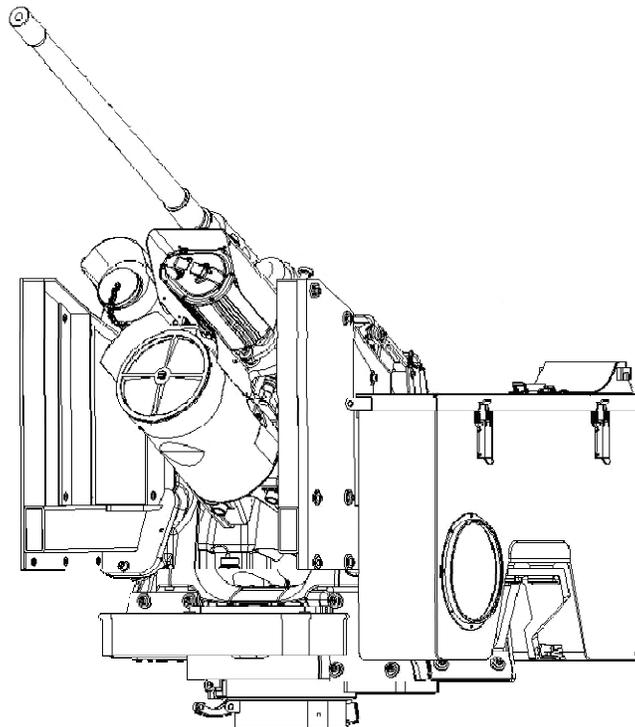


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**TECHNICAL MANUAL**  
**OPERATOR'S MANUAL**  
**FOR THE**  
**ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153**  
**COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**  
**PN 60201886-01**  
**NSN 1090-25-160-1150**  
**PN 60201886-03**  
**NSN 1090-25-160-1292**



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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**OCTOBER 2009**



**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

**WARNING SUMMARY**

---

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

**FIRST AID**

For first aid information, refer to FM 4-25.11, First Aid, Headquarters, Department of the Army, December 2002 (Change 1, 15 July 2004). For hazardous materials, refer to the label and/or Material Safety Data Sheet (MSDS).

Fire extinguisher(s), first aid kit, and eye wash/shower station should be close at hand (or easily accessible) in case of an emergency.

**EXPLANATION OF SAFETY WARNING ICONS**



**EXPLOSION** - rapidly expanding symbol shows that material may explode if subjected to high temperatures, sources of ignition, or high pressure.



**EYE PROTECTION** - person with goggles shows that material will injure eyes.



**HEARING PROTECTION** - headphones over ears shows that noise level will harm hearing.



**HEAVY PARTS** - heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.



**HOT AREA** - hand over object radiating heat shows that part is hot and can burn.



**LASER LIGHT** - laser light hazard symbol indicates extreme danger for eyes from laser beams and reflections.



**SHARP OBJECT** - pointed object in hand shows that a sharp object presents a danger to limb.



**WEAPON FIRE** - accidental discharge of a weapon could cause serious injury or death.

## GENERAL SAFETY WARNINGS DESCRIPTION

### WARNINGS



### EXPLOSION

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

### WARNING



### EYE PROTECTION

While performing boresighting operations, personnel must wear approved Safety Glasses and avoid looking into the borescope when the WS is moved to prevent personal injury.

### WARNINGS



### HEARING PROTECTION

Hearing protection must be worn when firing weapon to prevent injury to personnel.

High noise levels from vehicle operation and/or weapon firing can cause damage to hearing. All on-vehicle personnel must wear serviceable CVC helmets or equivalent. Personnel within 115 feet (35 m) of vehicle during firing of the installed weapon must wear hearing protection.

**WARNINGS**



**HEAVY PARTS**

Before elevating, depressing, or traversing CROWS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS may cause injury to personnel and damage to equipment.

After completion of the BIT, CROWS performs sight calibration. During calibration, the SSA moves to the upper left, lower right, and center. To avoid injury, ensure that personnel are clear of the WS during system startup.

Personnel must be clear of the installed weapon before exiting boresight mode since the WS immediately elevates. To prevent injury to personnel, ensure that adequate communication occurs while boresighting the installed weapon.

Operate CROWS at the slowest speed while performing the Boresighting Procedure to prevent injury to personnel and damage to equipment.

To prevent injury to personnel or damage to equipment, ensure CROWS is clear of obstacles before powering up.

Personnel must stay clear of Bolt when Weapon is charged and fired to avoid possible injury.

Ensure no power is applied while performing BEFORE and AFTER PMCS operating procedures on system unless instructed to do so. Failure to do so may result in personal injury and equipment damage.

Shut CROWS down prior to exiting vehicle to prevent injury to personnel and damage to equipment.

If Cocking Actuator Arm is extended on power up, CROWS retracts it possibly injuring personnel. Ensure that personnel are clear of WS when starting CROWS.

**GENERAL SAFETY WARNINGS DESCRIPTION - Cont**

**WARNING**



**HOT AREA**

Chamber may be hot. Use caution when inspecting T-slot to avoid burns.

**WARNING**



**LASER LIGHT**

The Laser Range Finder is classified as a Class 1 Laser Device and is safe in normal operating conditions, but failure in the electrical system can cause the laser to violate safety requirements. Do not point at humans or stare into the laser beam under any circumstances as this can cause serious eye injury.

**WARNING**



**SHARP OBJECT**

The Ammunition Insertion Cassette (AIC) has sharp metal edges. Wear Work Gloves (WP 0051, Item 7) when installing AIC to prevent injury.

**WARNINGS**



**WEAPON FIRE**

To prevent death or injury to personnel and damage to equipment, do not rely only on software to detect Safety Zones. Ensure activation of Safety Zones is visually verified and that personnel and equipment are clear before firing or traversing CROWS.

Do not initiate REMOTE SAFE during firing. Doing so may result in damage to the Primary Weapon and severe injury to personnel.

Ensure that the installed weapon is clear of ammunition before loading weapon. Accidental firing of weapon can kill or injure personnel.

Ensure that the installed weapon is aimed in a safe direction and that no personnel or equipment are in the Line of Fire. Doing so prevents death or injury to personnel and damage to equipment.

All personnel must leave WS area immediately after weapon is loaded to avoid possible injury.

When CROWS is powered off, REMOTE SAFE deactivates. Check the condition of the installed weapon before powering off to prevent injury to personnel.

If SAFETY OVERRIDE (OVRD) LED illuminates or if SAFETY OVERRIDE appears on screen when SAFETY OVRD switch is OFF, SAFETY OVRD function has failed, and CROWS is in SAFETY OVRD mode. Immediately power down CROWS and report CROWS deadline for maintenance action. Accidental operation in SAFETY OVRD mode may cause injury or death to personnel.

Avoid prolonged use of LRF to reduce risk of detection by an enemy using Night Vision Goggles (NVGs). The infrared beam is more visible to an enemy using NVGs in smoke, fog, or rain.

To prevent death or serious injury to personnel caused by discharge of weapon, ensure all firing range safety procedures are followed.

Boresighting must be performed before firing weapon if weapon has been removed from CROWS since last time boresighting was performed. This applies if same weapon is reinstalled or if a new weapon is installed. If boresighting is not performed, misalignment may exist between weapon and sight system. Failure to align weapon properly may cause injury or death to personnel and damage to equipment.

To prevent death or injury to personnel and damage to equipment, vehicle crew must report to Field Maintenance if SYSTEM ARMED LED remains illuminated when SYSTEM ARM/SAFE switch is set to SAFE.

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator moves when connecting Firing Solenoid Cable possibly injuring personnel.

Before installing solenoid, ensure that weapon is clear of ammunition and that M2 bolt is in forward position. Doing so prevents accidental firing of weapon and serious injury or death to personnel.

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

**GENERAL SAFETY WARNINGS DESCRIPTION - Cont**

**WARNINGS**



**WEAPON FIRE - Cont**

When Bolt Latch Release and trigger are both held down on weapon, M2 machine gun fires automatically. Avoid accidental firing of weapon to prevent injury or death to personnel.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

The FCU or DCP and MPU are not completely water tight and must not be sprayed with a hose. Water inside FCU or DCP and MPU causes immediate or latent damage to fire control circuits. Water-damaged fire control circuits cause inadvertent or erratic weapon operation. To prevent death or injury to personnel and damage to equipment due to water-damaged fire control circuits, ensure the FCU or DCP and MPU are bagged prior to cleaning hull interior with a hose.

Ensure first round is held in place by Belt-Holding Pawls. If first round is positioned against Round Positioning Block (to extreme right), first press of Charge Button chambers round, and accidental firing could result. Accidental firing of weapon can kill or injure personnel.

Do not power down system until firing has stopped and weapon has been cleared to prevent injury to personnel and damage to equipment.

Prior to performing troubleshooting, maintenance, or embedded training procedures, ensure the installed weapon is not loaded. Failure to do so may result in death or injury to personnel.

If a message is displayed on screen in red text, a system failure has occurred, and CROWS can no longer function properly under remote control. Manually operate CROWS to finish engagement before attempting to resolve this failure condition. Failure to do so may result in death or injury to personnel and/or damage to equipment.

Attempt to stop firing by activating REMOTE SAFE; however, REMOTE SAFE cannot always place the installed weapon in a safe position, and damage to equipment may result. Approach any weapon that has malfunctioned with extreme caution and ensure all personnel are under armor protection to prevent death or injury to personnel.

### EXPLANATION OF HAZARDOUS MATERIALS ICONS



CHEMICAL - drops of liquid on hand shows that material will cause burns or irritation to human skin or tissue.



EYE PROTECTION - person with goggles shows that material will injure eyes.



FIRE - flame shows that a material may ignite and cause burns.



VAPOR - human figure in a cloud shows that material vapors present a danger to life or health

### HAZARDOUS MATERIALS DESCRIPTION

#### WARNING



#### CLEANING SOLVENTS

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash exposed area immediately with soap and water.



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Original            30 October 2009

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 40 AND TOTAL  
NUMBER OF WORK PACKAGES IS 51, CONSISTING OF THE FOLLOWING:

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**TECHNICAL MANUAL**

**HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 30 OCTOBER 2009**

**OPERATOR'S MANUAL**

**FOR THE**

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PN 60201886-01  
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**HOW TO USE THIS MANUAL**

This manual contains all operator maintenance level descriptive, operational, troubleshooting, and maintenance information required to operate and maintain the Common Remotely Operated Weapon Station II (CROWS).

The manual is divided into chapters and each chapter is divided into work packages to group similar topics together. Pages are numbered consecutively within each work package. Each page number is prefixed with a work package number. For example, page nine of WP 0003 is numbered 0003-9. This manual consists of the following chapters:

- Chapter 1 General Information, Equipment Description, and Theory of Operation
- Chapter 2 Operation Instructions
- Chapter 3 Troubleshooting Procedures
- Chapter 5 Preventive Maintenance Checks and Services (PMCS)
- Chapter 5 Maintenance Instructions
- Chapter 6 Supporting Information

Each table in this manual is preceded with an introduction explaining the table format, content, and use.

This manual has a Table of Contents and an alphabetical subject index. The Table of Contents beginning on page ii is a detailed listing of contents in this manual. The alphabetical subject index at the back of the manual lists information available by subject matter. If the subject matter is known, then find the subject, and it will indicate the work package for that subject.

Throughout this manual you will see "WARNING," "CAUTION," and "NOTE." The information in them should be strictly observed. In addition to these specific items, common sense and good safety practices should be followed.

**HOW TO USE THIS MANUAL – Cont**

**WARNING**

Highlights an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in injury to or death of personnel.

**CAUTION**

Highlights an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

**NOTE**

Highlights an essential operating or maintenance procedure, condition, or statement.

Illustrations are provided throughout this manual to support procedures and assist in identifying parts.

## **CHAPTER 1**

# **GENERAL INFORMATION, EQUIPMENT DESCRIPTION, AND THEORY OF OPERATION**



---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
GENERAL INFORMATION**

---

## **SCOPE AND PURPOSE**

This technical manual (TM) provides operator-level instructions for the operation and maintenance of the Armament Subsystem, Remotely Operated: XM153 (CROWS). The TM contains technical information including procedural instructions, safety information, equipment specifications, and general descriptions of component construction. The purpose of the manual is to provide the basic knowledge required for the operation and preventive maintenance of CROWS.

The Unit Commander is responsible to assure that all requirements in this TM are accomplished. Therefore, the Commander has authority to grant waivers to deviate from these requirements as necessary to accomplish unit mission. In doing so, the Commander must accept all consequences of those actions.

## **MAINTENANCE FORMS AND REPORTS**

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-751, Functional Users Manual for the Army Maintenance Management Systems-Aviation (TAMMS-A) or AR 700-138, Army Logistics Readiness and Sustainability. Accidents involving injury to personnel or damage to equipment will be reported on DA Form 285, U.S. Army Accident Report, in accordance with AR 385-10, The Army Safety Program. Explosives and ammunition malfunctions will be reported in accordance with AR 75-1, Malfunctions Involving Ammunition and Explosives (RCS CSGLD 1961 (MI)).

## **REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)**

If your CROWS needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368, Product Quality Deficiency Report (PQDR). The PQDR can be completed via the internet at <https://aeps.ria.army.mil/aepspublic.cfm>. Select "Submit Quality Deficiency Report" under "Public Applications." Alternatively, the PQDR can be mailed to us at: U.S. Army Tank-automotive & Armaments Command, ATTN: AMSTA-CIP-W, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. We'll send you a reply. Instructions for preparing EIRs are provided in DA PAM 738-751.

## CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is of continuing concern. It is important that any corrosion problems with items contained in this technical manual be reported so the problem can be corrected and improvements made to prevent the problem in the future.

While corrosion is typically associated with the rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Corrosion problems may also include unusual cracking, softening, swelling, or breaking of these materials.

Report a corrosion problem by using SF 368, Product Quality Deficiency Report. Submit the form to: Commander, U.S. Army Tank-automotive & Armaments Command, ATTN: AMSTA-QAD, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. Use of keywords such as corrosion, rust, deterioration, or cracking will assure that the information is identified as a CPC problem.

### Corrosion Control

Corrosion is the deterioration of material by reaction to the environment. Corrosion accrues because of the natural tendency of most materials to return to their natural state: iron, for example, will revert to iron oxide in the presence of moist air. Corrosion or the deterioration of material starts the instant the fabrication or manufacturing process is completed and continues until the material is exhausted. Corrosion products take on many different colors depending on the metal and type of corrosion. Everybody knows red rust; but corrosion can also be white, gray, blue, yellow, green, black, etc.

**Uniform corrosion** affects a large area of exposed metal surface, like rust on steel or tarnish on silver, gradually reducing the metal thickness until it becomes too weak to support and fails.

**Crevice corrosion** occurs in crevices and is created by rubber seals, gaskets, bolt heads, tap joints, dirt, or other surface deposits. Crevice corrosion develops anywhere moisture or another corrosive agent is trapped and unable to drain or evaporate.

**Selective leaching** can create holes in metal. This type of corrosion happens when one element, usually the anodic element of an alloy, corrodes away, leaving the cathodic element.

**Erosion** is the result of a moving fluid across a metal, particularly when solid particles are present in the fluid. Corrosion occurs on the surface of the metal, but the moving fluid washes away the corrosion produced and exposes a new metal surface which also corrodes.

**Intergranular corrosion** is metal deterioration caused by corrosion of the bonds between or across the grain boundaries of a metal. Metal appears to be peeling off in sheets, flaking, or pushed apart in layers.

**Exfoliation** is a particular type of intergranular corrosion.

**Stress** is cracking or fatigue.

**Pitting** results from conditions similar to those for crevice corrosion. Pits can develop on various materials due to their composition. Pitting appears on rifle bores, for example.

**Galvanic corrosion** occurs when two different kinds of metals touch like steel bolts on aluminum.

**Fretting** is usually identified by a black powder residue or pits on the surface. Fretting occurs between two pieces of weight-bearing metal in contact with each other.

### **Corrosion Prevention/Control Program**

An appropriately exercised corrosion prevention/control program will disclose the corrosion attack while still in the early stages. The following paragraph outlines preventive maintenance necessary to retard corrosion of armament systems, subsystems, their components, and peculiar ground support equipment.

Minor maintenance will correct corrosion while advanced attacks will require extensive maintenance for repair. Preventive maintenance is the most effective, least costly, and time consuming method of corrosion control. Frequent cleaning is necessary to remove corrosive agents that are continually being deposited on metal surfaces and to remove any products that may accelerate the corrosion process.

Preventive maintenance includes the following specific functions as they relate to corrosion,:

1. An adequate cleaning program.
2. Detailed inspection program.
3. Treatment of corrosion as it occurs.
4. Restoration or touch-up of protective finishes.
5. Clean up of corrosive spills such as acids, salts, etc.
6. Periodic lubrication.
7. Application of supplementary preservative coating as necessary.
8. Proper handling and storage of components.

Additional information regarding approved materials and procedures for general control and prevention of corrosion on equipment is provided in TM 1-1500-344-23, Cleaning and Corrosion Control.

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**CORROSION PREVENTION AND CONTROL (CPC) - Cont****DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE**

To prevent enemy use, demilitarize the CROWS and associated equipment by mutilating, melting, cutting, tearing, scratching, crushing, breaking, punching, detonating, neutralizing, etc. As an alternative, use burial or deep water dumping when authorized. Demilitarization is conducted to prevent the further use of military offensive or defensive equipment for its originally intended military or lethal purpose and applies equally to material in use advantages inherent in certain types of equipment.

The use of precision-cutting torch fixtures, precision-cutting saws, or precision tools of any kind to minimize mutilation is forbidden. Crushing to the extent that the item is flattened and completely destroyed is the preferred method of mutilation. The cutting torch is the most thorough, but it is also the most time-consuming demilitarization method.

The following are specific procedures for demilitarization of the CROWS. Key points to be mutilated have been designated, and methods for accomplishment of demilitarization are prescribed. The provisions of this paragraph are applicable to all levels of maintenance.

Cut bomb racks in two places diagonally, and crush electrical/mechanical release mechanisms. Demilitarize ammunition magazines and chute assemblies, electronic components, control panels, and sights by cutting, breaking, crushing, melting, or dumping at sea.

For additional instructions pertaining to destruction of Army materiel to prevent enemy use, refer to TM 750-244-1-5 and DoD 4160.21-M.

**PREPARATION FOR STORAGE OR SHIPMENT**

The unit package quantity shall be one each CROWS as required. A unit package shall be so designed and constructed to ensure that there is no damage to the item through shipping, handling, and storage sequences. The outermost component of the unit package shall be a wood box or equivalent container. All shipping containers shall be the most cost effective and shall be of the minimum cube to contain and protect the items. The shipping container (including any necessary blocking, bracing, cushioning, or waterproofing) shall comply with the regulations of the carrier used and shall provide safe delivery to the destination at the lowest tariff cost. The shipping container shall be capable of multiple handling, stacking at least ten feet high, and storage under favorable conditions (such as enclosed facilities) for a minimum of one year.

Unless otherwise specified, cleaning and drying shall be in accordance with paragraph 5.2.1 of MIL-STD-2073-1. Weights and sizes are estimated and may vary slightly. Intermediate packaging and packing will be in accordance with specification MIL-STD-2073-1 or as otherwise specified hereon.

All non-manufactured wood used in packaging shall be heat treated to a core temperature of 56 degrees Celsius for a minimum of 30 minutes. The box/pallet manufacturer and the manufacturer of wood used as inner packaging must be affiliated with an inspection agency accredited by the board of review of the American Lumber Standard Committee. The box/pallet manufacturer and the manufacturer of wood used as inner packaging shall ensure tractability to the original source of heat treatment. Each box/pallet shall be marked to show the conformance to the International Standard for Phytosanitary Measures (ISPM), no. 15. Boxes/pallets and any wood used as inner packaging made of non-manufactured wood shall be heat-treated. The quality mark shall be placed on both ends of the outer packaging, between the end cleats or end battens of natural wood boxes and on two sides of the pallet. Foreign manufacturers shall have the heat treatment of non-manufactured wood products verified in accordance with their national plant protection organization's compliance program.

In addition, wood used as dunnage for blocking and bracing to secure items in ISO containers shall be ALSC certified. The dunnage shall either be ordered with the required ALSC marking for dunnage or the markings may be applied at the packaging facility at two foot intervals.

All unit packages, intermediate packs, exterior shipping containers, and unitized loads (if applicable) shall be marked in accordance with MIL-STD-129P, Change 4, Standard Practice for Military Marking for Shipment and Storage, 19 September 2007. The contractor is responsible for application of special markings as discussed in the Military Standard regardless of whether specified in the contract or not. Special markings include, but are not limited to, shelf-life markings, radioactive content as required by CFR 49, structural markings, and transportation special handling markings. Bar code markings are not required. The marking of pilferable and sensitive materiel will not identify the nature of the materiel. Unless otherwise specified, shipments shall have the address markings applied to the identification marked side of the exterior shipping container or to the unitized load markings. The following shall be marked, "FROM: name and address of consignor and TO: name and address of consignee."

Shipments shall be unitized in the most cost effective and efficient manner possible providing that the unitization configuration is stable and easily transported.

## LIST OF ABBREVIATIONS/ACRONYMS

Refer to the Glossary at the end of this manual for definitions of acronyms, abbreviations, and terms used in this manual. For convenience, a brief list of abbreviations and acronyms follows:

AIC	Ammunition Insertion Cassette
AUX	Auxiliary
AZ	Azimuth
BIT	Built-in-Test
CA	Cocking Actuator
CAL	Calibrate
CCD	Charge Coupled Device
CCW	Counterclockwise
CG	Control Grip

**LIST OF ABBREVIATIONS/ACRONYMS - Cont**

CHG	Charge
CROWS	Common Remotely Operated Weapon Station
CW	Clockwise
D	Down
DCP	Display and Control Panel
EL	Elevation
F	First
FCS	Fire control SW (system)
FCU	Fire Control Unit
FOV	Field of View
FPGA	Field Programmable Gate Array
HIU	Hatch Interrupt Unit
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
ID	Identification
IR	Infrared
JERRV	Joint Explosive Ordnance Disposal Rapid Response Vehicle
L	Left
LBS	Laser Borelight System
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LRF	Laser Range Finder
LRU	Line Replaceable Unit
LSSA	Left Side Support Assembly
M2	Machine gun, .50 Caliber, Browning M2, Heavy Barrel
M240B	7.62mm machine gun
M249	5.56mm Machine Gun
MASC	Multi Adapter, Small Caliber
MFA	Main Frame Assembly
MK19	40mm Automatic Grenade Launcher
MLT	Multiple Targets
MPI	Mean Point of Impact
MPU	Main Processing Unit
NBC	Nuclear, Biological and Chemical
NFOV	Narrow Field of View
NFZ	No Fire Zone
NIR	Near Infrared
NORM	Normal
NTZ	No Traverse Zone

NVG	Night Vision Goggles
OVRD	Override
PISC	Programmable Interface and Servo Controller
PLRT	Polarity
R	Right
RDY	Ready
RSSA	Right Side Support Assembly
RTCL	Reticle
RWS	Remote Weapon Station
S	Second
SBC	Single Board Computer
SEL	Select
SM	Soft Mount
SMA	Soft Mount Assembly
SSA	Sight Servo Assembly
SW	Software
TM	Technical Manual
TIM	Thermal Imaging Module (IR sight/sensor)
TFT	Thin Film Transistor
TNG	Training
TRP	Target Reference Points
U	Up
VIM	Visual Imaging Module (day sight/sensor)
WS	Weapon Station
Z	Displayed when Sight Zeroing values are included in the ballistics calculations

### **QUALITY ASSURANCE/QUALITY CONTROL (QC/QC)**

Refer to TM 750-245-4 for QA/QC information.

### **SAFETY, CARE, AND HANDLING**

The CROWS, weapons, ammunition, and ancillary equipment shall be handled, maintained, and operated in accordance with all approved safety and operational requirements. Any questions regarding safety, operation, or maintenance shall be addressed to the approval local appointed authority.

**SAFETY, CARE, AND HANDLING - Cont**

The CROWS incorporates a number of safety features. Observation of all safety precautions is MANDATORY at all times. Read the Warning Summary, provided inside the front cover of this manual, and the system specific TM before operating this system. Never work on electronic equipment unless there is another person nearby who is competent in administering first aid and is familiar with the operation and hazards of the equipment. The following general safety precautions are not related to any specific equipment or procedure and do not appear elsewhere in the manual. All concerned personnel must understand and apply these precautions during operation and maintenance of the equipment.

1. All personnel who supervise or perform work in connection with the handling of munitions will be familiar with the instructions and directives of the commands concerned.
2. All personnel must read the How to Use this Manual section before using the procedures contained within.
3. All concerned personnel will become familiar with the armament system and support equipment before undertaking any operation or procedure. All concerned personnel will read the complete operation or procedure thoroughly before starting to assure complete understanding by all involved.
4. All personnel must understand that observance of all safety precautions which apply to any specific equipment will be ineffective unless all safety precautions which apply to its related equipment are also observed at the same time.
5. Safety devices will always be used to minimize the possibility of accidents. Safety devices will be kept in good operating order.
6. Remove all jewelry and exposed metal objects from body and clothing before performing maintenance, adjustments, and/or troubleshooting to prevent personal injury.
7. Use and disposal of flammable and toxic materials will be in accordance with applicable regulations.

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL**  
**FOR THE**  
**ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153**  
**COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**  
**EQUIPMENT DESCRIPTION AND DATA**

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## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

### General System Description

The Common Remotely Operated Weapon Station (CROWS) is a Weapon Mount Turret that adapts to four standard weapons, the M2, MK19, M240, and M249. Designed to be mounted on top of a variety of combat vehicles, CROWS is remotely controlled by an Operator located inside the vehicle compartment. Remote operation provides armored protection from direct enemy fire.

CROWS is available in two configurations, FCU or DCP. The FCU configuration houses the display, controls, and processing technology within the Fire Control Unit (FCU) and is the original CROWS configuration. The DCP configuration allows CROWS to be mounted in vehicles with limited space and separates the display and controls (DCP) from the Main Processing Unit (MPU).

The FCU Configuration (NSN 1090-25-160-1150) is comprised of a Weapon Station (WS) (1), a computerized Fire Control Unit (FCU) (7), and a Control Grip (CG) (4) with Displacement Joystick (Figure 1). The FCU Configuration is interconnected with the following external cables: Cable W11 (2) and Fuse Box (3) connect FCU (7) to power source, Cable W1 (5) connects FCU (7) to CG (4), and Cables W3 (6) and W2 (8) connect FCU (7) to WS (1).

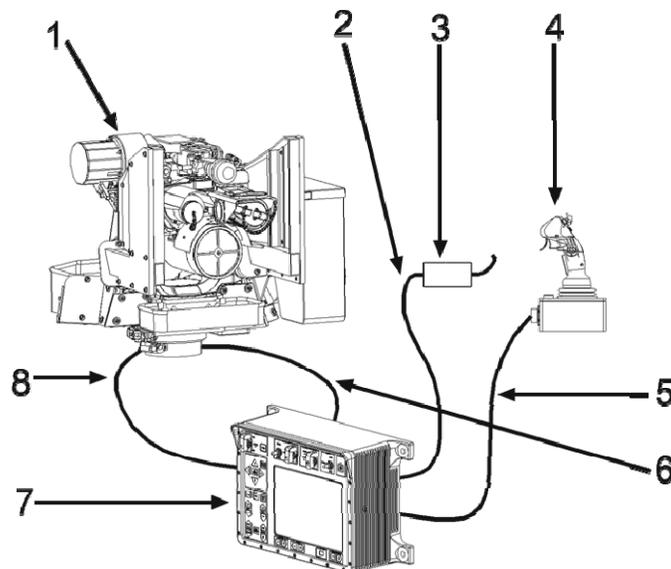
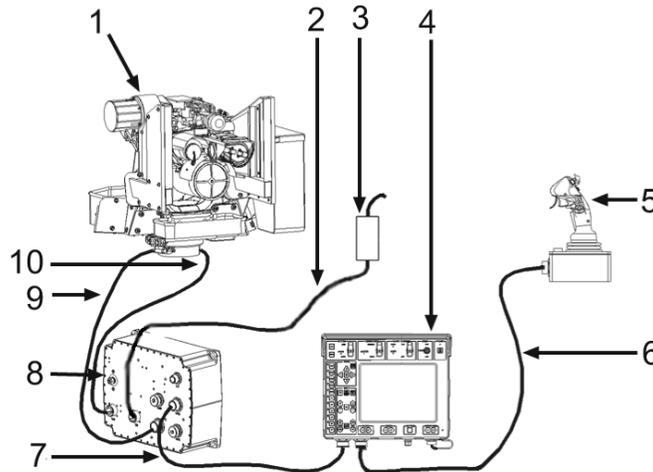


Figure 1. Major Components of FCU Configuration.

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - Cont

### General System Description - Cont

The DCP Configuration (NSN 1090-25-160-1292) is comprised of the WS (1), the Display and Control Panel (DCP) (4), the Main Processing Unit (MPU) (8) and a Control Grip (CG) (5) (Figure 2). In this configuration, CROWS components are connected as follows: Cable W11 (2) and Fuse Box (3) connect MPU (8) to power source, Cable W1 (6) connects DCP (4) to CG (5), Cables W2 (9) and W3 (10) connect MPU (8) to WS (1), and Cable W504 (7) links MPU (8) to DCP (4).



**Figure 2. Major Components of DCP Configuration.**

With the display and CG provided, the Operator controls elevation, depression, and 360-degree rotation of the installed weapon which can be loaded, cocked, and fired remotely. A stabilization system enables CROWS to track and engage targets if the Host Vehicle or other platform is in motion. Tracking and control capabilities ensure a high first-round hit probability against stationary or moving targets.

### CROWS Capabilities and Features

CROWS characteristics, capabilities, and features include:

Adaptability to the M2 .50 caliber machine gun, the MK19 40mm Machine Gun, the M240 7.62mm Machine Gun, or the M249 5.56mm Machine Gun.

Ability to traverse a full 360 degrees under power at an adjustable rate of 20 degrees to 90 degrees per second.

Powered elevation at a rate of 80 degrees per second.

Manual operation capability for WS positioning and firing of the installed weapon during power loss.

Integrated Fire Control Unit (FCU) or Display and Control Panel (DCP) and Main Processing Unit (MPU).

Elevation range of -20 degrees to +60 degrees.

Operation under armor protection.

Day and night sighting systems.

#### Four-Axes (2+2) Servo System

CROWS is designed with a four-axes servo system consisting of:

Elevation and Azimuth axes for WS line of bore.

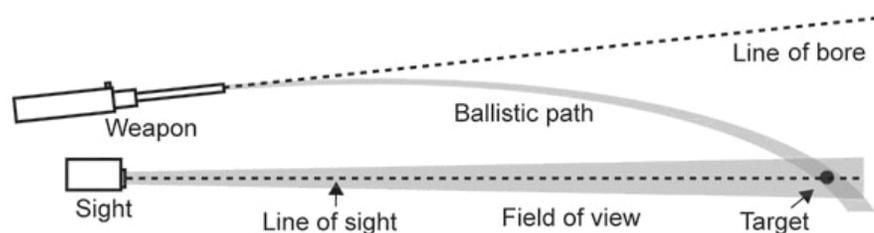
Elevation and Azimuth axes for Sight Sensor Assembly (SSA) line of sight.

The systems function as follows:

The Sight Servo Assembly (SSA) moves the optical sensors +/- 10 degrees in the azimuth axis and +/- 15 degrees in the elevation axis relative to the line of bore. This movement allows the system to compensate for the ballistics of the weapon (i.e., super elevation and drift). The principle of the four-axes system is equivalent to adjusting the sights on a regular weapon (Figure 3).

As opposed to a two-axes system where the sight always points in the direction of the line of bore, the four-axes system allows the user to zoom in on the target for identification prior to engagement. The main advantage is that the target remains in the center of the screen while the operator zooms in on the target without moving the entire WS.

The weapon and sight (sensor) axes move independently from each other (within limits).



**Figure 3. Four-Axes Servo System.**

The ballistic angles are calculated using ammunition type, range to target, and pitch and roll of the sight axis relative to ground plane (measured using a built-in inclinometer). Each time the target range changes, a new ballistics calculation is performed. Ballistics tables are used to find the super elevation and drift angles. Compensation for parallaxes and sideways tilt are then added.

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - Cont

### CROWS Capabilities and Features - Cont

The parallax calculations account for the vertical and horizontal parallax of both optical sensors relative to the installed weapon. Finally, the zeroing value is added to the ballistics value. The Servo Controller System implements the resulting correction angles.

#### Stabilization

Stabilization of the WS gives CROWS a Fire-On-The-Move capability. This capability allows CROWS to engage targets if the Host Vehicle or other platform is moving across varying terrain under battlefield conditions.

CROWS is a vector-stabilized system, i.e., the Weapon Barrel retains its initial angular position relative to a selected target regardless of changes to azimuth and elevation caused by movement of the Host Vehicle or other platform. CROWS operates in two modes, stabilized or non-stabilized, selected via CG. The CG Palm Switch activates stabilization from stabilization standby mode and ensures safe and reliable movement of the turret. The current mode of stabilization appears on screen.

The difference between the two stabilization modes is:

Non-stabilized mode – Weapon and sensor axis orientations are coupled to vehicle movements.

Stabilization mode – Weapon and sensor axis orientations are decoupled from vehicle movements.

In both modes, the Operator controls orientation of sighting devices via CG; however, in stabilization mode, the WS remains on target regardless of varying terrain (Figure 4).

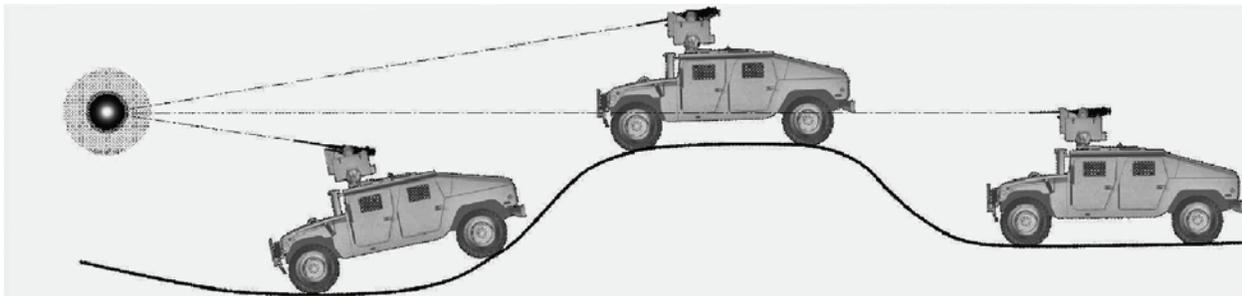


Figure 4. Stabilization Mode.

### Lead Angle Compensation

Lead Angle Compensation helps to engage a moving target and increase first-hit probability.

The ballistic angles are calculated based on ammunition type, range to target, and the pitch and roll of the sight axis relative to the ground plane (measured using the built-in inclinometer). Each time the target range changes, CROWS performs a new ballistic calculation and adjusts super elevation and drift. Vehicle velocity is not used in the calculations.

At power-up, Lead Angle Compensation is off by default but can be enabled by a CG button. When Lead Angle Compensation is enabled, LEAD ANGLE ON appears in Lead Angle Field on screen. When limit of compensation is reached, LEAD ANGLE LAG is displayed in Lead Angle Field.

When lead angle is larger than field of view (FOV) of camera, ZOOM OUT displays on reticle. This means hit point is outside visibility.

### Wind Compensation

CROWS allows the Operator to enter wind speed and direction and compensates for these variables in the ballistic calculation.

### Target Tracking

Target Tracking enables CROWS to automatically track a target based on image processing from the selected video source (either VIM or TIM). Target Tracking tracks objects in azimuth and elevation allowing the servo system to keep sight and weapon aimpoint fixed on the target. This permits to gunner to more precisely place the aimpoint before firing.

### Image Stabilization

CROWS can stabilize the image provided by the daylight and thermal sensors (VIM and TIM) to compensate for vehicle movement and firing of the installed weapon. Image Stabilization continuously moves the objective (target) to the center of the screen and suppresses structural vibrations that can otherwise blur the image when a narrow field of view (FOV) is in use. Black edges can appear on screen when the video is stabilized to compensate for missing video information.

**EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - Cont****CROWS Capabilities and Features - Cont**Modes of Operation

CROWS functions in the following operational modes (Table 1):

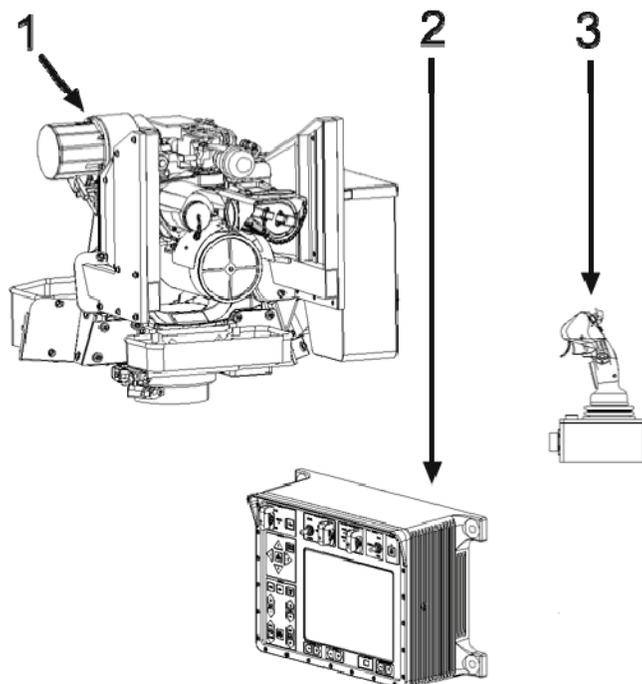
**Table 1. Operational Modes.**

<b>Mode</b>	<b>Description</b>
<b>Normal Mode</b>	CROWS operates from the CG and FCU/DCP in Normal Mode, set by means of the mode functions. All commands and actions are operated from inside vehicle. In Normal Mode, continuous BIT runs, and any system anomalies are identified and reported on screen.
<b>CAUTION</b>	
The Elevation Release Mechanism, Azimuth Lock, and Elevation Lock must be released in manual mode to prevent damage to equipment. Ensure that the WS is in proper azimuth alignment before powering CROWS up and returning to Normal Mode (WP 0035).	
<b>Manual Mode</b>	CROWS can operate manually meaning the installed weapon is operated and fired from the vehicle by hand. CROWS is normally powered off in Manual Mode.
<b>Surveillance Mode</b>	In surveillance mode, the WS is super elevated approximately 15 degrees above the line of sight. If CROWS is armed, surveillance mode is not available.
<b>Travel Mode</b>	Travel Mode is used when the WS is not in use (powered off) and the vehicle is moving. In this position, the WS points forward with maximum depression in the elevation axis and is locked by the azimuth and elevation travel locks. The Clamp Assembly is also installed.
<b>Auxiliary Mode</b>	In Auxiliary mode, external video input is selected. The Servo Control System freezes Weapon Station movement, and the system goes to SAFE with firing inhibited.
<b>Embedded Training Mode</b>	This mode is not implemented.

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS**

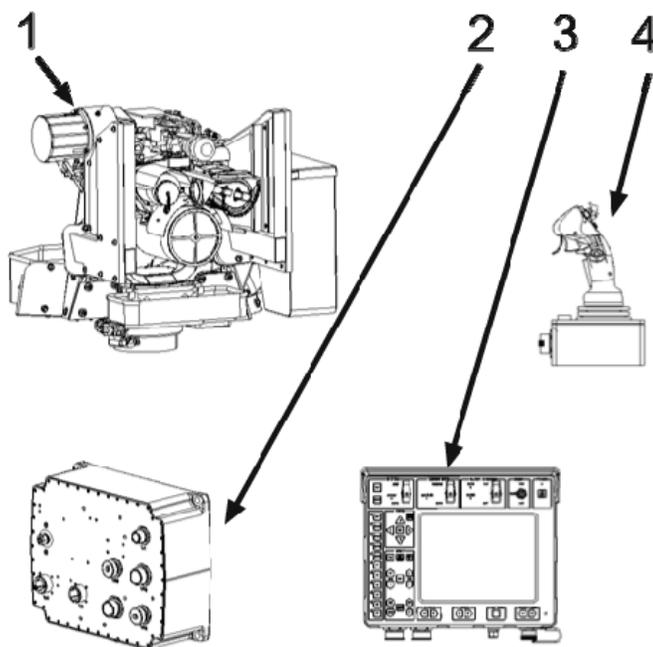
CROWS is available in two configurations, FCU and DCP.

When provided in the FCU Configuration (NSN 1090-25-160-1150), CROWS consists of three major assemblies (Figure 5): the Weapon Station (WS) (1), Fire Control Unit (FCU) (2), and Control Grip (CG) (3).



**Figure 5. Major Assemblies, FCU Configuration.**

When obtained in the DCP Configuration (NSN 1090-25-160-1292), CROWS consists of four major assemblies (Figure 6): Weapon Station (WS) (1), Main Processing Unit (MPU) (2), Display and Control Panel (DCP) (3), and Control Grip (CG) (4).



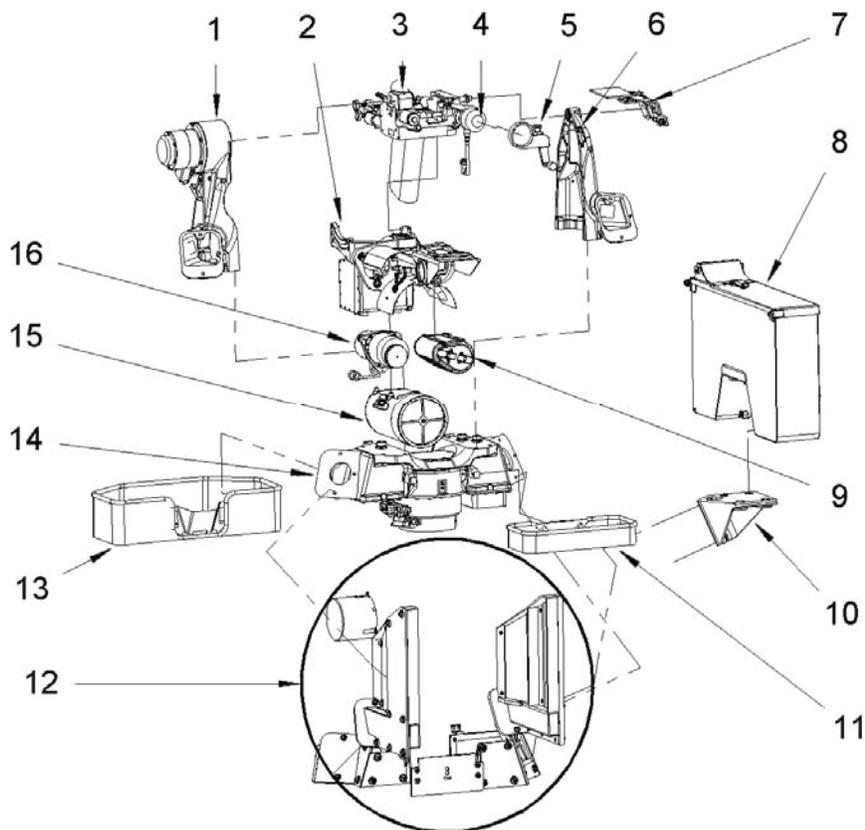
**Figure 6. Major Assemblies, DCP Configuration.**

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

### Weapon Station (WS)

When located in the approved position for a given vehicle, the WS is mounted on the outside of the vehicle and is operated remotely from inside vehicle. The WS accepts the M2 .50 Caliber Machine Gun, MK19 40mm Machine Gun, M240 7.62mm Machine Gun, or M249 5.56mm Machine Gun.

The WS (Figure 7) consists of these main components: Main Frame Assembly (14), Left Side Support Assembly (6), Right Side Support Assembly (1), Sight Servo Assembly (SSA) (2), Soft Mount (3), Cocking Actuator (4), Ammunition Box Assembly (8), Visual Imaging Module (VIM) (16), Thermal Imaging Module (TIM) (15), Laser Range Finder (LRF) (9), and Ballistic Protection (12).



**Figure 7. Weapon Station.**

In addition to the main parts, CROWS provides weapon adaption items to mount each compatible weapon: M2, MK19, M240, and M249. In addition, CROWS includes a Storage Bag to store these items with the system.

Descriptions of WS main parts and important subassemblies follow:

### Main Frame Assembly (MFA)

The MFA (Figure 8) rotates the WS 360 degrees on a Slip Ring (5). The MFA consists of a Frame (1), an Azimuth Travel Lock (6), mounting shoulders for the Ballistic Protection (3), and Hooks (2) and a Lock Spring (4) for front Casing Collector Bag (2) (Lock Spring and Hooks for rear Casing Collector Bag are not shown).

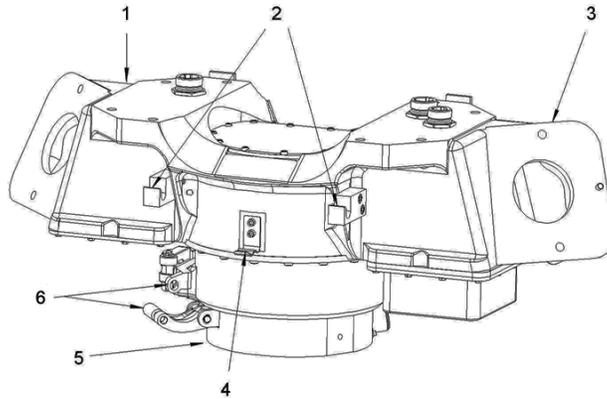


Figure 8. Main Frame Assembly.

### Left Side Support Assembly

The Left Side Support Assembly (Figure 9) attaches the left side of Soft Mount to the MFA and consists of a suspension (1) and a Mounting Shoulder (2). The Mounting Shoulder located at lower part of the assembly attaches the Ballistic Protection.

