tEODor™ EVO

TELERAD
An SAVS Company

PRODUCT DESCRIPTION

EOD ROBOT
tEODor EVO

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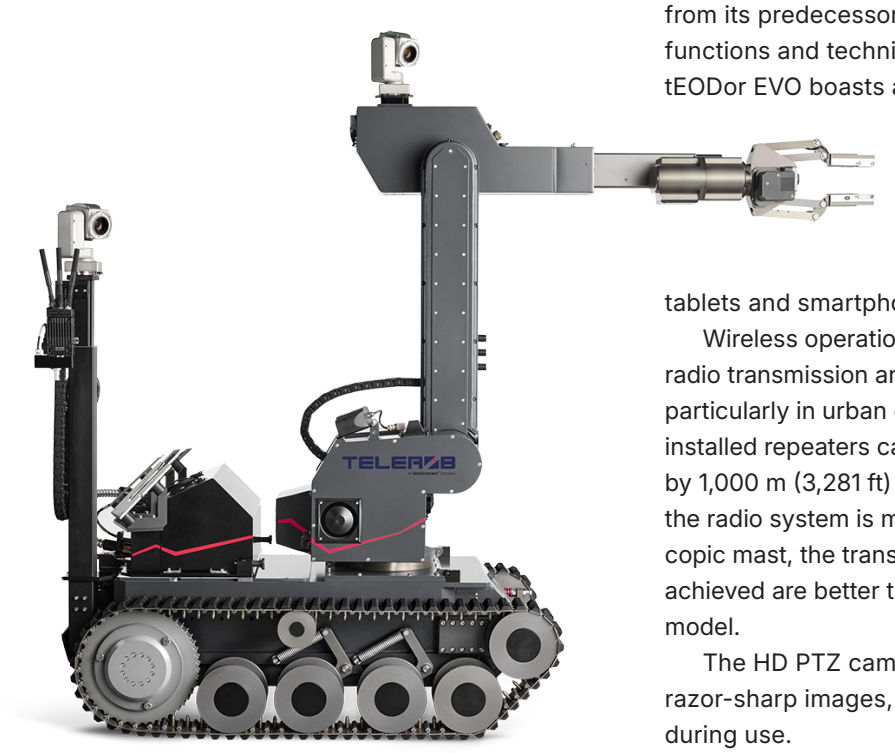
1 EOD ROBOT TEODOR EVO

The EOD robot tEODor (**T**elerob **E**xplosive **O**rdnance **D**isposal and **O**bservation **R**obot) is designed to replace people in especially dangerous situations and to perform hazardous tasks for them. Operated by remote control, the vehicle is capable of performing all the standard tasks of a bomb disposal engineer. These include:

- Gaining access (e.g. opening doors, breaking windows, removing obstacles)
- Reconnaissance, monitoring and investigation with the aid of built-in cameras, special cameras and x-ray systems
- Destruction of suspicious objects by ballistic means
- Opening of suspicious objects using water jet cutting technology
- Depositing objects in a bomb-proof container
- Detection and destruction of booby traps and concealed explosive devices
- Transport, positioning and remote-control operation of measuring equipment and sensors



Key characteristics of the EOD robot tEODor include its high levels of reliability, robustness and versatility. The 6-axis manipulator is characterised by its payload of up to 130 kg (287 lb) in particular. Since the year 2000, we have supplied over 650 systems to customers in 45 countries. No fewer than 24 NATO member nations now rely on tEODor for disarming improvised explosive and incendiary devices.

What sets the EOD robot tEODor EVO apart from its predecessor tEODor, is a multitude of new functions and technical further developments. The tEODor EVO boasts a modern, future-proof operating concept with multi-touch screen and an ergonomic design. Its intuitive operation is based on the applications we're all familiar with from the world of tablets and smartphones.

Wireless operation over IP Mesh guarantees stable radio transmission and outstanding network coverage, particularly in urban environments. The additionally installed repeaters can be used to increase the range by 1,000 m (3,281 ft) (LOS) each if necessary. Since the radio system is mounted on the EOD robot's telescopic mast, the transmitting and receiving capabilities achieved are better than those of the predecessor model.

The HD PTZ cameras with LED lighting produce razor-sharp images, ensuring a perfect overview during use.

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A GPS module and a 2-way audio module are integrated in the system as standard. The gripper also has an additional data interface, a video input, an integrated laser rangefinder and a camera with a wide-angle lens.

