield. For example, the Independent Stabilised Sight or Video Tracker and Controller (VTAC) can be easily integrated into existing Fire Control Systems and adapted for other Turrets and FCS.



#### Fixed Sight for Light Turrets with Ballistic Calculation

Day Camera	2 or 3 Fixed FOV Vehicle Recognition > 3 000m
Night Camera	Uncooled Thermal 8-12 $\mu$ m Vehicle Recognition > 2 400m
Laser Range Finder	Typical 10-15 km 5m Accuracy
User Display	Colour 1024 x 768
Ballistic Computer	16 Programmable keys Accuracy 0.1 mRad

#### Video Tracker And Controller (VTAC)

Video Input	2x PAL or NTSC, Differential and Isolated
Video Output	2x PAL or NTSC, Differential and Isolated
Interface	Serial for control and commands
Minimum Contrast	5%
Minimum S/N	4
Noise (position value)	< 1 tv line
Error latency	5ms
Power	MIL-STD-1275B Input 18-32 VDC 20 Watts

#### Stabilised Panoramic Video Sight

Excursion Range Elevation	-20° to 65°
Excursion Range Azimuth	n x 360°
Low Profile	Height < 400mm
Velocity Range	0.1 mrad/s to 2 rad/s
Acceleration	> 15 rad/s <sup>2</sup>
Stabilization	< 50 $\mu$ Rad (1 $\sigma$ )



Sensors Day Cameras, LRF and IR Camera

Camera performance Customised per application

Typical Thermal Camera Tank ID > 3km

Typical Day Camera Tank ID > 4km

LRF Up to 15km

Options Laser Pointer and GPS

#### Video Interface Computer (VIC)

Computing Ballistic Computation  
User mode and sub-system control

Panel type TFT, Active matrix

Panel size Sizes dependant on the  
LCD screen size

Panel resolution XGA 1024(H) x 768(V)  
(Can accommodate higher res video)

Video Input 6x PAL or NTSC,  
differential and isolated

Video Output 2x PAL or NTSC,  
differential and isolated  
Zero Delay

Communication 9x RS-422  
2x RS232  
1x USB

Discrete lines 20

Target Tracking Video target auto-tracker  
built-in

Operating system None, 6 sec start-up

Mass Typical 6 kg for 10 inch LCD

Operating temp -20°C to +55°C

Environmental MIL-STD-810E

Power Input 18 – 32 VDC 40 Watts

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# M-FIRST

MOBILE - FULLY INTERACTIVE RIFLE SHOOTING TRAINING



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DENEL VEHICLE SYSTEMS



**M-FIRST is the result of re-packaging the well-known FIRST-2 in-door marksman shooting training system into a mobile configuration.**

The M-FIRST provides a cost effective interactive training and mentoring system for use by military, para-military and security forces. Training is based on the 5-phases of shooting, Positioning, Holding, Aiming, Stabilisation and Triggering (PHAST), and each phase contributes to the end-result. Instructions and coaching feedback are given visually and also verbally to the user. Progressive monitoring of results provides direct feedback on training efficiency. Unlimited number of re-coil shots enables the training team to address all training aspects without excessive cost implications.

### Core Specifications

Configuration	1x Instructor station, Typical 5x Shooting Nodes
Support equipment	Compressed air re-charge, Power Generator
Sensors	Eye-safe IR with passive target system
Actual Distance	Rifle: 10-300m, Pistol: 5m
Simulated Distance	10 – 300 m (weapon specific)
Recoil Simulation	Compressed air (both low and high pressure options)
Assault Weapon	Most gas-operated assault Rifles can be adapted
Hand Weapons	Several 9mm pistols available
Ballistic Software	Ballistic calculation takes distance and wind into account
Coaching	Provides interactive coaching based on data from sensors
Software functions	Pre- and user defined tables, data logging, database and reports
Language	Language of choice
Targets	Static, pop-up remote controlled, moving, friend and foe



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# MST

MISSILE STABILISED TURRET



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DENEL VEHICLE SYSTEMS



The Missile Stabilised Turret (MST) is a lightweight remote controlled missile stabilised turret, firing the well-known Ingwe anti-tank missile and capable of engaging moving targets from typical 200m to 5 000m, while on the move.

A 7.62mm machine gun for close-up firing is offered as an option. The MST can be fitted on most lightweight vehicles such as the HUMVEE, the RG32 and the Panhard VBL/VBR. The stabilised sight is fitted with day cameras and a 3-5  $\mu\text{m}$  thermal imager for night capability. The user interface consists of a colour video display unit combined with the system controller and hand controller.