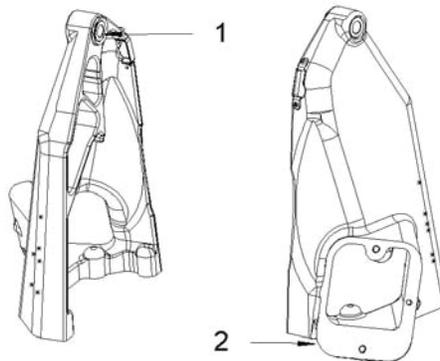
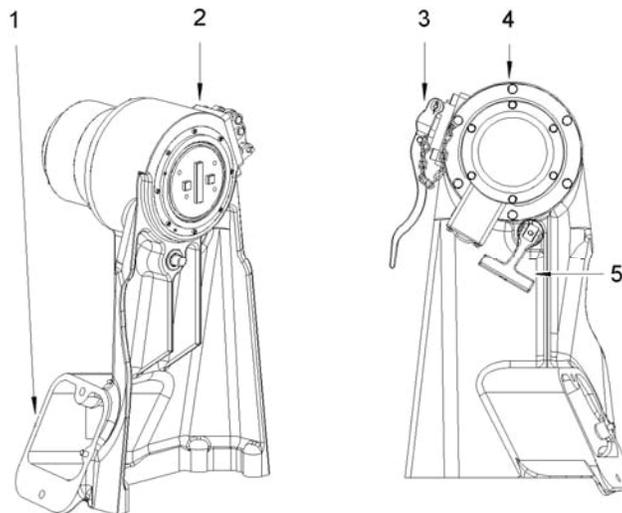


Figure 9. Left Side Support Assembly.

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Right Side Support Assembly**

The Right Side Support Assembly (Figure 10) attaches the right side of the Soft Mount to the MFA. It consists of a Mounting Shoulder for the Ballistic Protection (1), an Output Shaft (2), an Elevation Release Mechanism (3), the Servo Motor Housing (4), and an Elevation Transport Lock (5). The Servomotor and Gear (4) elevates the Soft Mount Assembly (with the installed weapon) and the Sight Servo Assembly (with the sensors) independently of the MFA.



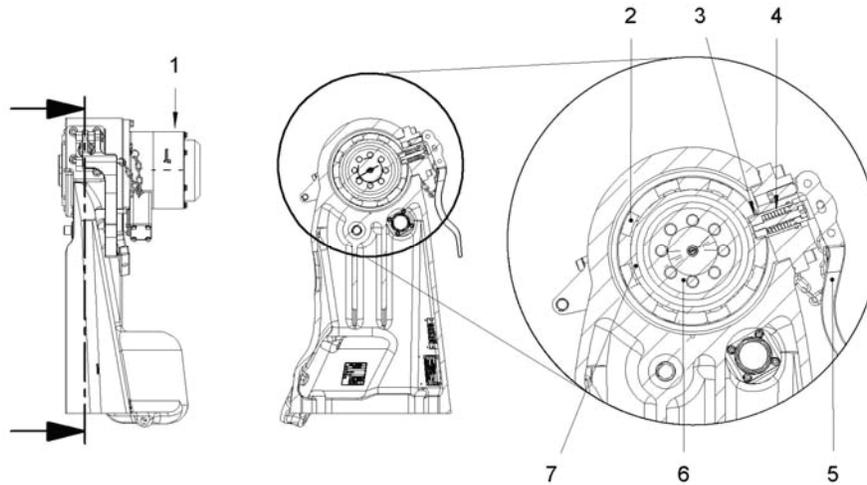
**Figure 10. Right Side Support Assembly.**

**Elevation Release Mechanism**

The Elevation Release Mechanism permits manual or remote operation of the installed weapon. The mechanism must be released prior to manual operation and engaged before remote operation.

The Elevation Release Assembly (Figure 11) consists of an External Bracket with a Release Arm (5) that is locked in position with a Lock Pin (3) secured to the Right Side Support Assembly with a chain. It is situated at rear of the Elevation Servo Motor (1).

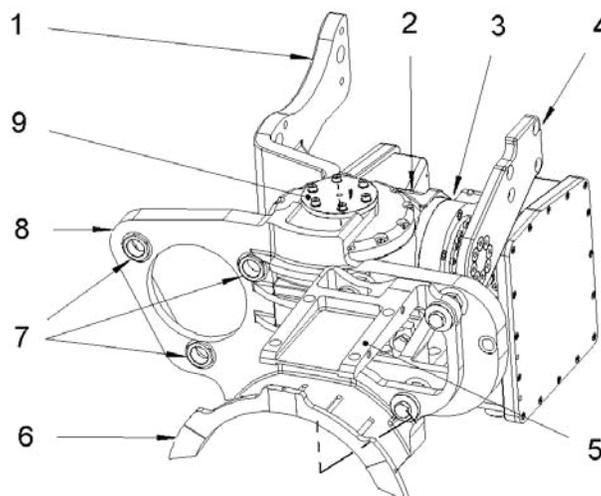
The Release Arm (5) is spring loaded and held in place with a tapered Lock Pin (3). It can be pivoted out (released) and in (engaged). The spring-loaded Latch Pin snaps into one of the eight latch holes of the Sleeve Coupling thus engaging the mechanism.



**Figure 11. Elevation Release Mechanism.**

**Sight Servo Assembly**

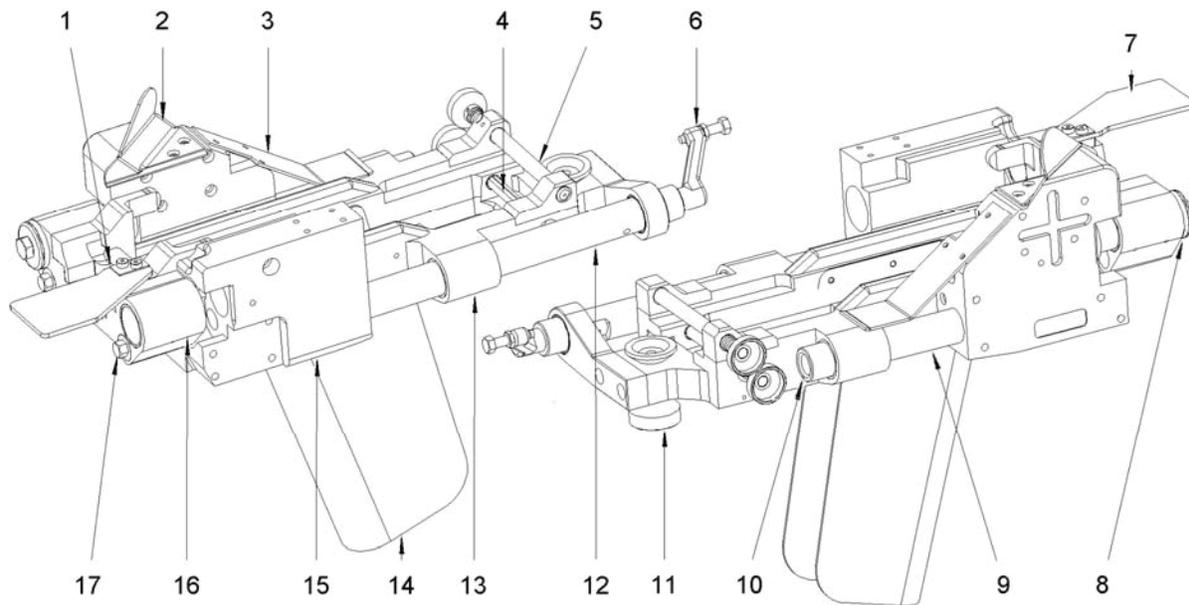
The Sight Servo Assembly (Figure 12) provides the elevation and azimuth control for the installed weapon and sensors by means of geared servomotors located inside. It also provides mountings for the three sensors: VIM, TIM, and LRF. The Sight Servo Assembly consists of a Right Bracket (1), Sight Servo Motor Housing (2), Elevation Servo (3), Left Bracket (4), LRF Mounting Bracket (5), Cable Guide (6), VIM Mounting (7), Sight Bracket (8), and Azimuth Servo (9).



**Figure 12. Sight Servo Assembly.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Soft Mount (SM)**

The Soft Mount (Figure 13) provides the mountings for the installed weapon on the WS and consists of these components: front Mounting for the M2 (1), Link Guide (2), Link Deflector (3), Rear Mounting Pin for M2 (4), Rear Mounting Pin for MK19 (5), Cocking Bracket Releaser (6), Link Cover (7), Front Rubber Buffers (8), the Right Sliding Spindle (9), Storage Position for Rear Mounting Pin (10), Straining Screw (11), Left Sliding Spindle (12), Internal Cradle (13), Sleeve Collector(14), External Cradle (15), Internal Cradle (16), and Screw Recoil Dampers (17).

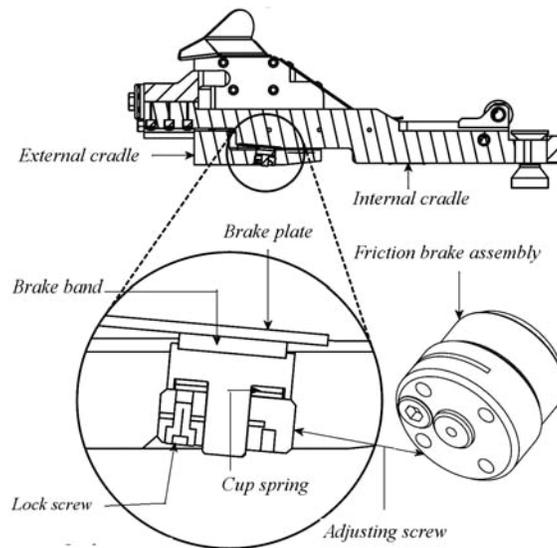


- 1042 -

**Figure 13. Soft Mount.****Friction Brake**

The Friction Brake (Figure 14) is a circular Friction Element (two brakes in total, one on left and one on right) located in the recesses underneath the external cradle. They apply a retarding force to the Internal Cradle.

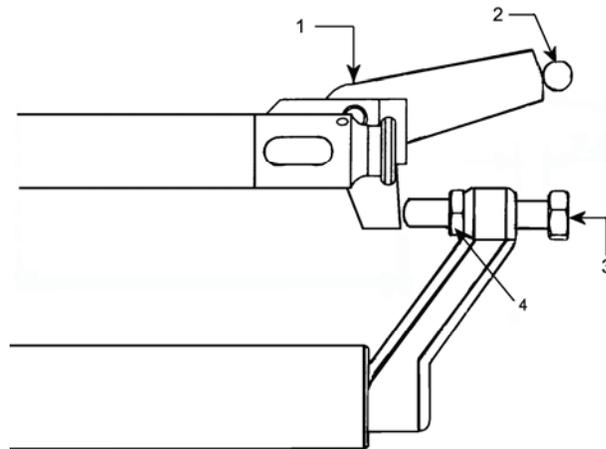
The Friction Element is applied by the compressive force of two cup springs (Belleville washers) per friction element against a Friction Band on the Brake pressing against a friction plate on the External Cradle during counter recoiling.



**Figure 14. Friction Brake.**

**Cocking Bracket Releaser**

The Cocking Bracket Releaser Assembly (Figure 15) is only required for operation of the M2 .50 caliber machine gun and is designed to release the Cocking Bracket (1) from the Cocking Bolt (2) at the correct moment after cocking the installed weapon. The assembly consists of an Adjustable Releaser (3) attached to the Releaser Arm on the rear part of the Left Sliding Spindle. It is locked by a counter Lock Nut (4).



**Figure 15. Cocking Bracket Releaser.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Sleeve Collector**

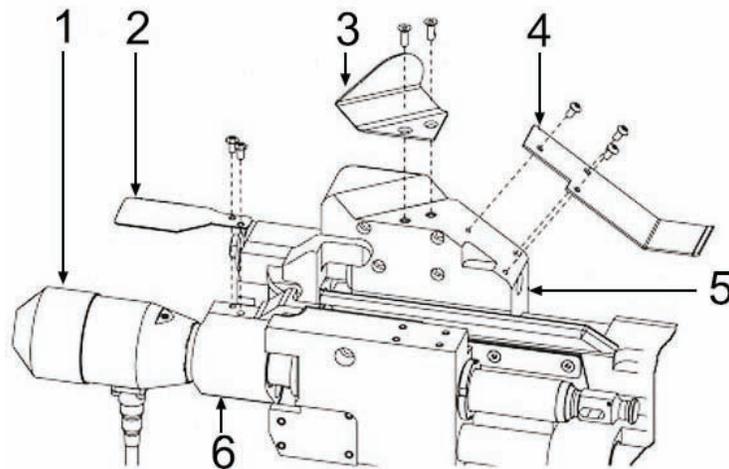
The Sleeve Collector (Figure 16) is made of rubber and glued to the inside surface of the Internal Cradle. The Sleeve Collector prevents spent cases from hitting the SSA.



**Figure 16. Sleeve Collector.**

**Link Guide, Link Deflector, and Link Cover**

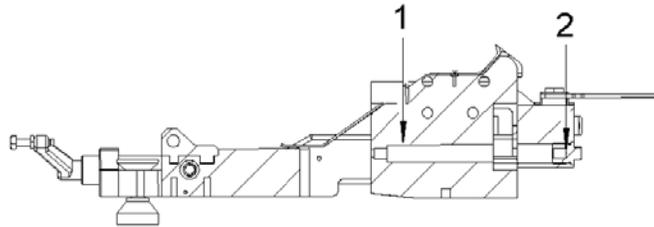
The Link Guide (3) (Figure 17) is fixed on top of the right side of the External Cradle (5) to guide the links down the Link Deflector (4). The Link Deflector (4) ejects the links from the Soft Mount. On the left side of the Internal Cradle (6) is a rubber Link Cover (2) which prevents the links from hitting the Cocking Actuator Motor (1).



**Figure 17. Link Guide, Link Deflector, and Link Cover.**

## Recoil Dampers

A Recoil Damper (2) runs through the Internal and External Cradles. It is comprised of a Recoil Damper Screw, Recoil Damper Rod and several cup-springs (1) (Figure 18).



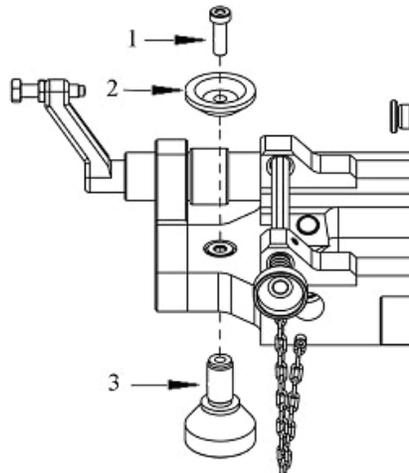
**Figure 18. Recoil Dampers.**

### NOTE

The Straining Screw is required for operation of the M2 .50 caliber machine gun and proper installation of the Multi-Adapter Small Caliber (MASC).

## Straining Screw

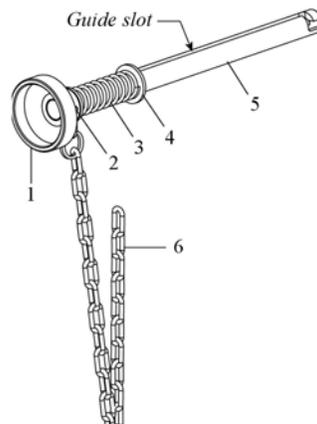
The Straining Screw (Figure 19) works from underneath the Internal Cradle up against the bottom plate of the M2. In order to minimize extensive play between the M2 and the mountings, a Straining Screw (1) is attached underneath the Internal Cradle and tightened against the bottom plate of the Receiver. It consists of a Bottom Screw (3) with a serrated, hand-operated Grip, a Tension Disk (2), and 1 x M6 Socket Head Lock Screw (1).



**Figure 19. Straining Screw.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Rear Mounting Pin**

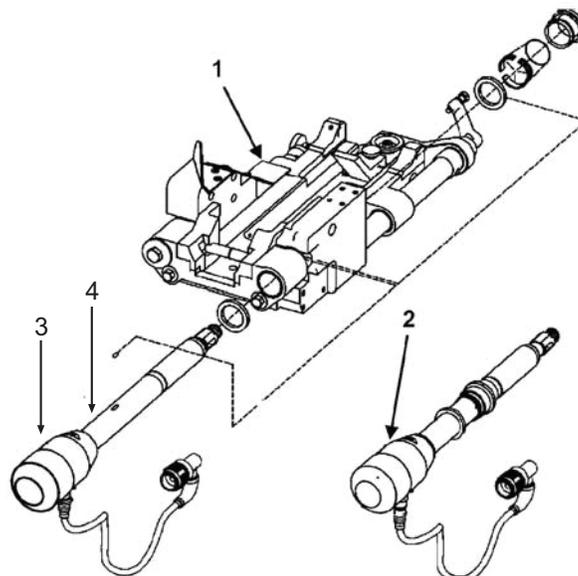
The Rear Mounting Pin Assembly (Figure 20) consists of a serrated, hand-operated Grip (1) with a Stop-Pin (2), Compression Spring (3), Stop Washer (4), Rod with Guide Slot and Locking Recess (5) and a Security Chain (6).



**Figure 20. Rear Mounting Pin.**

**Cocking Actuator (CA)**

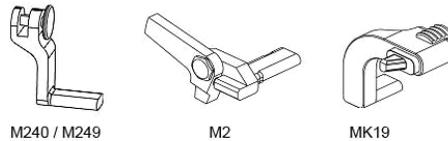
The Cocking Actuator (2) (Figure 21) is installed in the External Bracket (1) and consists of an Electric Motor (3) that forces the Cocking Rod (4) backward for remote cocking of the installed weapon.



**Figure 21. Cocking Actuator (CA).**

## Cocking Brackets

Each of the four weapons requires a Cocking Bracket (Figure 22) to be installed on the Cocking Rod to push the Bolt backward during cocking. The M240/M249 Cocking Bracket transfers the motion of the Cocking Rod to a Slide that transfers the cocking forces to the Bolt. For the M2 and MK19, the Cocking Brackets work directly on the bolt itself.



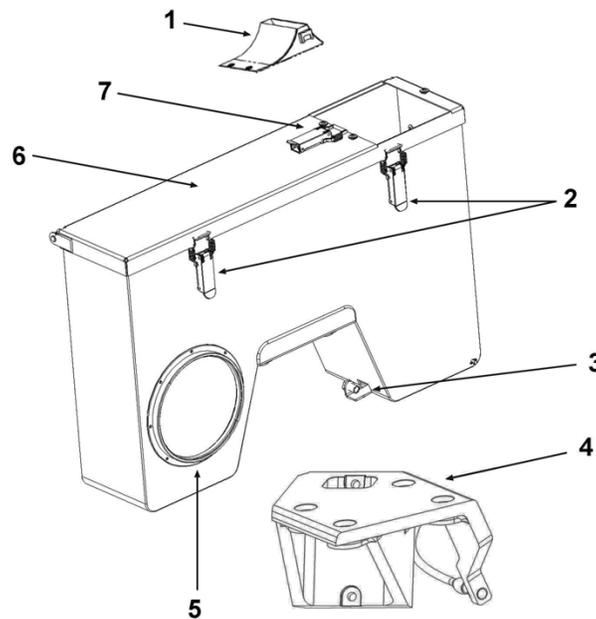
**Figure 22. Cocking Brackets.**

### NOTE

When the Host Vehicle or other platform is moving, the TIM Lens Cover can vibrate loose from the Ammunition Box Storage Ring. To prevent the loss of the cover, store the TIM Lens Cover in the CROWS Toolbag.

## Ammunition Box Assembly

The Ammunition Box (Figure 23) bolts onto the Ammunition Box Holder (4) with four screws. The same Ammunition Box is used for all ammunition types (5.56 mm, 7.62 mm, 50 cal. cartridges, and 40 mm grenades). Spring-loaded latches (2) hold the Ammunition Box Lid (6) in place. The Ammo Feed Guide (1) is selected based on the Ammunition Type and attaches with a spring-loaded latch (7). The Feed Guide (1) directs the Ammunition Belt into the Chute. The Ammunition Box Assembly also includes a Low Ammo Sensor Connector (3) and a TIM Lens Cover Storage Ring (5) where the TIM Lens Cover can be stowed.

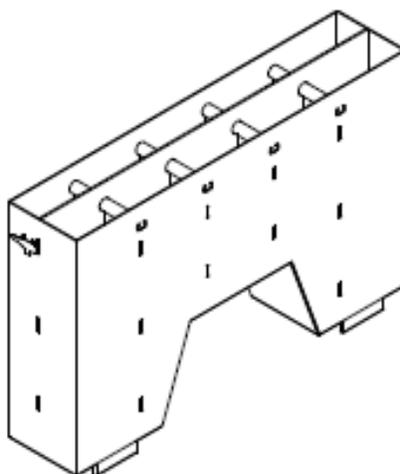


**Figure 23. Ammunition Box Assembly.**

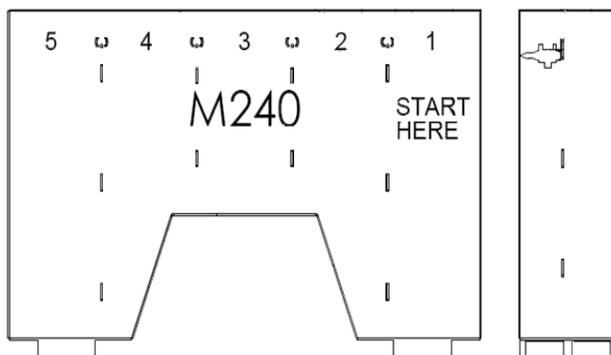
**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont**

**Ammunition Box Assembly - Cont**

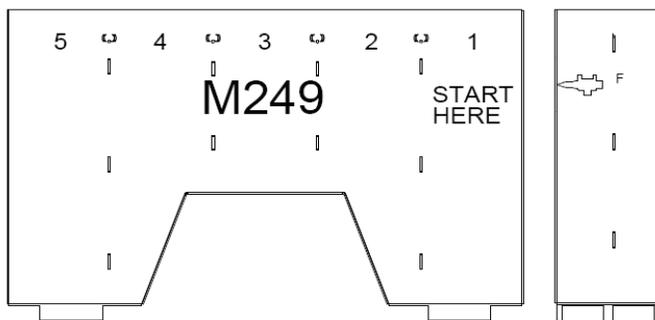
The Ammunition Insertion Cassette (AIC) (Figure 24) allows Ammunition for the M240 (Figure 25) or M249 (Figure 26) to be loaded into the Ammunition Box Assembly.



**Figure 24. Ammunition Insertion Cassette.**



**Figure 25. Ammunition Insertion Cassette, M240.**



**Figure 26. Ammunition Insertion Cassette, M249.**

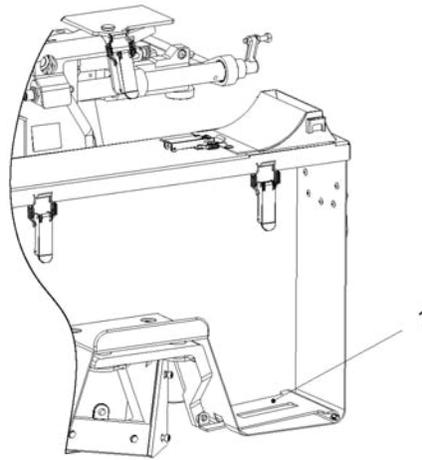
## Functioning of the Activation Plate

The interior of the Ammunition Box contains a spring-loaded Activation Plate (1) (Figure 27) which signals the Low Ammo Sensor to indicate Low Ammo status to the Operator on screen.

### NOTES

If Ammunition is loaded on the left side (not onto Activation Plate), the Low Ammo signal appears on screen before all Ammunition has been used.

Check the Low Ammo Sensor functionality by pushing the Activation Plate down by hand.



**Figure 27. Activation Plate.**

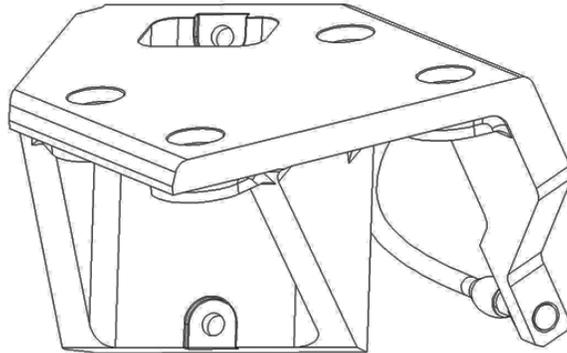
When the Ammunition Belt/AIC is loaded into the Ammo Box, the Activation Plate (1) with the Magnetic Actuator is forced down and covers the Low Ammo Sensor. As the level of the Ammunition decreases during firing, the Activation Plate rises back up to its set position. The Sensor activates when the Actuator leaves the position in front of the sensor. The Low Ammo Signal is then sent to the system and displayed in the status field on screen as LOW AMMO.

The LOW AMMO signal displays when there are approximately X rounds left in the Ammo Box:

- a. For the M2 (50 cal), there will be approximately 50-55 rounds left.
- b. For the MK19 (40 mm), there will be approximately 22-24 rounds left.
- c. For the M240 (7.62 mm), there will be approximately 90-95 rounds left.
- d. For the M249 (5.56 mm), there will be approximately 120 rounds left.

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Ammunition Box Holder Assembly**

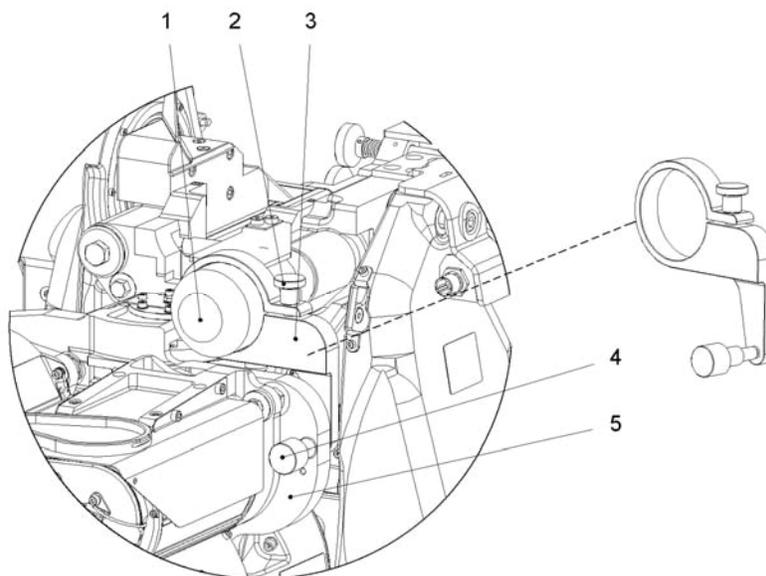
The Ammunition Box Holder (Figure 28) supports the Ammunition Box Assembly. The Holder bolts to the MFA with two screws. The holder also supports the Low Ammo Sensor.



**Figure 28. Ammunition Box Holder Assembly.**

**Clamp Assembly**

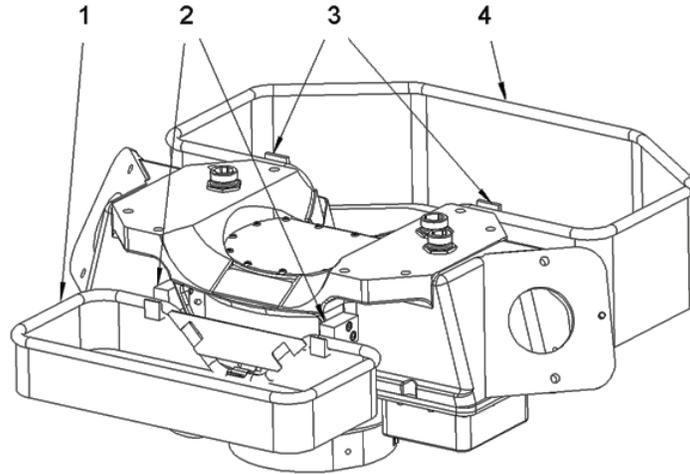
The Clamp Assembly (Figure 29) permits the safe transport of CROWS. It clamps around the Cocking Actuator (1) and fastens to the SSA to prevent the Sight Assembly Unit from uncontrolled movement during transport.



**Figure 29. Clamp Assembly.**

**Casing Collector Bags**

The Casing Collector Bags (Figure 30) collect spent cases and linkages when firing. This prevents the Casings and Linkages from jamming in places that can obstruct operation of the Hatches and WS. The Front Casing Collector Bag (1) is attached with Brackets (2) to the front of the MFA, and the Rear Casing Collector Bag (4) is attached with Brackets (3) at the rear of the MFA.

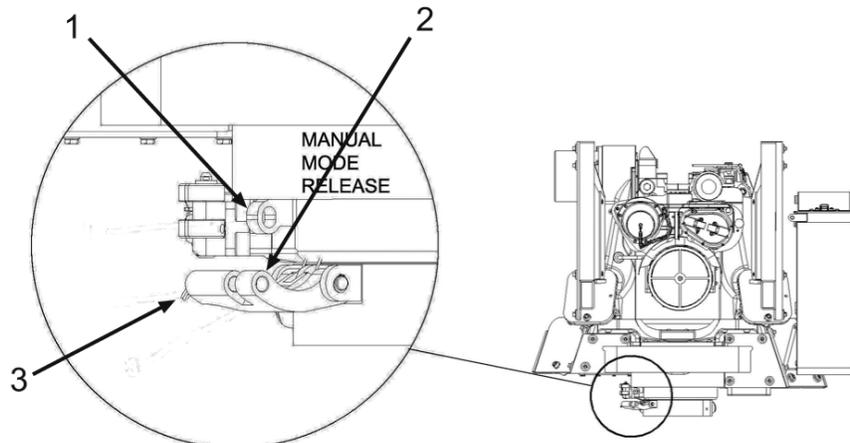


**Figure 30. Casing Collector Bags.**

**Weapon Station Locks**

Azimuth Travel Lock

The Azimuth Travel Lock (Figure 31) freezes Azimuth Movement of the WS when CROWS is stored or transported. Located on the outside of the Frame and Slip Ring, the Azimuth Travel Lock consists of a pivoting Locking Arm (2) with a Lock Pin (3) that locks the Arm to a Locking Bracket (1). The Locking Bracket (1) is part of the Release Arm Bracket so when it is turned to the 12 o'clock (Travel Mode) position at zero degrees, Azimuth Movement of the WS is prevented.



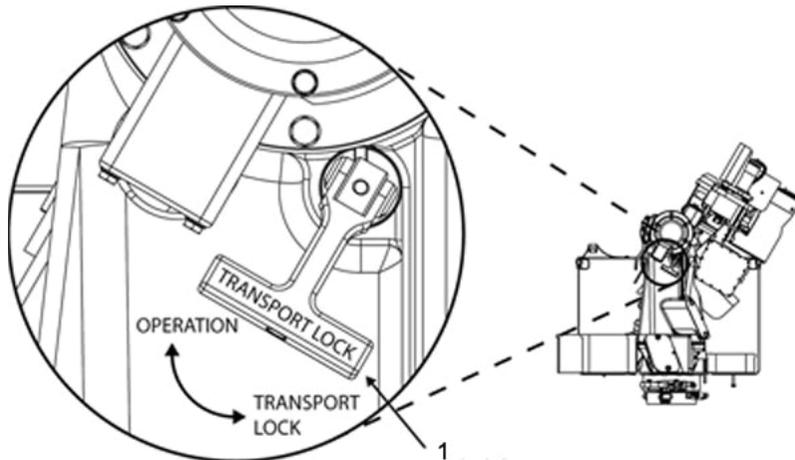
**Figure 31. Azimuth Travel Lock.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont**Elevation Transport Lock

The Elevation Transport Lock (Figure 32) consists of a spring-loaded, T-shaped rotating Locking Handle (1). The Lock is located underneath the Elevation Servo Motor on the Right Side Support Assembly (RSSA). The Lock has two modes, Transport and Operation:

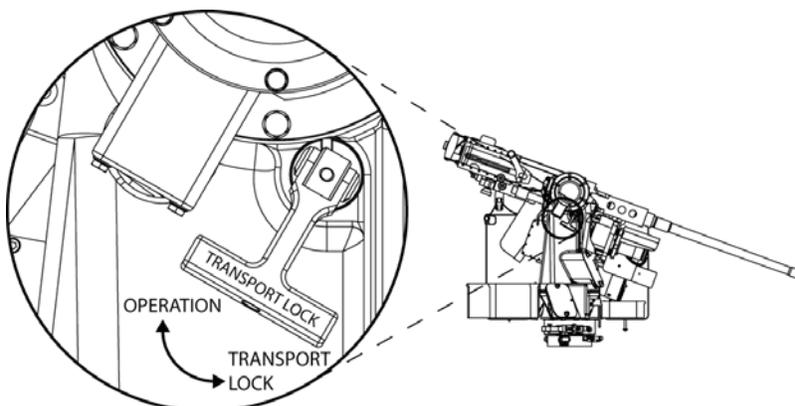
Transport mode: The Soft Mount tilts to two positions, maximum and minimum elevation:

Maximum Elevation locks the Soft Mount at maximum elevation (60 degrees). This position may be useful for maintenance purposes.



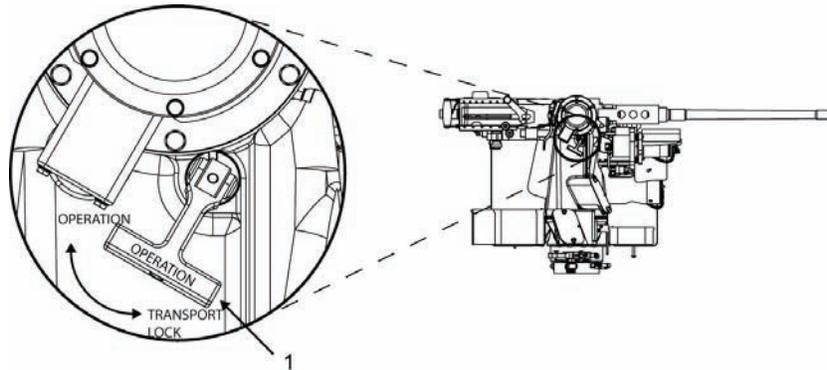
**Figure 32. Elevation Transport Lock, Maximum Elevation.**

Minimum Elevation (Figure 33) locks at a -20 degree elevation angle. This is the recommended position for transport when CROWS is mounted on a vehicle but powered off. TRANSPORT LOCK is visible on the T-handle.



**Figure 33. Elevation Transport Lock, Minimum Elevation.**

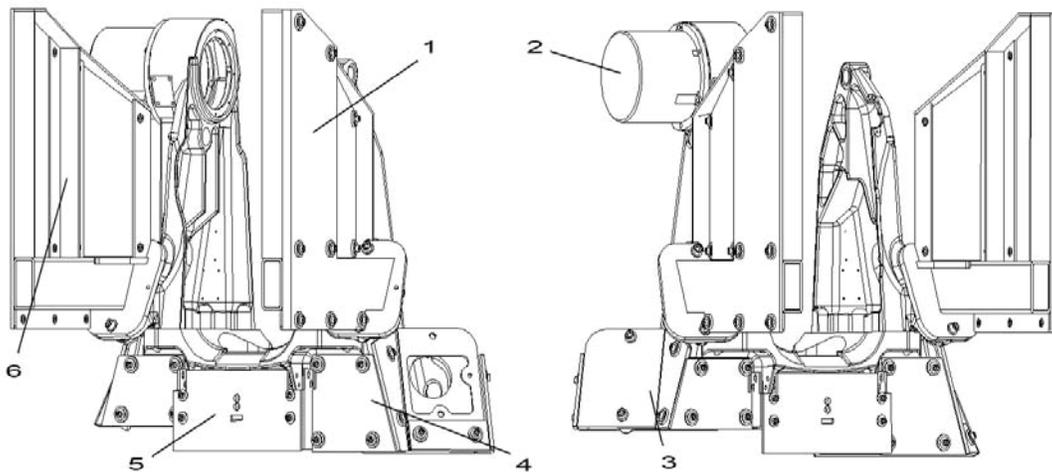
Operation mode (Figure 34) frees the Soft Mount to be elevated/depressed automatically from the CG. OPERATION is visible on the T-handle (1).



**Figure 34. Elevation Transport Lock, Operation Mode.**

### Ballistic Protection

For added protection of the Sight Sensors and electronics, CROWS provides a Ballistic Protection Kit (Figure 35) that mounts when needed. The kit consists of six assemblies to protect the Sight units, Servos, and electronics compartment. Sight unit protection consists of two frames (1 and 6) mounted on each of the side supports. Each frame holds an array of armor plates which provide side protection for the Sensor Unit. The servo protection for the azimuth drive consists of a series of Armor Plates (3, 4, and 5) mounted on the MFA. The Plates protect gear, motor, and servo electronics. The Elevation Drive is protected by an Armored Cup (2) covering the vulnerable parts, and the electronics boxes in the Sight Unit are protected by lids made of armored material. The Ballistic Protection Kit can be removed for low weight applications.

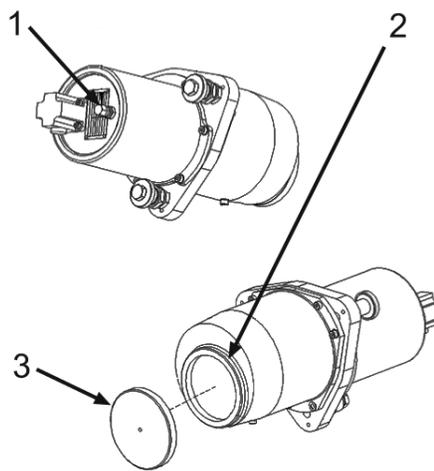


**Figure 35. Ballistic Protection.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Visual Imaging Module (VIM)****CAUTION**

Do not point the VIM directly towards the sun. This may damage the VIM iris.

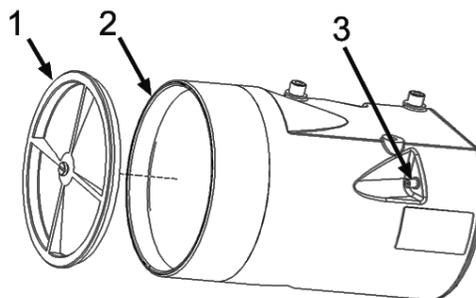
The VIM (Figure 36) produces a color view with a day sight/sensor. Its ability to detect Near Infra Red (NIR) radiation improves responsiveness during periods of dusk or dawn. Its motorized Optical Zoom Lens enables recognition of targets at long distances. This feature helps to distinguish between targets and non-targets. A Valve (1) at the back of the unit allows it to be purged with nitrogen to prevent humidity from damaging internal parts, and a Lens Cap (3) protects the Lens Surface (2) from the external environment.



**Figure 36. Visual Imaging Module (VIM).**

**Thermal Imaging Module (TIM)**

The TIM (Figure 37) produces a thermal view from an infrared sight/sensor. The TIM allows use of the installed weapon at night or during other limited visibility field conditions. The lens (2) is protected by a Lens Cap (1) when not in use. A valve (3) on the side of the housing allows the TIM to be purged with nitrogen to prevent humidity from damaging the internal parts.

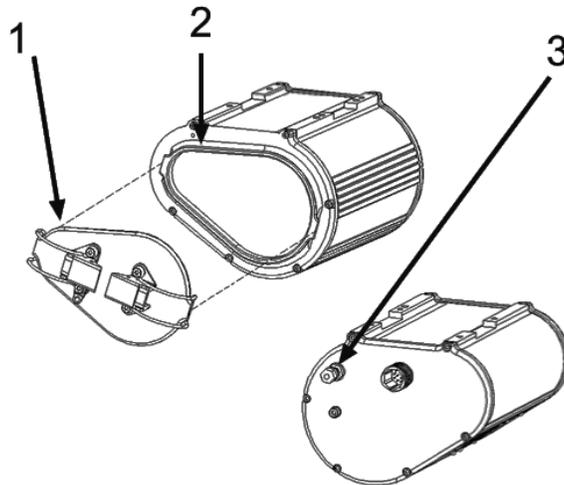


**Figure 37. Thermal Imaging Module (TIM).**

**Laser Range Finder (LRF)****WARNING****LASER LIGHT**

The Laser Range Finder is classified as a Class 1 Laser Device and is safe in normal operating conditions, but failure in the electrical system can cause the laser to violate safety requirements. Do not point at humans or stare into the laser beam under any circumstances as this can cause serious eye injury.

The LRF (Figure 38) determines the distance to targets. It detects multiple targets (up to three) for each measurement. If more than three targets are detected, the distances of the closest, second closest, and farthest targets are reported. A removable Lens Cap (1) protects the Optical Window (2) when not in use, and a Valve (3) at the back of the housing allows the unit to be purged with nitrogen to prevent humidity from damaging internal parts.

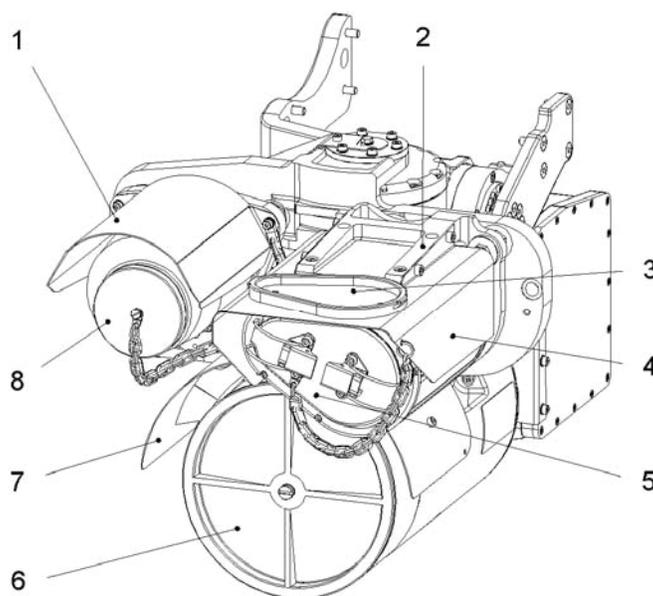


**Figure 38. Laser Range Finder (LRF).**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****Sight Protection Covers and Storage of Lens Caps**

To protect the Optical Devices from damage by spent casings, links, or other foreign objects, Sight Protection Covers (Figure 39) are provided. The covers for the VIM (1) and TIM (7) attach to the Sight Bracket of the SSA while the LRF cover (4) connects to the LRF Mounting Bracket (2).

The VIM Lens Cover (8) stows on the right side of the LRF Protective Cover (4), and the TIM Lens Cover (6) fastens to the Ammo Box when not in use. The LRF Lens Cover (5) is stowed at the Lens Cover Bracket (3) on top of the LRF.



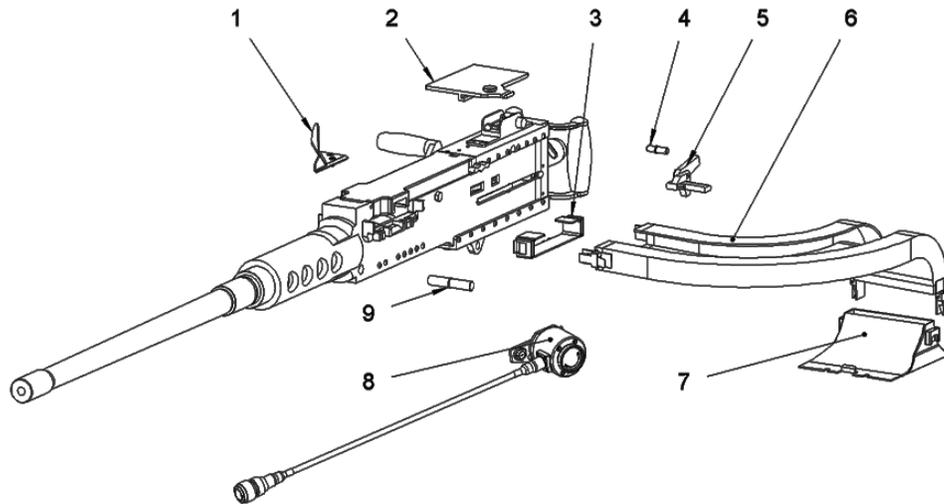
**Figure 39. Sight Protection Covers.**

**Weapon Adaption Items**

CROWS comes with the weapon adaption items necessary to mount four standard weapons, the M2, MK19, M240, and M249.

### M2 Weapon Adaption Items

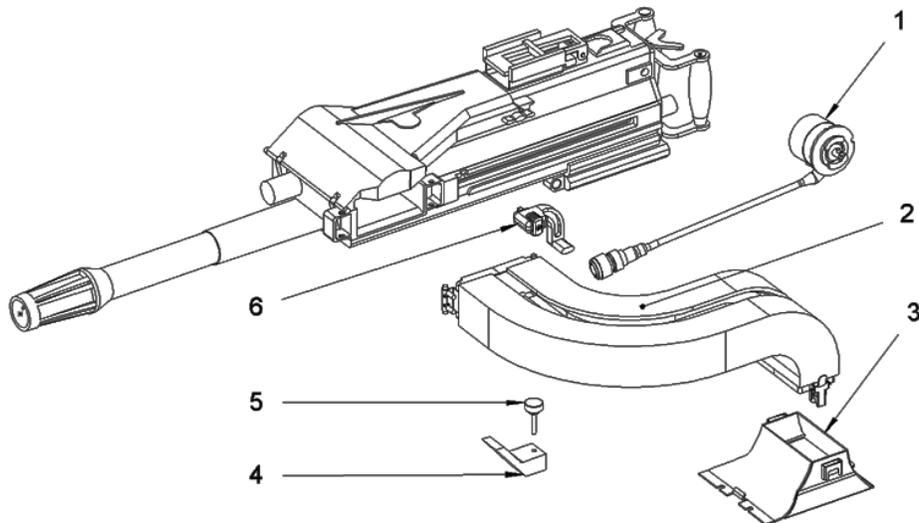
The M2 weapon adaption items (Figure 40) consists of a Link Guide (1), Link Deflector (2), Gun End Adapter (3), Cocking Bolt (4), Cocking Bracket (5), Chute (6), Ammunition Guide (7), Firing Solenoid (8), and Anchor Pin (9).