1.1 CHASSIS

The running gear is equipped with two rubber-padded metal tracks. This has the following advantages:

- Easy exchange of tracks and track elements
- High resistance to throwing
- Low maintenance costs
- Excellent maneuverability and good off-road performance

Each track is driven by its own high-torsion electromotor. Since the tracks can be operated in opposite directions, this results in a very narrow turning circle. It can overcome obstacles up to 250 mm (9.8 in) in height. Moreover, tEODor EVO is able to drive up and down stairs and ramps with a gradient of up to 45°*. Safety brakes automatically block the running gear during halts on gradients and sloping terrain. Furthermore, the running gear features spring-mounted wheels, giving the robot smooth, low-vibration running characteristics.

Owing to its compact design, tEODor EVO can also operate well in buildings and other confined spaces. A sensitive, high-precision joystick is used for controlling all driving movements.

Besides the motors and transmission system, the running gear contains two high-performance rechargeable lead gel batteries, the central computer, the control components and the components for transmitting data and images.

The running gear also features a mechanical interface for mounting optional accessories such as a fiber optic cable drum with integrated tool magazine. This interface means that the tEODor EVO can be quickly prepared for deployment or modified to meet new operational requirements.

1.2 MANIPULATOR

The rotating manipulator features five rotating axes and one linear axis, giving it excellent mobility. A sensitive, high-precision joystick is used for controlling all movements of the manipulator.

* This depends on the surface conditions and friction situation.

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The built-in linear axis with a telescopic range of 390 mm (15.4 in) offers unique possibilities for movement. This feature provides the user with numerous additional options for manipulating objects, e. g.:

- Introducing keys into locks
- Switching tools during an operation (e.g. electric drill)
- Precise positioning of ballistic systems, tools or x-ray systems
- Especially long reach in hard-to-access places (e.g. under vehicles)
- Improved upward reach of up to 2860 mm (113 in) (e.g. on top of vehicles or cabinets)

The extremely robust design makes it possible to deploy any available disrupter, and to lift objects weighing up to 130 kg (287 lb) (depending on the arm position). Safety clutches protect the manipulator's joints from damage due to overloading. A replaceable protection against wear attached to the gripper adds perfectly to the exceptionally well-built housing. The shape of the gripper jaws is excellent for also reliably gripping round and/or smooth objects.

Its integrated anti-collision technology is another special feature. A possible collision of individual arm components is recognized before it happens, and the movement is stopped. This way, the operator does not have to worry about damaging the manipulator during complex and critical situations.

The gripper jaws contain electrical contacts that automatically close or separate when a tool or firing system is picked up or put down. Additional cables for operating the automatically gripped tools or firing systems are not necessary, meaning that there is no risk of external damage here either.

A built-in force measurement function indicates the current pressure level. The display of the gripper force assists the operator when gripping fragile or sensitive objects; he can also be sure that the manipulator has a firm grip on a tool. Additionally, it is possible to display the gripper opening width on the control panel whenever required.

The manipulator has three sockets and three ballistic apertures. This makes mounting standard accessories very easy as well as facilitating integration of customer-specific devices. In addition, the manipulator features two external camera ports. The camera port located in the lower arm is intended for the aiming camera of a ballistic device mounted to the lower arm. All devices can be remotely actuated from the controller.

Thanks to the integrated video input and data interface the automatic tool change is possible for NBC equipment as well as for inspection cameras and aiming systems. Additionally, all information can be transmitted without disturbing cables via the video input and data interface.

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1.3 CONTROL

The EOD robot tEODor EVO can be controlled by radio link or via an optional fiber optic cable.

When operating in wireless mode, communication between the EOD robot and the control station takes place via IP MEsh radio that transmits encrypted signals in both directions. With a clear line of sight it is possible to attain ranges of up to 1,000 m (3,281 feet). Moreover, thanks to powerful transmitters, operations inside buildings or in urban areas do not pose a problem.

An optional fiber optic cable control system (with a 200 meter-long cable/656 feet-long cable) is available for certain operational situations. It is used when electromagnetic radiation must be absolutely avoided. When the fiber optic cable is connected, the wireless control components automatically switch off; this is a plug-and-play function.

The fiber optic cable is contained in an automatic cable drum located on the rear of the vehicle. Unwinding and winding of the cable is controlled automatically in conformity with the speed of the vehicle. This significantly reduces the risk of the cable being damaged or wedged under automobile tires, etc.