A touch screen provides easy access to selections by means of menu driven graphics overlaid on the video. The operator can lock onto target before launch and also manually override the automated guidance during missile flight, should it be necessary.

The system combines remote firing capability with high performance digital sensors such as the IR camera into optimised space and layout, low weight, battlefield information and easy operator control. Integration on existing vehicle platforms is easy with no structural changes required.

#### Turret

Mass (Turret Only)	290 kg
Mass (incl. 4 missiles)	420 kg
Elevation Angles	-10° to +25°
Optics and Guidance Unit - Integrated Module specific to Missile	
Power	Input 18 – 32 VDC
Missiles	4x Ingwe (can be adapted to fit other CLOS missiles)

#### User Interface

Type	Integrated LCD Display with Control Computer
Target Tracking	Integrated Video Auto-tracker
Interface	Soft keys with touch screen, 2x hand grips
Software	Modes programmed according to user
Language	Different language options
Recording	An optional video recording function is available

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# OMT

OVERHEAD MANNED TURRET



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DENEL VEHICLE SYSTEMS



The Overhead Manned Turret (OMT) is an enclosed turret for Light Armoured Vehicles (LAV) or Mine Protected Vehicles (MPV), operated by one crew member. It provides self protection, ground fire support and attack capabilities to the vehicle system with an optimal balance between situational awareness and crew protection capabilities.

The OMT accommodates one of the following weapons:

- 7.62mm General Purpose Machine Gun
- 12.7 mm Heavy Machine Gun
- 40mm Automatic Grenade Launcher

The system is equipped with manual turret drives with an optional electrical assist in traverse. All round vision of the battle field and a video sighting system allows for fast reaction time and accurate aiming of the weapon during day and night conditions. Effective situational awareness ensures application ranging from close to the vehicle up to the effective range of the respective weapon.

The system is equipped with safety interlocks and mechanisms for effective and safe use of the weapon from under cover. The turret provides protection to the crew and equipment against enemy fire such as shell fragments and small ammunition.

The turret is fitted with 4 smoke grenade launchers and provision is made to fit additional support equipment such as;

- Spotlights,
- An IR pointing device,
- Internal lighting and
- Communication equipment

#### System Components

The OMT has been modular designed to support different user requirements. Parameters such as protection level, weapon interface, sighting system and position control mechanism can be configured to suit specific applications.

#### System Application

Depending on the selected weapon configuration, the OMT can be effectively utilised against enemy targets up to 2200m (area coverage for the 40mm grenade).

#### Sight and Aiming System

The turret is fitted with a direct view optical (DVO) sight consisting of a laser dot aiming device.

A complete day/night video sight is optional available for enhanced performance and consists of:

- Day Camera
- Uncooled Thermal Camera
- Laser Range Finder

A full colour display unit with built-in ballistic calculations is located inside the turret providing the operator with target identification and accurate aiming capabilities.

#### System Characteristics

Height	Total height above the vehicle roof is less than 610 mm
Transport height	530 mm
Weight (excl Ammunition)	Between 500 and 560 kg depending on variant

#### Operational Envelope

Traverse	3 x 360°
Elevation	-10° to 45°

#### Weapon Safety and Operation

All weapons are remotely operated from under-cover including cocking, firing and safety

#### Protection

Ballistic	Operator is protected similar to level 2 STANAG 4569
Blast	Protection against blasts due to hand grenades (2xDM51)
Fire	Protection of crew compartment against external fires and liquids

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# SD-ROW

SELF DEFENCE REMOTELY OPERATED WEAPON



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DENEL VEHICLE SYSTEMS



The Self Defence Remotely Operated Weapon (SDROW) is a light-weight weapon system fitted with a Light Machine Gun (LMG) for use on a variety of soft-skinned, Armoured Personnel Carriers (APC) and Mine Protected Vehicles (MPV).

The system can be operated by one crew member from under or behind cover. The SDROW weapon system is designed for easy installation on a variation of vehicles.

The SDROW allows for vehicle protection without compromising the encapsulation of the cabin and thus mine blast protection.

Depending on the selected weapon configuration, the SDROW is effective against enemy targets over a 600 m range.