**Figure 40. M2 Weapon Adaption Items.**

### MK19 Weapon Adaption Items

The MK19 weapon adaption items (Figure 41) consists of a Firing Solenoid (1), Chute (2), Ammunition Guide (3), Damper Stop (4), Stop Screw (5), and Cocking Bracket (6).

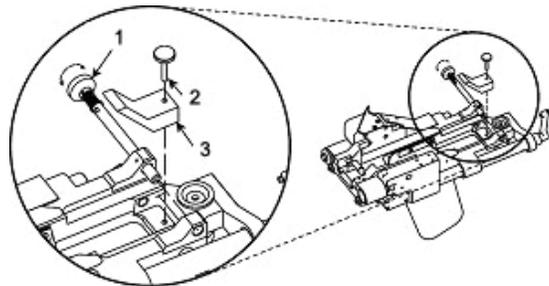


**Figure 41. MK19 Weapon Adaption Items.**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont****MK19 Damper Stop****CAUTION**

Remove the MK19 Mounting Pin (1) before installing the Damper Stop to prevent damage to equipment.

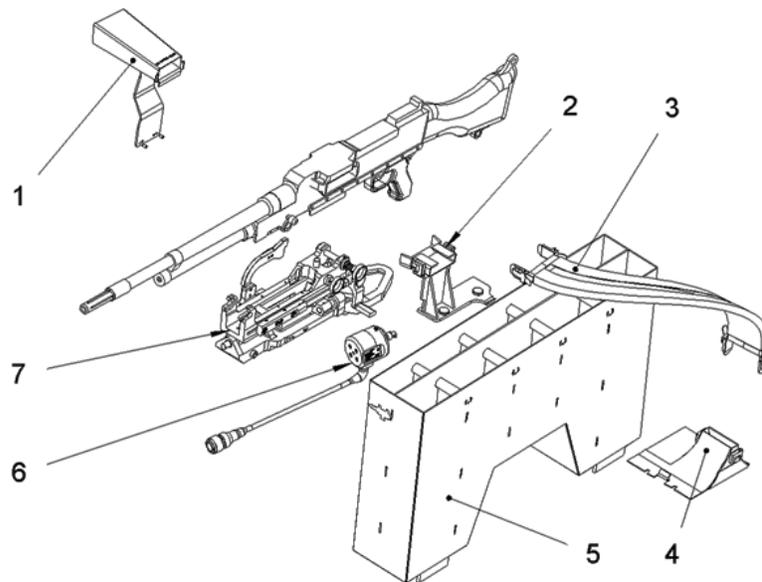
The Damper Stop (Figure 42) causes downward deflection of spent 40mm casings to minimize the risk of casings bouncing back after ejection. The Damper Stop Screw (2) attaches the Damper Stop (3) at the bottom of the Soft Mount.



**Figure 42. MK19 Damper Stop.**

**M240 Weapon Adaption Items**

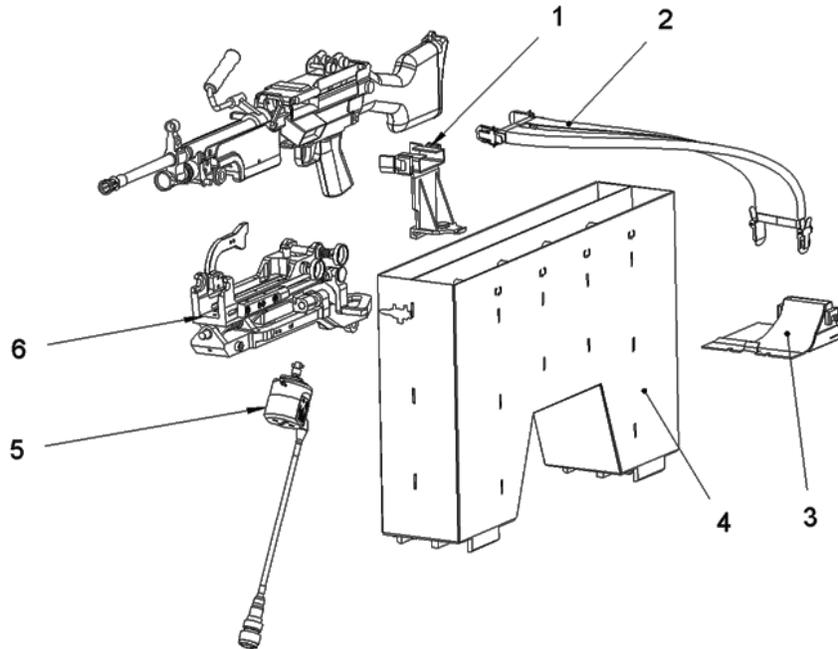
The M240 weapon adaption items (Figure 43) consists of a Link Tube (1), Ammunition Feed Assembly (2), Ammunition Chute (3), Ammunition Guide (4), Ammunition Insertion Cassette (AIC) (5), Firing Solenoid (6), and Multi-Adapter, Small Caliber (MASC) (7).



**Figure 43. M240 Weapon Adaption Items.**

### M249 Weapon Adaption Items

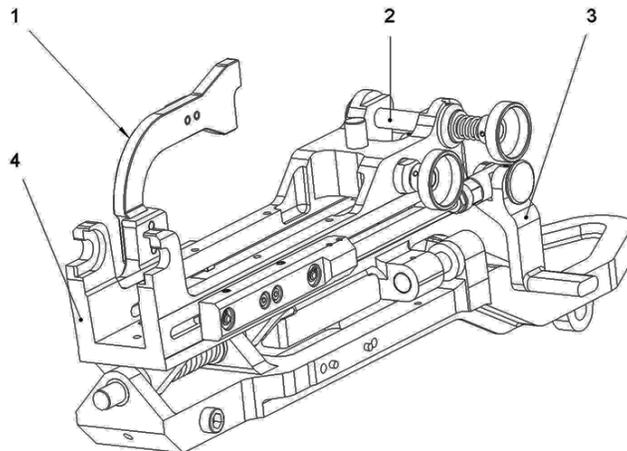
The M249 weapon adaption items (Figure 44) consists of an Ammunition Feed Assembly (1), Ammunition Chute (2), Ammunition Guide (3), AIC (4), Firing Solenoid (5), and MASC (6).



**Figure 44. M249 Weapon Adaption Items.**

### **M240/M249 Multi Adapter, Small Caliber (MASC)**

The M240/M249 Multi Adapter, Small Caliber (MASC) (Figure 45) interfaces the Soft Mount to the M240/M249 weapon and consists of a Push Bracket (1), a Mounting Pin (2) for small caliber weapons, Cocking Bracket (3), and MASC (4).



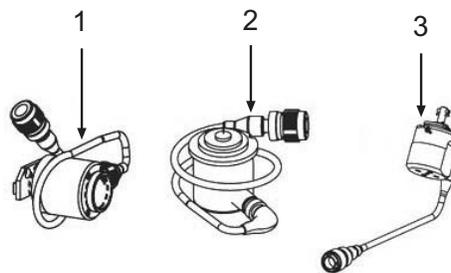
**Figure 45. M240/M249 Multi Adapter, Small Caliber (MASC).**

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont**

**Firing Solenoids**

CROWS requires a unique Weapon ID for each type of weapon used, and the Firing Solenoid (Figure 46), part of the weapon adaption items inventory, provides this ID. With the Firing Solenoid installed, CROWS detects the type of weapon mounted and displays that information on screen. The Weapon ID allows the system to automatically load the corresponding Ammunition Tables and configure the Ammunition Menu. CROWS disables firing whenever an unknown Weapon ID is read.

Separate solenoids are available for the M2 (1) and MK19 (2); the M240 and M249 utilize the same solenoid (3).



**Figure 46. Firing Solenoids.**

**Storage Bag**

The accessories in the Storage Bag provide many of the items necessary to mount the compatible weapons and support the system (Table 2).

**Table 2. Storage Bag.**

**Equipment stored in the Storage Bag**

1 Storage Bag Equipment	7 Connector Cover
2 CROWS Cover	8 Solenoid M2 with cable, Assembly
3 Packing Guide, Storage Bag Support Equipment	9 Ammo Guide for 12.7 (angled)
4 Checklist for packing of Storage Bag Equipment	10 Adapter, Gun End, M2
5 Instruction Sheet	11 Link Deflector
6 Clamp Assembly	12 Link Guide



## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

### Display and Control Panel (DCP) and Main Processing Unit (MPU)

The Display and Control Panel (DCP) (2) (Figure 48) provides the display and controls for the DCP Configuration (NSN 1090-25-160-1150). Like the FCU, the DCP is mounted inside the vehicle. Except for the addition of function keys down the left side of the DCP and minor changes to certain display fields such as REMOTE SAFE and SYSTEM, the DCP can be considered operationally equivalent to the FCU. The DCP consists of a housing, display, and front panel controls allowing full operation of CROWS in concert with the CG. The Main Processing Unit (MPU) (1) provides processing for the system and consists of a housing with connectors for the required cables. The DCP and MPU are connected through Cable W504.

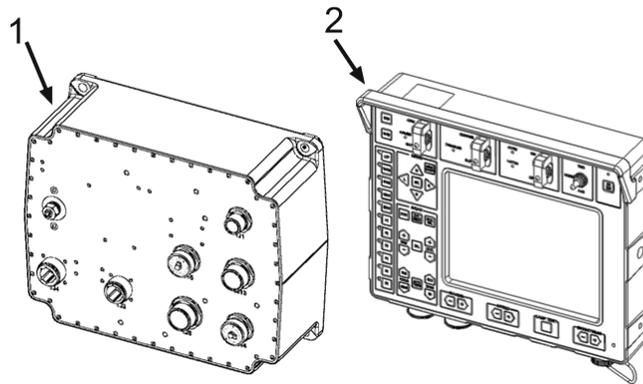


Figure 48. DCP and MPU.

### Control Grip (CG)

A ruggedized joystick, the CG (Figure 49) interprets hand movements to elevate and traverse the WS. The CG incorporates buttons and switches to charge (9) or fire (10) the installed weapon, fire the LRF (11), focus/autofocus (3), zoom (MAG) (2), and switch the Sight Sensors (1), start Target Tracking (8), Lead Compensation (4), WS Stabilization (5), and Drift Compensation (Nulling) (6), and a Palm Switch to (7) enable or disable CG functions. The CG mounts on an Armrest Bracket to reduce operator fatigue.

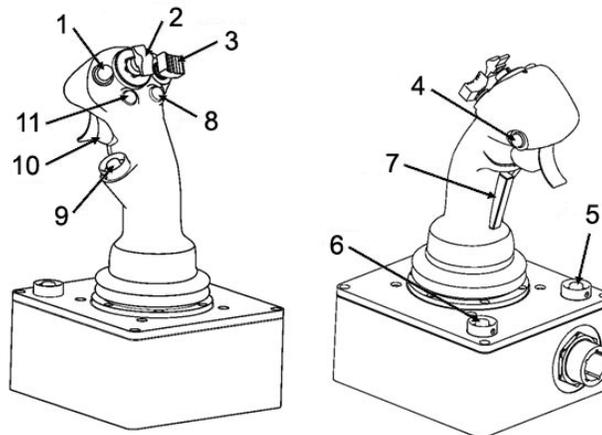


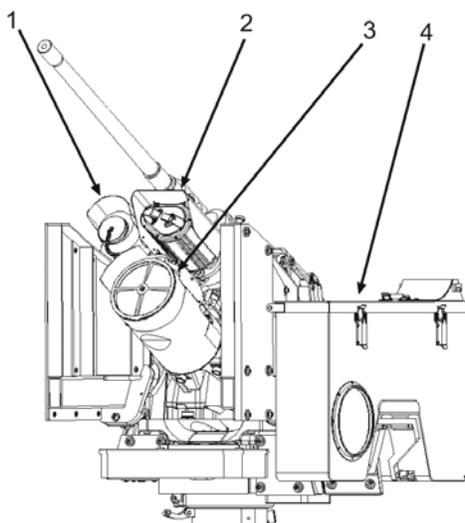
Figure 49. Control Grip.

## EQUIPMENT DATA

### Direction Designations

The front, rear, right, and left hand sides of CROWS are designated as follows:

- The VIM (1), LRF (2), and TIM (3) are mounted at the front of CROWS (Figure 50).
- The Soft Mount and Rear Casing Collector Bag are installed at rear of CROWS.
- The Ammunition Box (4) is on the left side of the system.
- The Elevation Servo Housing is on the right side.



**Figure 50. CROWS with M2, Left Front View.**

### System Weight

The weight of CROWS depends on the type of weapon mounted and the type of Ammunition loaded. Close approximations of the weights of various configurations are at Table 3:

**Table 3. Weight of CROWS.**

Item	Weight	Comments
CROWS, fully-loaded M2 (400 rounds), and Ballistic Protection	594 lbs (270 kg)	Complete CROWS including FCU, cables, and support bag
CROWS, fully-loaded MK19 (96 rounds), and Ballistic Protection	561 lbs (255 kg)	Complete CROWS including FCU, cables, and support bag
CROWS, fully-loaded M240B (1,000 rounds), AIC, and Ballistic Protection	502 lbs (228 kg)	Complete CROWS including FCU, cables, support bag, and Ballistic Protection
CROWS, fully-loaded M249 (1,600 rounds), AIC, and Ballistic Protection.	482 lbs (219 kg)	Complete CROWS including FCU, cables, support bag, and Ballistic Protection

**EQUIPMENT DATA - Cont****System Weight - Cont****Table 3. Weight of CROWS - Cont**

CROWS Assembled	396 lbs (180 kg)	
Weapon Station (WS)	320 lbs (145.5 kg)	
Fire Control Unit (FCU)	26 lbs (12 kg)	
Display and Control Panel (DCP)	18 lbs (8 kg)	
Main Processing Unit (MPU)	20 lbs (9 kg)	
Control Grip (CG)	4 lbs (2 kg)	
Ammo Box with 400 rounds of .50 caliber ammunition	176 lbs (80 kg)	
Ammo Box with 96 rounds of 40mm ammunition	150 lbs (68 kg)	
Ammo Box with 1,000 rounds of 7.62mm ammunition	119 lbs (54 kg)	
Ammo Box with 1,600 rounds of 5.56mm ammunition	110 lbs (50 kg)	
Storage Bag with weapon adaption items and other included items	31 lbs (14 kg)	Bag of attaching parts, weapon dependent

The approximate weights of the CROWS subassemblies after dismantling are shown at Table 4:

**Table 4. Weight of Subassemblies.**

<b>Item</b>	<b>Weight</b>	<b>Comments</b>
Main Frame Assembly (MFA)	106 lbs (48 kg)	
Right Side Support Assembly (RSSA)	44 lbs (20 kg)	
Left Side Support Assembly (LSSA)	9 lbs (4 kg)	
Thermal Imaging Module (TIM)	18 lbs (8 kg)	
Visual Imaging Module (VIM)	7 lbs (3 kg)	

Sight Servo Assembly (SSA)	15 kg (33 lbs)	
Laser Range Finder (LRF)	4 lbs (2 kg)	
Soft Mount Assembly (SMA)	42 lbs (19 kg)	Including Cocking Actuator
Cocking Actuator (CA)	7 lbs (3 kg)	
Ammo Box Holder	2 kg (4 lbs)	Including Low Ammo Sensor
Ammunition Box Assembly	55 lbs (25 kg)	
Ballistic Protection Kit	58 lbs (26.5 kg)	

### Capabilities of Armament

The capabilities of CROWS Armament are shown at Table 5:

**Table 5. CROWS Installation Armament Capabilities.**

<b>M2 Heavy Barrel, .50 Caliber, Flexible Machine Gun</b>	
Firing range	
Maximum range (approximately)	7,400 yards (6,767m)
Maximum range, CROWS ballistic solution	5,359 yards (4,900m)
Maximum effective range (approximately)	2,000 yards (1,829m)
Minimum range, CROWS ballistic solution	109 yards (100m)
Cyclic rate of fire:	485-635 rounds/min
<b>MK19 MOD3, 40mm, Grenade, Machine Gun</b>	
Firing range	
Maximum range (approximately)	2,419 yards (2,212m)
Maximum range, CROWS ballistic solution	1,640 yards (1,500m)
Maximum effective range (approximately)	1,640 yards (1,500m)
Minimum range, CROWS ballistic solution	109 yards (100m)
Cyclic rate of fire:	325-375 rounds/min
<b>M240B, 7.62mm Machine Gun</b>	
Firing range	
Maximum range	4,073 yards (3,725m)
Maximum range, CROWS ballistic solution	3,281 yards (3,000m)
Maximum effective range (area)	1,968 yards (1,800m)
Minimum range, CROWS ballistic solution	11 yards (10m)
Cyclic rate of fire (adjustable rpm):	650-950 rounds/min

**EQUIPMENT DATA - Cont****Capabilities of Armament - Cont****Table 5. CROWS Installation Armament Capabilities - Cont****M249, 5.56mm Squad Automatic Weapon**

Firing range	
Maximum range	3,937 yards (3,600m)
Maximum range, CROWS ballistic solution	2,734 yards (2,500m)
Maximum effective range (area)	1,093 yards (1,000m)
Minimum range, CROWS ballistic solution	11 yards (10m)
Cyclic rate of fire (adjustable rpm):	850 rounds/min

**Specifications of Sights**

Specifications for the VIM are at Table 6:

**Table 6. VIM Specifications.****Visual Imaging Module (VIM)**

Charge Coupled Device (CCD) color camera	
Resolution:	768 x 494 pixels
Spectral range:	400–950nm
<b>Motorized Continuous Telescopic Lens:</b>	
Field of view, horizontal (minimum):	< 2 degrees
Field of view, horizontal (maximum):	> 45 degrees
Focus distance:	2m to infinity
Video output format:	RS-170A (NTSC)

Specifications for the TIM are at Table 7:

**Table 7. TIM Specifications.****Thermal Imaging Module (TIM)**

Uncooled Micro Bolometer Thermal Imager	
Resolution:	640 x 480 pixels
Field of view, horizontal:	3 degrees and 9 degrees
Focus distance:	5m to infinity
Spectral range:	8–12 $\mu$ m
Video output format:	ANSI/SMPT-170M
Zoom:	2x to 4x digital

Specifications for the LRF are at Table 8:

**Table 8. LRF Specifications.**

**Laser Range Finder (LRF)**

Class of laser:	Class 1 according to ANSI Z136.1-2000
Laser diode material:	InGaAs/GaAs
Wavelength:	905nm
Maximum measuring distance (single measurement):	4,374 yards (4,000m)
Maximum measuring distance (higher reflective targets and lower light conditions):	6,562 yards (6,000m)
Minimum measuring distance:	66 feet (20m)
Range accuracy:	± 1m (1 sigma)
Measuring response time:	0.8 sec
Rest time to next measurement:	2 sec

**Motion of Different Axes**

Specifications for the Axes of Motion are at Table 9:

**Table 9. Axes of Motion.**

Traverse of Weapon Station	360 degrees
Maximum Elevation of Weapon Station (weapon)	+60 degrees
Maximum Depression of Weapon Station (weapon)	-20 degrees
Traverse Movement of Sight Servo Assembly, (sights and LRF) relative to the Weapon Station Assembly Azimuth Axis	-10 degrees +10 degrees
Maximum Elevation of Sight Servo Assembly (sights and LRF)	+3 degrees
Maximum Depression of Sight Servo Assembly (sights and LRF)	-15 degrees
Speed of laying, traverse and elevation	
High speed (at nominal voltage)	Up to 100 degrees/sec
Low speed	0.15 mrad/sec

**EQUIPMENT DATA - Cont**

**Screen and Video Details**

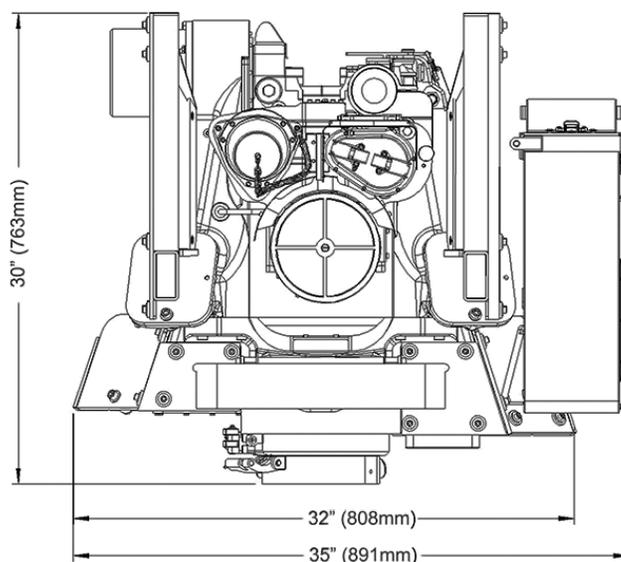
Screen and video details are at Table10:

**Table 10. Screen and Video Details.**

Screen	10.4" Active Matrix TFT-LCD Flat Panel Screen
Resolution	640 (H) x 480 (V) Addressable Pixels
Colors	262 114 (3 x 6 bit)
Scale	Grey, 64
Video Format	RS-170A (NTSC) External Video Input/Output

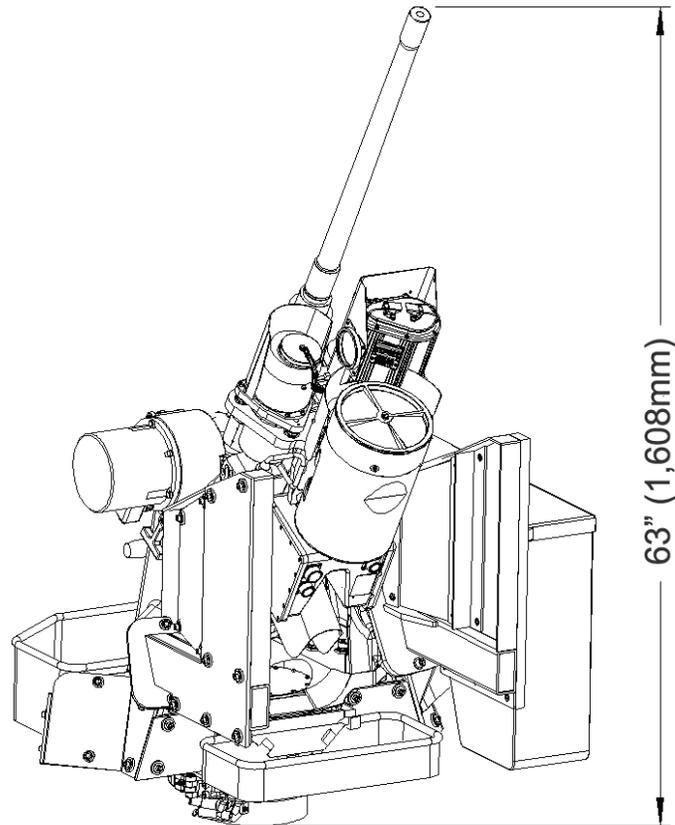
**Measurements**

The height of a CROWS Weapon Station (WS) without a weapon installed is 30" (Figure 51).



**Figure 51. Weapon Station.**

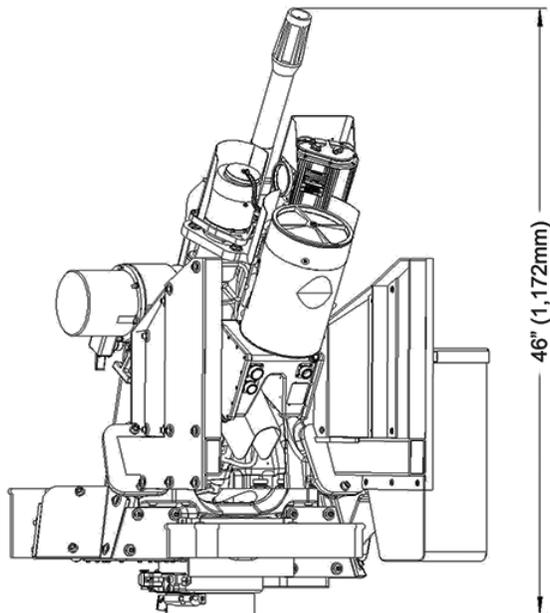
WS height with an M2 at maximum elevation is 63" (Figure 52).



**Figure 52. Height with M2 at Maximum Elevation.**

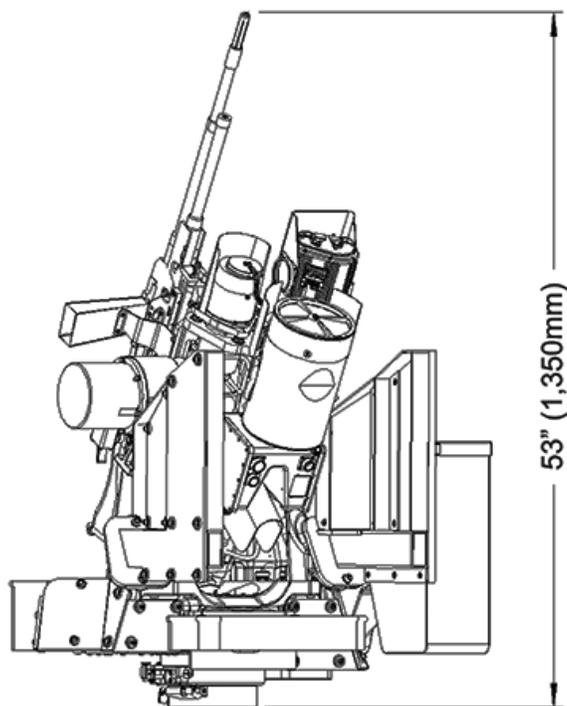
**EQUIPMENT DATA - Cont****Measurements - Cont**

WS height with a MK19 at maximum elevation is 46" (Figure 53).



**Figure 53. Height with MK19 at Maximum Elevation.**

WS height with an M240 at maximum elevation is 53" (Figure 54).



**Figure 54. Height with M240 at Maximum Elevation.**

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**Power Supply Specifications**

The specifications for the CROWS Power Supply are at Table 11:

**Table 11. Power Supply Specifications.**

Supply voltage:	
Nominal:	28 VDC
Voltage Range:	16–33 VDC
Current consumption:	
Nominal:	4–40 A
Peak (< 5 sec):	90 A

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
THEORY OF OPERATION**

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## **THEORY OF OPERATION**

### **General**

#### **NOTES**

CROWS II installation restrictions in specific vehicles such as the Joint Explosive Ordnance Disposal Rapid Response Vehicle (JERRV) require that the gunner face rearward. This orientation can result in ride-induced nausea or motion sickness. Gunners and vehicle Commanders must be aware of this situation and consider rest breaks and/or crew rotations when possible.

When the CROWS II gunner faces rearward in vehicles such as the JERRV, confusion between the gunner and the vehicle Commander when communicating directions such as left or right can result. Both the gunner and vehicle Commander must be aware of this possibility, and training must emphasize use of azimuth readings to relate direction.

Operation of the CROWS II on a M1151 HMMWV with the thick screen Fire Control Unit (FCU) configuration presents a Safety Hazard.

The CROWS II FCU thick screen configuration (PN 60201886-01) is a head impact hazard for the CROWS Operator because of the close proximity of the operator's head to the FCU screen. The thick screen configuration has a high likelihood of leading to eye strain and fatigue and may have a detrimental effect on operator performance.

Exposure to risk is most likely to occur during extreme HMMWV maneuvering, an Improvised Explosive Device (IED) attack, or an accident (collision or rollover).

Operators should remain seated as far from the FCU screen as physically possible. To reduce the probability and severity of an impact with the FCU screen, the CROWS II operator should:

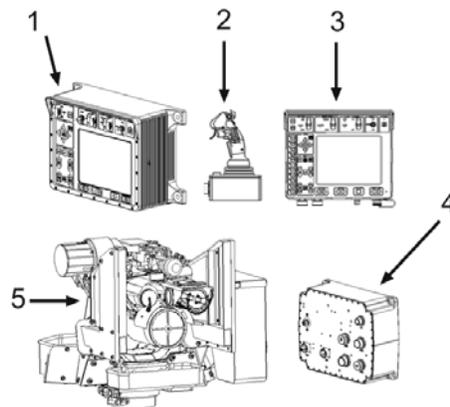
- (1) Avoid use of Camelback hydration system while operating CROWS II.
- (2) Wear body armor vest and combat helmet.
- (3) Use vehicle seatbelts when operating inside M1151 HMMWV.
- (4) Use arms to brace yourself in the event of an accident.
- (5) Use thermal camera to detect heat signatures of buried IEDs.
- (6) Request that vehicle driver limits speed to 35 mph when feasible.

**THEORY OF OPERATION - Cont****NOTES - Cont**

Gunner and vehicle Commanders must be aware of potential eye strain and fatigue and offer rest breaks or crew rotation to prevent or treat motion sickness

Review the respective vehicle for the location of CROWS. CROWS is a mount for M2 .50 caliber machine guns, MK19 40mm Machine Guns, M240 7.62mm Machine Guns, or M249 5.56mm Machine Guns. The installed weapon is aimed and fired remotely from inside the Host Vehicle or other platform. Remote operation allows armored protection from direct enemy fire.

CROWS is available in two configurations, FCU or DCP. In either configuration, CROWS provides a display and a Control Grip (CG) (2) to control the Weapon Station (WS) (5) remotely (Figure 1). In the FCU configuration (NSN 1090-25-160-1150), the FCU (1) contains a display, controls, and processing technology. In the DCP configuration (NSN 1090-25-160-1292), the DCP houses the display and controls while the MPU (4) provides the processing capabilities. Remote control capabilities include adjusting elevation and depression of WS, cocking and firing the installed weapon, and laze capabilities (a method for determining range of a target). CROWS tracking and control capabilities offer a high first round hit probability against stationary and moving targets even while the Host Vehicle or other platform is in motion.



**Figure 1. Major Components.**

**Features**

CROWS offers the following features:

1. Surveillance: The Day (VIM) and night (TIM) imaging systems along with the Motion Control System acquire imagery supporting both offensive and defensive missions.
2. Target Acquisition: CROWS improves target acquisition (detection, recognition, and identification) capability during the day or night in all specified environmental conditions. The Target scene is acquired through a sensor unit (VIM or TIM), and the image is displayed on the FCU or DCP screen. The zoom function is used when a target is identified or if an area of interest needs to be investigated in more detail.
3. Target Engagement: CROWS can immediately and effectively engage a target once detected and identified.

4. System Design: CROWS configuration preserves access to the installed weapon for maintenance, immediate action drills, or manual firing.
5. Weapon Firing: CROWS allows the installed weapon to be fired remotely, Ammunition usage to be controlled and monitored, and a fully automatic firing capability with a selectable burst is provided.
6. Weapon Charging: The installed weapon can be charged remotely from the FCU or DCP and the CG. The weapon can also be charged manually at the mount.
7. Target Reference Points: Target Reference Point (TRP) mode allows up to 200 individual targets to be assigned and stored in memory for rapid recall. CROWS scans the stored target points by location, and the rate (speed) of the scan can be adjusted.
8. Sector Scan: Two end points are designated to start an automatic sector scan. The system automatically and continuously moves the center of the field of view (FOV) back and forth between these points in a raster scan pattern, stepping in elevation by sensor FOV.
9. No-Fire Zones: A No-Fire Zone is a factory-set or user-configured safety feature that restricts WS movement or weapon firing. CROWS offers three types of No-Fire Zones: Elevation Depression Zones, Traverse Inhibit Zones, and Firing Inhibit Zones. CROWS provides a minimum of 20 azimuth No-Fire Zones to prevent firing at safety-sensitive vehicle components and for training and range safety.
10. Fire-Control Solution: CROWS provides a ballistics solution based on range-to-target, line-of-sight inclination, and vehicle cant for each combination of installed weapon and ammunition. In addition, CROWS can compensate for wind speed and direction by accepting a value for Windage. The ballistics solution produces super-elevation and azimuth displacement (projectile drift) signals and is used to reorient weapon and ballistic aimpoint while allowing gunner to maintain visual contact with target.
11. Set-Up: When an authorized weapon is first installed, the weapon is boresighted and the appropriate Ammunition Type is selected through the menu system. CROWS uses this configuration information to position the graphical data at the chosen FOV.
12. Laser Alignment for Target Engagement: The on-screen reticle is aligned with the target, and the laser is fired by pressing the LRF button on the CG. CROWS calculates the ballistic solution for engagement and elevates the installed weapon accordingly.
13. Stabilization: Stabilization (STAB) keeps the installed weapon on target if the Host Vehicle or other platform is in motion. CROWS is designed with a four-axes servo system consisting of separate axes for weapon and optical devices (VIM and TIM) so that the optics can compensate for the ballistics of each compatible weapon. As opposed to a two-axis system where the Sight always points in the direction of the Line of Bore, the four-axis system allows CROWS to zoom in on the target for identification prior to engagement without moving the WS. The main advantage is that the target can always be in the center of the screen without platform movement warning the potential targets.

**END OF WORK PACKAGE**



## **CHAPTER 2**

# **OPERATION INSTRUCTIONS**



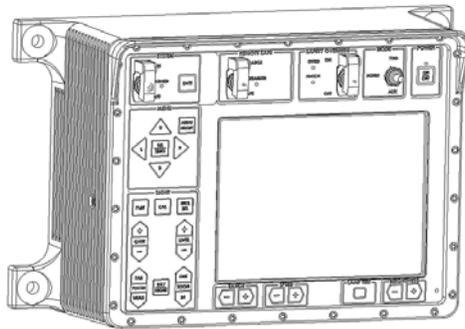
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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
DESCRIPTION AND USE OF CONTROLS AND INDICATORS**

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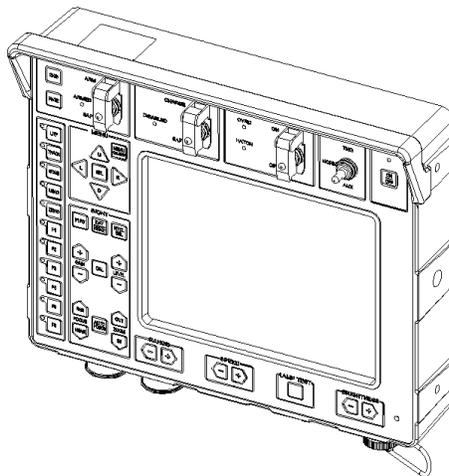
**DESCRIPTION OF FCU AND DCP CONTROLS AND INDICATORS**

CROWS is available in two configurations, FCU and DCP. In the FCU configuration (NSN 1090-25-160-1150), the Fire Control Unit (FCU) includes controls to input firing data and a Liquid Crystal Display (LCD) to view targets and system status (Figure 1).



**Figure 1. Fire Control Unit (FCU).**

In the DCP configuration (NSN 1090-25-160-1292), the Display and Control Panel (DCP) provides the display and controls (Figure 2). Except for the addition of function keys down the left side of the DCP and minor changes to certain display fields such as REMOTE SAFE, the FCU controls are identical to those provided by the DCP. Where differences between the controls exist, both the FCU and DCP controls will be illustrated.

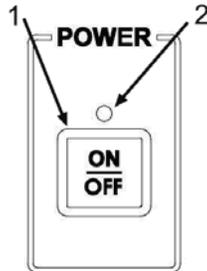


**Figure 2. Display and Control Panel (DCP).**

**DESCRIPTION OF FCU AND DCP CONTROLS AND INDICATORS - Cont**

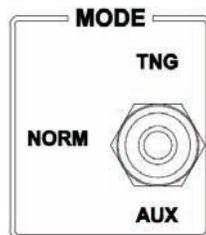
Descriptions for the controls common to the FCU and DCP follow:

The POWER field (Figure 3) is found in the upper right corner on the front side of the FCU and DCP. The POWER ON/OFF button (1) turns CROWS ON or OFF, and the POWER LED (2) illuminates when CROWS is ON.



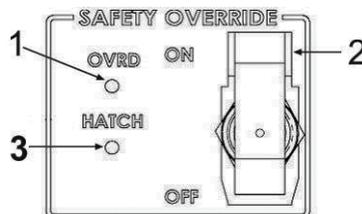
**Figure 3. POWER ON/OFF button.**

The MODE switch (Figure 4) is located to the left of the POWER ON/OFF button and toggles to select NORM (normal), TNG (Training), or AUX (auxiliary) modes of operation. During normal operation, the MODE switch should be set to NORM. In TNG mode, CROWS displays simulated gunnery scenarios from a separate video source. In AUX mode, incoming video signals can be viewed on the LCD. When the TNG or AUX modes are selected, the video mode is indicated in the status field.



**Figure 4. Mode Switch.**

The SAFETY OVERRIDE field (Figure 5) is located to the left of the MODE switch and is used to permit the installed weapon to be fired or the WS to be moved within a No Fire or No Traverse Zone (WP 0031). The SAFETY OVERRIDE ON/OFF switch overrides (disables) the restrictions set for weapon firing and WS traverse when set to ON. A Protective Guard (2) covers the SAFETY OVERRIDE ON/OFF switch to prevent accidental activation of the OVERRIDE function. The OVRD LED (1) is a yellow indicator that illuminates when SAFETY OVERRIDE switch is ON, and the HATCH LED (3) is a red indicator that illuminates when a hatch is open.



**Figure 5. Safety Override Button.**

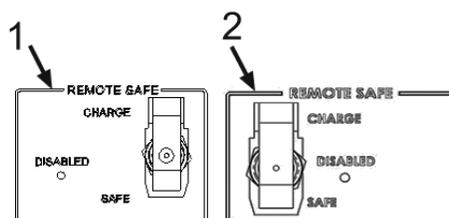
**WARNING**



**WEAPON FIRE**

Do not initiate REMOTE SAFE during firing. Doing so may result in damage to the installed weapon and severe injury to personnel.

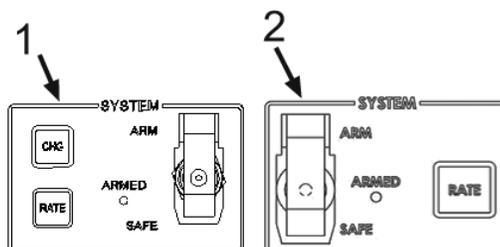
The REMOTE SAFE fields for the DCP (1) and FCU (2) are depicted (Figure 6). While not identical, the fields are operationally the same. The CHARGE/SAFE Switch toggles to safe (SAFE) the installed weapon or return the Cocking Actuator (CA) to forward position (CHARGE). When the REMOTE SAFE mechanism is disabled, the DISABLED LED is illuminated, and the REMOTE SAFE Switch must be toggled to CHARGE and back to SAFE to enable REMOTE SAFE. The DISABLED LED will then extinguish. A Protective Guard covers the CHARGE/SAFE switch and must be raised to operate the switch. If the Protective Guard is lowered, the CHARGE/SAFE switch returns to SAFE.



**Figure 6. REMOTE SAFE Switch.**

The SYSTEM fields for the DCP (1) and FCU (2) are similar except that the DCP has a CHG button for charging the installed weapon (Figure 7). The ARM/SAFE switch consists of the following controls:

1. The ARM/SAFE switch toggles to ARM or SAFE for the installed weapon. When ARM is selected, FIRING ENABLED displays in the FCU/DCP status field, and the installed weapon can be fired. The ARM/SAFE switch is covered by a Protective Guard which must be raised to operate the ARM/SAFE switch. If the Protective Guard is lowered, the ARM/SAFE switch returns to SAFE. The ARMED LED illuminates when the installed weapon is armed. Holding the Palm Switch and pressing the trigger on the CG fires the installed weapon.
2. The RATE button selects burst length and firing rate for the installed weapon. The default rate is five rounds at the full rate of the installed weapon; the reduced rate is 250 rounds for the M2 and 200 rounds for the MK19 but is not applicable to the M240 and M249.
3. The CHG button is available only on the DCP and remotely charges the installed weapon.

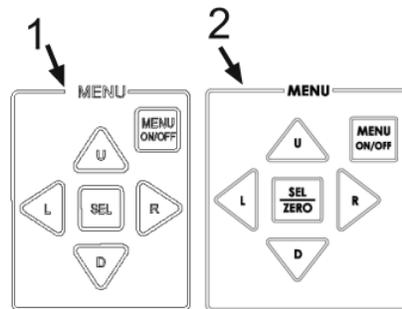


**Figure 7. SYSTEM Switch.**

## DESCRIPTION OF FCU AND DCP CONTROLS AND INDICATORS - Cont

The MENU field is located beneath the SYSTEM field on the DCP (1) and FCU (2) (Figure 8). The MENU field consists of the following controls:

1. The MENU ON/OFF button activates or deactivates the Main Menu. When pressed, the Main Menu appears on screen, and the MENU buttons activate. When pressed a second time, the Main Menu disappears from the screen, and the MENU buttons deactivate.
2. The MENU L/R/U/D (left, right, up, and down) buttons maneuver within the menus. Pressing the MENU ON/OFF button activates the L/R/U/D buttons. The L or R buttons maneuver between main menus and submenus. The U or D buttons navigate within the submenus.
3. The MENU SEL (DCP) or SEL/ZERO (FCU) button selects a submenu item, and the selected menu item is highlighted in yellow. The specified function or action is then performed.



**Figure 8. Menu Fields.**

Below the MENU field on the DCP (1) and FCU (2), the SIGHT field selects and controls the video signals generated by the selected camera (Figure 9). The SIGHT field consists of the following controls:

1. The PLRT (polarity) button inverts the selected camera image (VIM or TIM) from high-signal-black, low-signal-white (black-hot) to high-signal-white, low-signal-black (white-hot) or back again. The camera image inverts each time the PLRT button is pressed.
2. The CAL (calibrate) button is located in the middle of the SIGHT field on the DCP but is at the top of the FCU. The CAL button calibrates the infrared (IR) image on the TIM and can be used to recover from poor manual Level and Gain adjustments by restoring the settings to the default values. When pressed, the video image disappears temporarily while the FCU or MPU calculates a correction of pixel offset at shutter temperature. Double clicking the CAL button returns to automatic level mode for both cameras (VIM and TIM).
3. The RTCL SEL (reticle select) button selects one of five reticle patterns. Each successive press of button selects the next reticle pattern. The reticles are red and centered on screen regardless of WS position.
4. The GAIN +/- buttons adjust the signal gain of the selected camera and increases or decreases the brightness of the image on screen. For the VIM, Gain is adjusted from zero to 100 percent in four levels, and the default is zero percent. For the TIM, Gain adjusts from one to 100 percent in two percent steps, and the default is 70 percent.

5. The LEVEL +/- buttons adjust the video signal offset of the VIM or the temperature level of the TIM depending on which camera is selected. For the VIM, the video signal offset is 50 percent and offers 10 levels of adjustment. If the TIM is selected, the LEVEL button adjusts the temperature range in 50 steps of two percent. The default is 50 percent.
6. The FOCUS FAR/NEAR buttons are used to adjust the focus of the selected camera. A short press on the FAR or NEAR buttons increases or decreases focus step-wise. A long press on the FAR or NEAR button increases or decreases the focus to the maximum or minimum limits. The SIGHT field of the DCP also includes an AUTO FOCUS button. Like pressing the FOCUS button on the CG, pressing AUTO FOCUS on the DCP will focus the selected camera automatically.
7. The DAY/NIGHT button is at the top of the SIGHT field on the DCP (1) but is at the bottom of the FCU (2). The DAY/NIGHT button toggles the selected camera between VIM and TIM.
8. The ZOOM OUT/IN buttons increase or decrease the size of the image generated by the VIM. A short press of either button results in a minimum change to the FOV while holding a button down results in repeated change.

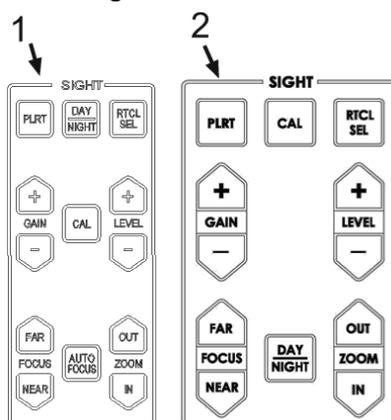


Figure 9. Sight Fields.

The RANGE +/- buttons set the target range (Figure 10). When the range is changed, a new ballistic solution calculates, and the installed weapon adjusts in elevation. A single press of a RANGE +/- button increases or decreases the range in 10-meter increments. A continuous press of a RANGE +/- button increases or decreases the range in 100-meter increments. The range field indicates the distance to the target in meters. The range scales from 100 to 2,200 meters. The default range at power-up is 700 meters.

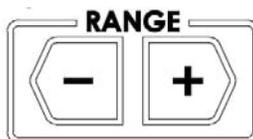
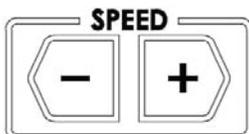


Figure 10. RANGE Button.

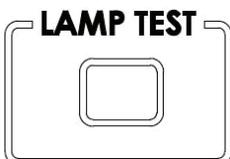
**DESCRIPTION OF FCU AND DCP CONTROLS AND INDICATORS - Cont**

The SPEED +/- buttons (Figure 11) adjust elevation and traverse speed of the WS. When a SPEED +/- button is pressed, the speed of WS movement increases or decreases accordingly. CROWS has four speed settings (100 percent, 50 percent, 10 percent, or two percent of full speed).



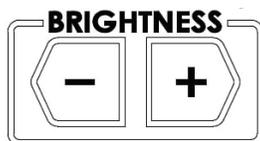
**Figure 11. SPEED Button.**

The LAMP TEST button (Figure 12) tests the function of the LEDs on the FCU or DCP. When pressed, all LEDs with the exception of the POWER LED blink until the LAMP TEST button is released. The POWER LED lights when CROWS powers up and remains lit until the system powers down.



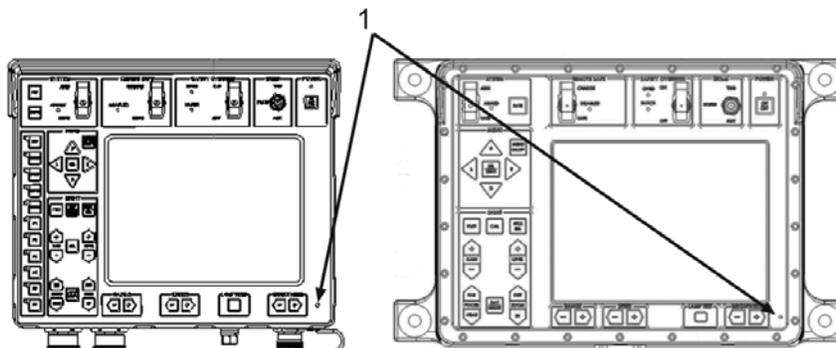
**Figure 12. LAMP TEST Button.**

The BRIGHTNESS +/- buttons (Figure 13) increase or decrease the intensity of the LCD backlight. A short press of the BRIGHTNESS +/- buttons results in a minimum change in brightness, and a long press results in a maximum change in brightness.