During radio and cable operation alike, a built-in computer takes over monitoring and control functions, relieving the pressure on the operator when conducting standardized sequences and control functions. An outstanding feature of the control system is the programmability of recurrent movement sequences, known as "automatic motion sequences“. These automatic moves are selected by pressing a button, causing the system to shift into the desired end position. Programming is very easy, and can be performed by the user at any time. Ex works, the following movement sequences and end-positions are on offer:

- Zero position / Packing position
- Shooting
- X-ray position
- Inspection of vehicle undercarriages
- Tool left
- Tool center
- Tool right

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Diagnosis interfaces on the vehicle and the controller permit access to the internal computer. With the help of a service program, this enables scanning and adjustment of numerous parameters, including:

› Selection and setting of a radio channel
› Viewing and setting of pre-programmed end-positions and movement sequences
› Calibration of the individual axes
› Adjustment of driving motors and battery voltage
› Setting of gripper strength end-value

The diagnosis system features an easy to use graphic surface. This facilitates and improves the process of searching for errors.

1.4 Loading

The tEODor EVO's batteries are charged using a charger, which is connected to the EOD robot using a corresponding cable.

1.5 CAMERAS

The standard version of the robot is equipped with three color cameras:

› Front camera
› Rear camera
› Gripper camera

Optional cameras:

› HD PTZ camera day/night with connection TEI
› Inspection camera
› 360° camera

The drive cameras are equipped with their own bright light-emitting diodes (LEDs) spotlights, which can be switched between five different stages. To create an enlarged, brightly illuminated viewing range, the gripper camera is fitted with a wide-angle lens and LEDs, which can also be switched between five stages. The optional high-resolution PTZ camera day/night features white light LEDs and infrared LEDs that can be selected alternately. The brightness of the LEDs can be continuously adjusted. The vehicle is also prepared for the use and control of other optional (special) cameras, such as:

› X-ray camera
› Aiming cameras for diverse standoff ballistic systems

The vehicle allows the display of four camera images at the same time with the quad view technique. This makes driving in confined spaces much easier, and also substantially simplifies manipulator operations.

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2 CHARACTERISTICS OF EOD ROBOT TEODOR / TEODOR EVO

	tEODor	tEODor EVO
RADIO SYSTEM	Digital and analog	IP Mesh radio (control data, video data and audio data, higher data rate, various options, e.g. use of repeaters
OPERATING CONCEPT ROBO COMMAND	✕	✓
TELESCOPIC MAST	Optional	Mandatory
MOUNTING OF ANTENNAS	Manipulator	Telescopic mast (better transmission and reception characteristics)
PTZ CAMERA IN HD QUALITY (OPTIONAL)	✕	Optional
OPTICAL ZOOM RANGE PTZ CAMERA	18x	30x (optional HD PTZ camera)
VIDEO RECORDER	External	Integrated video recording
VIDEO DISPLAY	Picture-in-picture	Quad view
2-WAY-AUDIO SYSTEM	Optional	Integrated
GPS RECEIVER	Optional	Integrated
MICROPHONE	1	2
LIGHTING	Halogen	White light LEDs and infrared LEDs
SUN SHIELD	External	Integrated in controller
OPERATING LED CHASSIS	Monochrome LED	Two-colour LED for various states
MULTI-ROBOT OPERATION	✕	✓

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3 TECHNICAL DATA
3.1 CHASSIS