#### Intuitive Control Interface

For easy operation in a typical truck cabin, the SDROW operator manipulates the turret and fires the weapon using a simple Human Machine Interface (HMI), consisting of a unique control interface with an integrated display (similar to a game console). The HMI unit can be stowed and is portable, enabling the driver or co-driver to operate the SDROW. Real-time video received from the cameras on the weapon station is displayed to the operator overlaying information digitally. Fixed ballistic aiming lines are displayed to help the operator compensate for distance. The aiming point moves according to the selected distance. The system has a typical 10 - 600 m application distance resulting in a very low trajectory for 7.62 mm and 5.56 mm calibre ammunition.

Direct input buttons for fast left, front and right turret positioning enables the operator to rapidly acquire and engage targets without becoming disoriented.

#### System Characteristics

Height	< 600 mm
Width	< 500 mm
Sweep radius	< 650 mm (including a 7.62 mm calibre barrel)
Weight	75 kg including 200 rounds of ammunition

Stabilisation	Stabilised for use on the move
Laying accuracy	< 1 mRad

#### Operational Envelope and Performance

Traverse Standard:	$\pm 135^\circ$ , Optional n x $360^\circ$
Elevation	$-20^\circ$ to $80^\circ$
Speed Traverse	100°/s - Elevation: 80°/s

#### Weapons

SDROW can be adapted for various NATO or non-NATO LMG's.

All weapon functions such as cocking, safety and firing are remotely controlled from within the cabin of the vehicle. Various safety mechanisms are fitted.

#### Sight and Aiming System

Standard	2 FOV day camera $5^\circ$ and $22^\circ$
Optional	LRF up to a range of at least 2500 m with < 5 m accuracy
Optional	Un-cooled TIS with FOV of $9.4^\circ$ and $4.7^\circ$

Ability to detect a human up to 2000 m and recognition up to 700 m by night

Various options of thermal cameras can be offered

#### Operator Control Unit

The system is controlled by a single handheld controller/display unit

Real-time computer calculates ballistic compensation

Display type 6.5" LCD: 1 024 x 768 resolution

Start-up response time < 5 seconds to start-up

#### Vehicle Interface

Mechanical on roof	3x M10 Bolts
Inside vehicle	Flat panel mount
Electrical	24 VDC nominal 5 A with 30 A peaks

#### Qualification

Environmental qualification according to MIL-standards

#### Benefits

- Allows under-armour protected target engagement without exposing the gunner
- Greater accuracy than a ring station
- "On-the-move" engagement and observation capability
- Gunner or driver can operate the weapon without changing position
- Accurate target confirmation/identification
- Simple and fast installation and removal for transport or to change to another vehicle (typically less than 30 minutes)
- Weapon can be easily removed for personal deployment

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# TRT

TACTICAL REMOTE TURRET



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DENEL VEHICLE SYSTEMS



The Tactical Remote Turret (TRT) is operated by one person and provides self protection and ground fire support for Light Armoured Vehicles (LAV), Mine Protected Vehicles (MPV) and Infantry Combat Vehicles (ICV).

### Overview

The TRT Family of Turrets is intended for a range of applications on Armoured vehicles capable of supporting various weapon configurations. With a low-weight design philosophy in mind, the system provides the required firepower in a defensive and offensive role to high mobility tactical vehicles. Its high fire-power and low weight makes it also feasible for amphibious applications.

The TRT base structure and Man Machine Interface (MMI) is common for all configurations supporting a dedicated weapon cradle for the configuration of choice. The TRT Turret's armament suite consists of a rapid fire cannon, co-axial machine gun as well as possible anti-tank Guided Missiles (ATGM).

### Electrical System

The system is equipped with electro-mechanical drives and sight equipment giving it all round observation, fast reaction time and accurate weapon firing abilities. The system is equipped with safety interlocks and mechanisms for effective and safe use of the weapons from behind cover.

### Operational use

The system is controlled remotely while the operator is seated under protection inside the vehicle. The operator interface is intuitive and easy to understand. The video with symbology as displayed on the MMI can be made available to secondary systems such as BMS and a commander display.