**Figure 13. Brightness Buttons.**

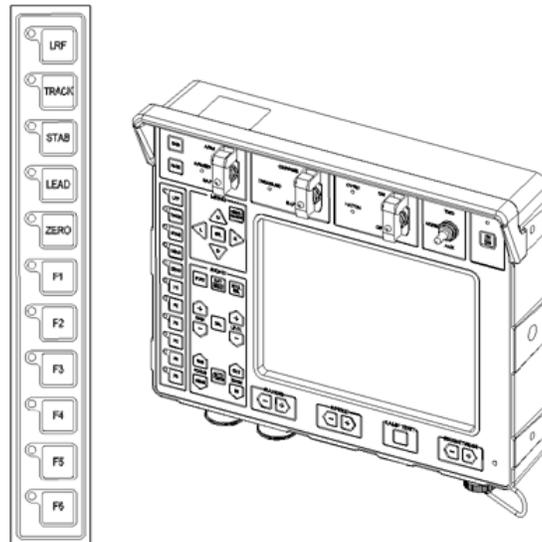
The light sensor (1) to the right of the BRIGHTNESS field on the DCP (left side of figure) or FCU (right side of figure) allows CROWS to adjust the brightness of the button backlighting automatically (Figure 14). With low or no ambient light, CROWS illuminates each of the controls for easier location. For this to work, the sensor must not be blocked or covered and must be kept free of dirt and dust.



**Figure 14. Light Sensor.**

## DESCRIPTION OF DCP FUNCTION KEY CONTROLS AND INDICATORS

Unlike the FCU, the DCP provides a row of function keys down the left side (Figure 15). These controls are unique to the DCP but duplicate functions available from the CG or menu system. The controls are described as follows beginning at the top:



**Figure 15. DCP Function Keys.**

The LRF button performs a laser range measurement and toggles continuous LRF. This function is duplicated on the CG. A single press of the button performs a single LRF measurement or toggles between different ranges (multiple targets). A double press (twice within one second) enables or disables continuous LRF measurement. In addition, the button includes an LED which illuminates when continuous LRF measurement is enabled.

The TRACK button activates/deactivates the video target tracker, and this function is duplicated on the CG. The TRACK button LED illuminates when Target Tracking is enabled.

The STAB button switches WS stabilization on and off. This function is duplicated on the CG. The STAB button LED illuminates when stabilization is on.

The LEAD button activates or deactivates automatic Lead Angle Compensation, and this function is also available on the CG. The LEAD button LED is lit when Lead Angle Compensation is activated.

The ZERO button enables the Sight Zeroing function which can also be accessed through the menu system. The ZERO button LED indicates that Zeroing has been performed.

The F1 button toggles the Sniper Detection feature of Vanguard systems and is not applicable to CROWS. The F1 button LED illuminates when this feature is active.

The buttons F2 through F6 are not currently implemented and are reserved for future functionality.

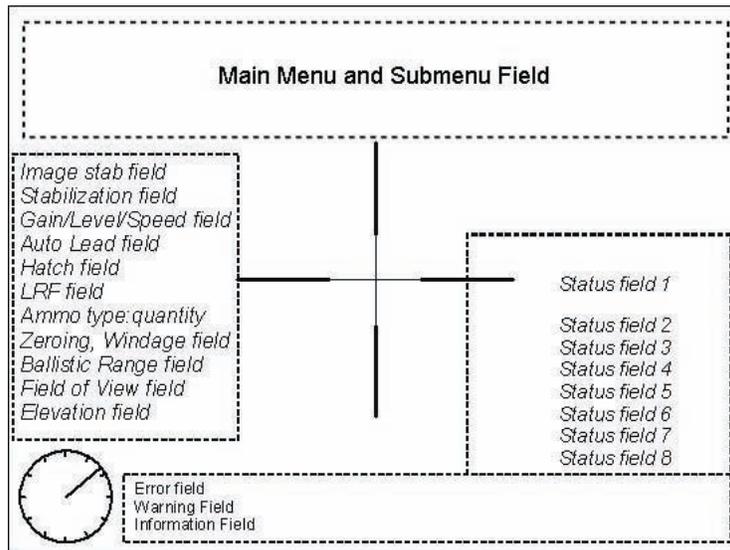
**DISPLAY OPERATOR CONTROL FUNCTIONS**

The FCU and DCP house an LCD display with a native resolution of 640 x 480 pixels. Descriptions of its various graphic elements, control functions, and fields follow:

The on screen display fields used during normal operation (excluding the menus, submenus, and messages) are shown in Figure 16. Explanations of all on screen display fields follow:

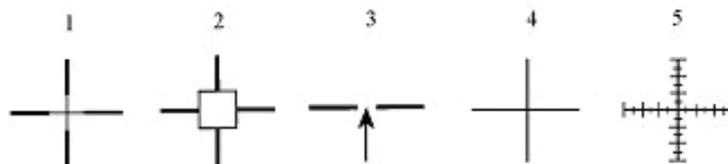
**NOTE**

All fields shown inside dashed boxes display only temporarily or on request to avoid obscuring the view from the optical devices.



**Figure 16. Display Fields.**

1. Reticles: The Reticles display in the center of the screen and are colored red. The five available reticles are depicted in Figure 17. A Reticle is chosen according to personal preference, but the first Reticle is the default at power up.



**Figure 17. Reticles.**

2. Main Menu Field: The Main Menu Field is where Main Menu displays when the MENU ON/OFF button is pressed on the FCU or DCP. The Main Menu is comprised of SETTING, DEFINITIONS, AMMO, and MAINTENANCE options with submenus available under each.
3. Submenu Field: This field displays a menu tree for a selected Main Menu item.
4. Image Stab: When the Image Stabilization function is activated, IMAGE STAB displays and remains as long as the function is active.
5. Stabilization Field: If WS Stabilization is enabled but not activated by holding the Palm Switch, STAB -/- displays. If Stabilization is activated and all the rate gyros are working properly, STAB AZ/EL displays. If Stabilization is not enabled, the field clears.
6. Gain/Level Field: The Gain/Level field displays the current Gain or Level setting of the TIM when TIM is the selected camera and the Gain +/- or Level +/- buttons are pressed. The information displays for five seconds after the last button was pressed; however, if a Gain adjustment is made immediately following a change to the Level setting, the information in the Gain/Level field changes immediately to from Level to Gain.
7. Lead Angle Field: The Lead Angle field displays LEAD ANGLE when automatic Lead Angle Compensation is active. If ballistic compensation exceeds the motion envelope of the SSA, LEAD ANGLE LAG displays on screen. If Lead Angle Compensation is off, no text displays.
8. Hatch Field: When a hatch is opened, the name of the hatch displays for three seconds.
9. Remaining Ammo Field: The Remaining Ammo field displays the Ammunition Type and number of Rounds loaded in the Ammo Box minus Rounds fired, for example, M33 : xxx. The amount of Ammunition remaining is still available after CROWS is shutdown and then powered back up.
10. LRF Field: The LRF Field displays the range, status, and messages concerning the LRF. This text field is cleared one minute after the last range measurement was performed.
11. Zeroing, Windage Field: As soon as the Zeroing function is activated, a capital letter Z appears on screen indicating that Zeroing has been performed. The letter disappears when the functions RESTORE BORE VALUES or BORE SIGHT ADJUST are activated. If a value for Windage is provided, a capital letter W displays on screen indicating that windage has been added to the ballistic solution. The letter is removed when Windage is set to zero. The field is empty at power up.
12. Ballistic Range Field: The Ballistic Range field displays the Target Range in meters used in the ballistic calculations and implemented by the Servo System.
13. Field of View (FOV) Field: The Field of View field displays the FOV of the selected camera in degrees.
14. Elevation Field: The Elevation field displays the elevation of the SSA followed by the elevation of the Soft Mount in parenthesis. Negative angles are toward the vehicle; positive angles are away from the vehicle. The Elevation angle will be between -20 and 60 degrees (-20 degrees ≤ Elevation angle ≤ 60 degrees).

**DISPLAY OPERATOR CONTROL FUNCTIONS - Cont**

15. **Clock Face:** The Clock Face (Figure 18) indicates the relative azimuth (horizontal rotation) angle of the WS with respect to the Host Vehicle or other platform. A zero angle means the azimuth position is parallel to the center line along the vehicle. The Clock Face is marked at each 30 degree azimuth increment. Positive angles are in a clockwise direction. When detecting an open hatch, the traverse restrictions defined for that hatch are displayed as a yellow line within the outer edge of the Clock Face.

**Figure 18. Clock Face.**

16. **Error-, Warning-, and Information- Text Fields:** These fields show the error and warning text displayed by the system Built-In Test (BIT), and the information text displayed by the system function. These fields are displayed over three lines in the bottom left of the screen to the right of the Clock Face. The first two lines show the Technical Warning and Error messages specifying the LRUs and sublevels where a failure occurred. The messages are color coded according to the severity of error. The color assignments are shown in Table 1.

**Table 1. Color Assignments for Error, Warning, and Information Text Fields.**

<b>Color</b>	<b>Severity</b>
Red	A fatal error that halts further system operation, i.e., a safety-related error with no workaround. Firing is disabled, and WS movement is inhibited. These messages will not be removed from the display. Text messages are stored by the system and are displayed with a sequence number indicating the order of appearance. If there is more than one error, the error messages are displayed for 10 seconds.
Yellow	Warning for nonfatal errors that may reduce system functionality.
Green	Information on events and cautions.

17. Status Fields: The Status field messages indicate the status of the system functions and are shown in Table 2 and described in Table 3.

**Table 2. Status Field Messages.**

	Level 1	Level 2	Level 3	Level 4
<b>Status field 1</b>	ARMED	Surveillance		
<b>Status field 2</b>	Training	Aux Video	Zeroing	Low Voltage
<b>Status field 3</b>	Vehicle ID Invalid	Vehicle Type Invalid	Safety Override	Traverse Inhibit
<b>Status field 4</b>	Low Ammo			
<b>Status field 5</b>	System Failure	Weapon ID Unknown	Firing Inhibit	Firing Enabled
<b>Status field 6</b>	TRP Scan	Sector Scan		
<b>Status field 7</b>	Firing Rate/Burst			
<b>Status field 8</b>	Remote Safe	Charged		

**Table 3. Status Field Message Descriptions.**

Message Text	Description
Training	Displayed when the FCU or DCP Mode switch is in TNG position.
Aux Video	Displayed when video from the external video source is displayed on the LCD screen. The MODE switch is in the AUX position.
Zeroing	Displayed when the ZERO function key (DCP) or the MENU SEL/ZERO button (FCU) is pushed without an active menu. The Zeroing function is activated.
Low Voltage	Displayed when the measured supply voltage is below specified limit.
Vehicle ID Invalid	The Vehicle ID read from Hatch Interrupt Unit (HIU) does not specify a known vehicle. The system is blocked. Firing and WS movement is disabled by the system.
Vehicle Type Invalid	The Vehicle ID read from Hatch Interrupt Unit (HIU) defines a vehicle type that is not set up with CROWS. The system is blocked. Firing and WS movement is disabled by the system.
Safety Override	Displayed when the SAFETY OVRD switch on the FCU or DCP is activated.
Traverse Inhibit	WS movement is inhibited by the system while a hatch is open. Moving the Safety Override switch to On removes text and enables WS movement.
Low Ammo	Displayed when the Low Ammo Sensor reports low ammunition.

## DISPLAY OPERATOR CONTROL FUNCTIONS - Cont

Table 3. Status Field Message Descriptions - Cont.

Message text	Description
System Failure	Displayed when a fatal system failure is encountered. Both the firing and servo systems are disabled.
Weapon ID Unknown	Displayed when the Weapon ID read from the Fire Solenoid is invalid. Firing is disabled. The Safety Override cannot override an invalid weapon state.
Firing Inhibit	The ARM/SAFE switch is in the ARM position, but firing is disabled by the system.
Firing Enabled	The system is armed and ready for firing.
ARMED	Indicates that the ARM/SAFE switch is in the ARM position. Note that this only indicates the position of the ARM/SAFE switch regardless of the state of the Firing Circuit.
Remote Safe	Displayed when the Remote Safe activation criteria are met.
Surveillance	Indicates that the system is in Surveillance mode.
Firing Rate/Burst	In Burst/Full Rate, text is removed after five seconds. For other firing rate/burst settings, the following text is displayed: Burst, 5 rounds @ full rate: Burst/Full Single Shot: Single Shot Continuous Fire @ full rate: Continuous/Full Burst, 5 rounds @ reduced rate: Burst/Reduced Continuous Fire @ reduced rate: Continuous/Low
Charged	The Cocking Actuator has completed a cocking stroke.

## Operator Menu Functions

System functions can be initiated through menu interactions. The top level menu is called the Main menu and contains the following main items (Table 4):

**Table 4. Operator Menu Functions.**

<b>SETTING</b>	<b>Operator Function</b>	<b>Menus</b>
Surveillance	Toggles the system in or out of surveillance mode. When the system is set in surveillance mode, the WS super elevates approximately 15 degrees above the line of sight.	SETTINGS Surveillance LRF Min Range Restore Bore Values Zeroing
LRF Min Range	The minimum range can be adjusted so only ranges above the range specified are displayed (e.g., to disregard a tree line between CROWS and a target).	Windage Ammo Counter Sniper Detection Camera ->
Restore Bore Values	To remove Zeroing and Windage and to restore the default boresight values.	Boresighting Video Image Stab Graphics Level CG Shaping
Zeroing	Zeroing is the procedure for adjusting the Sight to eliminate a deviation between the firing hit point and the firing aim point. It requires that the installed weapon has been fired and that the hit point has been noticed.	
Windage	To input the wind strength and direction to the system.	
Ammo Counter	To set the number of rounds in the Ammo Box. This number will be counted down with input from the Ammo Counter.	
Sniper Detection	Provides position information of the shot detected and automatically traverses to that position for the Vanguard System. Default setting at power-up is ON	
Camera -> Boresighting	Displays the Camera submenu. To define the relative weapon and Sight alignment.	
Video Image Stab	To enable/disable Video Image Stabilization used to improve ability to observe the target during weapon fire.	
Graphics Level	To adjust the brightness level of the graphic overlay.	
CG Shaping	To change joystick shaping between X3, X5, and proportional to Field Of View.	

**Operator Menu Functions - Cont**

**Table 4. Operator Menu Functions - Cont**

<b>Camera -&gt;</b>	<b>Operator Function</b>	<b>Menus</b>
TIM Temperature Calibration	As the ambient temperature changes from startup, the TIM picture quality can be affected. To compensate, TIM Temperature Calibration is adjusted to the current temperature.	TIM Temperature Calibration VIM Exposure Time
VIM Exposure Time	To adjust the exposure time of the VIM.	
<b>DEFINITIONS</b>	<b>Operator Function</b>	<b>Menus</b>
Target Ref Points ->	Displays the Target Ref Points submenu.	DEFINITIONS
Auto Sector Scan	To define the sector and start the scan.	Target Ref Points ->
No Traverse Zone ->	Displays the No-Traverse Zone submenu.	Auto Sector Scan
No Fire Zone ->	Displays the No-Fire Zone submenu.	No Traverse Zone ->
No Fire Zone ->	Displays the No-Fire Zone submenu.	No Fire Zone ->
<b>Target Ref Points</b>	<b>Operator Function</b>	<b>Menus</b>
Activate Scan	To activate scanning of the specified Target Reference Points (TRPs) in a selected location	Activate Scan
Select Location	To select a previously defined location and the associated set of TRPs and to define the platform heading.	Select Location
Define Location	To define the current vehicle location, heading, and the associated set of TRPs.	Define Location
Delete Location	To delete a location and the associated set of TRPs.	Delete Location
<b>No Traverse Zone</b>	<b>Operator Function</b>	<b>Menus</b>
View	To graphically view Vehicle Dependent Zones and User-Defined, No-Traverse Zones.	View
New	To define a new User-Defined, No-Traverse Zone. The defined zones are stored at power down.	New
Delete	To delete a User-Defined No Traverse Zone.	Delete
Table	To define, modify, and delete user-defined zones with the Zone Table Screen.	Table

<b>No Fire Zone</b>	<b>Operator Function</b>	<b>Menus</b>
View	To graphically view the Vehicle Dependent Zones and User-Defined No Fire Zones.	View New Delete
New	To define a new User-Defined No Fire Zone. Defined zones are stored at power down.	Table
Delete Table	To delete a User-Defined No Fire Zone. To define, modify, and delete user defined zones with the Zone Table Screen.	
<b>AMMO</b>	<b>Operator Function</b>	<b>Menus</b>
	To select the Ammunition Type for the installed weapon.  Note that the number of items varies according to the number of Ammunition Types defined for the installed weapon.	AMMO Ammo type 1 Ammo type 2 Ammo type 3 ----- Ammo type n MILES
<b>AMMO (M2)</b>	<b>Operator Function</b>	<b>Menus</b>
M33 BALL M8 API M20 API_TRACER XM903 SLAP MILES	M33 Ball Combat Ammo (Default) M8 Armor Piercing Incendiary (API) M20 API Tracer M903 Saboted Light Armor Penetrate Multiple Integrated Laser Engagement System	AMMO M33 BALL M8 API M20 API_TRACER XM903 SLAP MILES
<b>AMMO (MK19)</b>	<b>Operator Function</b>	<b>Menus</b>
M383 HE M430 M430 A1_HEDP M918 TP MILES	M383 High Explosive (Default) M430 High Explosive M430A1 High Explosive Dual Purpose M918 Target Practice Multiple Integrated Laser Engagement System	AMMO M383 HE M430 M430 A1_HEDP M918 TP MILES
<b>AMMO (M240)</b>	<b>Operator Function</b>	<b>Menus</b>
M80 BALL M62 TRACER MILES	M80 Ball (Default) M62 Tracer Multiple Integrated Laser Engagement System	AMMO M80 BALL M62 TRACER MILES
<b>AMMO (M249)</b>	<b>Operator Function</b>	<b>Menus</b>
M855 BALL M856 TRACER MILES	M855 Ball (Default) M856 Tracer Multiple Integrated Laser Engagement System	AMMO M855 BALL M856 TRACER MILES

**Operator Menu Functions - Cont****CAUTION**

To prevent damage to equipment, Maintenance Functions must be performed by qualified Maintenance Technicians only.

**Table 4. Operator Menu Functions - Cont**

<b>Maintenance</b>	<b>Operator Function</b>	<b>Menus</b>
Status	To display the real time system status.	MAINTENANCE
Cal. Pos Sensors	To run the Azimuth and Elevation Sensors Calibration Procedure during Normal operational mode. Calibration must only be performed by a qualified technician after replacing the FCU, DCP, MPU, MFA, or RSSA.	Status Cal. Pos Sensors Adjust Reticle Center Voltage Threshold FOV Calibration
Adjust Reticle center	To move the reticle on screen when it is no longer aligned with the Line of Sight. This must be performed for both of the cameras, and the cameras cannot be changed during the procedure.	
Voltage Threshold	To define the voltage at which the system reports low voltage. If activated accidentally, the function can be aborted by pressing MENU ON/OFF.	
FOV Calibration	To calibrate the VIM so an accurate FOV is calculated from the zoom and focus lens positions. If activated accidentally, the function can be aborted by pressing MENU ON/OFF.	

**DESCRIPTION OF CONTROL GRIP (CG) CONTROLS AND INDICATORS****NOTES**

The Palm Switch must be pressed on the CG to allow for continuous movement of the WS or to operate any other buttons or switches on the CG.

The Trigger Guard prevents accidental firing of the installed weapon and must be flipped up to access the Trigger. The Trigger fires the installed weapon when the Palm Switch is engaged.

The functionality of DAY/NT button is duplicated by the SIGHT DAY/NIGHT button on the Fire Control Unit (FCU) or Display and Control Panel (DCP).

The Visual Imaging Module (VIM) is the default camera at power-up.

When changing cameras, the Field of View (FOV) automatically updates to match the closest FOV of the previous camera.

The CG (Figure 19) controls the movement of the WS and fires the installed weapon. The CG includes the following controls:

1. The DAY/NT button (1) switches the cameras between the VIM (DAY) and TIM (NIGHT).
2. The MAG switch (2) is the zoom function for the cameras. Pushing the MAG switch up once zooms the camera in one step which reduces the Field of View (FOV). Pushing the MAG switch down once zooms the camera out which increases the FOV by one step. The FOV angle displays on screen. See the VIM and TIM Field of View table for the FOV steps (Table 5).

**Table 5. Field of View.**

Field of View (degrees)	FOV1	FOV2	FOV3	FOV4	FOV5	FOV6
VIM	1.7	3.3	5	10	25	47
TIM	1.7	3.3	5	10		

**NOTES**

The functionality of the MAG switch is duplicated by the SIGHT FOCUS FAR/NEAR button on the FCU or DCP with the exception of the autofocus feature which is only available in the SIGHT field of the DCP.

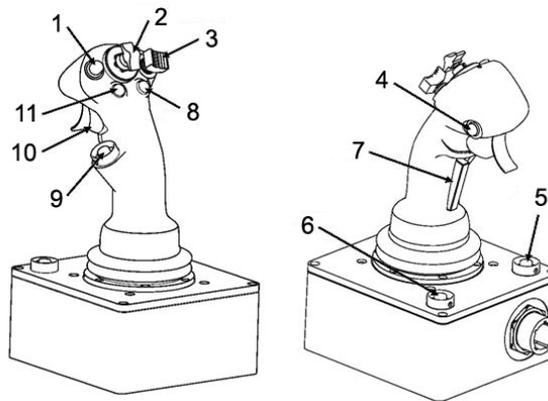
The Autofocus feature times out if the Target lacks enough detail for autofocus to work effectively.

3. The FOCUS switch (3) is a toggle switch with a built-in pushbutton which controls both manual and automatic focusing. Pushing the FOCUS switch left focuses the camera near; pushing the FOCUS switch right focuses the camera far. Pressing the FOCUS button starts automatic focusing of the selected camera. Automatic focusing is overridden by pressing the FOCUS switch left or right.
4. The LEAD button (4) when pressed while holding Palm Switch starts Lead Angle Compensation. LEAD ANGLE ON appears in the Auto Lead Field on screen.
5. The STAB button (5) starts starts WS Stabilization mode for engaging targets while the Host Vehicle or other platform is on the move. STAB (AZ-EL) appears on screen when Palm Switch is pressed.
6. The Null button (6) compensates for drift in the gyros. When pressed with the Palm Switch disengaged, the drift compensation (nulling) procedure is initiated. The procedure takes 20 seconds during which time no platform motion can occur.
7. The Palm Switch (7) when held allows WS movement in response to directions from the CG and enables other CG functions.
8. The TRACK button (8) operates the Video Target Tracker (WP 0032).

**DESCRIPTION OF CONTROL GRIP (CG) CONTROLS AND INDICATORS - Cont****NOTE**

The functionality of the CHG button is duplicated by REMOTE SAFE CHARGE on the FCU or DCP or the CHG button in the SYSTEM field of the DCP.

9. The CHG button (9) charges the installed weapon remotely by activating the Cocking Actuator (CA). During charging, the Fire Circuit is disabled. Once charging completes, CROWS prevents additional charging for four seconds.
10. The Trigger button (10) when pressed while holding Palm Switch fires the installed weapon. The Trigger button is protected by a cover to prevent accidental firing.



**Figure 19. Control Grip (CG).**

**WARNING****LASER LIGHT**

The LRF is classified as a Class 1 Laser and is safe in normal operations and conditions, but failure in the electrical system can cause the laser to violate safety requirements. Do not point at humans or stare into the laser beam as this can cause serious eye injury.

11. The Laser Range Finder (LRF) button (11) performs a laser range measurement and displays the target range on screen. If multiple targets are found, a first and last target range can be displayed if the LRF button is pressed within five seconds of the initial lasing. The minimum LRF range is 20 meters (65.6 feet).

A summary of CG functions is provided in Table 6.

**Table 6. Summary of CG Functions.**

<b>Button/Switch:</b>	<b>Operator Function:</b>
Palm Switch	To enable/disable the other CG functions.
CG – Platform Speed	To move the WS in azimuth and elevation axes.
Trigger	To fire the installed weapon.
DAY/NT	To toggle between the VIM and TIM as the selected camera.
MAG	To change the magnification (zoom/FOV) of the selected camera.
FOCUS	The FOCUS switch is a toggle switch with a built-in pushbutton used for controlling both manual and automatic focusing of the selected camera. Switch - Focus (Near/Far): To adjust focus of the selected camera. Push Button – Auto Focus: To manually start automatic focusing of the selected camera.
LRF	To perform a laser range measurement.
TRACK	To operate the Video Target Tracker.
LEAD	To activate/deactivate automatic Lead Angle Compensation.
CHG	To remotely charge the installed weapon, i.e. to activate the Cocking Actuator.
STAB ON/OFF	Switch WS Stabilization on and off.
NULL	To perform drift compensation, reducing the drift when in stabilized mode.

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
PREPARATION FOR USE**

---

**THIS WORK PACKAGE COVERS:**

Preparation of CROWS for operation.

---

**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
TM 9-1005-213-10  
WP 0002  
WP 0011  
WP 0012  
WP 0016  
WP 0020  
WP 0021

**References - Cont**

WP 0025  
WP 0033  
WP 0038  
WP 0047

**Equipment Conditions**

Vehicle Engine On (Vehicle Operator  
Manual)

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**PREPARATION OF CROWS FOR OPERATION**

**WARNINGS**



**WEAPON FIRE**

Ensure that the installed weapon is clear of ammunition before loading weapon. Accidental firing of weapon can kill or injure personnel.

Ensure that the installed weapon is aimed in a safe direction and that no personnel or equipment are in the Line of Fire. Doing so prevents death or injury to personnel and damage to equipment.

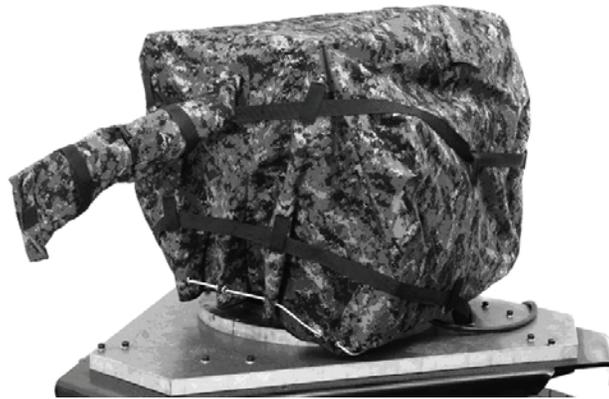
**NOTES**

If the situation permits, the Host Vehicle engine should be running during CROWS power up to maintain vehicle battery charge.

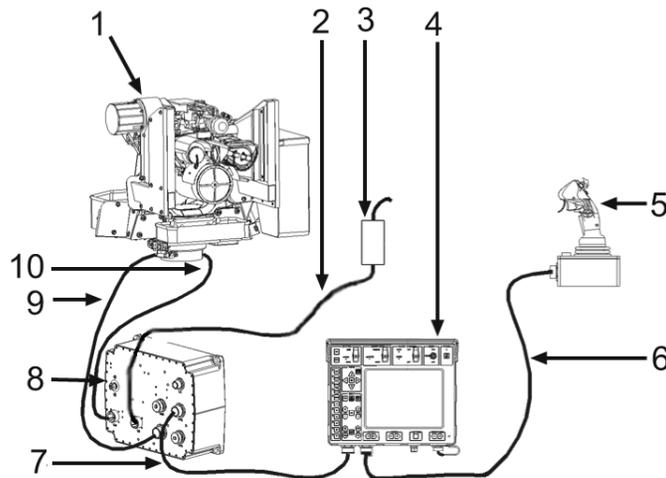
When properly tightened, the threaded Cable End covers the Red Band on the connector. If you cannot see the Red Band, the Cable should be properly connected.

**PREPARATION OF CROWS FOR OPERATION - Cont**

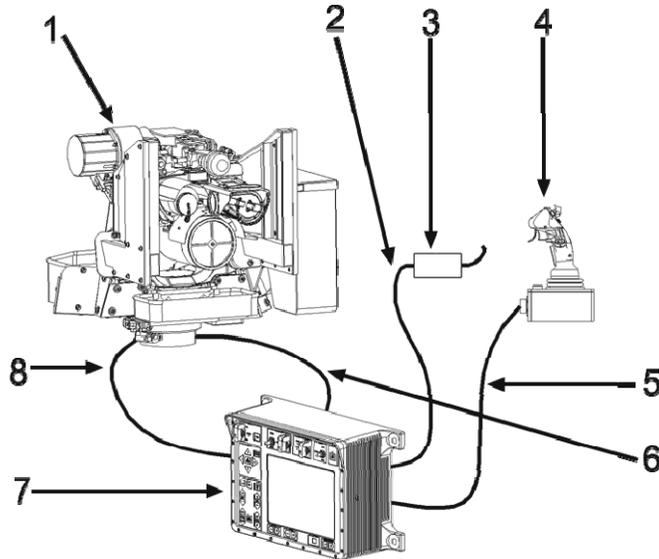
1. Remove the Protective Cover (WP 0038) (Figure 1).

**Figure 1. Protective Cover.**

2. Verify that the main System Cables are properly connected (WP 0002). Turn the Cable End CW until the Red Band on the Connector is no longer visible.
  - a. For the DCP Configuration (NSN 1090-25-160-1292), CROWS components are connected as follows: Cable W11 (2) and Fuse Box (3) connect MPU (8) to power source, Cable W1 (6) connects DCP (4) to CG (5), Cables W2 (9) and W3 (10) connect MPU (8) to WS (1), and Cable W504 (7) links MPU (8) to DCP (4) (Figure 2).

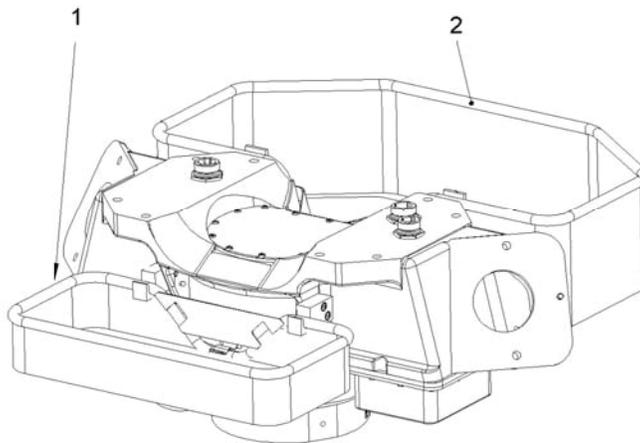
**Figure 2. Cable Connections for DCP Configuration.**

- b. For the FCU Configuration (NSN 1090-25-160-1150), CROWS components are connected with the following external cables: Cable W11 (2) and Fuse Box (3) connect FCU (7) to power source, Cable W1 (5) connects FCU (7) to CG (4), and Cables W3 (6) and W2 (8) connect FCU (7) to WS (1) (Figure 3).



**Figure 3. Cable Connections for FCU Configuration.**

- 3. Ensure that the front and rear (2) Casing Collector Bags (WP 0047) are installed for the M2 and MK19 and that the front (1) Casing Collector Bag is installed for small caliber weapons (M240/M249) (Figure 4).



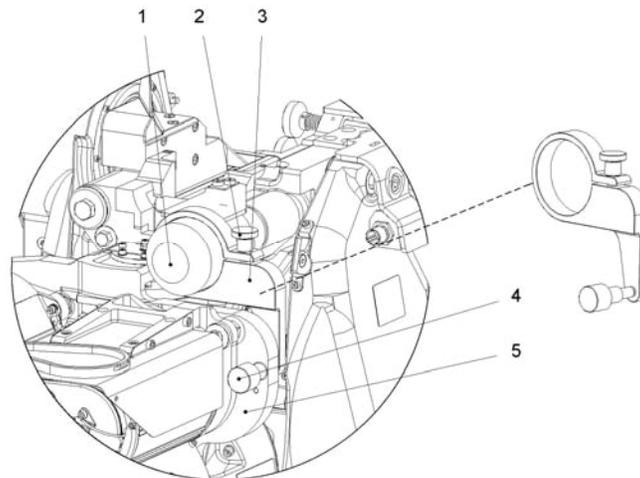
**Figure 4. Casing Collector Bags.**

**CAUTION**

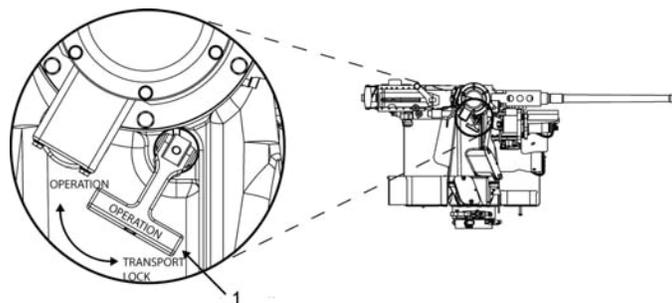
Do not power up CROWS before the Clamp Assembly is removed or while the ELEVATION TRANSPORT LOCK or AZIMUTH TRAVEL LOCK are engaged. Doing so damages equipment.

**PREPARATION OF CROWS FOR OPERATION - Cont**

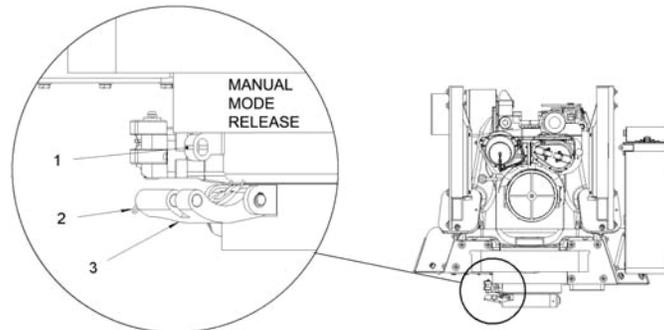
4. Remove the Clamp Assembly (Figure 5) from the Sight Servo Assembly if present.
  - a. Loosen the Clamp Screw (2) by turning CCW.
  - b. Remove the Lock Screw (4) by turning CCW.
  - c. Remove the Clamp Assembly by raising the end and pulling the assembly forward and off the Cocking Actuator (1).
  - d. Store the Clamp Assembly in the Storage Bag.

**Figure 5. Clamp Assembly.**

5. Ensure the ELEVATION TRANSPORT LOCK (Figure 6) is in operation mode.
  - a. Pull the T-handle (1) up and out before turning 180 degrees until the OPERATION side of handle shows.
  - b. Push the T-handle down against the Side Support.
  - c. Verify that the Soft Mount elevates and depresses by hand.

**Figure 6. Elevation Transport Lock.**

6. Unlock the AZIMUTH TRAVEL LOCK (Figure 7).
  - a. Pull out the spring-loaded Locking Pin (2) from the Locking Bracket (1) and Locking Arm (3).
  - b. Push the Locking Arm (3) down and away from the Locking Bracket.



**Figure 7. Azimuth Travel Lock.**

7. Remove the VIM, TIM, and LRF Lens Caps and place them in their storage positions (Figure 8).

#### **NOTE**

To prevent the LRF Lens Cap Chain from hanging in front of the LRF during operation, loop the chain under the LRF Lens Cap Clip when the Cover is in storage position.

- a. The VIM Lens Cover (8) unscrews from the lens and stows on the right side of LRF Cover (4).

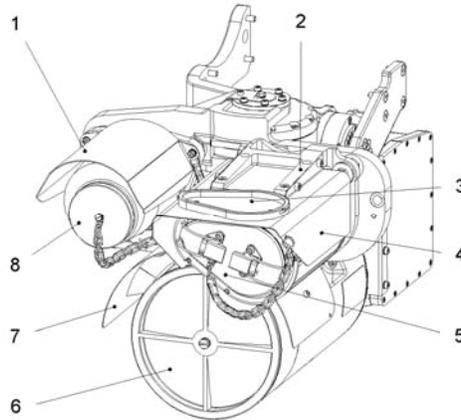
#### **CAUTION**

The TIM Lens Cover can vibrate loose from the Ammunition Box Storage Position when the Host Vehicle is in motion. To prevent loss or damage of equipment, store the TIM Lens Cover in the CROWS Toolbag.

- b. The TIM Lens Cover (6) unscrews and fastens to the Ammunition Box when not in use.

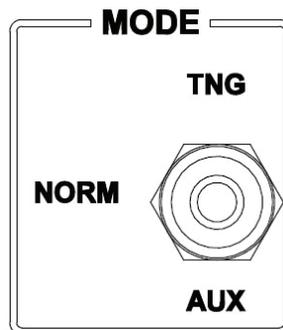
**PREPARATION OF CROWS FOR OPERATION - Cont**

- c. The LRF Lens Cover (5) unclamps and clips to LRF Lens Cover Bracket (3).



**Figure 8. Lens Caps.**

8. Ensure that the appropriate weapon (M2-WP 0011, MK19-WP0016, M240-WP 0020, or M249-WP 0025) is installed.
9. Adjust the Firing Solenoid if necessary (M2-WP 0012 and M240/M249-WP 0021).
10. Verify that the Weapon Barrel is mounted and adjusted (M2 only, TM 9-1005-213-10).
11. Set the MODE switch (Figure 9) to NORM on the FCU or DCP.



**Figure 9. MODE Switch.**

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
STARTUP**

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**THIS WORK PACKAGE COVERS:**

CROWS Startup.

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**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
TM 9-1005-213-10  
WP 0013  
WP 0020  
WP 0022  
WP 0029

**References - Cont**

WP 0036  
WP 0050

**Equipment Conditions**

CROWS Powered Down (WP 0036)  
Vehicle Engine Running (Vehicle  
Operator Manual)

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**STARTUP**

**WARNINGS**



**HEAVY PARTS**

To prevent injury to personnel or damage to equipment, ensure CROWS is clear of obstacles before powering up.

If Cocking Actuator Arm is extended on power up, CROWS retracts it possibly injuring personnel. Ensure that personnel are clear of WS when starting CROWS.

**STARTUP - Cont****WARNINGS****WEAPON FIRE**

Ensure that the installed weapon is clear of ammunition before loading weapon. Accidental firing of weapon can kill or injure personnel.

Ensure that the installed weapon is aimed in a safe direction and that no personnel or equipment are in the Line of Fire. Doing so prevents death or injury to personnel and damage to equipment.

**CAUTIONS**

Do not operate any CG or FCU/DCP switches until power-up is complete. Failure to do so can damage equipment.

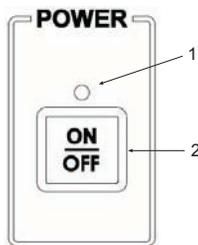
Do not power up CROWS before the Clamp Assembly is removed or while the ELEVATION TRANSPORT LOCK or AZIMUTH TRAVEL LOCK are engaged. Doing so damages equipment.

**NOTES**

If the situation permits, the vehicle engine should be running during CROWS power up to maintain the battery charge.

Unlike the FCU, the DCP Power LED blinks during the first 60 seconds of startup. This does not indicate a problem, and startup should complete normally.

1. Press POWER ON/OFF (2) on the FCU or DCP (Figure 1). The POWER LED (1) lights as CROWS powers up.



**Figure 1. POWER ON/OFF.**

2. About 90 seconds after power is switched on, the Startup/Status Screen appears (Figure 2). The system then runs an internal startup Built-In Test (BIT) to check the status of all the peripheral devices. The BIT finishes in 30 seconds, and the results appear on screen.
  - a. Contact Maintenance Personnel if faults/errors appear during startup.

**CAUTION**

If the Platform ID on the Startup/Status Screen reads PRODUCTION 1.0, a PPC file (vehicle ID) has not been properly loaded. To prevent damage to equipment, power CROWS off and report the system to Field Maintenance. Do not operate CROWS without accurate vehicle identification.

- b. Verify that the Vehicle ID matches the vehicle in use.
- c. Ensure that the Weapon ID matches the weapon installed.
- d. Verify that the Ammunition in use matches the selected Ammunition Type.

```

.....Power UP...SW Release: CROWS IIx.x.....
***** CAUTION *****
DO NOT OPERATE ANY RWS CONTROLS DURING POWER UP

Vehicle ID           : M1114 HMMWV
Weapon ID           : M2
Amm o               : M33 BALL
Fire Controller      : SW version x.x OK
Sensor Controller    : SW version x.x OK
Thermal Imaging Module : OK
Visible Imaging Module : OK
Laser Range Finder   : Version Kxxx OK
Control Grip         : OK
Servo System         : OK
Main Frame           : OK
Stabilization        : Az = OK / El = OK
Number Of Powerups   : xx
Uptime (hh:mm:ss)    : xxxx.xx.xx
    
```

Collecting startup status (10)

**Figure 2. Startup/Status Screen.**

3. When the following text displays on screen (Figure 3), the BIT completed successfully.

**Press the 'SEL' button in the 'Menu' field to continue**  
**Warning: the platform will move (calibrate sight)**

**Figure 3. Continue Startup.**

STARTUP - Cont

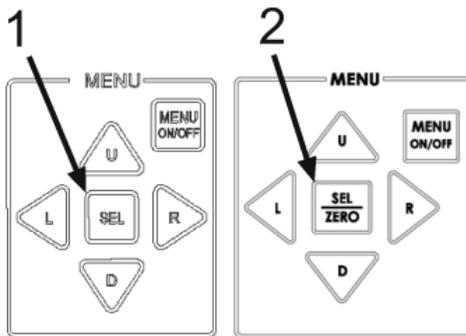
**WARNING**



**HEAVY PARTS**

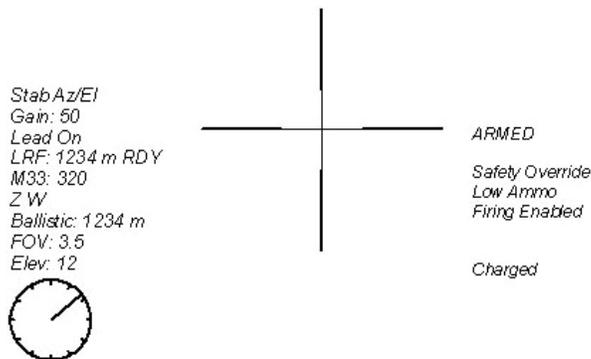
After completion of the BIT, CROWS performs sight calibration. During calibration, the SSA moves to the upper left, lower right, and center. To avoid injury, ensure that personnel are clear of the WS during system startup.

4. Press MENU SEL on the DCP (1) or MENU SEL/ZERO (2) on the FCU to complete system startup (Figure 4).



**Figure 4. MENU SEL and MENU SEL/ZERO.**

5. The Startup/Status Screen disappears and is replaced by the Operating Screen (Figure 5).



**Figure 5. Operating Screen.**

6. If the M240/M249 Firing Solenoid is installed, CROWS prompts with the following message (Figure 6):

**Weapon: M249**  
**Use 'U'/D' keys to change.**

**Press 'SEL' to continue.**

**Figure 6. Set Small Caliber Weapon.**

7. Press MENU U (Up) or MENU D (Down) to indicate the appropriate small caliber weapon (either M240 or M249) if necessary and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the correct weapon.
8. If No-Fire Zones are stored, CROWS prompts with the following message (Figure 7):

**Delete User Zones: NO (20)**  
**Use 'U'/D' keys to change.**

**Press 'SEL' to continue.**

**Figure 7. Delete User Zones.**

9. If existing No-Fire Zones should be removed, press MENU U (Up) or MENU D (Down) to change the prompt to YES and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS allows 20 seconds to complete this action or the system removes the prompt and retains the zones. Only user-defined, No-Fire Zones are removed; factory-set zones cannot be deleted.

## NOTES

When the system is started with the Azimuth Traverse Lock aligned whether the Lock is engaged or not, CROWS must prompt with the following message to prevent equipment damage (Figure 8). If the message does not appear, position calibration is incorrect. Report the system to Field Maintenance.

**WARNING**  
**Ensure Azimuth Traverse Lock**  
**is not Engaged**

**Press 'SEL' to continue.**

**Figure 8. Startup Warning.**

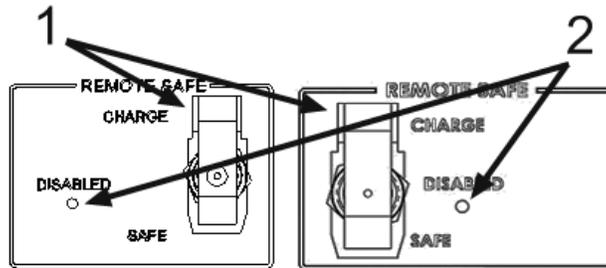
The system performs sight calibration and displays the calibration text in the information/warning field on screen (Figure 9). When complete, the calibration text disappears automatically.

CALIBRATING SIGHTS. THE PLATFORM ELEVATES

**Figure 9. Calibration Text.**

**STARTUP - Cont**

10. On startup, REMOTE SAFE is disabled, and the DISABLED LED (2) is lit on the DCP (left side of figure) or the FCU (right side of figure) (Figure 10). Lift the Safety Cap (1) and toggle REMOTE SAFE to CHARGE and back to SAFE. The DISABLED LED (2) will go out, and REMOTE SAFE will be enabled.

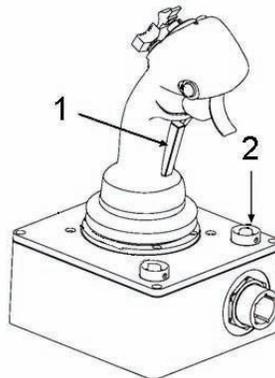


**Figure 10. REMOTE SAFE.**

**NOTE**

WS Stabilization allows CROWS to engage targets by retaining the Weapon Barrel position while the Host Vehicle or other platform is moving. Stabilization is not needed when CROWS is used from a stationary position.