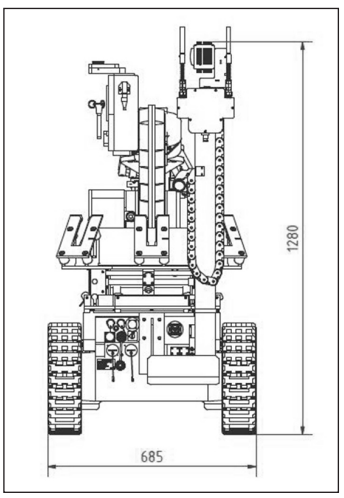

Figure: Packing position, front view

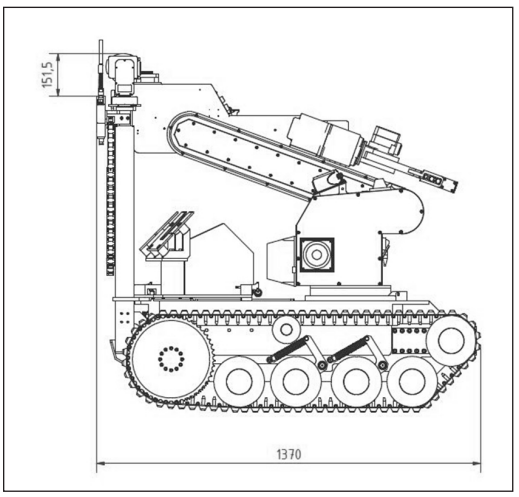

Figure: Packing position, side view

LENGTH	Approx. 1370 mm (54 in) (system in packing position)
WIDTH	≤ 685 mm (27 in)
HEIGHT	1130 mm (44 in) (packing position w/o accessories)
WEIGHT	Approx. 383 kg (844 lb) (w/o accessories)
SPEED	Max. 3 km/h (1.8 mph)
TURNING CIRCLE	1490 mm (theoretical) (59 in)
CLIMBING ABILITY (SLOPES/STAIRS)	45°
CLIMBING ABILITY	250 mm (10 in)
WADING DEPTH	≤ 300 mm (12 in)
PAYLOAD	350 kg (771 lb)
SAFE FIRING CIRCLES	Yes
TOWING CAPACITY	3000 N (permanent)
POWER SUPPLY	Lead-gel rechargeable battery; 2 × 12 V, 85 Ah
NOMINAL LIFE	Approx. 3-4 h mixed operation, approx. 20 h camera operation only

Technical data ±0,5% tolerance

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3.2 MANIPULATOR

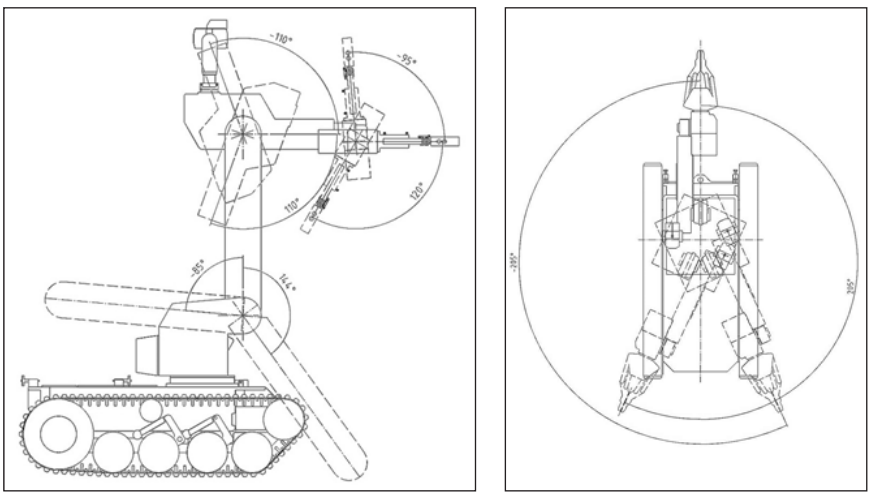

Figure: Range of movement of the turret and manipulator

AXES	5 rotating axes and one linear axis in the lower arm
ROTATE TURRET	+/- 205°
INCLINE UPPER ARM	+144°/ -85°
LENGTH OF UPPER ARM	800 mm (31.5 in)
INCLINE LOWER ARM	+/-110°
TELESCOPE IN LOWER ARM	0-390 mm (0-15 in)
LENGTH OF LOWER ARM	500-890 mm (20-35 in)
GRIPPER OPENING	0-300 mm (0-12 in)
INCLINE GRIPPER	+120°/ -95°
ROTATE GRIPPER	+/- infinite
GRIPPER CLOSING FORCE	600 N
GRIPPER PAYLOAD	20-100 kg (44-220 lb)
UPWARD REACH	2860 mm (113 in) (gripper vertical) 2410 mm (95 in) (gripper horizontal)
FORWARD REACH	1860 mm (73 in)
DOWNWARD REACH	1260 mm (50 in)
FIRING CHANNELS	3