### Weapons and Ammunition ready to fire

Dual feed Cannon: 20 to 30mm Typical  
300 - 400 ready rounds

Co-axial machine gun: 7.62 mm Typical  
1 000 ready rounds

ATGM 2 x Semi-automatic Command to Line of Sight (SACLOS) can be integrated

### Typical Dimensions

Height < 1 120mm  
< 1 420mm incl sight

Sweep radius < 1 500mm excl Barrel

Weight 900 kg – 1 800 kg (complete with weapons & ammunition depending on configuration and protection)

### Operational Envelope

Traverse n x 360°

Elevation -15° to +55°

Prohibited zones Controlled in azimuth and elevation

### Performance

Traverse speed 55°/s

Elevation speed 55°/s

Stabilisation Fully stabilised for observation and accurate firing on the move

Tracking Auto track with manual video lock-on

### Sighting System

An independent stabilized sight provides silent all round surveillance. Fitted with state of the art electro-optics having its range and effectiveness determined by the choice of weapons. Targets can typically be identified at >4 000 m by day and >3 000 m during night conditions.

Day Continuous zoom 2.5° to 22.5°

Thermal Continuous zoom 2.5° to 22.5°

Thermal (IR) camera for detection of target at > 12 000 m at night (Various options)

Laser range finder > 10 km with 5m accuracy (Eye safe according to IEC 60825-1 Class 1)

### Operator Control Unit

The MMI is integrated with the ballistic computer offering a space-saving solution inside the vehicle

Video interface with 10.4" LCD touch screen display (mounted at any location inside the vehicle)

Display language of choice with menu driven software

User-defined "game-boy", yoke or joystick control mechanisms

Ballistic calculations with manual entry of environmental parameters

### Rapid Target Designation

Unique functionality for fast target acquisition and locking of target auto tracker

### Protection

Optional depending on user application

### Qualification

MIL-STD-810 G Environmental conditions

MIL-STD-461 E Electromagnetic interference

MIL-STD-1275 B Vehicle power requirements

### Benefits

Light weight reduce overall vehicle load vs fire power

Non-complex vehicle interface with no vehicle penetration

Increased internal space for crew or load capacity

High accurate performance with simple-to-use operator interface

"On-the-move" engagement and firing capability

Rapid target designation

Can integrate with systems such as BMS and threat locating devices

Integration with situational awareness systems

### Ammunition Replenishment

The turret has been integrated with a semi-automatic ammunition replenishment system

Turret accommodates two pre-prepared ammunition bins of 200 x 30mm capacity each

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# TURRETS FOR ATTACK HELICOPTERS



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DENEL VEHICLE SYSTEMS



Denel Mechatronics' turrets have been successfully integrated onto various helicopter platforms, including the Rooivalk and Mi-24 Hind attack helicopters.

#### Range of turret solutions

- Hydraulic or Electric Drives
- Turrets for a defensive role on light utility and transport helicopters
- Turrets for an offensive role on attack helicopters
- The above options may cover a variety of turreted cannons, with this specific product utilising the 20 x 139mm cannon

#### Operational Capabilities

- Nose mounted gun turret with freedom of movement in azimuth and elevation
- The system can be slaved from on-board equipment such as a main sight, as well as a helmet pointing system
- Optional dual feed system depending on the type of cannon

#### Turret control unit

The turret control unit (Ballistic computer) or TCU is a line replaceable unit interfacing between the pilot and Weapon Systems Officer's helmet sight, aircraft sensory and avionics system, the Control Panel and the turret. The TCU implements amongst others the following turret subsystem operations:

- Turret position and rate control loops
- Fire control corrections
- Control of firing safety interlocks
- Control of weapon safety functions, firing and stowing
- Ammunition management
- Turret subsystem built in test

#### Typical Characteristics

Cannon	GIAT F2 or G12 firing 20x139 mm rounds
Cannon effective Range	2000 m (15 mm armour penetration)
Firing Rate	720 rounds per minute
Power	Hydraulically powered: 27 l/min @ 15 MPa Peak 17 l/min @ 17 MPa Continuous
Turret accuracy	< 1.5 mrad 3σ pointing accuracy < 3 mrad 3σ slow tracking accuracy
Operating Envelope	-110 to +110 deg in Azimuth -55 to +15 deg in Elevation
Maximum Slew Rate	110 deg/s in Azimuth 75 deg/s in Elevation
Maximum Acceleration	1 000 deg/s <sup>2</sup>
Reaction Time	1.8 sec from selection of cannon, to firing at 60 deg traverse, -45 deg elevation
Dimensions	875mm high x 900mm long (excluding cannon) x 600mm wide
Mass	175 kg, excluding ammunition, but including TCU, cannon of 76kg
Turnaround time	Reloading cannon: 4 min using 2 persons Reload ammunition: 10 min
Environmental specifications	Fully qualified to MIL-STD-810E

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