11. Stabilize the WS pressing the STAB button (2) on the CG (Figure 11). STAB (AZ-EL) appears on screen and stabilization is active when the Palm Switch (1) is pressed. WS Stabilization is also available on the DCP as the STAB function key. Activating this function stabilizes the WS for engaging targets while on move.



**Figure 11. STAB Button.**

**END OF TASK****TEST BASIC SYSTEM FUNCTIONS**

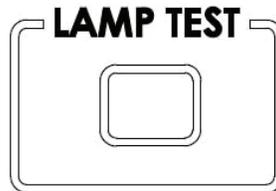
1. Ensure that CROWS has started normally.

**NOTE**

If any tests described below fail, contact Maintenance Personnel.

2. Test the following system functions:

- a. Press the LAMP TEST button at the bottom of the DCP or FCU (Figure 12). Ensure all LEDs blink while the button is held except the POWER LED which lights when CROWS is started.



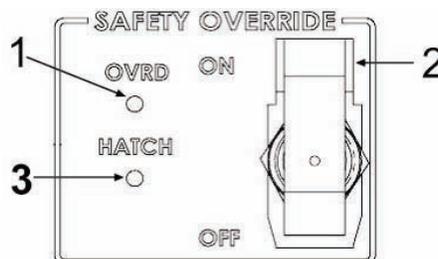
**Figure 12. LAMP TEST.**

- b. Test the SAFETY OVERRIDE (Figure 13) function.



If SAFETY OVERRIDE (OVRD) LED illuminates or if SAFETY OVERRIDE appears on screen when SAFETY OVRD switch is OFF, SAFETY OVRD function has failed, and CROWS is in SAFETY OVRD mode. Immediately power down CROWS and report CROWS deadline for maintenance action. Accidental operation in SAFETY OVRD mode may cause injury or death to personnel.

- (1) Lift the Safety Cap (2) and set the ON/OFF switch to ON. The OVRD LED (1) lights, and Safety Override appears in the status field on screen.
- (2) Set the switch to OFF. The OVRD LED should go out. This is the normal operating position for the OVRD LED.
- (3) Test the HATCH LED in the SAFETY OVERRIDE field. When a vehicle hatch opens, the HATCH LED (1) lights; the HATCH LED goes out when the hatch closes.



**Figure 13. SAFETY OVERRIDE Field.**

## TEST BASIC SYSTEM FUNCTIONS - Cont

## NOTE

To test REMOTE SAFE, a Weapon Firing Solenoid must be installed.

- c. Test the REMOTE SAFE function on the DCP (left side of figure) or FCU (right side of figure) (Figure 14).
  - (1) Lift the Safety Cap (1) and set the REMOTE SAFE switch to CHARGE. REMOTE SAFE displays on screen, and the DISABLED LED (2) illuminates.
  - (2) Close the Safety Cap (1) to set REMOTE SAFE back to the SAFE position. The DISABLED LED (2) goes out.

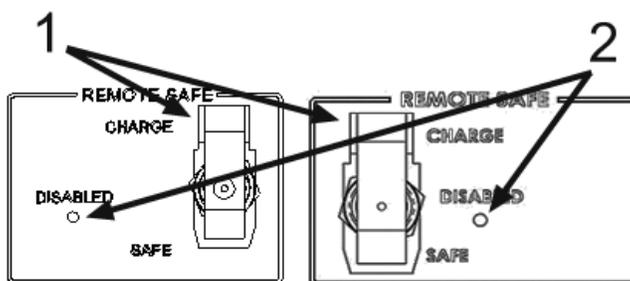


Figure 14. REMOTE SAFE Fields.

## NOTE

All firing conditions must be met for the ARMED LED to illuminate.

3. Test the SYSTEM function on the DCP (left side of figure) or FCU (right side of figure) (Figure 15).
  - a. With REMOTE SAFE set to CHARGE, lift the Safety Cap (1) and set the SYSTEM Switch to ARM. ARMED should appear on screen.
  - b. Hold the Palm Switch on the CG. The ARMED LED (2) illuminates. When the Palm Switch is released, the ARMED LED (2) goes out.
  - c. Close the REMOTE SAFE and SYSTEM Safety Caps to safe the installed weapon. ARMED disappears from the screen, and the REMOTE SAFE DISABLED LED goes out.

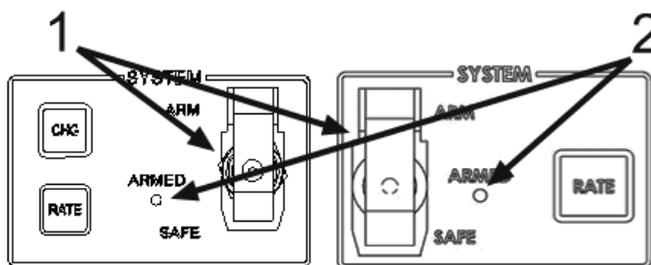
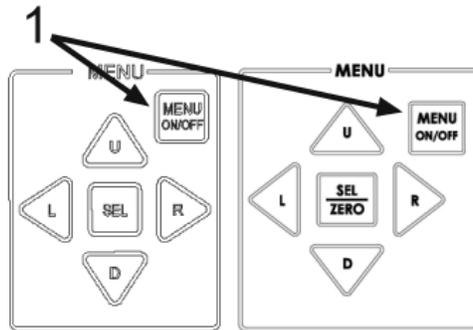


Figure 15. SYSTEM Fields.

**NOTE**

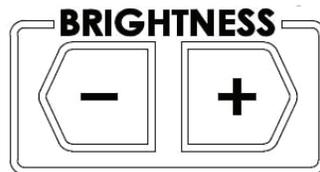
The Main Menu will not display if the system is armed.

4. Test the Main Menu function by pressing MENU ON/OFF in the MENU field of the DCP (left side of figure) or FCU (right side of figure) (Figure 16). The Main Menu appears on screen. Press MENU ON/OFF again to exit the Main Menu.



**Figure 16. MENU ON/OFF.**

5. Adjust Screen Brightness by pressing the BRIGHTNESS (-/+) buttons (Figure 17) on the FCU/DCP until the desired display brightness is set.



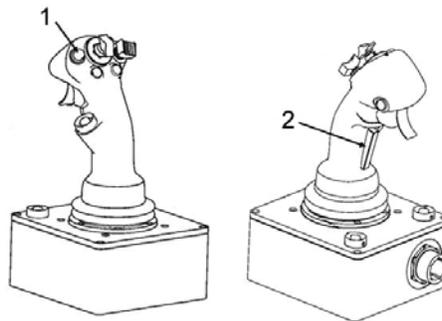
**Figure 17. BRIGHTNESS Field.**

**CAUTION**

To prevent damage to equipment, do not point the VIM directly toward the sun. The VIM iris may be damaged.

**TEST BASIC SYSTEM FUNCTIONS - Cont**

6. Select the required camera (VIM or TIM) by pressing the SIGHT DAY/NIGHT button (Figure 18) on the FCU/DCP or by holding the Palm Switch (2) and pressing the DAY/NT button (1) on the CG (Figure 19). The buttons perform the same function.

**Figure 18. SIGHT DAY/NIGHT.****Figure 19. DAY/NT button on CG.**

7. Adjust the image of the selected camera by pressing GAIN (-/+) (4) and LEVEL (-/+) (3) in the SIGHT Field of the DCP (left side of figure) or FCU (right side of figure) (Figure 20).
8. Adjust camera focus if required by pressing SIGHT FOCUS FAR/NEAR (5) on the FCU/DCP or by holding the Palm Switch and tilting the FOCUS (Far/Near) switch left or right on the CG. Pressing the Palm Switch and FOCUS on the CG starts autofocus.

**NOTE**

When changing the FOV, the reticle must remain pointing to the same place on the target. If the reticle moves from the target during zoom, report the system to Field Maintenance. This applies to zooming with the VIM as well as the TIM.

9. Press SIGHT ZOOM IN/OUT (4) on the FCU/DCP or MAG (IN/OUT) switch on the CG to control the zoom capability or FOV.

10. If the TIM is the selected camera:
  - a. Press SIGHT PLRT (1) on the DCP (left side of figure) or FCU (right side of figure) to change polarity which inverts the image from black-hot to white-hot. Press SIGHT PLRT again to return to the previous setting if desired.
  - b. Press SIGHT CAL (2) to calibrate the TIM for ambient temperature.

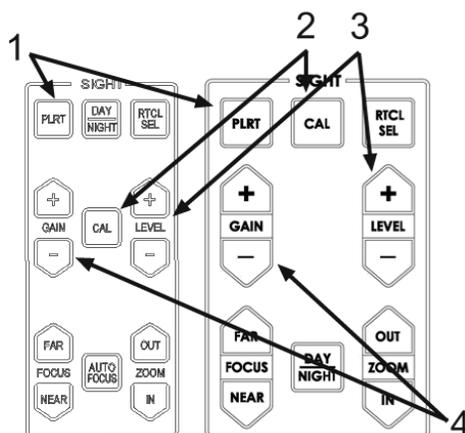


Figure 20. SIGHT Fields.

END OF TASK

END OF WORK PACKAGE



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
OPERATE TRAVERSE AND ELEVATION**

---

**THIS WORK PACKAGE COVERS:**

Operation of WS Traverse and Elevation.

---

**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006

**Equipment Conditions**

Vehicle Engine On (Vehicle Operator  
Manual)

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**OPERATING PROCEDURES**

**WARNING**



**HEAVY PARTS**

Before elevating or depressing gun or traversing CROWS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS may cause injury to personnel and damage to equipment.

**CAUTION**

Do not power up CROWS before the Clamp Assembly is removed or while the ELEVATION TRANSPORT LOCK or AZIMUTH TRAVEL LOCK are engaged. Doing so damages equipment.

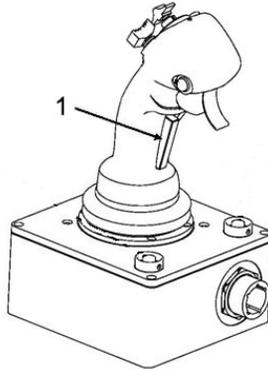
1. Power-up CROWS (WP 0006) if necessary.

**NOTE**

The Control Grip (CG) is very sensitive. Speed and movement of the CG must be controlled very carefully. The speed of WS movement can be adjusted by pressing SPEED (+/-) on the FCU/DCP. CROWS has four speed settings (100 percent, 50 percent, 10 percent, or 2 percent of full speed).

**OPERATING PROCEDURES - Cont**

2. For continuous movement of the WS, press and hold the Palm Switch (1) on the CG (Figure 1) while operating the CG.



**Figure 1. Palm Switch.**

3. CG movement is summarized in Table 1.

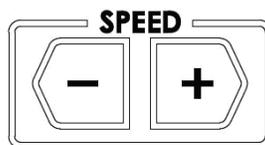
**Table 1. CG Movement.**

Direction of CG	Movement of WS
Left	Weapon and cameras move counterclockwise
Right	Weapon and cameras move clockwise
Down	Weapon and cameras depress
Up	Weapon and cameras elevate

**NOTE**

At power-up, the servomotors are operating at 100 percent speed capability. Weapon station speed cannot be increased.

4. Use SPEED +/- buttons (Figure 2) at the bottom of the FCU or DCP in conjunction with the CG to adjust elevation and traverse speed of CROWS. When the SPEED +/- buttons are pressed, the speed of the WS platform increases or decreases accordingly.



**Figure 2. Speed Buttons.**

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
OPERATE VISUAL IMAGING MODULE (VIM)**

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**THIS WORK PACKAGE COVERS:**

Operation of Visual Imaging Module (VIM).

---

**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Vehicle Engine On (Vehicle Operator  
Manual)

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**OPERATING THE VIM FROM THE FCU OR DCP**

**WARNINGS**



**HEAVY PARTS**

To prevent injury to personnel or damage to equipment, ensure CROWS is clear of obstacles before powering up.

Before elevating or depressing gun or traversing CROWS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS may cause injury to personnel and damage to equipment.

**CAUTION**

Do not point the VIM directly at the sun. The VIM Iris might be damaged.

**NOTE**

The VIM is the default optical device when CROWS powers up.

1. Select the VIM if necessary by pressing DAY/NIGHT in the SIGHT field of the FCU/DCP.
2. Acquire a target at approximately 2,000 meters using the CG.

### OPERATING THE VIM FROM THE FCU OR DCP - Cont

3. Obtain a clear image by making adjustments within the SIGHT field of the DCP (left side of figure) or FCU (right side of figure) (Figure 1). Hold any of the buttons to adjust the settings continuously.
  - a. Press the SIGHT ZOOM OUT/IN buttons (3) on the FCU/DCP to zoom out and in as needed.
  - b. Press the SIGHT FOCUS FAR/NEAR buttons (4) to adjust VIM focus.
  - c. Press the SIGHT GAIN +/- buttons (1) to adjust the brightness of the VIM (target) image.
  - d. Press the SIGHT LEVEL +/- buttons (2) to adjust contrast.

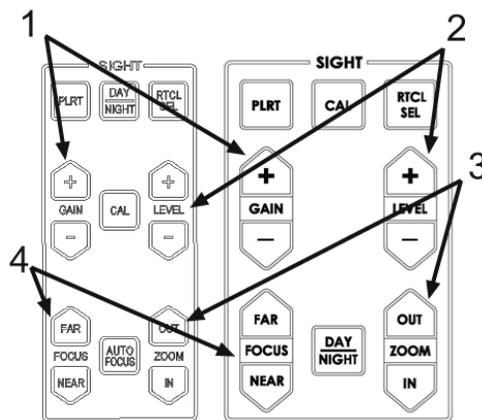


Figure 1. SIGHT Fields.

### END OF TASK

### OPERATING THE VIM FROM THE CG

#### NOTES

The Palm Switch on the Control Grip (CG) must be engaged to activate CG functions.

The DAY/NT and FOCUS switches on the CG are duplicated by the SIGHT DAY/NIGHT and SIGHT FOCUS FAR/NEAR buttons on the FCU/DCP respectively, but autofocus is only available on the DCP or by pressing the FOCUS button on the CG.

1. Select the VIM if necessary by pressing DAY/NT (1) on the CG (Figure 2).

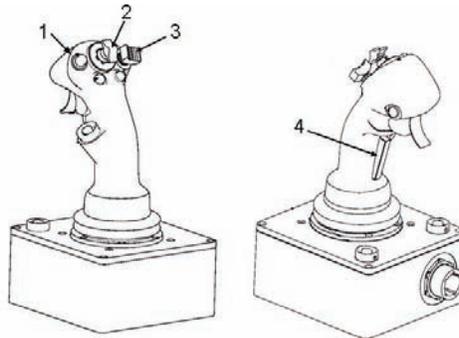
### NOTES

A time lag may occur between FOV adjustment and displaying the FOV angle position on the FCU/DCP.

The selected camera FOV automatically updates to match the FOV of the previous camera as closely as possible.

The VIM FOV has six distinct FOVs: 47 degrees, 25 degrees, 10 degrees, 5 degrees, 3.3 degrees, and 1.7 degrees.

2. Hold the Palm Switch (4) and press the MAG switch (2) upward to zoom in. Hold the Palm Switch (4) and press the MAG switch (2) downward to zoom out. Pressing the MAG switch once results in one Field of View (FOV) step. The FOV angle displays on screen.
3. Hold the Palm Switch (4) and press the FOCUS switch (3) left or right to focus on target.
4. To activate VIM autofocus, hold the Palm Switch (4) and push the FOCUS switch (3) in. Autofocus requires approximately three to five seconds and times out after 10 seconds if the ideal focus is not found.



**Figure 2. CG Zoom and Focus Adjustment.**

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
OPERATE THERMAL IMAGING MODULE (TIM)**

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**THIS WORK PACKAGE COVERS:**

Operation of the Thermal Imaging Module (TIM).

---

**INITIAL SETUP:**

**References**

WP 0006  
WP 0007

**Equipment Conditions**

CROWS Powered Up (WP 0006)

---

**OPERATING THE TIM**

**WARNINGS**



**HEAVY PARTS**

To prevent injury to personnel or damage to equipment, ensure CROWS is clear of obstacles before powering up.

Before elevating or depressing gun or traversing CROWS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS may cause injury to personnel and damage to equipment.

**Select the TIM**

1. Elevate and traverse the WS (WP 0007) to acquire a target at about 2,000 meters.
2. Press SIGHT DAY/NIGHT on the DCP or FCU to select the TIM if necessary (Figure 1). The TIM can also be selected by holding the Palm Switch (2) and pressing DAY/NT (1).



Figure 1. DAY/NIGHT on the FCU/DCP and CG.

**END OF TASK**

**OPERATING THE TIM - Cont****Calibrate and Adjust the TIM Image****NOTES**

Perform temperature calibration on the TIM each time CROWS is powered up so the device adjusts to the ambient temperature.

Calibrate the TIM when the following message is received:

0635: TIM TEMPERATURE CHANGE: Perform temp. Calibration

The default level is dependent on the temperature composition of the scene (target). Temperature range parameters are between -40 degrees F (-40 degrees C) to 185 degrees F (85 degrees C) and are adjustable within this range in 100 increments.

If TIM level adjustment is active, only the level value displays on screen.

1. Press the SIGHT CAL button (2) on the DCP (left side of figure) or FCU (right side of figure) once to calibrate the TIM image (Figure 2).
2. Press the SIGHT LEVEL +/- buttons (3) on the DCP (left side of figure) or FCU (right side of figure) to manually adjust the TIM temperature level for optimal view.
3. Press the SIGHT CAL button (2) on the DCP (left side of figure) or FCU (right side of figure) twice within one second (double click) to restore the default settings.
4. Press the SIGHT GAIN +/- buttons (4) on the DCP (left side of figure) or FCU (right side of figure) to adjust TIM video signal gain.

**NOTE**

Select the polarity setting most appropriate for the mission and conditions.

5. Press the SIGHT PLRT button (1) on the DCP (left side of figure) or FCU (right side of figure) and select either black-hot or white-hot depending on mission requirements.

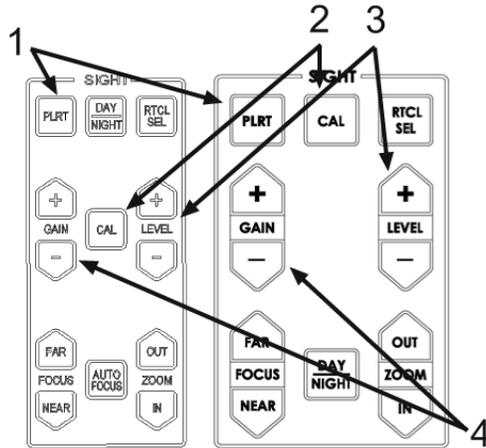


Figure 2. SIGHT Fields.

- The Gain/Level/Speed Field (1) appears temporarily on screen (Figure 3) to reflect the new values.

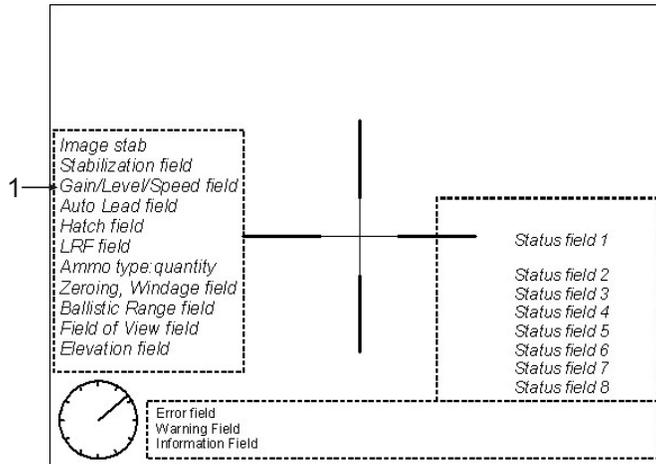


Figure 3. Gain/Level/Speed Field.

**END OF TASK**

**Adjust TIM Field of View (FOV) and Focus**

**NOTES**

The TIM Field of View (FOV) is fixed in four single steps: 10 degrees, 5 degrees, 3.3 degrees, and 1.7 degrees.

The SIGHT ZOOM IN/OUT buttons on the FCU and the MAG Switch on the CG perform the same function, and any of these controls can be used for this procedure. The FOCUS buttons are duplicated in much the same way, but the autofocus adjustment can only be started from the CG or the DCP.

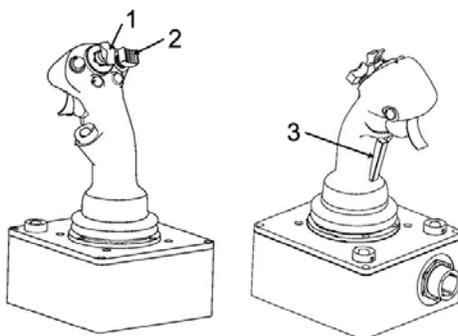
**OPERATING THE TIM - Cont****Adjust TIM Field of View (FOV) and Focus - Cont**

1. Hold the Palm Switch (3) and push the MAG Switch (1) up or down on the CG to change TIM FOV (Figure 4).
2. Hold the Palm Switch (3) and tilt the FOCUS button (2) left or right to manually adjust TIM focus.

**NOTE**

Autofocus ceases if focus is adjusted manually, the FOV is changed, or the selected camera is switched to the VIM.

3. Adjust TIM focus automatically by holding the Palm Switch (3) and pressing the FOCUS button (2). The Autofocus adjustment is also available in the SIGHT field of the DCP.



**Figure 4. MAG and FOCUS Buttons.**

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
OPERATE LASER RANGE FINDER**

---

**THIS WORK PACKAGE COVERS:**

Operation of Laser Range Finder (LRF).

---

**INITIAL SETUP:**

**References**  
WP 0006

**Equipment Conditions**  
CROWS Powered Up (WP 0006)

---

**DETERMINE RANGE TO TARGET**

**WARNING**



**HEAVY PARTS**

Before elevating, depressing, or traversing WS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS unexpectedly can injure personnel and damage equipment.

**WARNINGS**



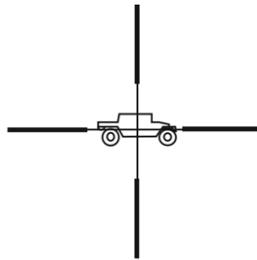
**LASER LIGHT**

The Laser Range Finder is classified as a Class 1 Laser Device and is safe in normal operating conditions, but failure in the electrical system can cause the laser to violate safety requirements. Do not point at humans or stare into the laser beam under any circumstances as this can cause serious eye injury.

Avoid prolonged use of LRF to reduce risk of detection by an enemy using Night Vision Goggles (NVGs). The infrared beam is more visible to an enemy using NVGs in smoke, fog, or rain.

**DETERMINE RANGE TO TARGET - Cont**

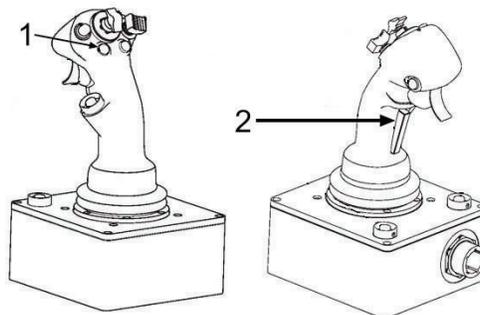
1. Hold the Palm Switch and lay on-screen reticle on the center of the target using the CG
  - a. Elevation Laying: While holding the Palm Switch, move the CG forward for depression or backward for elevation.
  - b. Traverse Laying: While holding the Palm Switch, move the CG left if laying to the left or right if laying to the right.

**Figure 1. Acquire Target.****NOTES**

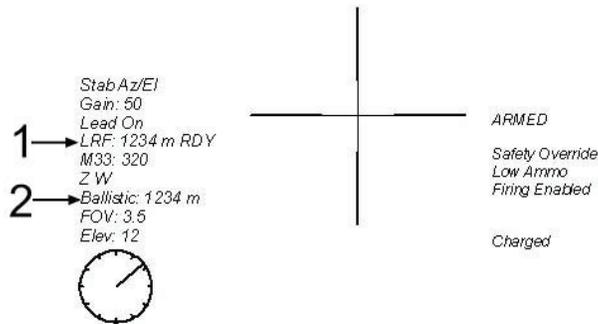
The LRF detects multiple targets (up to three) for each measurement. If more than three targets are detected, the distances of the closest, second closest, and farthest targets are reported. If no range is measured, the Ballistic Range is unaffected.

CROWS will fire the LRF and adjust the range continuously if the CG LRF button or the DCP LRF function key is double clicked. This can result in an inaccurate range result.

2. Hold the Palm Switch (2) and press LRF (1) on the CG to fire the LRF (Figure 2).

**Figure 2. LRF Button.**

- Observe that the range result displays in the LRF field (1) and Ballistic Range field (2) on screen (Figure 3).



**Figure 3. LRF and Ballistic Range Fields.**

**NOTE**

A warning message displays in the Warning Field on screen if the the Ballistic Range was exceeded.

- Verify that the measured range is within the maximum Ballistic Range of the installed weapon (Table 1).

**Table 1, Maximum Ballistic Range of Weapons**

Weapon	Max Range (meters)
M2 .50 cal	4,900 (5,359 yards)
MK19 40mm	1,500 (1,640 yards)
M240B 7.62mm	3,000 (3,281 yards)
M249 5.56mm	2,500 (2,734 yards)

**END OF TASK**

**SET MINIMUM RANGE**

**NOTE**

The default LRF minimum range is 20 meters (66 feet). This is the minimum effective distance of the device and cannot be lowered. Should conditions warrant, the LRF range value can be raised to a maximum of 9,499 meters.

**SET MINIMUM RANGE - Cont**

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 4).
2. Highlight SETTING (use MENU L or R on FCU/DCP if needed) and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the SETTING submenu.
3. Press MENU D once to highlight LRF MIN RANGE and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
<b>LRF Min Range</b>			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 4. Main Menu, LRF Min Range.**

4. CROWS displays the LRF MIN RANGE message (Figure 5). Use MENU U and D to adjust the value in meters, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to store the value.

LRF min mg: 20 m

Use the 'U'/'D' buttons  
To change setting.  
Press 'SEL' to continue.  
Press 'MENU ON/OFF' to abort.

**Figure 5. LRF Min Range Message.**

5. Press MENU ON/OFF to exit.

**END OF TASK**

A summary of typical range results and operator actions are listed below (Table 2).

**Table 2. LRF Range and Ballistic Results.**

<b>Range Result</b>	<b>Description</b>	<b>Operator Action</b>
LRF: 758 m Ballistic: 758 m	Measured range is for a target within maximum range of weapon.	Fire weapon.
LRF: Wait	LRF button is pressed when LRF is not ready to fire.	Wait for LRF to confirm that it is ready to be fired, and fire again: LRF: ----m RDY
LRF: 1352m MLT F	Multiple targets are detected, the range to nearest target (F – first) is displayed.	Press LRF button within three seconds to display range to second nearest target (S – second): LRF: 1,535 m MLT S Press LRF button within three seconds to display range to last (farthest) target (L – last): LRF: 1,895m MLT L As long as LRF button is pressed within three seconds of last LRF button activation, Operator can toggle between first, second and last range. Otherwise LRF is ready to be fired again: LRF: 1,895m RDY
LRF: 3421 m Ballistic: 1760 m	Measured range is outside maximum range of weapon.	Wait for LRF to confirm that it is ready to be fired, and fire toward a target closer to own vehicle: LRF: ----m RDY
LRF: No Target	There is no target to measure.	Wait for LRF to confirm that it is ready to be fired, and fire again: LRF: ----m RDY

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALL M2 .50 CAL MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Installation of the M2 .50 Cal Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

Cotter Pin  
19mm Wrench (WP 0049, Table 3, Item 4)  
3mm Hex Key (WP 0049, Table 3, Item 7)  
Needle-Nose Pliers (WP 0049, Table 3,  
Item 5)

**Personnel Required:** Two  
Operator and Assistant

**References**

TM 9-1005-213-10  
Vehicle Operator Manual  
WP 0012  
WP 0013  
WP 0029  
WP 0036

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator Manual)  
CROWS Shutdown (WP 0030)  
Weapon Ammo clear (TM 9-1005-213-10)  
Weapon maintenance performed  
(TM 9-1005-213-10)  
Left-hand charger assembly removed  
(TM 9-1005-213-10)  
All Accessories present and serviceable  
(TM 9-1005-213-10)  
Weapon set to Automatic Fire  
(TM 9-1005-213-10)  
Multi Adapter, Small Caliber (MASC)  
Removed (WP 0020 or WP 0023)

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**INSTALLATION OF THE M2 .50 CAL MACHINE GUN****WARNINGS****WEAPON FIRE**

Clear M2 .50 Cal Machine Gun of ammunition prior to installation. Accidental firing of weapon can kill or injure personnel.

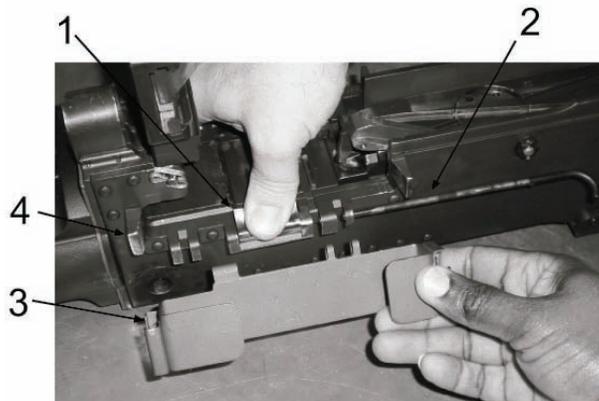
Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator moves when Firing Solenoid Cable is connected possibly injuring personnel.

**INSTALLATION OF THE M2 .50 CAL MACHINE GUN - Cont****Install the M2 Gun End Adapter, Cocking Bolt, and Anchor Pin****NOTES**

CROWS requires that weapons feed Ammunition from the left hand side.

The M2 weapon adaption items including the M2 Gun End Adapter, Anchor Bolt, and Cocking Bolt are stowed in the Storage Bag.

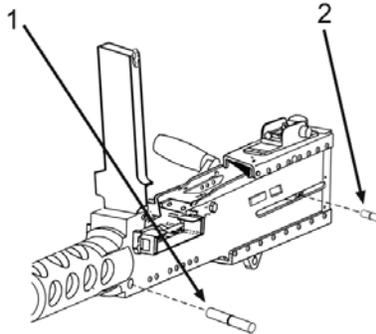
1. Verify that the weapon is clear of ammunition (TM 9-1005-213-10).
2. Open the Gun Cover (TM 9-1005-213-10).
3. Install the M2 Gun End Adapter (3) onto the M2 (Figure 1).
  - a. Hold the Ammunition Pawl in place (1).
  - b. Remove the Pawl Pin (2).
  - c. Mount the Gun End Adapter (3) on the Pawl Brackets (4).
  - d. Reinsert the Pawl Pin (2) with the hooked end to the rear.
  - e. Release the Ammunition Pawl.



**Figure 1. M2 Gun End Adapter.**

4. Ensure the Weapon Bolt is in the forward position (TM 9-1005-213-10).
5. Remove the M2 Back Plate and Drive Spring (TM 9-1005-213-10).

6. Pull the Bolt back to the Notch (about halfway back) to insert the Cocking Bolt (1) (Figure 2).
7. Insert and center the Anchor Pin (2).

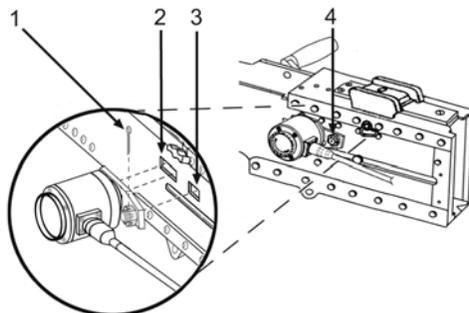


**Figure 2. M2 Cocking Bolt and Anchor Pin.**

## END OF TASK

### Install the Firing Solenoid and Cocking Bracket

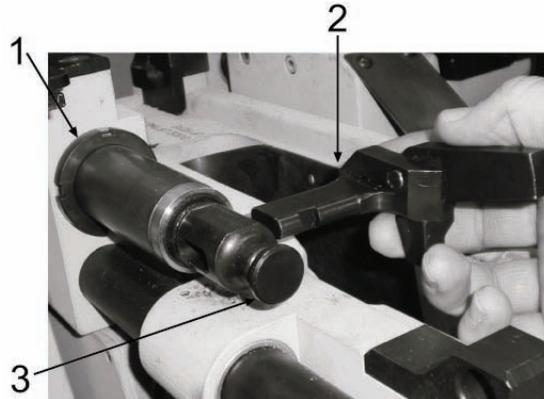
1. Install the M2 Firing Solenoid (Figure 3).
  - a. Remove the Cotter Pin (1) from the slotted Hexagon Nut (4) with Needle-Nose Pliers (WP 0049, Table 3, Item 5) if present.
  - b. Loosen the Shoulder Bolt by unscrewing the Hexagon Nut (4). Do not remove Nut.
  - c. Position the Firing Solenoid so that the front notch and Shoulder Bolt align with the front (2) and rear (3) slots in the Receiver. Insert the rear beveled end of the Shoulder Bolt into the Weapon Housing first.
  - d. Finger tighten the slotted Hexagon Nut (4) ensuring the Shoulder Bolt does not turn. Finish tightening the Shoulder Bolt using a 19mm Wrench (WP 0049, Table 3, Item 4). Do not over tighten.
  - e. Manually slide the Weapon Bolt back and forward to ensure the Bolt clears the Solenoid Shoulder Bolt.
  - f. Install a Cotter Pin (1) in the Hexagon Nut (4).



**Figure 3. M2 Firing Solenoid.**

**INSTALLATION OF M2 .50 CAL MACHINE GUN - Cont****Install the Firing Solenoid and Cocking Bracket - Cont**

2. Reinstall the Drive Spring and Back Plate (TM 9-1005-213-10).
3. With the Bolt in the forward position, close the Weapon Feed Tray Cover.
4. Ensure the Cocking Bracket Lock (3) is fully extended before pushing the Cocking Bracket (2) completely into the Cocking Actuator Arm (1) from the right-hand side (Figure 4).



**Figure 4. M2 Cocking Bracket.**

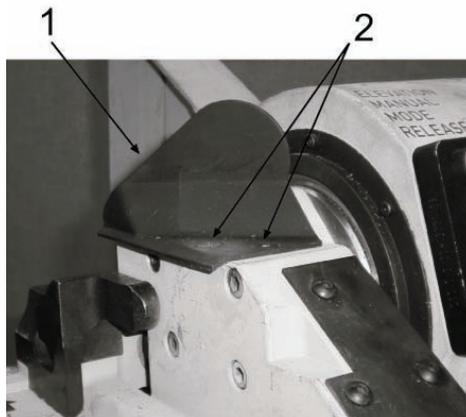
**END OF TASK****Install the M2 on the Soft Mount**

1. Verify that the M2 or MK19 Mounting Pins are removed from the Soft Mount Mounting Holes.

**NOTE**

Fasten the two screws back into the Soft Mount when the Link Guide is removed.

2. Place the M2 Link Guide (1) on the top front of the Soft Mount and fasten with 3mm Hex Key (WP 0049, Table 3, Item 7) and the two screws (2) provided (Figure 5).



**Figure 5. M2 Link Guide.**

3. Hand the weapon up to the Operator at the Vehicle Mounting Position.
4. While raising the Gun End Adapter to clear the Soft Mount, slide the M2 Anchor Pin into the grooves at the front of the Soft Mount and pull the weapon back to align the rear Mounting Holes (Figure 6).

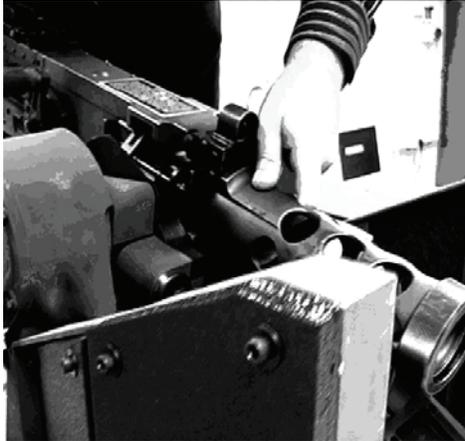


Figure 6. M2 Anchor Pin.

#### CAUTION

Ensure that the Mounting Pins are fully inserted and locked in place during installation, removal, operation, or shipment to prevent damage to equipment.

#### NOTE

The M2 Mounting Pin is the shorter of the two Mounting Pins.

5. Insert the M2 Mounting Pin (1) into the lower Soft Mount mounting hole (2), push in and rotate pin 1/4 turn CW to the locked position (Figure 7). The Mounting Pin is spring loaded and must be pushed in firmly before turning. The unused pin should be placed in the storage position (3).

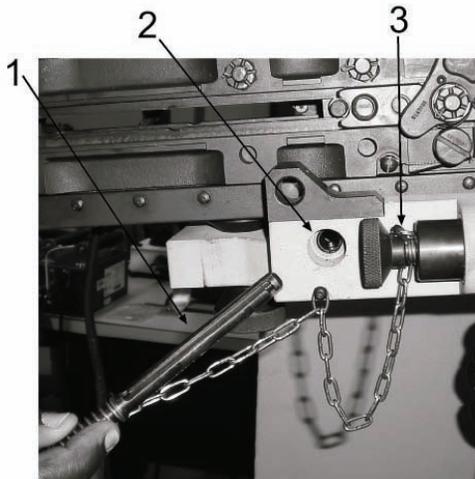
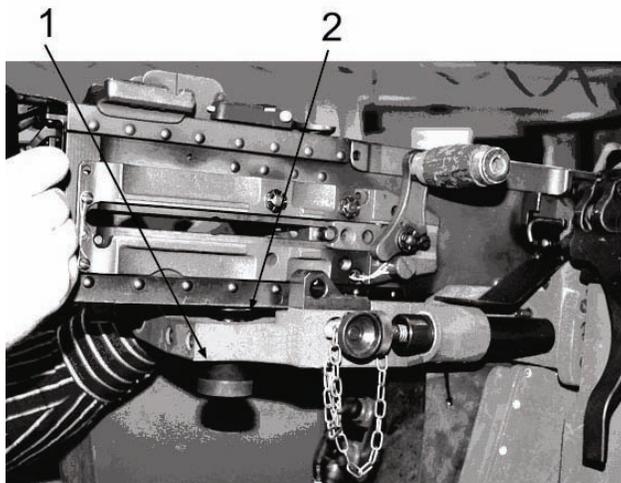


Figure 7. M2 Mounting Pin.

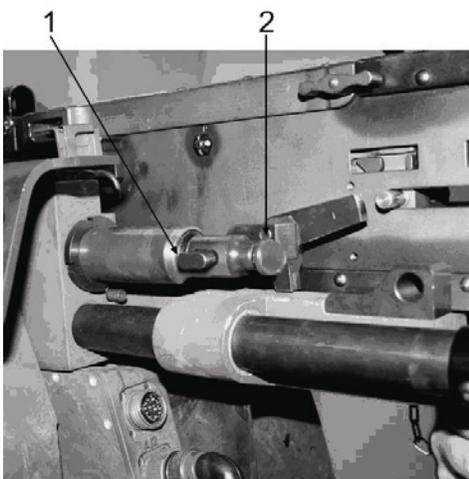
**INSTALLATION OF the M2 .50 CAL MACHINE GUN - Cont****Install the M2 on the Soft Mount - Cont**

6. Finger tighten the Straining Screw (1) against the Bottom Plate of the Receiver until fastened without play (Figure 8). Verify that there is no clearance between the Straining Screw and the weapon (2).



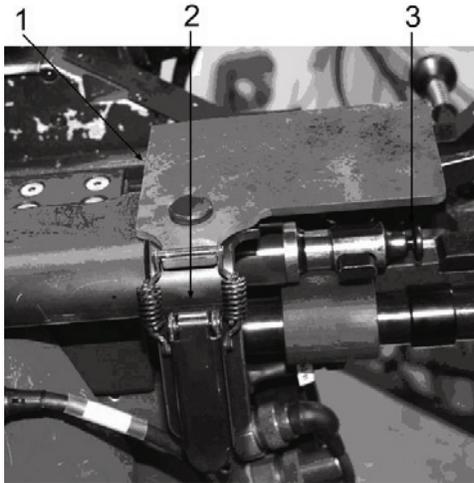
**Figure 8. Straining Screw.**

7. Push the Cocking Bracket (1) toward the weapon and push in the Cocking Bracket Lock (2) to lock the Cocking Bracket in place (Figure 9).



**Figure 9. Cocking Bracket Lock.**

- Align the notches and grooves on the bottom of the M2 Link Deflector (1) and latch with the spring-loaded clip (2) to install above the Cocking Bracket Lock (3) (Figure 10).



**Figure 10. M2 Link Deflector.**

- Mount the Weapon Barrel (TM 9-1005-213-10).
- Perform headspace and timing adjustment of the M2 if required (TM 9-1005-213-10).

### CAUTION

Ensure that CROWS is powered off when connecting/disconnecting electrical cables to prevent damage to equipment.

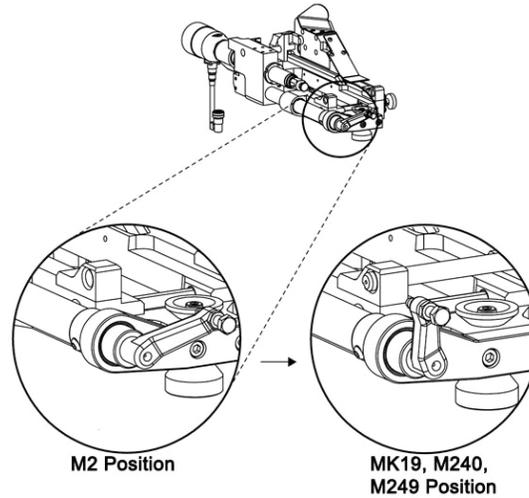
- Align Cable Pins with the Connector and attach the Solenoid Firing Cable W7 (1) to the SSA Connector 4J2 at the rear of the SSA (Figure 11). Turn the Cable End CW until the Red Band on the SSA Connector is no longer visible. The SSA can be tilted down if necessary to improve access.



**Figure 11. Solenoid Firing Cable W7.**

**INSTALLATION OF M2 .50 CAL MACHINE GUN - Cont****Install the M2 on the Soft Mount - Cont**

12. Push the spring-loaded Cocking Bracket Releaser Assembly Arm forward and turn to the rightmost position until set for the M2 (Figure 12).

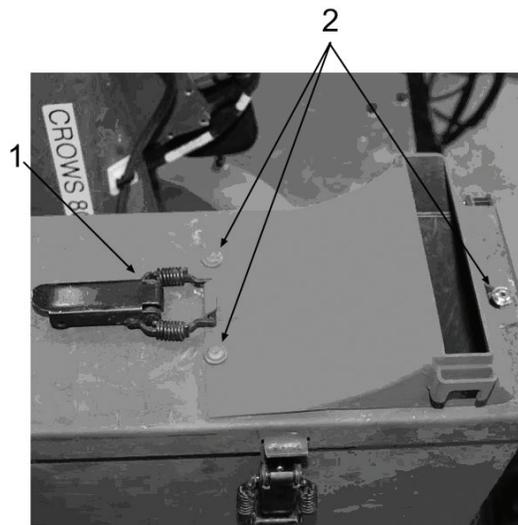


**Figure 12. M2 Cocking Bracket Releaser.**

13. Press down the Butterfly Trigger to check for Firing Pin release (clicking sound).

**END OF TASK****Install M2 Ammo Feed and Finish Installation**

1. Slide the M2 Ammunition Guide underneath the three Ammunition Box Lid Rivets (2) and fasten with the Latch (1) (Figure 13).

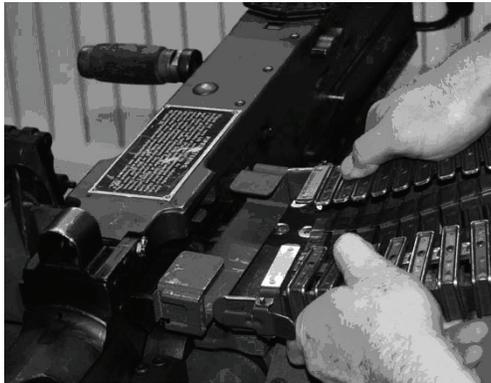


**Figure 13. M2 Ammo Guide.**

**NOTE**

Mount the labeled end of the Ammunition Chute to the M2 Gun End Adapter with the Slot to the top.

2. Push the Ammunition Chute onto the M2 Gun End Adapter until it locks with a click (Figure 14).



**Figure 14. M2 Gun End Adapter and Ammo Chute.**

3. Push the Ammunition Chute onto the M2 Ammo Guide until it locks with a click (Figure 15).



**Figure 15. M2 Ammo Guide and Chute.**

4. Adjust the Firing Solenoid (WP 0012).
5. Boresight the weapon (WP 0029).
6. Load the weapon (WP 0013).

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
ADJUST M2 .50 CAL MACHINE GUN FIRING SOLENOID**

---

**THIS WORK PACKAGE COVERS:**

Adjustment of the M2 .50 Cal Machine Gun Firing Solenoid.

---

**INITIAL SETUP:**

**Tools and Special Tools**

M2 Timing Gauge (WP 0050, Item 1)

**Personnel Required:** Two

CROWS Operator and Assistant

**References**

TM 9-1005-213-10  
Vehicle Operator Manual  
WP 0006  
WP 0011

**References - Cont**

WP 0029

**Equipment Conditions**

Vehicle Engine Shutdown (Vehicle Operator Manual)  
Weapon Installed (WP 0011)  
Weapon Cleared (TM 9-1005-213-10)  
M2 Firing Solenoid Installed (WP 0011)  
Weapon Boresighted (WP 0029)  
CROWS Powered Up (WP 0006)

---

**GENERAL**

Timing is the adjustment of the electrical Firing Solenoid so that firing takes place when the recoiling parts of the weapon are between 0.012 inches and 0.116 inches out of Battery Position (fully forward). The reason for this is to make sure that the Round is fully chambered before the Firing Pin is released. The adjustment is performed so that the Sear Plunger Protrusion is sufficient to force the Sear Slide to release the Firing Pin.