Technical data ±0,5% tolerance

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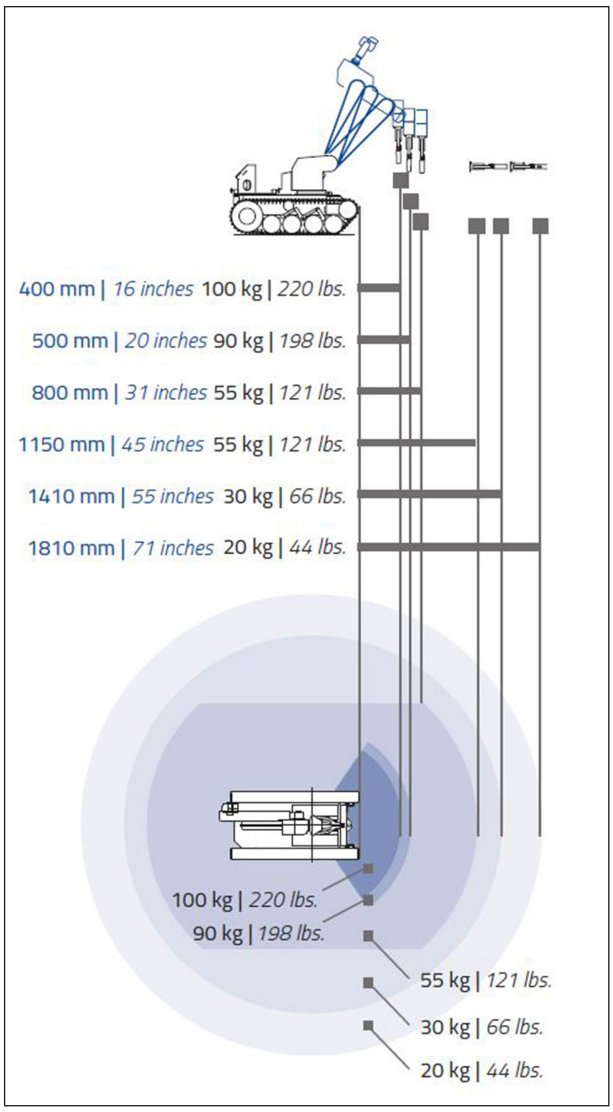

Figure: Payload in gripper

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3.2.1 VELOCITIES OF MANIPULATOR AXES

ROTATE TURRET	0 ... 1,6 / min
INCLINE UPPER ARM	0 ... 1,6 / min
INCLINE LOWER ARM	0 ... 1,6 / min
EXTEND TELESCOPE	0 ... 0,8 m / min
INCLINE GRIPPER	0 ... 1,2 / min
ROTATE GRIPPER	0 ... 4,7 / min

3.3 ADDITIONAL DATA

BTN NUMBER	8497 5000
END USER CERTIFICATE	Required

3.3.1 ELECTRICAL/ELECTRONICS

ELECTROMAGNETIC COMPATIBILITY (EMC)	EN 50081-1 EN 50082-2 EN 55022 (DIN VDE 0878 Part 22) EN 61000 - 4 Part 2, 3, 4, 6

3.3.2 RADIO LINK

The network is self-configuring, i.e. the best connection is always selected automatically, e.g. via repeaters. The frequency range can be restricted on the software side if required.

NETNODE IP MESH RADIO

FREQUENCY BAND	1,14 ... 1,5 GHz 2,0 ... 2,5 GHz 4,4 ... 5,0 GHz
BANDWIDTH	6 MHz
TRANSMITTING POWER	1 W

MPU5 IP MESH RADIO

FREQUENCY BAND	1,35 ... 1,39 GHz 2,2 ... 2,5 GHz 4,4 ... 5,0 GHz
BANDWIDTH	10 MHz
TRANSMITTING POWER	Depending on radio module 3×3,3 W (frequency band 1,35 ... 1,39 GHz / 2,2 ... 2,5 GHz) 3×2 W (frequency band 4,4 ... 5,0 GHz)

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3.3.3 AMBIENT OPERATING CONDITIONS

TEMPERATURE RANGE	-20°C to +60°C
MOISTURE	Cleaning and decontamination with running water
IP RATING	Vehicle IP 65, telescope IP 54

3.3.4 CAMERAS

NUMBER OF CAMERAS	Up to 7 cameras possible (3 cameras standard scope of delivery, 4 cameras optional)
FRONT CAMERA	Color, fixed focus, 2.5 mm lens, LED lighting (5 adjustable levels of intensity)
REAR CAMERA	Color, fixed focus, 3.6 mm lens, LED lighting (5 adjustable levels of intensity)
GRIPPER CAMERA	Color, fixed focus, 140° angle of view, 2.5 mm lens, LED lighting (5 adjustable levels of intensity)
HD PTZ CAMERA DAY/NIGHT WITH CONNECTION TEI (OPTIONAL)	Color automatic focusing, zoom, day/night, 0.01 lx (F1.6, AGC on, 1/30s), 30 x optical zoom, Full HD (1920 × 1080), wide angle 63.7°, tele 2,3°, pan/tilt head, 6 white light LEDs, 6 infrared LEDs (LEDs infinitely variable)
360° CAMERA (OPTIONAL)	Color, 30 x zoom, LED lighting (continuously switchable)
SPECIAL CAMERAS (OPTIONAL)	Inspection camera X-ray camera Video aiming device / target camera

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4 SCOPE OF DELIVERY FOR STANDARD VEHICLE

4.1 EOD ROBOT

› Ready-to-operate hull with drives, tracks and batteries
› Manipulator with rotating turret and telescopic lower arm
› Telescopic mast
› Manipulator axes protected by safety clutches
› Built-in collision protection
› 8 automatic moves (7 of which are programmable)
› Interfaces for adapting customer-specific devices
› 3 color cameras (fix-focus) with integrated lighting (with five adjustable levels of intensity)
› Integrated 2-way audio module
› Integrated GPS module
› Video display: quad view
› Color: anthracite grey (RAL 7016), other colors on request

4.2 ADDITIONAL

› Firing cable
› Replacement fuses
› Set of tools onboard
› Ring binder with manual, illustrated parts catalog and test certificate

5 COMPULSORY COMPONENTS

5.1 ROBO COMMAND

› Communication unit with telescopic mast, power supply and battery
› Controller
› Radio equipment IP Mesh
› Power supply unit with cable
› 3m cable (9.8 feet cable)
› Headset

5.2 RADIO AND VIDEO TRANSMISSON

An operational system needs at least one of the following components:

› NETNode IP Mesh radio
› MPU5 IP Mesh radio
› Fiber optic cable drum, 200 m (656 ft)

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6 OPTIONAL ACCESSORIES

The following optional accessories are available for the EOD robot tEODor EVO. The product description of the individual items is available separately upon request. We would be pleased to assist you with customized solutions or in integrating other systems.

If desired we also deliver the firing systems with the respective holders. Please note, in doing so, special regulations have to be met which might affect the delivery time.

6.1 FIRING SYSTEMS GRIPPER

- Holder ABL 2000
- Holder ABL 2000 L
- Holder ABL 3000
- Holder ABL 3000 L
- Holder DemiMod/MiniMod
- Holder NEEDLE
- Holder PROPARMS 12.5 RC
- Holder PROPARMS 20 RC MKIII / 29 RC XLT
- Holder PROPARMS 20 Neutrex
- Holder PROPARMS 29 Neutrex
- Holder HOTROD
- Holder HOTROD L
- Holder PIGSTICK
- Holder PIGSTICK L
- Holder RE 12g Mini
- Holder RE70 M3 Plus / Vulkan
- Holder Recoilless firing systems
- Holder TELEJET-short

6.2 FIRING SYSTEMS LOWER ARM

- TELEJET-long
- BENELLI M4 Super 90
- Holder LANCE
- Holder PAN
- Holder RE 70 M3 Plus / Vulkan
- Ignition cable drum

6.3 CAMERAS

- HD PTZ camera day/night with connection TEI
- Inspection camera
- 360° camera

6.4 TOOLS AND TOOL MAGAZINE

- Tool magazine
- Electrical tools
  - Grinder
  - Universal cutter
  - Hammer drill
  - Saw
- Holder MULTIBLOCK
- Mechanical tools (requirement: Holder MULTIBLOCK)
  - Magnetic clamp
  - Tearing hook
  - Window breaker
  - Spring hook
  - Belt cutter
  - Key holder

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6.5 SPECIAL TOOLS
- Fiber optic cable, 200 m, with automatic rewind and integrated tool magazine
- Fiber optic cable light, 200 m (requirement: tool magazine)

6.6 X-RAY SYSTEMS
- Holder for x-ray systems
- VCSecurity
- NOVO
- X-ray source INSPECTOR XR150, XR200 and XRS3

6.7 SPECIAL GRIPPER JAWS
- Large gripper (for barrels)
- Prism gripper (for spherical objects)

6.8 SPARE PARTS PACKAGES
- Electronic spare parts package
- Mechanical spare parts package
- Batteries spare parts package

6.9 OTHER ACCESSORIES
- T-mini controller
- Holder Sansolo
- UCI extension TEI
- Transport container
- Transport container (IP 67)
- Ramp (foldable)
- Automatic hitch
- Repeater NETNode
- Repeater MPU5
- HD PTZ camera for repeater
- Adapter repeater for tool magazine
- Car-towing device

Subject to technical change without notice.