**NOTE**

Use of Timing Gauges is performed according to the instructions described in the M2 Weapon Manual (TM 9-1005-213-10).

Timing on the electrical Firing Solenoid should be checked and adjusted:

- a. After installation of electrical Firing Solenoid.
- b. After another weapon of the same type is installed.
- c. Each time headspace is adjusted (in accordance with the Weapon Manual).
- d. If there is a doubt that the timing is correct.

## ADJUST M2 FIRING SOLENOID

Two persons are required to complete the procedure. The Operator works within vehicle charging and firing the weapon, and the Assistant makes the solenoid adjustments at the WS.

### WARNINGS



### WEAPON FIRE

Before adjusting solenoid, ensure that weapon is clear of ammunition and that M2 bolt is in forward position. Doing so prevents accidental firing of weapon and serious injury or death to personnel.

Headspace should be checked and adjusted before firing weapon, after assembling weapon, and after replacing barrel. Improper headspace and timing may cause malfunctions, damage to gun, and injury to personnel.

To prevent injury to personnel or damage to equipment, ensure CROWS WS is clear of obstacles before powering up.

### NOTES

First perform the timing adjustment of the weapon according to the M2 Weapon Manual. The reason for this is to prepare weapon for manual mode functions. If headspace and timing cannot be obtained, turn in the weapon to Field Maintenance.

All attempts to fire during this procedure must be performed using the CG. The Manual (butterfly) Trigger must not be used. A spent .50 caliber shell can be placed under the Butterfly Trigger to prevent this.

1. Ensure headspace and timing adjustment of the M2 .50 Caliber Machine Gun has been performed (TM 9-1005-213-10).
2. Rotate the Adjustment Cap (1) on the Firing Solenoid (Figure 1) CW (OUT direction) until end stop. This action fully extends the Sear Plunger (2) from the Firing Solenoid.

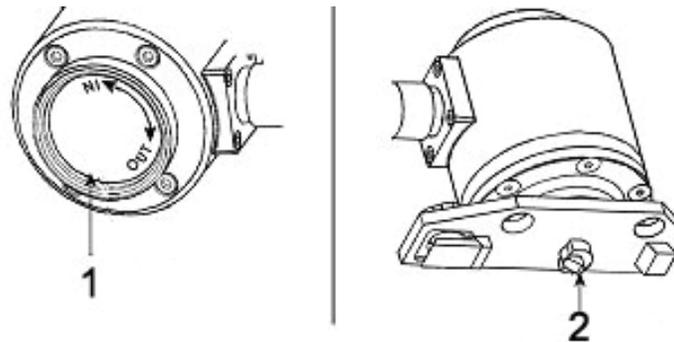
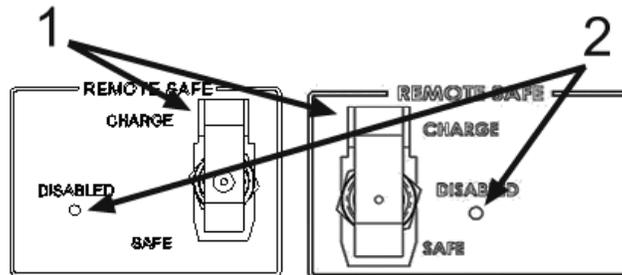


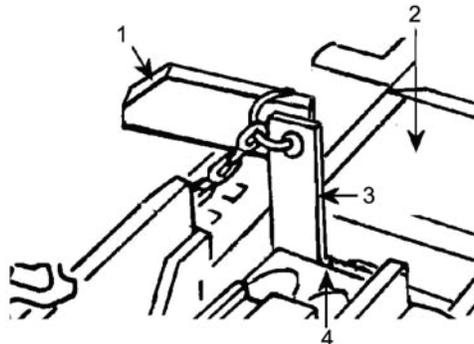
Figure 1. M2 Firing Solenoid.

3. Set the weapon to automatic mode if necessary (TM 9-1005-213-10).
4. Charge the weapon by raising the Switch Guard (1) and flipping the Toggle Switch up to the CHARGE position on the DCP (left side of figure) or FCU (right side of figure) (Figure 2). The DISABLED LED (2) should be illuminated.



**Figure 2. REMOTE SAFE.**

5. Open the Weapon Feed Tray Cover if necessary.
6. Raise the Extractor and pull the Charging Handle back until the front end of the Barrel Extension (4) is about 1/4-inch from the Trunnion Block (2) (Figure 3).
7. Insert the FIRE Timing Gauge (3) between the Barrel Extension (4) and the Trunnion Block (2) with the Bevel-Edged Gauge (1) on the curved portion of the barrel.



**Figure 3. M2 Timing Gauge, FIRE.**

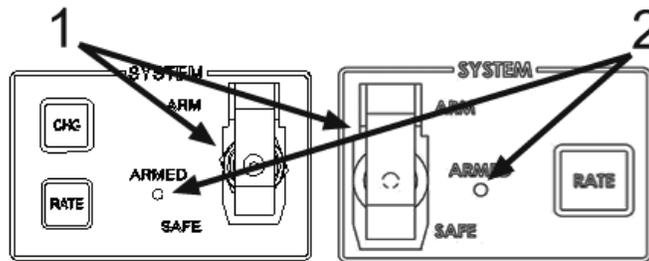
### CAUTION

Do not release the Charging Handle on the M2. Damage to the equipment could occur. Hold the Charging Handle and allow it to move gently forward until the Barrel Extension and the Trunnion Block meet with or without the Gauge inserted as required.

8. Release the Charging Handle under control allowing the Barrel Extension to close gently on the Gauge.

**ADJUST M2 FIRING SOLENOID - Cont**

9. Stand in a safe position at the rear of the weapon.
10. Set ARM/SAFE (1) to ARM in the SYSTEM Field (Figure 4) of the DCP (left side of figure) or FCU (right side of figure). ARMED appears on screen and the ARMED LED (2) illuminates when the Palm Switch is held.



**Figure 4. SYSTEM Fields.**

**WARNING****HEAVY PARTS**

Personnel must stay clear of Bolt when Weapon is charged and fired to avoid possible injury.

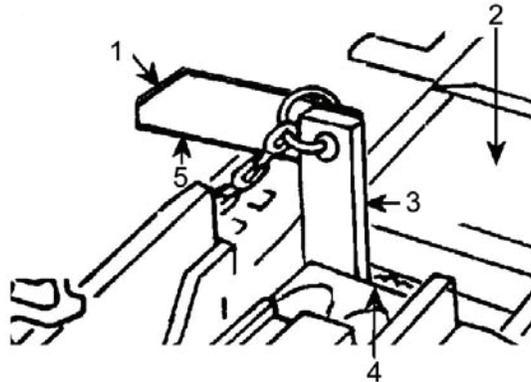
11. Fire the weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on CG.

**NOTE**

A metallic click sound indicates that the weapon has fired. The weapon should not fire on the first attempt. If the weapon fires on the first attempt with no adjustment of the Firing Solenoid, replace the Solenoid and perform this procedure again from step 1.

12. If the gun does not fire, rotate (advance) the Adjustment Cap on the Solenoid CCW (IN) one click.
13. Repeat steps 11 through 12 until the gun fires. When the weapon fires, continue with the procedure from this point.
14. Retract the Bolt just enough to remove the FIRE Timing Gauge and return the Charging Handle gently to the forward position.
15. Lower the Switch Guards on the SYSTEM Switch and REMOTE SAFE.
16. Charge the weapon by raising the Protective Guard on REMOTE SAFE and flipping the Toggle Switch up to the CHARGE position on the FCU/DCP. The DISABLED LED lights.

17. Raise the Extractor and pull the Charging Handle back to insert the NO FIRE Timing Gauge (3) (Figure 5).



**Figure 5. M2 Timing Gauge, NO FIRE.**

18. Set ARM/SAFE to ARM in the SYSTEM field of the FCU/DCP. ARMED appears on screen, and the ARMED LED illuminates when the Palm Switch is held.
19. Fire weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on the CG; the weapon should not fire.
20. Rotate (advance) the Adjustment Cap on the Firing Solenoid CCW (IN) one click.
21. Note the number of times the Solenoid is adjusted (number of clicks).
22. Repeat steps 17 through 20 until the gun fires. When the weapon fires, continue with the procedure from this point.

#### **NOTE**

If the weapon does not fire and the limit of the M2 Firing Solenoid is reached, remove and replace the Firing Solenoid. Restart the Solenoid Adjustment Procedure from the first step.

23. Rotate the Adjustment Cap on the Firing Solenoid CW (OUT) half the number of clicks counted during step 20.
24. Retract the Bolt just enough to remove the NO FIRE Timing Gauge and return the Charging Handle gently to the forward position.
25. Lower the Switch Guards on the SYSTEM Switch and REMOTE SAFE.
26. Charge the weapon by raising the Protective Guard and flipping the Toggle Switch up to the CHARGE position on the FCU/DCP. The DISABLED LED illuminates.
27. Set ARM/SAFE to ARM in SYSTEM field of FCU/DCP. ARMED appears on screen and ARMED LED illuminates when Palm Switch is held.

**ADJUST M2 FIRING SOLENOID - Cont**

28. Insert the NO FIRE Timing Gauge.
29. Fire the weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on the CG; the weapon should not fire with multiple attempts. If the gun fires, repeat the procedure from step 2.
30. Remove the NO FIRE Timing Gauge.
31. Lower the Switch Guards on the SYSTEM Switch and REMOTE SAFE.
32. Charge the weapon by raising the Protective Guard and flipping the Toggle Switch up to the CHARGE position on the FCU/DCP. The DISABLED LED illuminates.
33. Insert the FIRE Timing Gauge.
34. Set ARM/SAFE to ARM in the SYSTEM field of the FCU/DCP. ARMED appears on screen, and the ARMED LED illuminates when the Palm Switch is held.
35. Fire the weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on the CG; the weapon should fire with a single squeeze of the CG trigger. If the gun does not fire, repeat the procedure from step 2.
36. Remove the FIRE Timing Gauge.
37. With the Bolt in the forward position, close the Weapon Feed Tray Cover.
38. Lower the Switch Guards on the SYSTEM Switch and REMOTE SAFE.

**END OF TASK****END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
LOAD M2 .50 CAL MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Loading the M2 .50 Caliber Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
CROWS Operator and Assistant

**References**  
TM 9-1005-213-10  
WP 0006  
WP 0011  
WP 0034  
WP 0036

**Equipment Conditions**  
CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1005-213-10)  
Weapon maintenance performed  
(TM 9-1005-213-10)  
All Accessories present and serviceable  
(TM 9-1005-213-10)  
Weapon Installed (WP 0011)

---

**LOAD M2 .50 CALIBER MACHINE GUN****Load Ammunition into Ammunition Box****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**LOAD M2 .50 CALIBER MACHINE GUN - Cont****Load Ammunition into Ammunition Box - Cont****WARNINGS - Cont****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

When Bolt Latch Release and trigger are both held down on weapon, M2 machine gun fires automatically. Avoid accidental firing of weapon to prevent injury or death to personnel.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

**WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**CAUTIONS**

Before installing the Ammunition Belt into the Ammo Box, check that the Ammunition is of the correct type, the metallic links are clean, and the Rounds are properly linked. Doing so prevents damage to equipment.

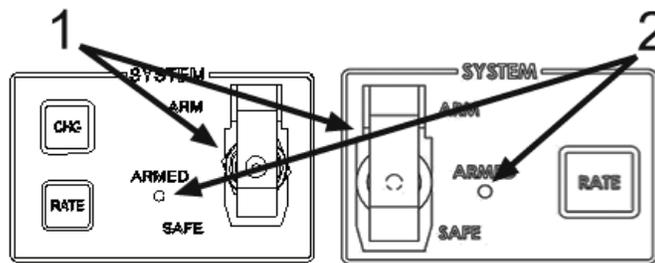
Empty the Rear Casing Collector Bag if necessary before reloading the installed weapon to prevent damage to equipment.

**NOTE**

The Bolt Latch must be set to the automatic position (down) before the Ammunition loading commences.

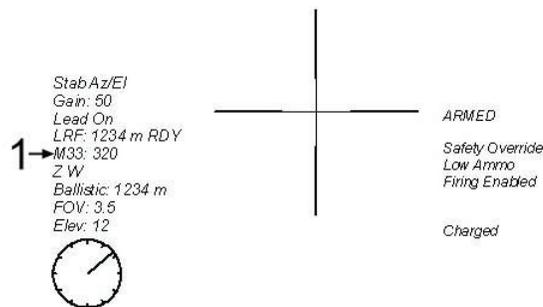
If the DISABLED LED is lit when the REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable the REMOTE SAFE.

1. Verify that the SYSTEM Switch Guard (1) is down on the DCP (left side of figure) or FCU (right side of figure) (Figure 1). The ARMED LED (2) should not be lit.



**Figure 1. SYSTEM ARM/SAFE.**

2. Ensure that the Weapon Bolt is in the forward position (TM 9-1005-213-10).
3. Verify that the correct type of ammunition is selected. The selected Ammunition displays in Ammunition Field (1) on screen (Figure 2).



**Figure 2. Ammunition Field.**

**LOAD M2 .50 CALIBER MACHINE GUN - Cont****Load Ammunition into Ammunition Box - Cont**

4. Select the correct type of ammunition if necessary (Figure 3).
  - a. Press MENU ON/OFF on the FCU/DCP to display the Main Menu.
  - b. Press MENU R (Right) twice to highlight the AMMO menu option.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the ammunition types available.
  - d. Press MENU D (Down) until the correct Ammunition Type is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the Ammunition. The correct Ammunition Type displays in the Ammunition Field.
  - f. Press MENU ON/OFF to remove the Main Menu from the display.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
		M33 BALL	
		M8 API	
		M20 API_TRACER	
		M903 SLAP	
		MILES	

**Figure 3. Main Menu, AMMO.****CAUTION**

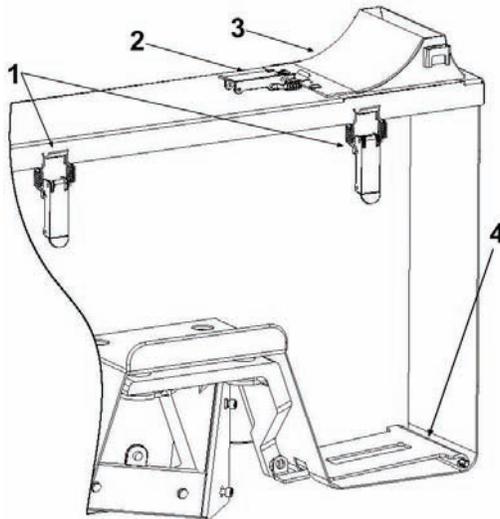
Do not overload the Ammunition Box. Ensure there is enough clearance (at least one half inch) between the loaded Ammunition and Ammunition Box Cover to permit free movement of the Ammunition to the receiver. Overloading the Ammunition Box can damage or jam equipment.

**NOTES**

The Ammunition Box holds 400 rounds of .50 cal ammunition.

If the last round of the Ammunition Belt is installed opposite the Activation Plate, the LOW AMMO signal appears on screen before all the Ammunition has been used. Ensure that the last Round is installed over the Activation Plate.

5. Remove the Ammo Guide (3) from the Ammo Box Lid if necessary by releasing the Ammo Box Lid Clip (2) and pulling the Ammo Guide from underneath the three Ammo Box Lid Rivets (Figure 4).
6. Release the two Ammo Box Lid Latches (1) and open the Ammunition Box Cover.
7. Insert the Ammunition Belt into the Ammo Box with the last link (first link in box) resting on the Low Ammo Actuator Plate (4).



**Figure 4. Ammunition Guide and Cover Locks.**

8. Close and Latch the Ammo Box Lid.

## **END OF TASK**

### **Threading the Ammunition through the Ammo Guide and Chute**

1. Reach into the Ammo Box through the hole for the M2 Ammo Guide in the Lid and lift the end of the Ammunition Belt out of the Ammo Box.
2. Thread the Ammunition Belt through the bottom and out the top of the Ammo Guide and into the Ammo Chute.
3. While holding the Ammunition Belt in place, install the Ammo Guide underneath the three rivets on the Ammunition Box Lid and fasten with the Latch.

**LOAD M2 .50 CALIBER MACHINE GUN - Cont****Threading the Ammunition through the Ammo Guide and Chute - Cont**

4. Push the Chute onto the Ammo Guide until it locks with a click if necessary (Figure 5).



**Figure 5. Ammunition Guide and Chute.**

5. Pull the Ammunition Belt to the labeled end of the Ammo Chute.

**END OF TASK****Load the Weapon**

1. Push the labeled end of the Ammo Chute onto the M2 Gun End Adapter until it locks with a click if necessary (Figure 6).



**Figure 6. Fasten Chute to Weapon.**

2. Open the M2 gun cover (TM 9-1005-213-10).

3. Insert the double-looped end (female) of the Ammunition Belt into the Feedway until the Belt Holding Pawls engage the first round (Figure 7).



Figure 7. End of Ammunition Chute.

4. With the Bolt in the forward position, close the Feed Tray Cover.

**WARNING**



**WEAPON FIRE**

All personnel must evacuate WS area immediately after weapon is loaded to avoid possible injury.

5. Verify that all the Hatches are closed and evacuate the WS platform.
6. Verify that LOW AMMO (1) disappeared from the Ammunition Status Field (Figure 8).

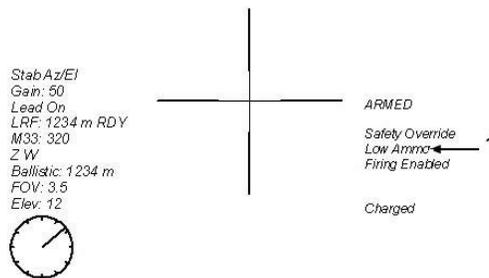


Figure 8. Ammo Status Field.

**LOAD M2 .50 CALIBER MACHINE GUN - Cont****Load the Weapon - Cont**

7. Reset the number of rounds loaded in the AMMO COUNTER submenu if different from default (Default value: 400 rounds) (Figure 9).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Ensure SETTING is highlighted and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING options.
  - c. Press MENU D (Down) five times until AMMO COUNTER is highlighted.
  - d. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the AMMO COUNTER.
  - e. Press MENU U (Up) or D (Down) until the correct Ammunition Count is highlighted.
  - f. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the Ammunition Count.
  - g. Press MENU ON/OFF to exit the Main Menu.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
<b>Ammo Counter</b>			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 9. Main Menu, AMMO.**

8. To fire the weapon, refer to WP 0034.

**END OF TASK****END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
UNLOAD M2 .50 CAL MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Unloading the M2 .50 Caliber Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
CROWS Operator and Assistant

**References**  
TM 9-1005-213-10  
WP 0006  
WP 0036

**Equipment Conditions**  
CROWS Powered Up (WP 0006)  
Weapon maintenance performed  
(TM 9-1005-213-10)  
All Accessories present and serviceable  
(TM 9-1005-213-10)

---

**UNLOAD M2 .50 CAL MACHINE GUN**

**WARNINGS**



**EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**UNLOAD M2 .50 CAL MACHINE GUN - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNING****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

When Bolt Latch Release and trigger are both held down on weapon, M2 machine gun fires automatically. Avoid accidental firing of weapon to prevent injury or death to personnel.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

1. Power up CROWS (WP 0006) if necessary.

**NOTE**

If the DISABLED LED is lit when the REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

- Verify that the SYSTEM and REMOTE SAFE Switch Guards (1) are down on the DCP (top of figure) or FCU (bottom of figure) (Figure 1). Both the DISABLED LED (2) and the ARMED LED (3) should not be lit.

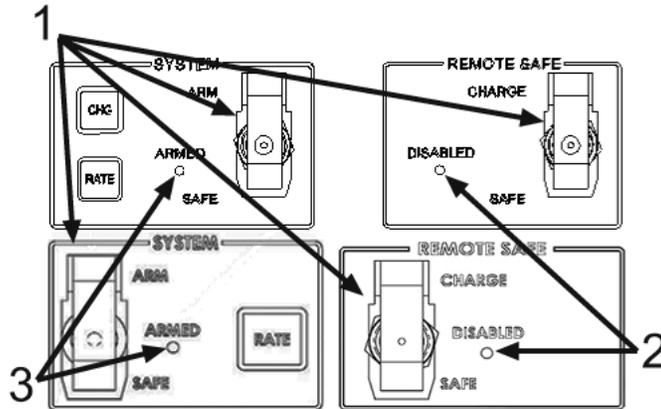


Figure 1. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.

- Ensure that the Weapon Bolt is in the forward position (TM 9-1005-213-10).

#### WARNING



#### HOT AREA

Chamber may be hot. Use caution when inspecting T-slot to avoid burns.

- Open the Feed Cover on Weapon Receiver.
- Remove the Ammunition Belt from the Feedway and push it back down the Ammo Chute into the Ammunition Box.
- Inspect the Chamber to verify that the installed weapon is clear of ammunition (TM 9-1005-213-10).
- Remove the Ammunition Chute from the Ammunition Guide.
- Release the two Ammunition Box Latches and open the Ammunition Box.
- Remove ammunition; close and latch the Ammunition Box.
- Reattach the Ammunition Chute to the Ammo Guide if necessary.

**UNLOAD M2 .50 CAL MACHINE GUN - Cont****WARNING****HEAVY PARTS**

Personnel must stay clear of Bolt when Weapon is charged and fired to avoid possible injury.

11. Lift the Switch Guard and set the REMOTE SAFE to CHARGE.
12. With the Bolt in the forward position, close the Feed Tray Cover.
13. Lower the Switch Guard on the REMOTE SAFE.

**END OF TASK****END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
REMOVE M2 .50 CAL MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Removal of the M2 .50 Cal Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

Cotter Pin  
19mm Wrench (WP 0049, Table 3, Item 4)  
3mm Hex Key (WP 0049, Table 3, Item 7)  
Needle-Nose Pliers (WP 0049, Table 3,  
Item 5)

**Personnel Required:** Two  
Operator and Assistant

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator Manual)  
CROWS Shutdown (WP 0036)  
Weapon Ammo clear (TM 9-1005-213-10)  
Weapon maintenance performed  
(TM 9-1005-213-10)  
All Accessories present and serviceable  
(TM 9-1005-213-10)

**References**

TM 9-1005-213-10  
Vehicle Operator Manual  
WP 0012  
WP 0036

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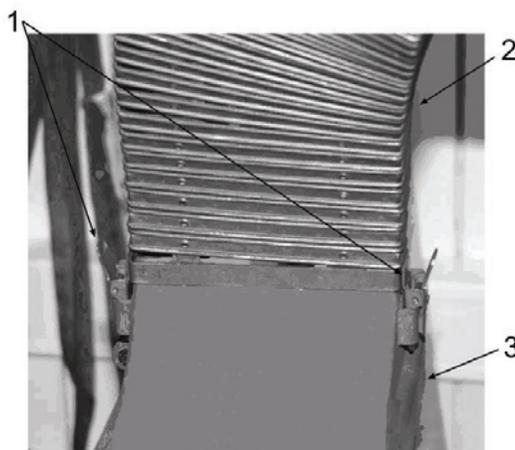
**REMOVAL OF THE M2 .50 CAL MACHINE GUN****WARNINGS****WEAPON FIRE**

Clear M2 .50 Cal Machine Gun of ammunition prior to removal. Accidental firing of weapon can kill or injure personnel.

Make sure CROWS power is switched off prior to removing weapon. If power is switched on, Cocking Actuator moves when connecting Firing Solenoid Cable possibly injuring personnel.

**REMOVAL OF THE M2 .50 CAL MACHINE GUN - Cont****Remove the M2 Ammo Feed**

1. Power CROWS off if not already done (WP 0036).
2. Verify the weapon is clear of Ammunition and that the Weapon Bolt is in the forward position (TM 9-1005-213-10).
3. Squeeze the clips (1) on each side of the M2 Ammo Chute (2) and pull the chute away from the Ammo Guide (3) (Figure 1).



**Figure 1. M2 Ammo Guide and Chute.**

4. Squeeze the clips on each side of the M2 Ammo Chute, and pull the chute away from the M2 Gun End Adapter (Figure 2).



**Figure 2. M2 Ammo Chute.**

5. Remove the M2 Ammo Guide if necessary by unfastening the Ammo Guide Latch (1) and pulling the Ammo Guide back and away from the Latch and the three rivets (2) (Figure 3).

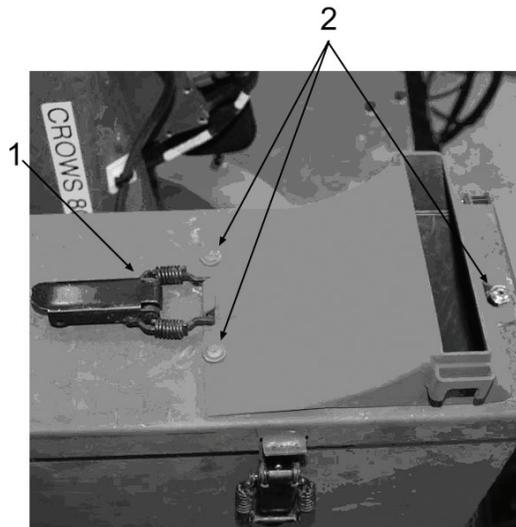


Figure 3. M2 Ammo Guide.

## END OF TASK

### Remove the M2 from the Soft Mount

#### CAUTION

Ensure that CROWS is powered off when connecting/disconnecting the electrical cables to prevent damage to equipment.

1. Unplug the Solenoid Cable W7 (1) from the SSA Connector 4J2 at rear of the SSA by turning CCW (Figure 4). The SSA can be tilted downward to improve access.

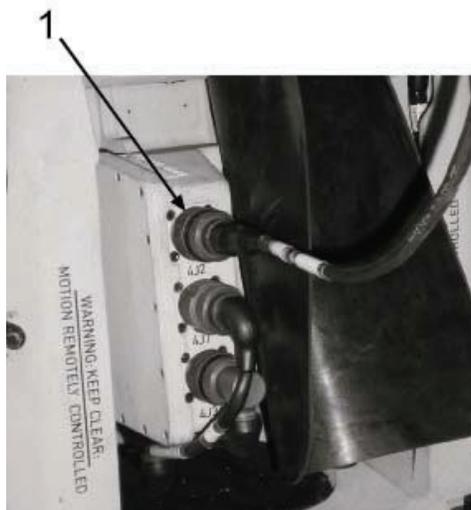
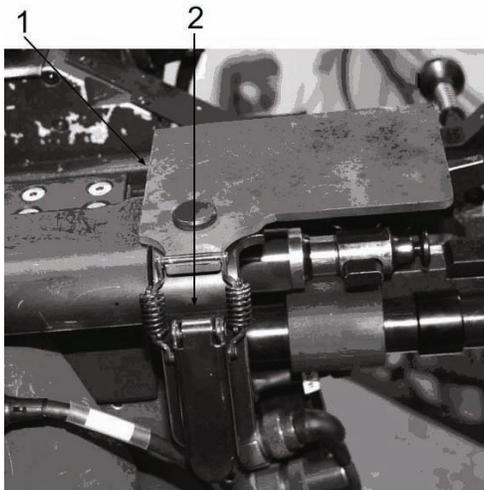


Figure 4. M2 Solenoid Firing Cable.

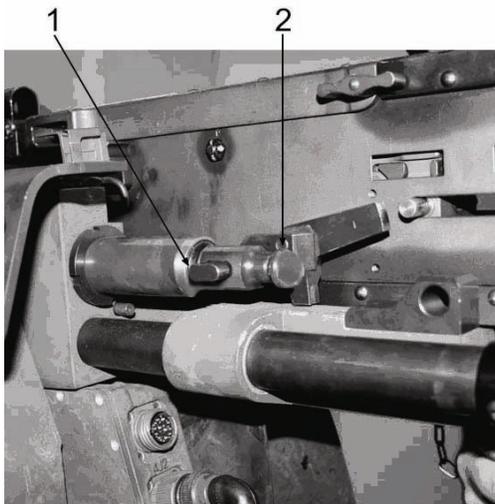
**REMOVAL OF THE M2 .50 CAL MACHINE GUN - Cont****Remove the M2 from the Soft Mount - Cont**

2. Remove the Weapon Barrel (TM 9-1005-213-10).
3. Remove the Link Deflector (1) by unclipping the Latch (2) (Figure 5).



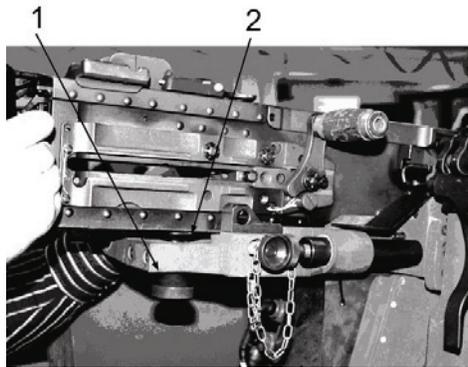
**Figure 5. Link Deflector.**

4. Pull the Cocking Bracket Lock (2) out, and push the Cocking Bracket (1) away from the weapon (Figure 6).



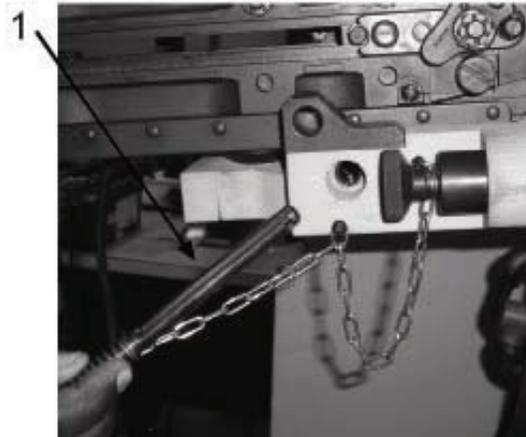
**Figure 6. Cocking Bracket Lock.**

5. Turn the Straining Screw (1) CCW by hand to loosen from the Bottom Plate (2) (Figure 7).



**Figure 7. Straining Screw.**

6. Remove the M2 Mounting Pin (1) by pushing in and turning CCW. The Mounting Pin is spring loaded and should pop out after a 1/4 turn (Figure 8). Let the Mounting Pin hang from the chain temporarily.



**Figure 8. M2 Mounting Pin.**

**REMOVAL OF THE M2 .50 CAL MACHINE GUN - Cont****Remove the M2 from the Soft Mount - Cont**

7. Push the weapon forward then up and out of the Soft Mount grooves (Figure 9). Hand the weapon down from the top of the Host Vehicle or other platform.

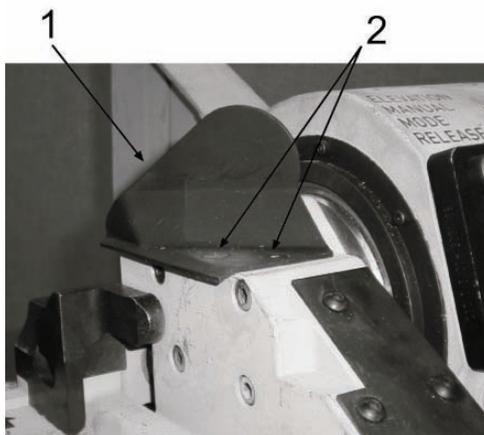


**Figure 9. Remove Weapon.**

**NOTE**

When the Link Guide is not installed, fasten the two screws back into Soft Mount for storage.

9. Remove the M2 Link Guide (1) from the Soft Mount if necessary by loosening the two screws (2) with a 3mm Hex Key (WP 0049, Table 3, Item 7) (Figure 10).



**Figure 10. M2 Link Guide.**

**END OF TASK**

## Remove the Cocking Bracket and Firing Solenoid

1. Ensure that the Cocking Bracket Lock (3) is fully extended, and pull the Cocking Bracket (2) from the Cocking Actuator Arm (1) (Figure 11).

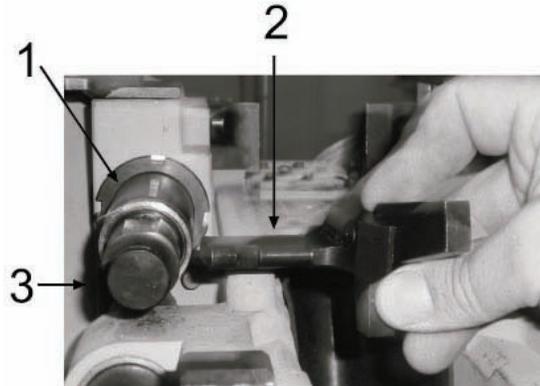


Figure 11. M2 Cocking Bracket.

2. Remove the Firing Solenoid (Figure 12).
  - a. Remove the Cotter Pin from the slotted Hexagon Nut (1) with a Needle-Nose Pliers (WP 0049, Table 3, Item 5).
  - b. Using a 19mm Wrench (WP 0049, Table 3, Item 4), loosen and remove the slotted Hexagon Nut (1) from the Shoulder Bolt (2) in order to remove the Firing Solenoid.
  - c. Pull the Firing Solenoid away from the weapon.

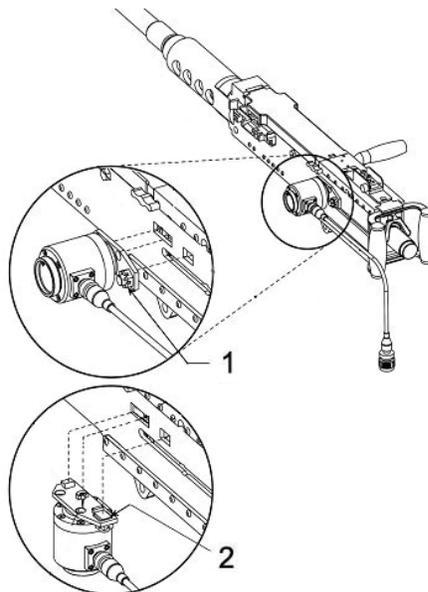


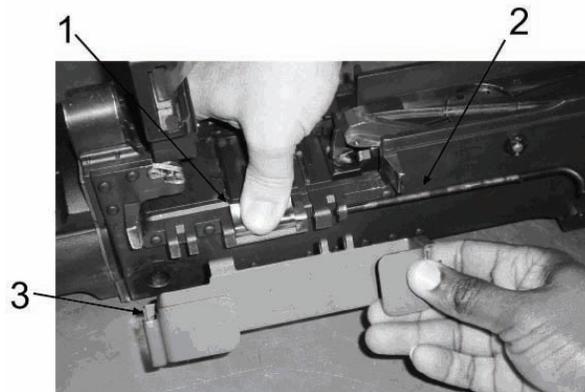
Figure 12. Firing Solenoid.

**END OF TASK**

**REMOVAL OF THE M2 .50 CAL MACHINE GUN - Cont****Remove the M2 Gun End Adapter, Cocking Bolt, and Anchor Pin****NOTE**

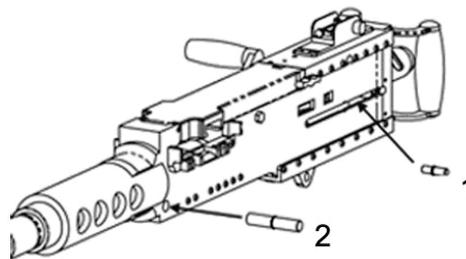
Remove the M2 Gun End Adapter, Cocking Bolt, and Anchor Pin only if the weapon will not be reinstalled.

1. Open the Feed Tray Cover.
2. While holding the Pawls in place (1), pull out the Pawl Pin (2) to remove the Gun End Adapter (3) from the M2 and reinsert the Pawl Pin (Figure 13).



**Figure 13. M2 Gun End Adapter.**

3. Ensure the Bolt is in the forward position, and remove the Backplate and Drive Spring to remove the Cocking Bolt (1) from the weapon (TM 9-1005-213-10) (Figure 14).
4. Remove the Anchor Pin from the weapon (2).



**Figure 14. M2 Cocking Bolt and Anchor Pin.**

5. Reinstall the Drive Spring and the Back Plate (TM 9-1005-213-10).
6. Store the M2 Gun End Adapter, Cocking Bolt, and Anchor Pin in the Storage Bag.

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALL MK19 40MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Installation of the MK19 40mm Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
Operator and Assistant

**References**

TM 9-1010-230-10  
Vehicle Operator Manual  
WP 0013  
WP 0015  
WP 0017  
WP 0024  
WP 0028  
WP 0029  
WP 0036

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator Manual)  
CROWS Shutdown (WP 0036)  
Weapon Ammo clear (TM 9-1010-230-10)  
Weapon maintenance performed  
(TM 9-1010-230-10)  
Left-hand charger assembly removed  
(TM 9-1010-230-10)  
All Accessories present and serviceable  
(TM 9-1010-230-10)  
Multi Adapter, Small Caliber (MASC)  
Removed (WP 0024 or WP 0028)

---

**INSTALLATION OF THE MK19 40MM MACHINE GUN****WARNINGS****WEAPON FIRE**

Clear MK19 40mm Machine Gun of ammunition prior to installation. Accidental firing of weapon can kill or injure personnel.

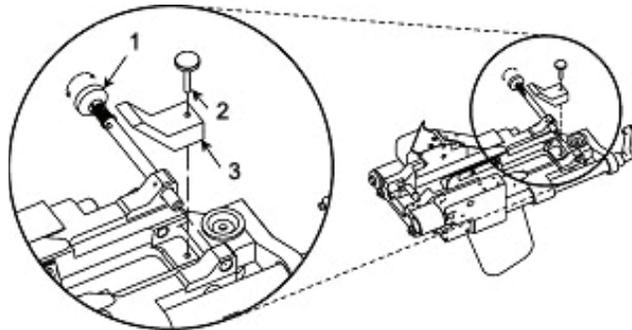
Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

**INSTALLATION OF THE MK19 40MM MACHINE GUN - Cont****Install the Damper Stop****NOTES**

CROWS requires all weapons to feed ammunition from the left hand side.

The MK19 weapon adaption items including the Damper Stop, Cocking Bracket, and Firing Solenoid are stowed in the Storage Bag.

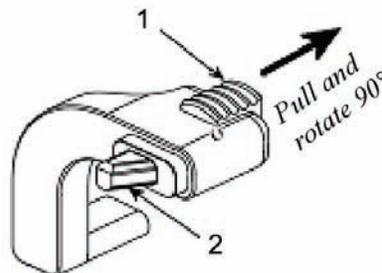
1. Push in the spring-loaded Mounting Pin (1) and rotate 1/4 turn CCW to remove from the upper hole in the Soft Mount (Figure 1). The MK19 mounting pin is the larger of the two pins.
2. Place the Damper Stop (3) at the bottom of the Soft Mount.
3. Tighten the Stop Screw (2) with fingers to fasten the Damper Stop to the Soft Mount.
4. Ensure that the Mounting Pin (1) moves freely over the Stop Screw (2) and reinsert over the Damper Stop (3) turning CW to lock.



**Figure 1. MK19 Damper Stop.**

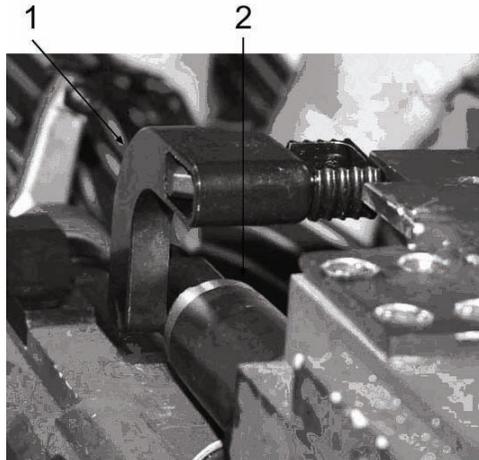
**END OF TASK****Install the Cocking Bracket and Firing Solenoid**

1. Place the Charger Hook (2) inside the Cocking Bracket by pulling the Finger Grip (1) out and rotating it 90 degrees (Figure 2).



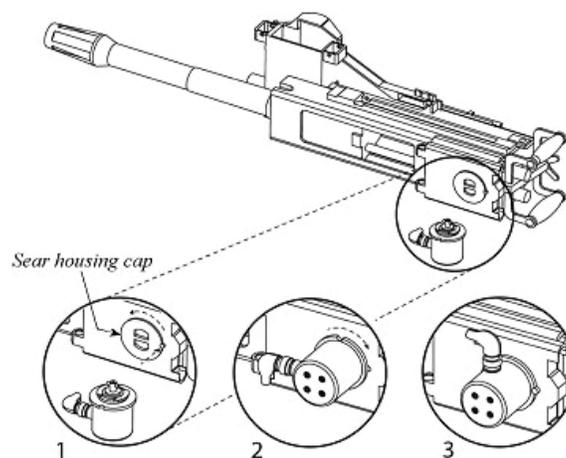
**Figure 2. MK19 Charger Hook.**

2. Ensure the Cocking Bracket Lock is fully extended before pushing the Cocking Bracket (1) completely into the Cocking Actuator Arm (2) from the right-hand side (Figure 3).



**Figure 3. MK19 Cocking Bracket.**

3. Remove the left-hand Charging Handle from the weapon if not already done (TM 9-1010-230-10).
4. Turn the weapon upside down.
5. Press in the Sear Detent Pin and remove the Sear Housing Cap (1) from the Sear Housing by rotating 90 degrees either direction and lifting up (Figure 4).
6. The Solenoid Bracket fits into the housing only one way. Line up the cutout on the Solenoid Bracket with the cutout in the housing and push the Solenoid in (2).
7. Rotate the Solenoid 90 degrees until the notch aligns with the Sear Detent Pin and snaps the Solenoid into place (3).



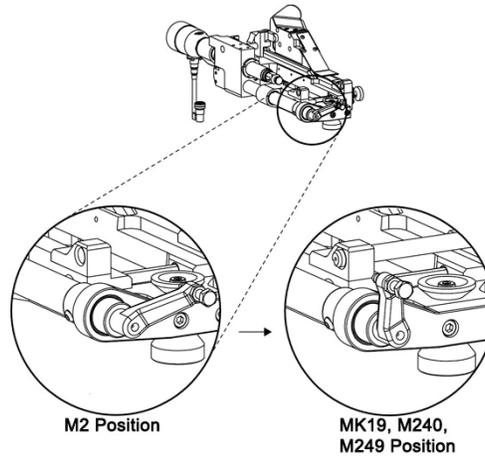
**Figure 4. MK19 Firing Solenoid.**

**END OF TASK**

## INSTALLATION OF THE MK19 40MM MACHINE GUN - Cont

### Install the MK19 on the Soft Mount

1. Push the spring-loaded Cocking Bracket Releaser Assembly Arm forward and swing to the left until set to the MK19 position (Figure 5) if necessary.



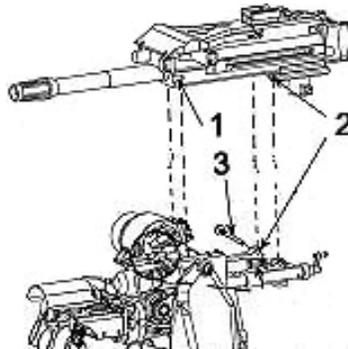
**Figure 5. MK19 Cocking Bracket Releaser Position.**

2. Push in the spring-loaded Mounting Pin (3) and rotate 1/4 turn CCW to remove from the Soft Mount (Figure 6).
3. Ensure that the M2 Link Guide has been removed (WP 0015).
4. Lower the weapon onto the Soft Mount by sliding the front Mounting Lugs (1) into the grooves at the front of Soft Mount and pulling the weapon back slowly to align the Mounting Holes (2).

### CAUTION

Ensure that the Mounting Pins are fully inserted and locked in place during installation, removal, operation, or shipment to prevent damage to equipment.

5. Reinsert the Mounting Pin (3) through the rear mounting holes (2), push in, and rotate 1/4 turn CW to locked position.

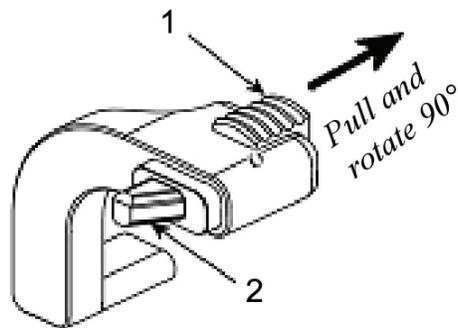


**Figure 6. MK19 and Soft Mount.**

**CAUTION**

Make certain that the Weapon Bolt has been set in the forward position before the Charger Hook engages.

6. Ensure the Cocking Bracket is flush with the Cocking Actuator Arm and push the Cocking Bracket Lock into the Actuator Arm to lock the Bracket.
7. Turn the Cocking Bracket Finger Grip (1) 90 degrees in either direction for the Charger Hook (2) to enter the Bolt Rail through the Receiver Rail for cocking position (Figure 7).



**Figure 7. MK19 Cocking Bracket.**

**CAUTION**

Ensure that CROWS is powered off when connecting/disconnecting electrical cables to prevent damage to equipment.

8. Align the Cable Pins with the Connector and attach the Solenoid Cable W7 (1) on the SSA Connector 4J2 at the rear of the SSA (Figure 8). Turn the Cable End CW until the Red Band on the SSA Connector is no longer visible. The SSA can be tilted down if necessary to improve access.

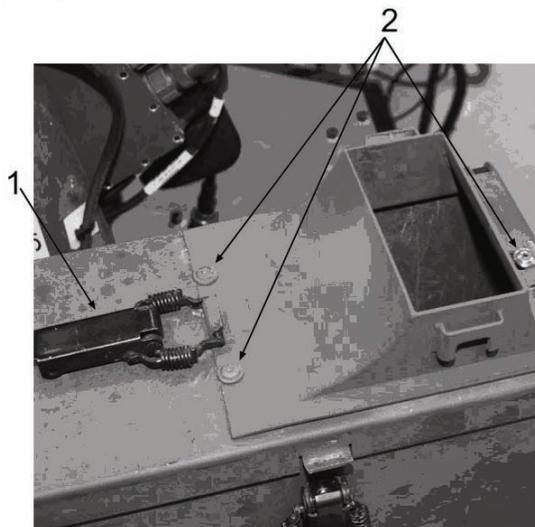


**Figure 8. Firing Solenoid Cable.**

**END OF TASK**

**INSTALLATION OF THE MK19 40MM MACHINE GUN - Cont****Install the MK19 Ammo Feed**

1. Slide the MK19 Ammo Guide underneath the three Ammunition Box Lid Rivets (2) and fasten with the Latch (1) (Figure 9).

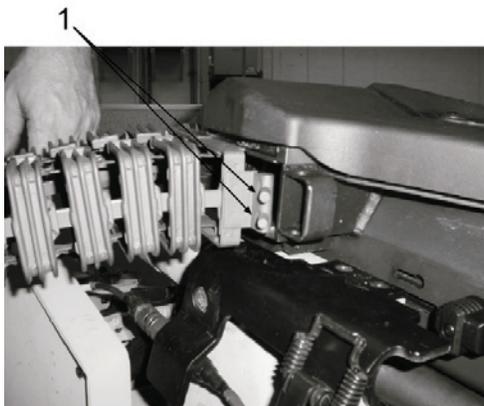


**Figure 9. MK19 Ammo Guide.**

**NOTE**

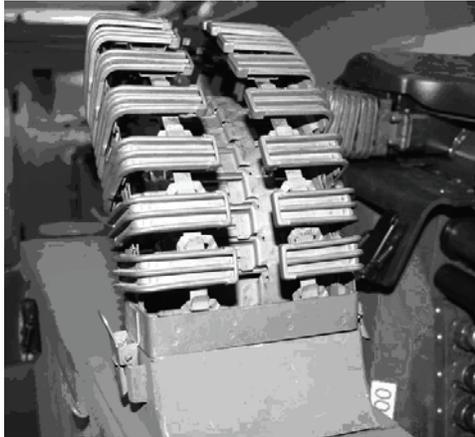
Mount the labeled end of the MK19 Ammo Chute to the MK19 Gun End Adapter with the slot to the top.

2. Squeeze both pairs of Mounting Pins (1) on each side of the labeled end of the MK19 Ammunition Chute and push into the Gun End until it locks with a click (Figure 10).



**Figure 10. MK19 Ammo Chute.**

3. Push the MK19 Chute onto the MK19 Ammo Guide until it locks with a click (Figure 11).



**Figure 11. MK19 Ammo Guide and Chute.**

4. Boresight the weapon (WP 0029).
5. Load the weapon (WP 0017).

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
LOAD MK19 40MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Loading the MK19 40mm Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
CROWS Operator and Assistant

**References**  
TM 9-1010-230-10  
WP 0006  
WP 0016  
WP 0034  
WP 0036

**Equipment Conditions**  
CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1010-230-10)  
Weapon maintenance performed  
(TM 9-1010-230-10)  
All Accessories present and serviceable  
(TM 9-1010-230-10)  
Weapon Installed (WP 0016)

---

**LOAD THE MK19 40MM MACHINE GUN****Load the Ammunition into the Ammunition Box****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**LOAD THE MK19 40MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNINGS****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

**CAUTIONS**

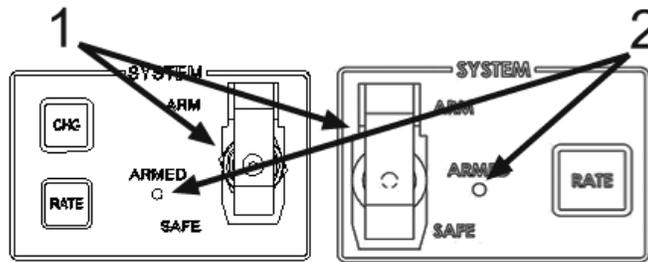
Before installing the Ammunition Belt into the Ammo Box, check that the Ammunition is of the correct type, metallic links are clean, and the Rounds are properly linked. Doing so prevents damage to equipment.

Empty the Rear Casing Collector Bag if necessary before reloading the installed weapon to prevent damage to equipment.

**NOTE**

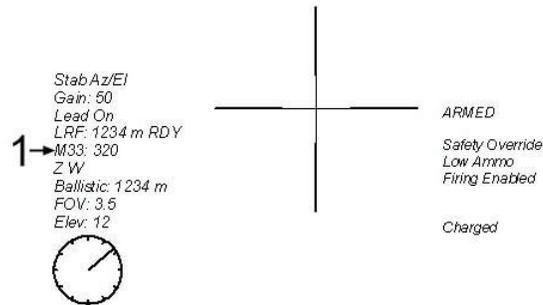
If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

1. Verify that the SYSTEM Switch Guard (1) is down on the DCP (left side of figure) or FCU (right side of figure) (Figure 1). The ARMED LED (2) should not be lit.



**Figure 1. SYSTEM ARM/SAFE.**

2. Ensure that the Weapon Bolt is in the forward position (TM 9-1005-213-10).
3. Verify that the correct type of Ammunition is selected. The selected Ammunition displays in the Ammunition Field (1) on screen (Figure 2).



**Figure 2. Ammunition Field.**

**LOAD THE MK19 40MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont**

4. Select the correct type of Ammunition if necessary (Figure 3).
  - a. Press MENU ON/OFF on the FCU/DCP to display the Main Menu.
  - b. Press MENU R (Right) twice to highlight the AMMO menu option.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the available Ammunition types.
  - d. Press MENU D (Down) until the correct Ammunition Type is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the Ammunition. The correct Ammunition Type displays in the Ammunition Field.
  - f. Press MENU ON/OFF to remove the Main Menu from the display.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
		M383 HE	
		M430	
		M430 A1_HEDP	
		M918 TP	
		MILES	

**Figure 3. Main Menu, AMMO.****CAUTION**

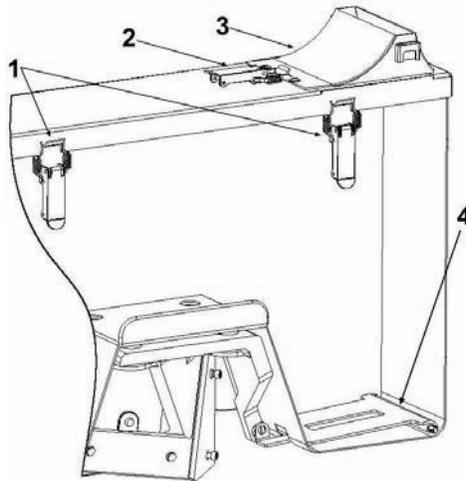
Do not overload the Ammunition Box. Ensure there is enough clearance (at least one half inch) between the loaded Ammunition and the Ammunition Box Cover to permit free movement of the Ammunition to the Receiver. Overloading the Ammunition Box can damage or jam equipment.

**NOTES**

The Ammunition Box holds 96 rounds of 40mm Ammunition.

If the last round of the Ammunition Belt is installed opposite the Activation Plate, the LOW AMMO signal appears on screen before all the Ammunition has been used. Ensure that the last Round is installed over the Activation Plate.

5. Remove the Ammo Guide (3) from the Ammo Box Lid if necessary by releasing the Ammo Box Lid Clip (2) and pulling the Ammo Guide from underneath the three Ammo Box Lid Rivets (Figure 4).
6. Release the two Ammo Box Lid Latches (1) and open the Ammunition Box Cover.
7. Insert the Ammunition Belt into the Ammo Box with the last link (first link in box) resting on the Low Ammo Actuator Plate (4).



**Figure 4. Ammunition Guide and Cover Locks.**

8. Close and latch the Ammo Box Lid.

#### **END OF TASK**

#### **Threading the Ammunition through the Ammo Guide and Chute**

1. Reach into the Ammunition Box through the hole for the MK19 Ammunition Guide in Lid and lift the end of the Ammunition Belt out of the Ammunition Box.
2. Thread the Ammunition Belt through the bottom and out the top of the MK19 Ammunition Guide. Hold the Ammunition Belt in place.
3. Install the Ammunition Guide underneath the three rivets on the Ammunition Box Lid and fasten with the latch.

**LOAD THE MK19 40MM MACHINE GUN - Cont****Threading the Ammunition through the Ammo Guide and Chute - Cont**

4. Thread the Ammo Belt into the Ammo Chute and push the Chute onto the Ammo Guide until it locks with a click if necessary (Figure 5).
5. Pull the Ammunition to the labeled end of the Ammo Chute.



**Figure 5. Ammunition Guide and Chute.**

**END OF TASK****Load Weapon**

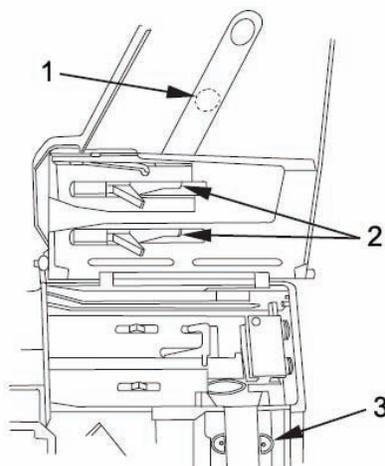
1. Open the MK19 Top Cover (TM 9-1010-230-10).

**WARNING****WEAPON FIRE**

Ensure first round is held in place by Belt-Holding Pawls. If first round is positioned against Round Positioning Block (to extreme right), first press of Charge Button chambers round, and accidental firing could result. Accidental firing of weapon can kill or injure personnel.

2. Insert the first Round into the Feedway (female link first) until the Ammo is past the first set of Pawls.

3. Before closing the Top Cover (Figure 6), ensure:
  - a. The Secondary Drive Lever (1) is engaged with the Feed Slide Pin.
  - b. The Feed Slide Assembly (2) is all the way left. The Spring should be touching the Top Cover.
  - c. The Weapon Bolt (3) is in the forward position.



**Figure 6. MK19 Top Cover.**

4. Close the MK19 Top Cover.



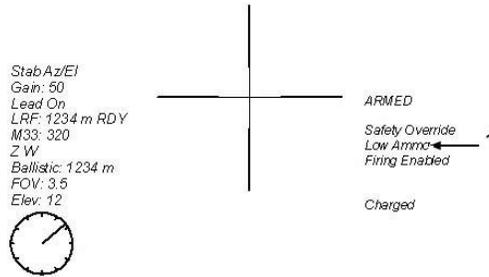
All personnel must leave WS area immediately after weapon is loaded to avoid possible injury.

5. Verify that all the Hatches are closed and evacuate the WS platform.

**LOAD THE MK19 40MM MACHINE GUN - Cont**

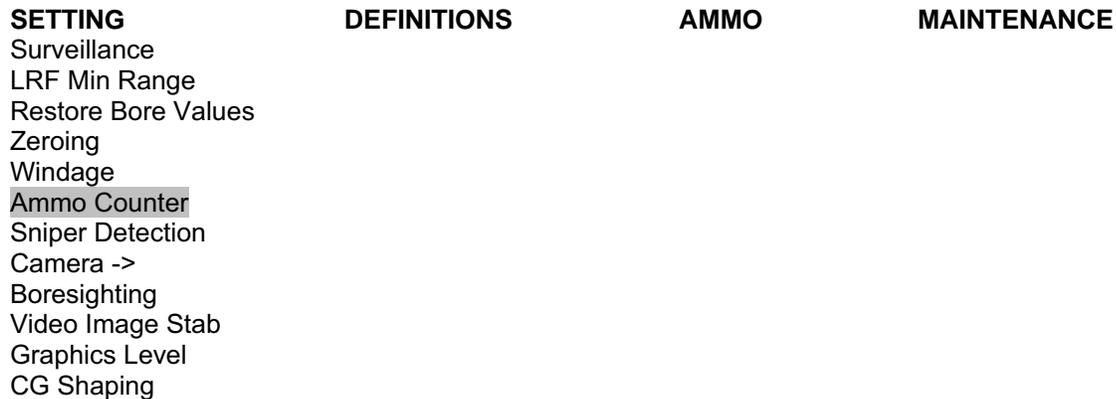
**Load the Weapon - Cont**

6. Verify that LOW AMMO (1) disappeared from the Ammunition Status Field (Figure 7).



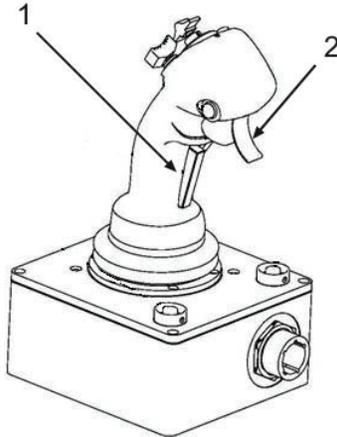
**Figure 7. Ammunition Status Field.**

7. Reset the number of rounds loaded in the AMMO COUNTER submenu under SETTING if different from the default value (96 rounds) (Figure 8).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Ensure SETTING is highlighted and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING options.
  - c. Press MENU D (Down) five times until the AMMO COUNTER is highlighted.
  - d. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the AMMO COUNTER.
  - e. Press MENU U (Up) or D (Down) until the correct Ammunition Count is highlighted.
  - f. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the Ammunition Count.
  - g. Press MENU ON/OFF to exit the Main Menu.



**Figure 8. Main Menu, AMMO.**

8. Press CHG (while holding the Palm Switch) on the CG.
9. Lift the Switch Guard and set SYSTEM ARM/SAFE to ARM.
10. Hold the Palm Switch (1), lift the Trigger Guard (2), and squeeze the Trigger on the CG (Figure 9).



**Figure 9. Trigger and Trigger Guard.**

11. Lower the Switch Guard to set SYSTEM ARM/SAFE to SAFE.
12. To fire the weapon, refer to WP 0034.

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
UNLOAD MK19 40MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Unloading the MK19 40mm Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

Screwdriver (WP 0049, Table 3, Item 3)

**Personnel Required:** Two

CROWS Operator and Assistant

**References**

TM 9-1010-230-10

WP 0006

WP 0036

**Equipment Conditions**

CROWS Powered Up (WP 0006)

Weapon Ammo Clear (TM 9-1010-230-10)

Weapon maintenance performed  
(TM 9-1010-230-10)

All Accessories present and serviceable  
(TM 9-1010-230-10)

---

**REMOVE AMMUNITION****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**REMOVE AMMUNITION - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNINGS****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

1. Power up CROWS (WP 0006) if necessary.

**NOTE**

If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

- Verify that the SYSTEM and REMOTE SAFE Switch Guards (1) are down on the DCP (top of figure) or FCU (bottom of figure) (Figure 1). Both the DISABLED LED (2) and ARMED LED (3) should not be lit.

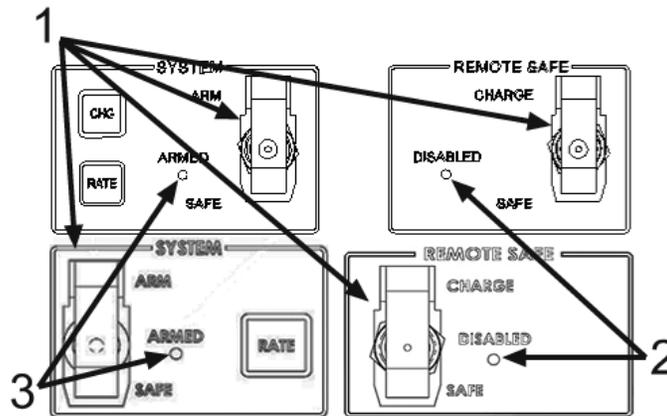


Figure 1. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.

- Open the Feed Cover on the Weapon Receiver.

#### WARNING



#### HOT AREA

Chamber may be hot. Use caution when inspecting T-slot to avoid burns.

#### NOTE

Use a cleaning rod to remove an empty case or live round from the weapon (TM 9-1010-230-10). Only if a cleaning rod is unavailable, use the screwdriver included in the CROWS Operator Toolkit (WP 0049, Table 3, Item 3).

- Verify that the weapon is clear of live Rounds or spent cases (TM 9-1010-230-10).
- Remove the Ammunition Belt from the Feedway and push it back down the Ammunition Chute into the Ammunition Box.
- Remove the Ammo Chute from the weapon.
- Ensure that the Secondary Drive Lever is engaged with the Feed Slide Pin, the Feed Slide Assembly is all the way left (Spring is touching Top Cover), and the Weapon Bolt is in the forward position (TM 9-1010-230-10).
- Close the Top Cover.

**REMOVE AMMUNITION - Cont**

9. Release the two Ammo Box Lid Latches and open the Ammunition Box.
10. Remove the Ammunition Belt.
11. Close and latch Ammunition Box.

**END OF TASK****END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
REMOVE MK19 40MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Removal of the MK19 40mm Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
Operator and Assistant

**References**

TM 9-1010-230-10  
Vehicle Operator Manual  
WP 0013  
WP 0016  
WP 0018  
WP 0036

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator Manual)  
CROWS Shutdown (WP 0036)  
Weapon Ammo clear (TM 9-1010-230-10)  
Weapon maintenance performed  
(TM 9-1010-230-10)  
All Accessories present and serviceable  
(TM 9-1010-230-10)

---

**REMOVAL OF THE MK19 40MM MACHINE GUN**

**WARNINGS**



**WEAPON FIRE**

Clear MK19 40mm Machine Gun of ammunition prior to installation. Accidental firing of weapon can kill or injure personnel.

Make sure CROWS power is switched off prior to removing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

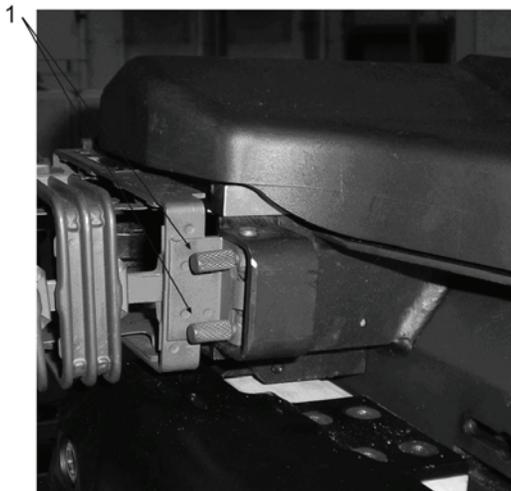
**REMOVAL OF THE MK19 40MM MACHINE GUN - Cont****Remove the MK19 Ammo Feed**

1. Power CROWS off if necessary (WP 0036).
2. Verify the weapon is clear of Ammunition and that the Weapon Bolt is in the forward position (TM 9-1010-230-10).
3. Squeeze the Clips (1) on each side of the MK19 Ammo Chute, and pull the Chute away from the Ammo Guide (Figure 1).



**Figure 1. MK19 Ammo Guide and Chute.**

4. Squeeze the Clips (1) together on each side of the Ammo Chute, and pull to remove the Chute from the MK19 Gun End (Figure 2) if necessary.



**Figure 2. MK19 Ammo Chute.**

5. Remove the MK19 Ammo Guide if necessary by unfastening the Ammo Guide Latch (1) and pulling the Ammo Guide back and away from the latch and three rivets (2) (Figure 3).

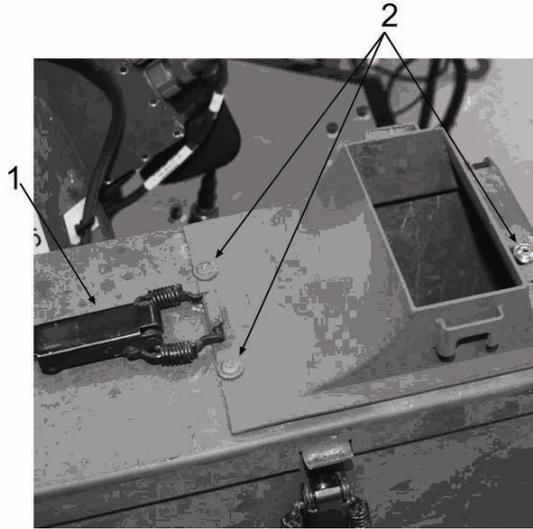


Figure 3. MK19 Ammo Guide.

## END OF TASK

### Remove the MK19 from the Soft Mount

#### CAUTION

Ensure that CROWS is powered off when connecting/disconnecting the Electrical Cables to prevent damage to equipment.

1. Unplug the Solenoid Firing Cable W7 from the SSA Connector 4J2 (1) at the rear of the SSA by turning CCW (Figure 4). The SSA can be tilted downward to improve access.

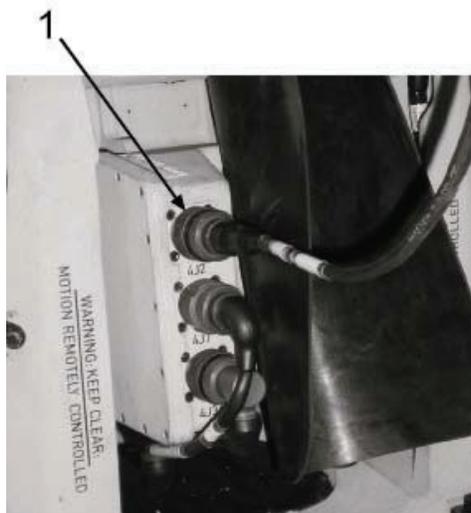
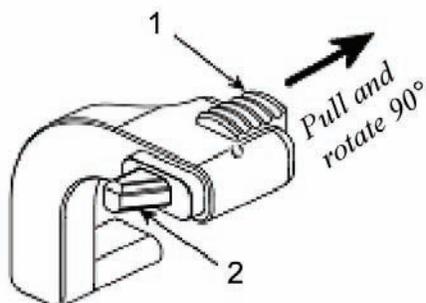


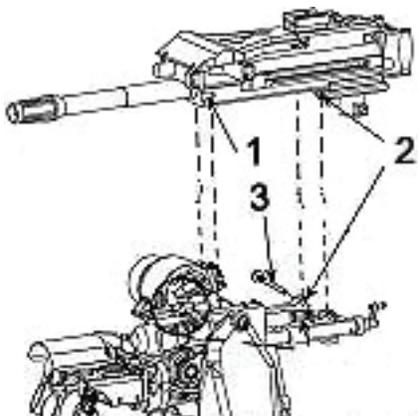
Figure 4. MK19 Firing Solenoid Cable.

**REMOVAL OF THE MK19 40MM MACHINE GUN - Cont****Remove the MK19 from the Soft Mount - Cont**

2. Place the Charger Hook (2) inside the Cocking Bracket by pulling the Finger Grip (1) out and rotating it 90 degrees (Figure 5).

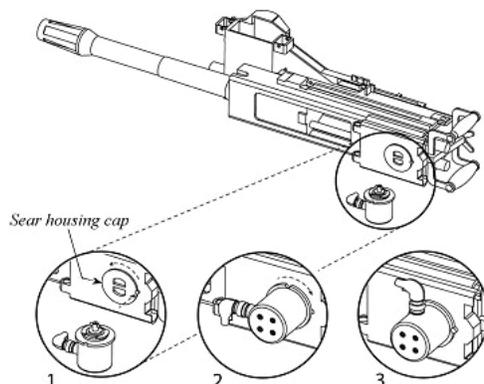
**Figure 5. MK19 Charger Hook.**

3. Push in the spring-loaded Mounting Pin (3) and rotate 1/4 turn CCW and remove from the Mounting Holes (2) (Figure 6).
4. Pull back on the weapon to move the front Mounting Lugs (1) to the rear of the Soft Mount grooves.
5. Raise the weapon off the Soft Mount.

**Figure 6. MK19 and Soft Mount.****END OF TASK****Remove the MK19 Firing Solenoid, Cocking Bracket, and Damper Stop****NOTE**

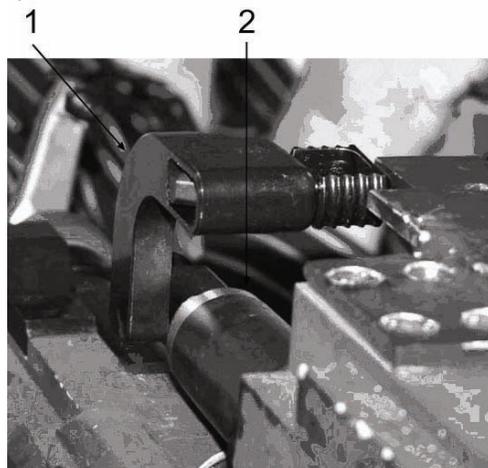
Remove the Firing Solenoid, Cocking Bracket, and Damper Stop only if the weapon will not be reinstalled.

1. Turn the weapon upside down.
2. Depress the Sear Detent Pin, turn the Firing Solenoid (3) 90 degrees CCW (2) and pull out to remove. (Figure 7).
3. Depress the Sear Detent Pin, insert the Sear Housing Cap (1) into the Sear Housing, and turn 90 degrees either direction to lock into the weapon.



**Figure 7. MK19 Firing Solenoid.**

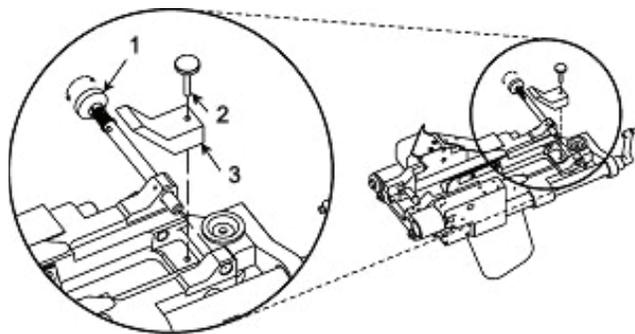
4. Pull out the Cocking Bracket Lock to remove the Cocking Bracket (1) from the Cocking Actuator Arm (2) (Figure 8).



**Figure 8. MK19 Cocking Bracket.**

**REMOVAL OF THE MK19 40MM MACHINE GUN - Cont****Remove the MK19 Firing Solenoid, Cocking Bracket, and Damper Stop – Cont**

5. Push in the spring-loaded Mounting Pin (1) and rotate 1/4 turn CCW to remove from the upper hole in the Soft Mount if necessary (Figure 9).
6. Loosen the Stop Screw (2) with fingers to remove the Damper Stop (3) from the Soft Mount.



**Figure 9. MK19 Damper Stop.**

7. Store the Firing Solenoid, Cocking Bracket, Damper Stop, and the Screw in the Storage Bag.

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALL M240 7.62MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Installation of the M240 7.62mm Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

3mm Hex Key (WP 0049, Table 3, Item 7)  
7mm Nut driver (WP0049, Table 3, Item 8)  
Offset Charging Handle Adapter  
(WP 0050, Item 2)

**Personnel Required:** Two

**References**

TM 9-1005-313-10  
Vehicle Operator Manual  
WP 0021  
WP 0029

WP 0036

WP 0047

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator Manual)  
CROWS Shutdown (WP 0036)  
Weapon Clear of Ammo  
(TM 9-1005-313-10)  
Weapon Maintenance Performed  
(TM 9-1005-313-10)  
All Accessories Present and Serviceable  
(TM 9-1005-313-10)

---

**INSTALLATION OF THE M240 7.62MM MACHINE GUN****WARNINGS****WEAPON FIRE**

Clear M240 7.62mm Machine Gun of ammunition prior to installation. Failure to do so may result in death or injury to personnel.

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

**CAUTION**

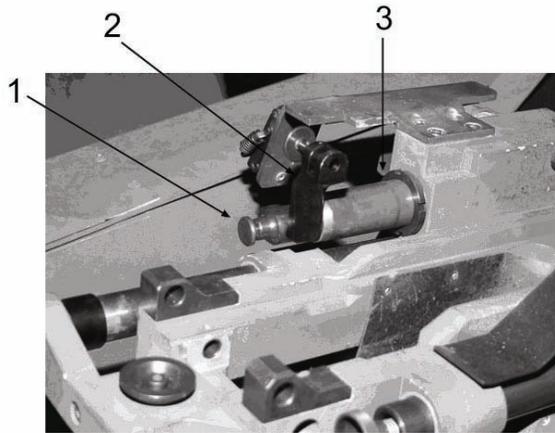
Do not install the Rear Casing Collector Bag when using M240 or M249 to prevent damage to equipment.

**INSTALLATION OF THE M240 7.62MM MACHINE GUN - Cont****Install the M240 Cocking Bracket and Link Tube****NOTES**

CROWS requires all weapons to feed ammunition from the left hand side.

The M240 weapon adaption items including the Link Tube are stowed in the Storage Bag. The Cocking Bracket can be stowed with the MASC.

1. Ensure the Cocking Bracket Releaser (1) is fully extended before pushing the Cocking Bracket (2) completely into the Cocking Actuator Arm (3) from the right-hand side (Figure 1).



**Figure 1. M240 Cocking Bracket.**

2. Fasten the M240 Link Tube (1) to the M240/M249 Multi Adapter Small Caliber (MASC) (2) using the 3mm Hex Key (WP 0049, Table 3, Item 7) and the two screws provided (Figure 2).



**Figure 2. M240 Link Tube.**

**END OF TASK**

### Install the Firing Solenoid

1. Turn the M240/M249 MASC upside down.
2. Line up the Solenoid Bracket with the slot in the Trigger Lever Fork.
3. Push the Solenoid in and rotate it 90 degrees CCW so that the notch in the Solenoid aligns with the spring-loaded Locking Pin which snaps into the notch.
4. Turn the M240/M249 MASC right side up.
5. Ensure the Trigger Lever Fork is centered underneath the Pin in the Solenoid (Figure 3).

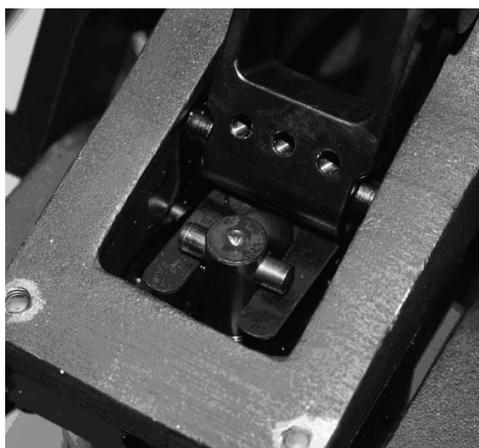


Figure 3. M240 Firing Solenoid.

### END OF TASK

### Install the MASC on the Soft Mount

#### WARNING



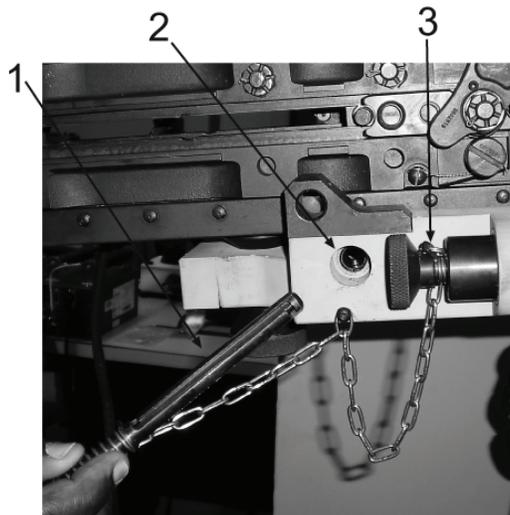
#### WEAPON FIRE

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator moves when connecting Firing Solenoid Cable possibly injuring personnel.

**INSTALLATION OF THE M240 7.62MM MACHINE GUN - Cont****Install the M240/M249 MASC on the Soft Mount - Cont****CAUTION**

Ensure that the Mounting Pins are fully inserted and locked in place during installation, removal, operation, or shipment to prevent damage to equipment.

1. Push the spring-loaded M2 Mounting Pin (1) in and rotate 1/4 turn CCW to remove from the Soft Mount (Figure 4). The M2 Pin is the shorter of the two mounting pins and fits into the lower Mounting Hole (2). Place the MK19 Pin (3) into storage position if necessary.



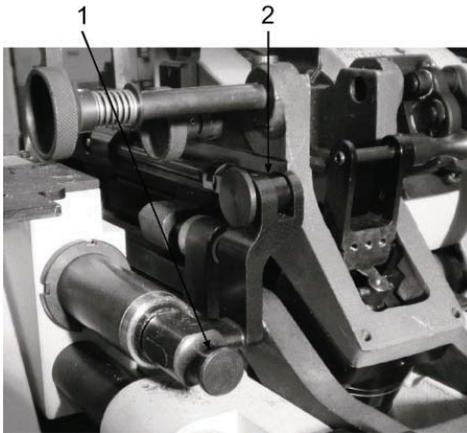
**Figure 4. Mounting Pin.**

2. Ensuring the back of the MASC is beneath the Cocking Bracket, lower the MASC onto the Soft Mount with the pins at the front of the MASC in the grooves at the front of the Soft Mount.
3. Pull the MASC slowly backward until the rear Mounting Holes are aligned (Figure 5).



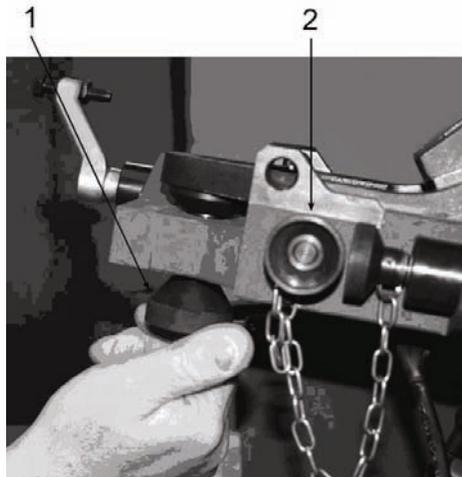
**Figure 5. M240/M249 MASC.**

4. Align the Cocking Bracket with the Cocking Arm and connect by pushing the Cocking Bracket Pin (2) through the end of the Cocking Arm (Figure 6).
5. Push in the Cocking Bracket Lock (1) to lock in place.



**Figure 6. Cocking Bracket Lock.**

6. Insert the spring-loaded M2 Mounting Pin (2) into the lower hole of the Soft Mount, push in, and rotate 1/4 turn CW to locked position (Figure 7).
7. Finger-tighten the Straining Screw (1) against the Bottom Plate of the MASC by turning CW until fastened without play.



**Figure 7. Straining Screw.**

**INSTALLATION OF THE M240 7.62MM MACHINE GUN - Cont****Install the M240/M249 MASC on the Soft Mount - Cont****CAUTION**

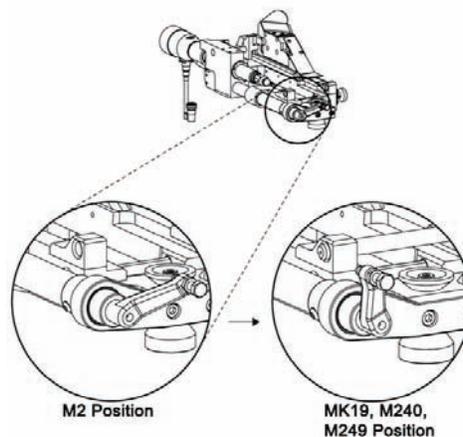
Ensure that CROWS is powered off when connecting/disconnecting Electrical Cables to prevent damage to equipment.

8. Align the Cable Pins with the Connector and attach the Solenoid Firing Cable W7 (1) on the SSA connector 4J2 at the rear of the SSA (Figure 8). Turn the Cable End CW until the Red Band on the SSA Connector is no longer visible. The SSA can be tilted down if necessary to improve access.



**Figure 8. M240 Solenoid Cable.**

9. Push the spring-loaded Cocking Bracket Releaser Arm in and turn CCW to the M240 position if necessary (Figure 9).



**Figure 9. Cocking Bracket Releaser.**

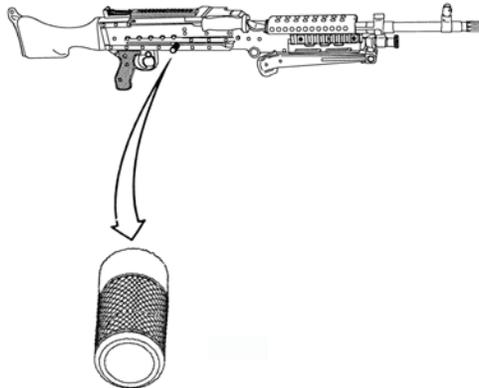
**END OF TASK**

## Identify the M240 Charging Handle

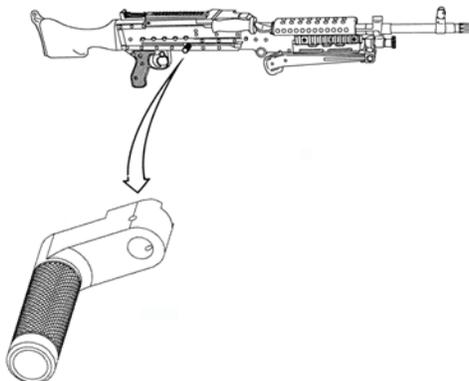
### CAUTION

The M240 can be equipped with the original Charging Handle or the Offset Charging Handle. Use the Charging Handle Adapter (WP 0050, Item 2) with the Offset Charging Handle to ensure that the WS properly charges the weapon and to prevent damage to equipment.

1. The Original M240 Charging Handle (Figure 10) is straight while the Offset Charging Handle (Figure 11) moves the handle toward the rear of the weapon. Identify the Charging Handle furnished with the weapon.



**Figure 10. Original Charging Handle.**



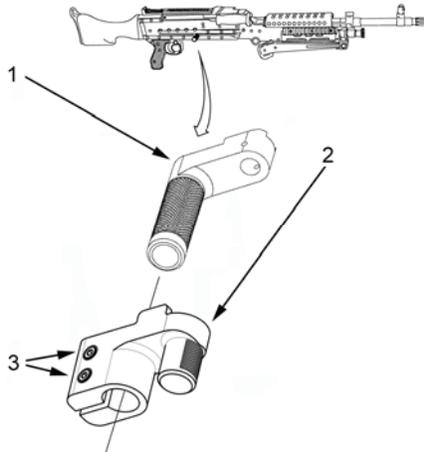
**Figure 11. Offset Charging Handle.**

2. If the weapon uses the Original Charging Handle, continue the installation with Install M240 on M240/M249 MASC. If the weapon uses the Offset Charging Handle, install the M240 Offset Charging Handle Adapter (WP 0050, Item 2) with the following procedure.

**END OF TASK**

**INSTALLATION OF THE M240 7.62MM MACHINE GUN - Cont****Install the M240 Charging Handle Adapter**

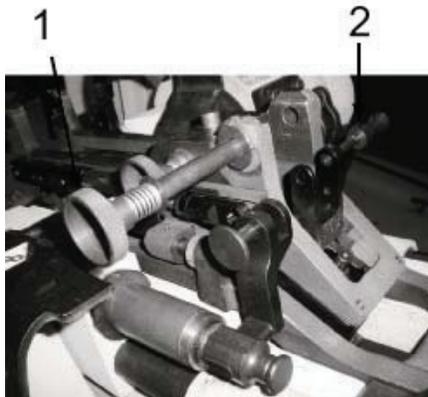
1. Slide the Offset Charging Handle Adapter (2) onto the Offset Charging Handle (1) (Figure 12).
2. Ensure the bottom surface of the Adapter (2) is in full contact with the Handle (1).
3. Tighten the two Screws (3) on the Adapter with a 3mm Hex key. Hold the self-locking nut with a 7mm nut driver. Tighten the Adapter (2) until fastened firmly to the Handle (1).



**Figure 12. Offset Charging Handle and Adapter.**

**END OF TASK****Install M240 on M240/M249 MASC**

1. Push the spring-loaded MASC Mounting Pin (1) in and rotate 1/4 turn CCW before pulling out as far as it goes (Figure 13).
2. Pull the Trigger Pin (2) out as far as it goes.



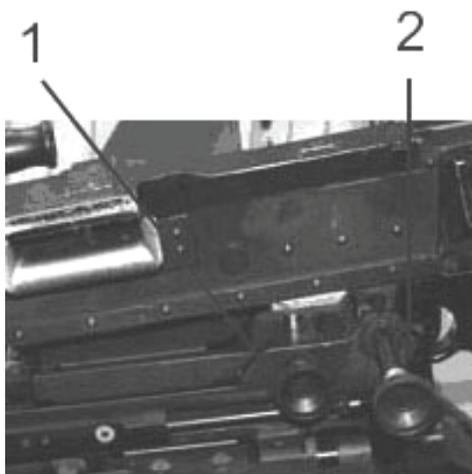
**Figure 13. MASC Mounting Pin.**

3. Pull the Charging Handle to the rear (TM 9-1005-313-10).
4. Ensure the Bipod Legs are in the locked upright position if necessary.
5. Slide the M240 Front Receiver Bushing into the Front Fork Grooves of the MASC and pull the weapon backward to align the Rear Mounting Holes (Figure 14).



**Figure 14. M240 and MASC.**

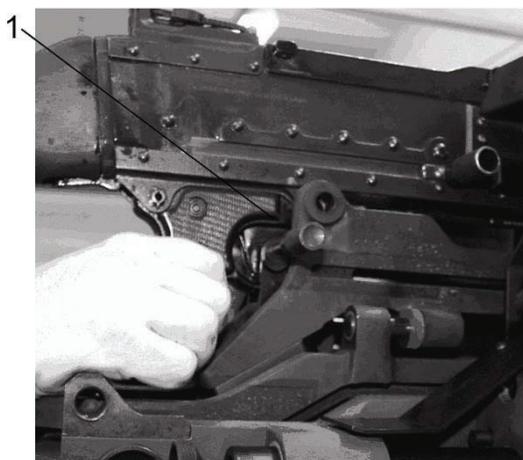
6. Insert the spring-loaded Mounting Pin (2), push in, and rotate 1/4 turn CW to the locked position (Figure 15).
7. Turn the Tightening Screw (1) CW until the weapon is firmly fastened to the MASC.



**Figure 15. M240 and MASC Mounting Pin.**

**INSTALLATION OF M240 7.62MM MACHINE GUN - Cont****Install M240 on M240/M249 MASC - Cont**

8. Push the Trigger Pin (1) completely in until locked in front of the Trigger (Figure 16).

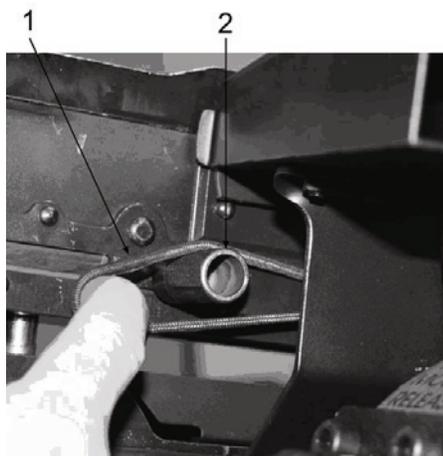


**Figure 16. Trigger Pin.**

**CAUTION**

Remove the Push Bracket Band to charge the weapon manually. Ensure the Band is reattached before firing with CROWS to prevent unnecessary wear and tear on the Charging Handle.

9. Pull the Push Bracket Band (1) from the MASC over the Charging Handle (2) or Offset Charging Handle Adapter if used (Figure 17).

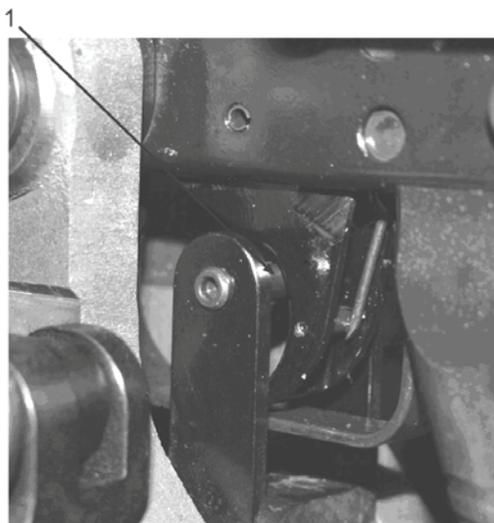


**Figure 17. Push Bracket Band.**

**NOTE**

Verify that there is a gap between the Trigger Arm and the Trigger. The Gap must be small enough that the weapon fires when the Trigger is pressed but large enough that the gun does not fire unintentionally.

10. Perform the Solenoid Adjustment Procedure (WP 0021) until the proper gap is set (1) if necessary (Figure 18).



**Figure 18. M240/M249 Firing Solenoid Gap.**

**END OF TASK****Install the M240 Ammunition Feed**

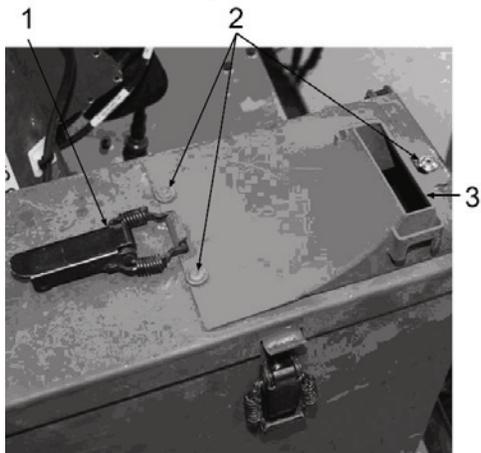
1. Fasten the M240 Ammo Feed Assembly (1) onto the Ammo Feed Bracket (3) of the MASC with the Latch (2) (Figure 19).



**Figure 19. M240 Ammunition Feed Assembly.**

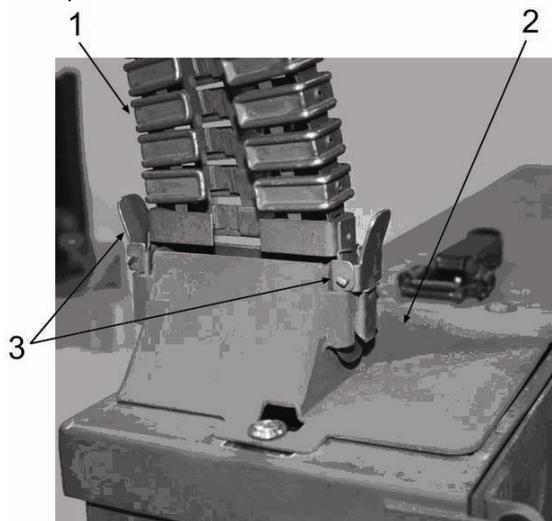
**INSTALLATION OF M240 7.62MM MACHINE GUN - Cont****Install the M240 Ammunition Feed - Cont**

2. Slide the M240/M249 Ammunition Guide (3) underneath the three Ammunition Box Lid Rivets (2) and fasten with the latch (1) (Figure 20).



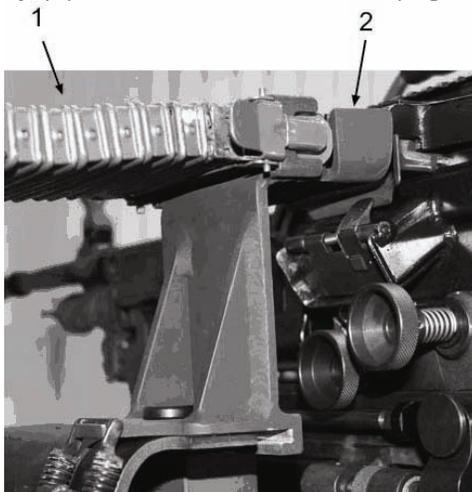
**Figure 20. M240 Ammunition Feed Guide.**

3. Push the Ammunition Chute (1) onto the Ammunition Guide (2) with the slot to the top until it locks with a click (Figure 21).



**Figure 21. M240 Ammunition Chute.**

4. Push the labeled end of the Ammunition Chute (1) with the slot to the top onto the Ammunition Feed Assembly (2) until it locks with a click (Figure 22).



**Figure 22. M240 Ammunition Feed Assembly.**

5. Ensure the Front Casing Collector Bag is installed (WP 0047).
6. Adjust the Firing Solenoid (WP 0021).
7. Boresight the weapon (WP 0029).
8. Load the weapon (WP 0022).

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
ADJUST M240/M249 MACHINE GUN FIRING SOLENOID**

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**THIS WORK PACKAGE COVERS:**

Adjustment of the M240/M249 Firing Solenoid.

---

**INITIAL SETUP:****Tools and Special Tools**

2mm Hex Key (WP 0049, Table 3, Item 6)

**References - Cont**

WP 0020/WP 0025

WP 0024/WP 0028

**Personnel Required:** One

**References**

TM 9-1005-313-10

TM 9-1005-201-10

Vehicle Operator Manual

WP 0006

**Equipment Conditions**

Vehicle Engine Shutdown (Vehicle  
Operator Manual)

Weapon Installed (WP 0020/WP 0025)

Weapon Cleared (TM 9-1005-313-10 or  
TM 9-1005-201-10)

CROWS Powered Up (WP 0006)

---

**ADJUSTMENT OF THE M240/M249 FIRING SOLENOID****General**

The adjustment of the M240/M249 Firing Solenoid should be checked:

- a. After installation of the electrical Firing Solenoid.
- b. After another weapon of the same type is installed.
- c. If there is a doubt that the timing is correct.

A correctly adjusted Solenoid leaves a minimum of play between the Trigger Pin and the Trigger. The Solenoid adjustment ensures the weapon fires when the Solenoid is activated and eliminates the chance of accidental firing. To operate properly with CROWS, two weapons of the same make and model might require slightly different gaps between the Trigger Pin and Trigger so the Solenoid cannot always be adjusted to one exact setting. The solenoid must be installed, tested, removed, and adjusted as many times as is necessary to obtain the proper setting, and the exact Solenoid adjustment required for each weapon must be determined with the following procedure.

**ADJUSTMENT OF THE M240/M249 FIRING SOLENOID - Cont****Adjust the M240/M249 Firing Solenoid****WARNINGS****WEAPON FIRE**

Before adjusting solenoid, ensure that weapon is clear of ammunition, M240/M249 bolt is in the forward position, and weapon cannot be fired. Doing so prevents accidental firing of weapon and serious injury or death to personnel.

**WARNING****HEAVY PARTS**

To prevent injury to personnel or damage to equipment, ensure CROWS WS is clear of obstacles before powering up.

**CAUTIONS**

First, perform the timing adjustment of the weapon according to the weapon manual. The reason for this is to prepare the weapon for manual mode functions.

The weapon Trigger is not to be used during the adjustment of the Solenoid. All attempts to fire during this procedure must be performed using the CG to prevent damage to equipment.

**NOTE**

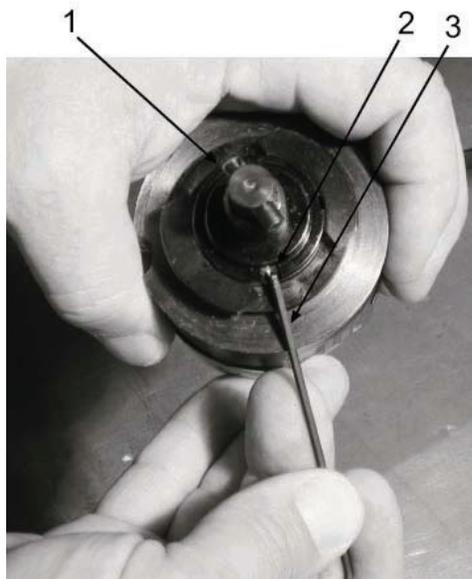
If the correct timing cannot be obtained, replace the Firing Solenoid.

1. Remove the weapon from the M240/M249 MASC (WP 0024/0028).
2. Remove the MASC from the Soft Mount (WP 0024/0028).
3. Remove the M240/M249 Firing Solenoid from the MASC (WP 0024/0028).
4. Use a 2mm Hex Key (WP 0049, Table 3, Item 6) (3) to loosen the Set Screw (2) (Figure 1).

**NOTE**

Rotate the Solenoid Plunger CW to reduce the gap between the Trigger Pin and the Trigger or CCW to increase the gap. Turn the Plunger 180 degrees at a time for fine adjustments.

5. Turn the Plunger (1) by hand until the suitable gap is set.
6. Tighten the Set Screw (2) with a 2mm Hex Key (WP 0049, Table 3, Item 6) (3).

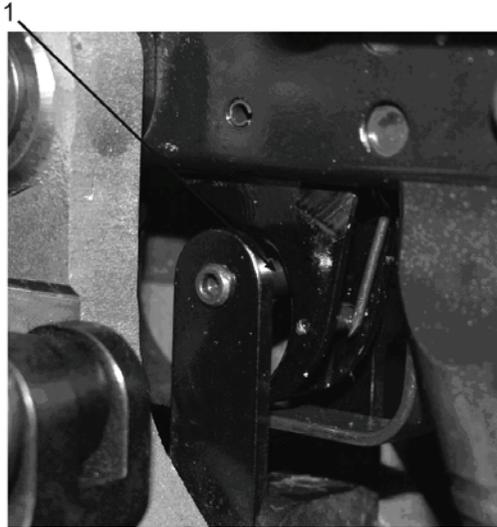


**Figure 1. Adjustment of M240/M249 Firing Solenoid.**

7. Reinstall the Solenoid, MASC, and weapon (WP 0020/0025).
8. Verify that the gap between the Trigger Arm and the Trigger is small enough that the weapon fires when the trigger is pressed but large enough that the gun does not fire unintentionally.

**ADJUSTMENT OF THE M240/M249 FIRING SOLENOID - Cont****Adjust the M240/M249 Firing Solenoid**

9. Repeat the Solenoid Adjustment Procedure until the proper gap is set (1) (Figure 2).



**Figure 2. M240/M249 Firing Solenoid Gap.**

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
LOAD M240 7.62MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Loading the M240 7.62mm Machine Gun

---

**INITIAL SETUP:****Tools and Special Tools**

Work Gloves (WP 0051, Item 7)

**Personnel Required:** Two

**References**

TM 9-1005-313-10  
WP 0020  
WP 0034

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1005-313-10)  
Weapon maintenance performed  
(TM 9-1005-313-10)  
All Accessories present and serviceable  
(TM 9-1005-313-10)  
Weapon Installed (WP 0020)

---

**LOAD THE M240 7.62MM MACHINE GUN****Load the Ammunition into the Ammunition Box****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**LOAD THE M240 7.62MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNING****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

**CAUTION**

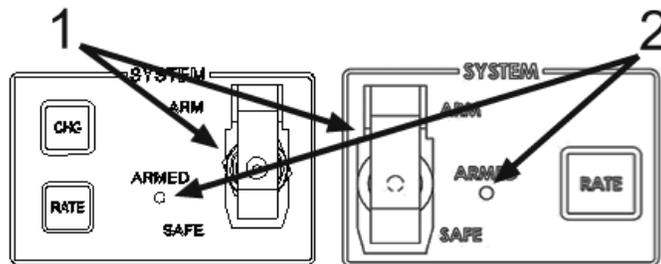
Before installing the Ammunition Belt into the Ammunition Box, check that the Ammunition is of the correct type, metallic links are clean, and the Rounds are properly linked. Doing so prevents damage to equipment.

Empty the Front Casing Collector Bag if necessary before reloading the installed weapon to prevent damage to equipment.

**NOTE**

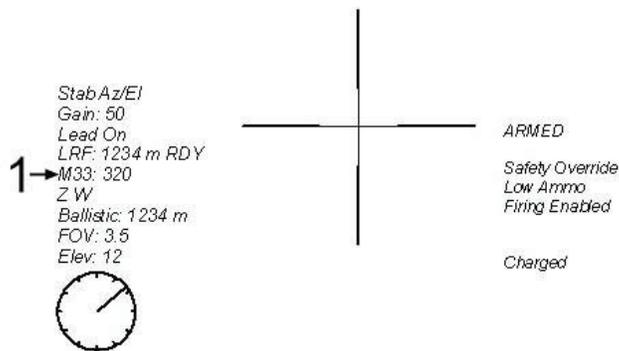
If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

1. Power up CROWS (WP 0006) if necessary.
2. Verify that the SYSTEM Switch Guard (1) is down on the DCP (left side of figure) or FCU (right side of figure) (Figure 1). The ARMED LED (2) should not be lit.



**Figure 1. SYSTEM ARM/SAFE.**

3. Ensure the Charging Handle Assembly is fully forward in the locked position (TM 9-1010-230-10).
4. Verify that the correct type of Ammunition is selected. The selected Ammunition displays in Ammunition Field (1) on screen (Figure 2).



**Figure 2. Ammunition Field.**

**LOAD THE M240 7.62MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont**

5. Select the correct type of Ammunition if necessary (Figure 3).
  - a. Press MENU ON/OFF on DCP or FCU to display the Main Menu.
  - b. Press MENU R (Right) twice to highlight the AMMO menu option.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the available Ammunition Types.
  - d. Press MENU D (Down) until the correct Ammunition Type is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the Ammunition. The correct Ammunition Type displays in the Ammunition Field.
  - f. Press MENU ON/OFF to remove the Main Menu from the display.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
		M80 BALL	
		M62 TRACER	
		MILES	

**Figure 3. Main Menu, AMMO.****CAUTION**

Do not overload the Ammunition Box. Allow at least 3.25 inches (approximately 83mm) between the loaded 7.62mm Ammunition and the Ammunition Box Cover to permit free movement of Ammunition to the Receiver. Overloading the Ammunition Box can damage or jam equipment.

**NOTES**

The Ammunition Box holds 1,000 rounds of 7.62mm ammunition.

If the last Round on the Ammunition Belt is installed opposite the Activation Plate, the LOW AMMO signal appears on screen before all the Ammunition has been used. Ensure that the last Round is installed over the Activation Plate.

6. Remove the Ammunition Guide (3) from the Ammunition Box Lid if necessary by releasing the Ammunition Box Lid Clip (2) and pulling the Ammunition Guide from underneath the three Ammunition Box Lid Rivets (Figure 4). The Ammunition Guide (3) is above the Low Ammo Actuator Plate (4).
7. Release the two Ammunition Box Lid Latches (1) and open the Ammunition Box Cover.

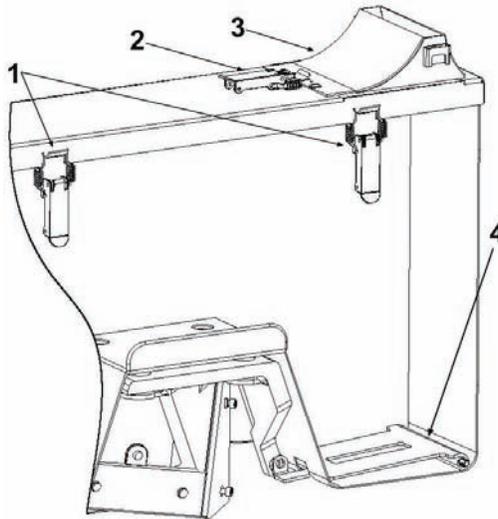


Figure 4. Ammunition Guide and Cover Locks.

**WARNING**



**SHARP OBJECT**

The Ammunition Insertion Cassette (AIC) has sharp metal edges. Wear Work Gloves (WP 0051, Item 7) when installing AIC to prevent injury.

8. Insert the Ammunition Insertion Cassette (AIC) into the Ammunition Box (Figure 5) ensuring that the M240 label faces away from the system.

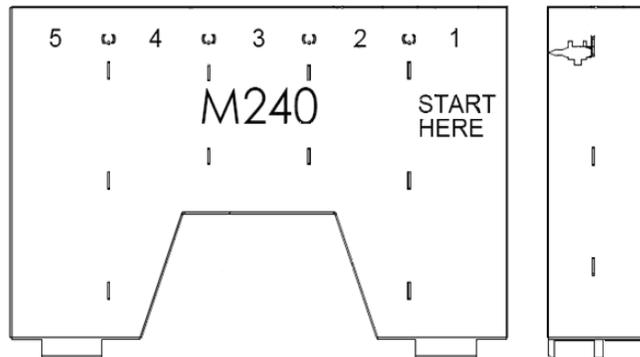
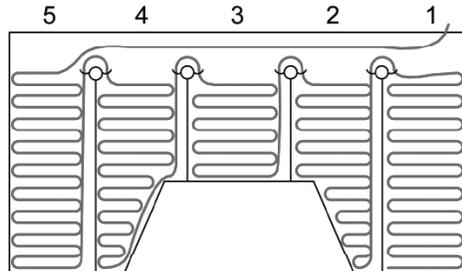


Figure 5. Ammunition Insertion Cassette.

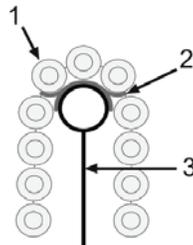
**LOAD THE M240 7.62MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont**

9. Insert the Ammunition Belt into the first chamber of the AIC with the last link (first link in box) resting on the Low Ammo Actuator Plate (Figure 6).



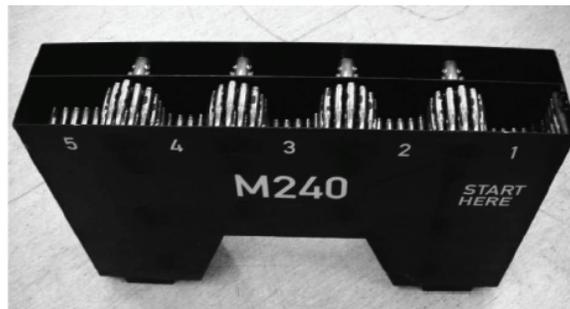
**Figure 6. Distribution of Ammunition.**

10. Continue inserting Ammunition into the first chamber of the AIC until the Ammunition is no less than 3.25 inches (approximately 83mm) from the Ammo Box lid.
11. When the first chamber has been filled, fold the Ammunition Belt over the baffle (3). Ensure the wings (two on each side) of the Ammo Retainers (2) are inserted between rounds (1) (Figure 7).



**Figure 7. Ammo Retainers.**

12. Fill each chamber in turn (no less than 3.25 inches from the Ammo Box Lid) and fold the Ammunition Belt over the next baffle with the wings of the Ammo Retainers properly inserted between rounds until the fifth chamber is filled.
13. Place the remaining Ammunition over the top of the baffles as illustrated (Figure 8).



**Figure 8. Fully Loaded AIC.**

14. Close and latch the Ammunition Box Lid.

### END OF TASK

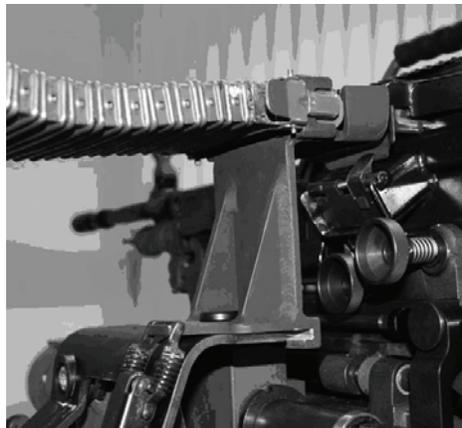
### Threading the Ammunition through the Ammo Guide and Chute

1. Reach into the Ammunition Box through the hole for the M240 Ammunition Guide in the Lid and lift the end of the Ammunition Belt out of the Ammunition Box.
2. Thread the Ammunition Belt through bottom and out the top of the Ammunition Guide.
3. Install the Ammunition Guide underneath the three rivets on the Ammunition Box Lid and fasten with the Latch.
4. Thread the Ammunition into the Ammunition Chute and push the Chute onto the Ammunition Guide until it locks with a click.
5. Pull the Ammunition to the labeled end of the Ammunition Chute.

### END OF TASK

### Load the Weapon

1. Push the labeled end of the Ammunition Chute onto the Gun End Adapter until it locks with a click (Figure 9).

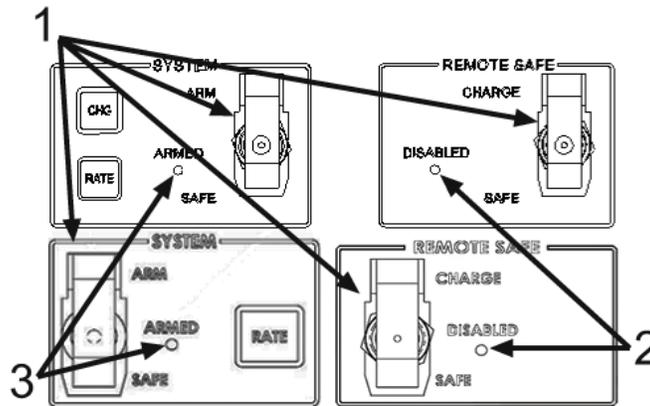


**Figure 9. Ammunition Chute and Gun End Adapter.**

2. Push in the Latches to open the Weapon Cover Assembly (TM 9-1005-313-10).
3. Raise the Feed Tray Assembly and inspect the Chamber to ensure that the weapon is clear (TM 9-1005-313-10).

**LOAD THE M240 7.62MM MACHINE GUN - Cont****Load the Weapon - Cont**

- Lift the SYSTEM and REMOTE SAFE Switch Guards (1) on the DCP (top of figure) or FCU (bottom of figure) and set REMOTE SAFE to CHARGE and SYSTEM Switch to ARM (Figure 10). ARMED appears on screen, and both the DISABLED LED (2) and the ARMED LED (3) should be lit.



**Figure 10. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.**

**WARNING****HEAVY PARTS**

Personnel must stay clear of Bolt when Weapon is charged and fired to avoid possible injury.

- Fire the weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on the CG to place the Bolt in the forward position.

**NOTE**

Position the open side of the links down.

- Place the Link Belt in the Feed Tray with the first round positioned against the Cartridge Stop.

**NOTE**

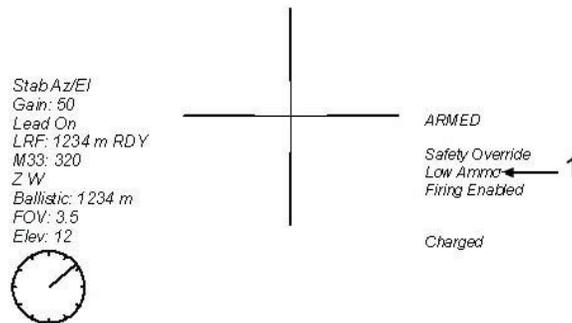
Ensure the first Round does not move away from the Cartridge Stop during closing and latching of the Cover.

- Close the Cover Assembly and ensure it locks shut.

**WARNINGS****WEAPON FIRE**

All personnel must leave WS area immediately after weapon is loaded to avoid possible injury.

8. Verify that all the Hatches are closed and evacuate the WS platform.
9. Lower the Switch Guards on the REMOTE SAFE and SYSTEM Switch.
10. Verify that LOW AMMO (1) disappeared from the Ammunition Status Field on screen (Figure 11).



**Figure 11. Ammunition Status Field.**

11. Reset the number of rounds loaded in the AMMO COUNTER submenu under SETTING if different from the default (Default value: 1,000 rounds) (Figure 12).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Ensure SETTING is highlighted and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING options.
  - c. Press MENU D (Down) five times until the AMMO COUNTER is highlighted.
  - d. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the AMMO COUNTER.
  - e. Press MENU U (Up) or D (Down) until the correct Ammunition Count is highlighted.
  - f. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the Ammunition Count.
  - g. Press MENU ON/OFF to exit the Main Menu.

**LOAD THE M240 7.62MM MACHINE GUN - Cont****Load the Weapon - Cont**

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b>	<b>MAINTENANCE</b>
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 12. Main Menu, AMMO.**

12. To fire the weapon, refer to WP 0034.

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
UNLOAD M240 7.62MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Unloading the M240 7.62mm Machine Gun.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
CROWS Operator and Assistant

**References**  
TM 9-1005-313-10  
WP 0006  
WP 0020  
WP 0036

**Equipment Conditions**  
CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1005-313-10)  
Weapon maintenance performed  
(TM 9-1005-313-10)  
All Accessories present and serviceable  
(TM 9-1005-313-10)  
Weapon Installed (WP 0020)

---

**REMOVE AMMUNITION**

**WARNINGS**



**EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**REMOVE AMMUNITION - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNINGS****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

1. Power up CROWS (WP 0006) if necessary.

**NOTE**

If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

- Verify that the SYSTEM and REMOTE SAFE Switch Guards (1) are down on the DCP (top of figure) or FCU (bottom of figure) (Figure 1). Both the DISABLED LED (2) and the ARMED LED (3) should not be lit.

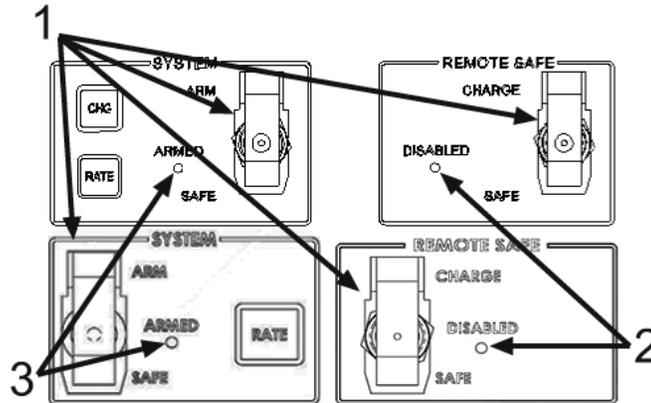


Figure 1. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.

### WARNING

Chamber may be hot. Use caution when inspecting T-slot to avoid burns.

- Push in the Latches to open the Weapon Cover Assembly (TM 9-1005-313-10).
- Remove the Ammunition Belt from the Feed Tray and push it back down the Ammunition Chute and into the Ammunition Box.
- Raise the Feed Tray Assembly to verify the Chamber is clear of Ammunition (TM 9-1005-313-10).
- Remove the Ammunition Chute from the weapon.
- Close the Weapon Cover Assembly.
- Release the two Ammo Box Latches and open the Ammunition Box.
- Remove the AIC; close and latch the Ammunition Box.

**END OF TASK**

**END OF WORK PACKAGE**



---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
REMOVE M240 7.62MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Removal of the M240 7.62mm Machine Gun.

---

**INITIAL SETUP:**

**Tools and Special Tools**

3mm Hex Key (WP 0049, Table 3, Item 7)

**Personnel Required:** Two

**References**

TM 9-1005-313-10  
Vehicle Operator Manual  
WP 0023  
WP 0036

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator  
Manual)  
CROWS Shutdown (WP 0036)  
Weapon Clear of Ammo  
(TM 9-1005-313-10)  
Weapon Maintenance Performed  
(TM 9-1005-313-10)  
All Accessories Present and Serviceable  
(TM 9-1005-313-10)

---

**REMOVAL OF THE M240 7.62MM MACHINE GUN**

**WARNINGS**



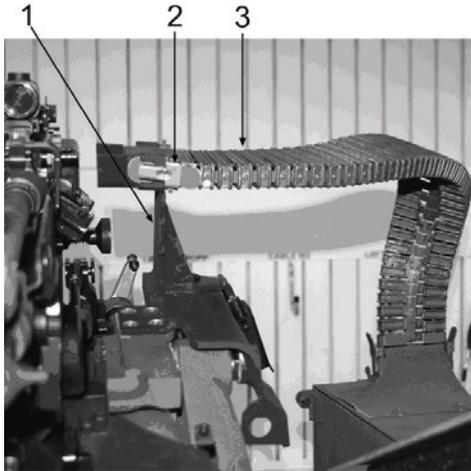
**WEAPON FIRE**

Clear M240 7.62mm Machine Gun of ammunition prior to removal. Accidental firing of weapon can kill or injure personnel.

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

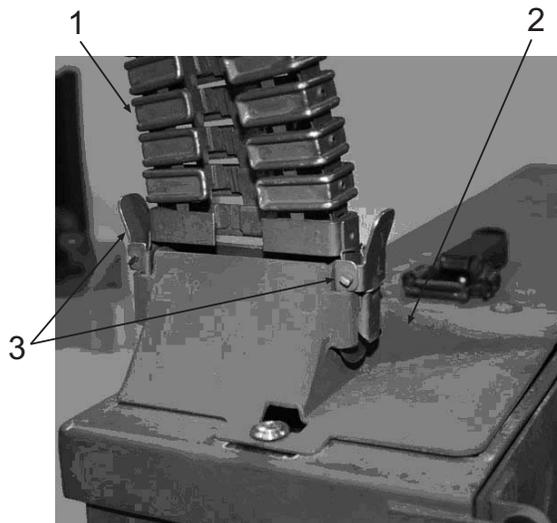
**REMOVAL OF THE M240 7.62MM MACHINE GUN - Cont****Remove the M240 Ammunition Feed**

1. Power CROWS off if not already done (WP 0036).
2. Verify the weapon is clear of Ammunition (TM 9-1005-313-10).
3. Remove the Ammunition Chute (3) by squeezing the Clips (2) on each side of the Chute End and pulling the Chute away from the Ammunition Feed Assembly (1) (Figure 1).



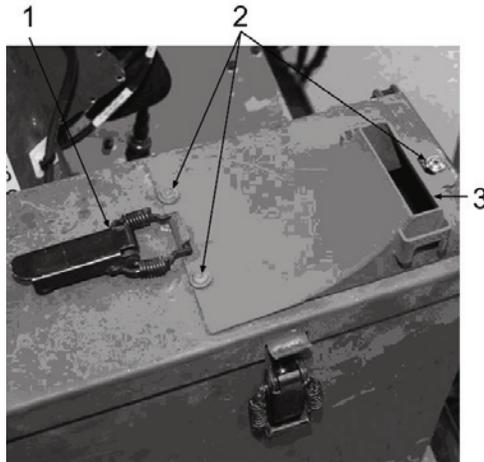
**Figure 1. M240 Ammunition Feed Assembly.**

4. Remove the Ammunition Chute (1) from the Ammunition Guide (2) by squeezing the Chute Clips (3) on each side of the Chute End and pulling the Chute End away from the Ammunition Guide (Figure 2).



**Figure 2. M240 Ammunition Chute.**

5. Remove the Ammunition Guide (3) if necessary by unfastening the Guide Latch (1) and pulling the Ammunition Guide away from the Latch and three Rivets (2) (Figure 3).



**Figure 3. M240 Ammunition Feed Guide.**

6. Unfasten the Latch (2) and pull the M240 Ammunition Feed Assembly (1) away from the Ammunition Feed Bracket (2) of the MASC (Figure 4).



**Figure 4. M240 Ammunition Feed Assembly.**

## **END OF TASK**

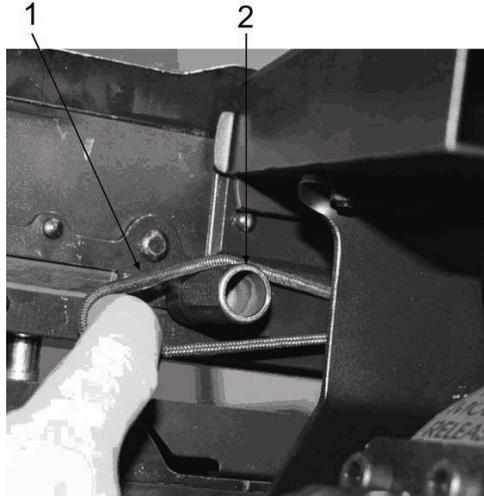
**Remove the M240 from the MASC**

## **CAUTION**

Remove the Push Bracket Band to cock the weapon manually. Ensure the Band is reattached before firing with CROWS to prevent unnecessary wear and tear to the Charging Handle.

**REMOVAL OF THE M240 7.62MM MACHINE GUN - Cont****Remove the M240 from the M240/M249 MASC - Cont**

1. Remove the Push Bracket Band (1) (Figure 5) from the Cocking Arm (2).



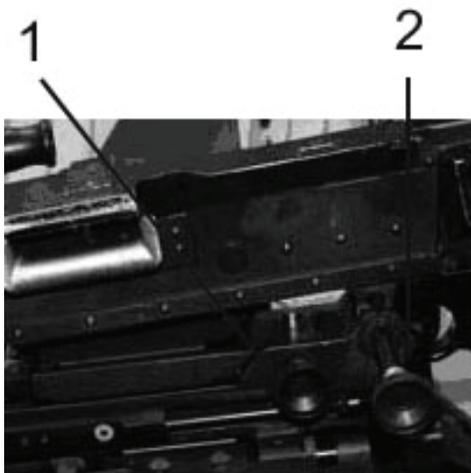
**Figure 5. M240 Push Bracket Band.**

2. Pull the Trigger Pin (1) completely out of the Trigger (Figure 6).



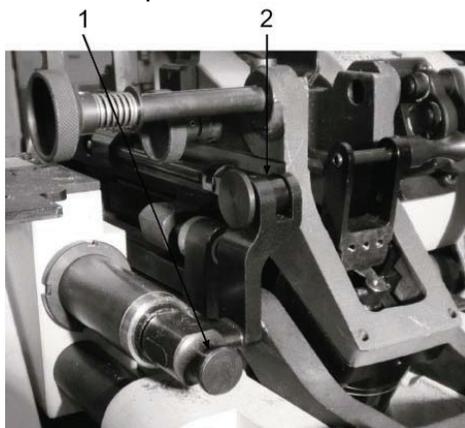
**Figure 6. Trigger Pin.**

3. Turn the Tightening Screw (1) CCW until the Screw releases the weapon from the MASC (Figure 7).
4. Push the Mounting Pin (2) in and rotate 1/4 turn CCW before pulling out as far as it goes.



**Figure 7. MASC Mounting Pin.**

5. Disconnect the Cocking Bracket from the Cocking Arm by pulling the Cocking Bracket Pin (2) from the end of the Cocking Arm (Figure 8). Pull the Cocking Arm from the Cocking Bracket.
6. Pull out the Cocking Bracket Lock (1) and move the Cocking Bracket into the Cocking Actuator Arm and away from the weapon.



**Figure 8. Cocking Bracket Lock.**

**REMOVAL OF THE M240 7.62MM MACHINE GUN - Cont****Remove the M240 from the M240/M249 MASC - Cont**

7. Remove the M240 from the MASC by raising the rear of the weapon and pushing forward (Figure 9).

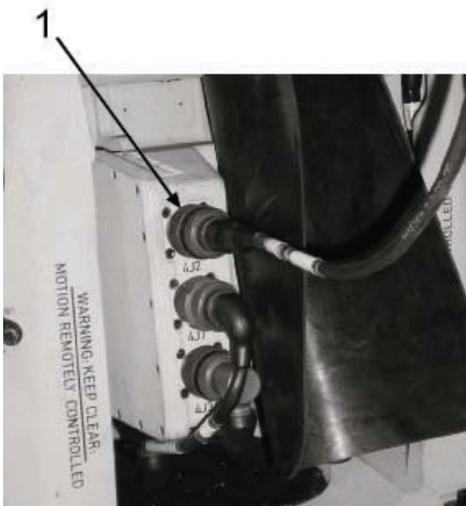


**Figure 9. M240 and MASC.**

**END OF TASK****Remove the M240/M249 MASC from the Soft Mount****CAUTION**

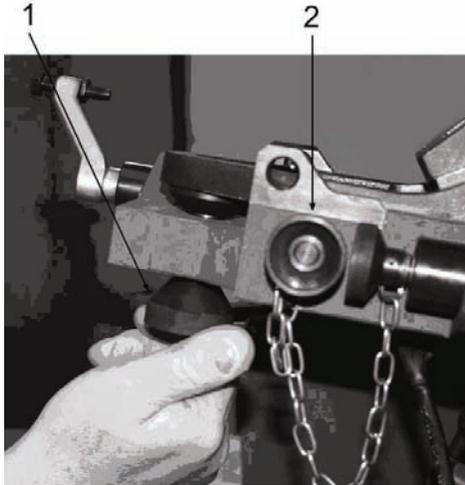
Ensure that CROWS is powered off when connecting/disconnecting the Electrical Cables to prevent damage to equipment.

1. Disconnect the Solenoid Cable W7 (1) from the SSA Connector 4J2 at rear of the SSA by turning CCW (Figure 10). The SSA can be tilted downward to improve access.



**Figure 10. M240 Solenoid Cable.**

2. Loosen the Straining Screw (1) from the Bottom Plate of the MASC by turning CCW (Figure 11).
3. Remove the spring-loaded Mounting Pin (2) by pushing in and rotating 1/4 turn CCW to the unlocked position.



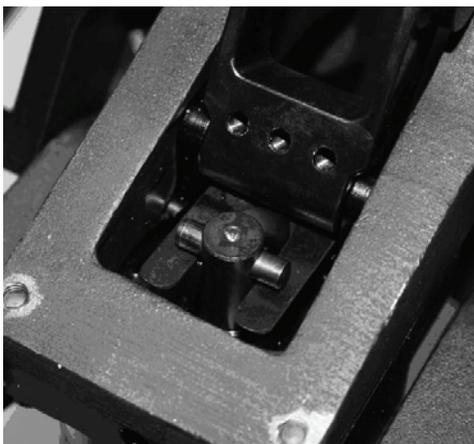
**Figure 11. Straining Screw.**

4. Push the MASC slowly forward until unfastened from the Soft Mount and raise the MASC off the Soft Mount.

#### **END OF TASK**

#### **Remove the Firing Solenoid, Cocking Bracket, and Link Tube**

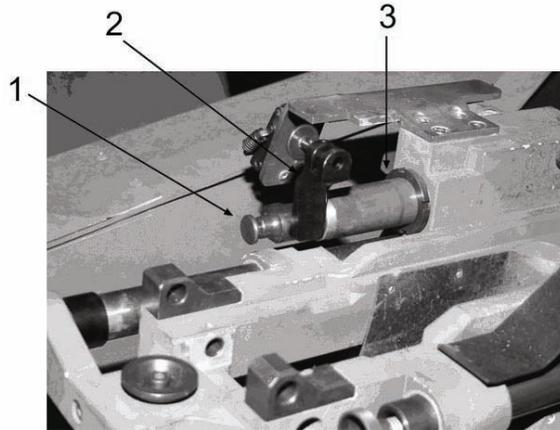
1. Turn the MASC upside down.
2. Rotate the Solenoid 90 degrees and pull it out of the Trigger Lever Fork (Figure 12).



**Figure 12. M240 Firing Solenoid.**

**REMOVAL OF THE M240 7.62MM MACHINE GUN - Cont****Remove the Firing Solenoid, Cocking Bracket, and Link Tube - Cont**

3. Verify that the Cocking Bracket Lock is out (1) and remove the Cocking Bracket (2) from the Cocking Actuator Arm (3) (Figure 13).



**Figure 13. M240 Cocking Bracket.**

4. Remove the Link Tube (1) using a 3mm Hex Key (WP 0049, Table 3, Item 7) to loosen the two screws (Figure 14). The Screws should not be removed from the Link Tube.



**Figure 14. M240 Link Tube.**

5. If the weapon uses the Offset Charging Handle, remove the Charging Handle Adapter by loosening the two Screws with a 3mm Hex key. Do not remove the Screws from the Adapter.
6. Store the Firing Solenoid and Link Tube in the Storage Bag. Reconnect the Cocking Bracket to the Cocking Arm for storage with the MASC.

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALL M249 5.56MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Installation of the M249 5.56mm Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

3mm Hex Key (WP 0049, Table 3, Item 7)

**References - Cont**

WP 0047

**Personnel Required:** Two

**Equipment Conditions**

Vehicle Wheels Chocked/Engine Shutdown  
(Vehicle Operator Manual)

CROWS Shutdown (WP 0036)

Weapon clear of Ammo  
(TM 9-1005-201-10)

Weapon maintenance performed  
(TM 9-1005-201-10)

All Accessories present and serviceable

**References**

TM 9-1005-201-10

Vehicle Operator Manual

WP 0021

WP 0026

WP 0029

WP 0036

---

**INSTALLATION OF THE M249 5.56MM MACHINE GUN****Install the M249 Cocking Bracket****WARNINGS****WEAPON FIRE**

Clear M249 5.56mm Machine Gun of ammunition prior to installation. Failure to do so may result in death or injury to personnel.

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

**CAUTION**

Do not install the Rear Casing Collector Bag when using the M240 or M249 to prevent damage to equipment.

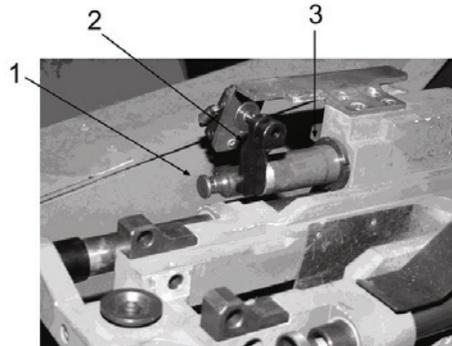
**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Install the M249 Cocking Bracket - Cont****NOTES**

CROWS requires all weapons to feed Ammunition from the left hand side.

The M249 weapon adaption items are stowed in the Storage Bag. The Cocking Bracket can be stowed with the MASC.

Do not use the M249 short barrel (NSN: 1005-01-470-5046) with CROWS. CROWS Ballistics Tables are written for the long barrel (NSN: 1005-01-387-8516) only (TM 9-1005-201-10). Use of the short barrel will result in inaccurate ballistic solutions.

1. Pull out the Cocking Bracket Lock (1) and slide the M240/M249 Cocking Bracket (2) into the Cocking Actuator Arm (3) as far as possible (Figure 1).



**Figure 1. M249 Cocking Bracket.**

2. Remove the M240 Link Tube (1) if installed on the Multi Adapter Small Caliber (MASC) (2) using a 3mm Hex Key (WP 0049, Table 3, Item 7) to loosen the two Screws (Figure 2). The Screws should not be removed from the Link Tube.



**Figure 2. M240 Link Tube.**

**END OF TASK**

### Install the Firing Solenoid

1. Turn the M240/M249 MASC upside down.
2. Line up the Solenoid Bracket with the slot in the Trigger Lever Fork.
3. Push the Solenoid in and rotate it 90 degrees so that the notch in the Solenoid aligns with the spring-loaded the Locking Pin which snaps into the notch.
4. Turn the MASC right side up.
5. Ensure the Trigger Lever Fork is centered underneath the Pin in the Solenoid (Figure 3).

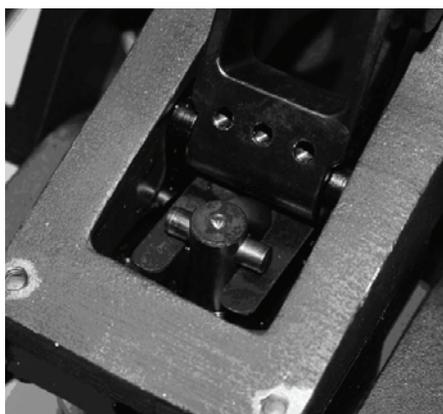


Figure 3. M249 Firing Solenoid.

### END OF TASK

#### Install the M240/M249 MASC on the Soft Mount

#### WARNING

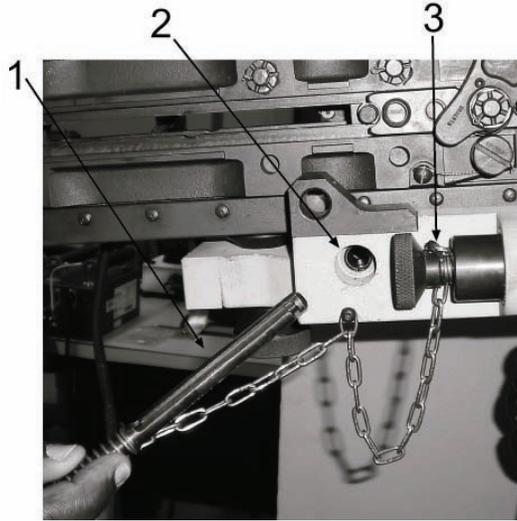


#### WEAPON FIRE

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator moves when connecting Firing Solenoid Cable possibly injuring personnel.

**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Install the M240/M249 MASC on the Soft Mount - Cont**

1. Push the spring-loaded M2 Mounting Pin (1) in and rotate a 1/4 turn CCW to remove from the lower Mounting Hole (2) in the Soft Mount if necessary (Figure 4). The M2 Mounting Pin is the shorter of the two Mounting Pins. Place the MK19 Pin (3) into the storage position if necessary.



**Figure 4. Mounting Pin.**

2. Ensuring the back of the MASC is beneath the Cocking Bracket, lower the MASC onto the Soft Mount with the Pins at the front of the MASC in the grooves at the front of the Soft Mount.
3. Pull the MASC slowly backward until the Rear Mounting Holes are aligned (Figure 5).

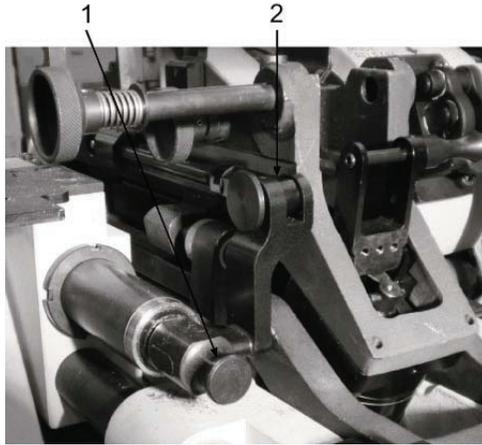
**NOTE**

The M240 Link Tube must be removed for M249 installation.



**Figure 5. M240/M249 MASC.**

4. Align the Cocking Bracket with the Cocking Arm and connect by pushing the Cocking Bracket Pin (2) through the end of the Cocking Arm (Figure 6).
5. Push in the Cocking Bracket Lock (1) to lock in place.

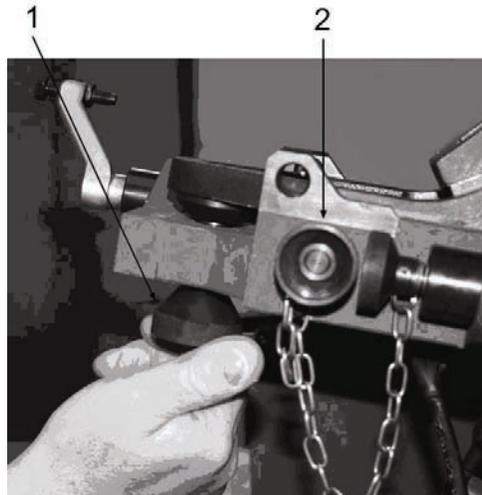


**Figure 6. Cocking Bracket Lock.**

### CAUTION

Ensure that the Mounting Pins are fully inserted and locked in place during installation, removal, operation, or shipment to prevent damage to equipment.

6. Insert the spring-loaded M2 Mounting Pin (2) into the lower hole of the Soft Mount, push in and rotate 1/4 turn CW to the locked position (Figure 7).
7. Finger-tighten the Straining Screw (1) against the Bottom Plate of the MASC by turning CW until fastened without play.

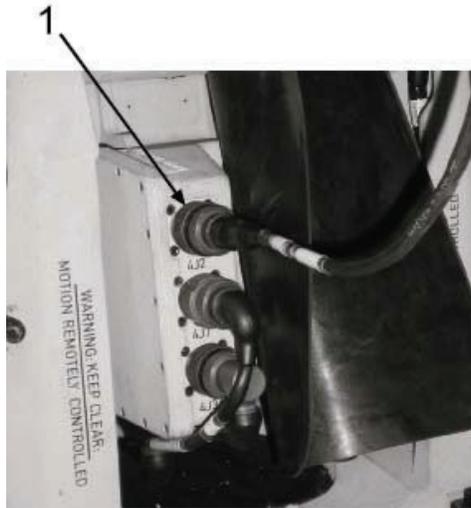


**Figure 7. Straining Screw.**

**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Install the M240/M249 MASC on the Soft Mount - Cont****CAUTION**

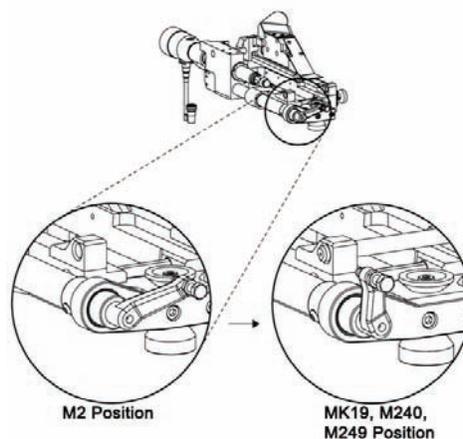
Ensure that CROWS is powered off when connecting/disconnecting the Electrical Cables to prevent damage to equipment.

8. Align the Cable Pins with the Connector and attach the Solenoid Firing Cable W7 (1) on the SSA Connector 4J2 at the rear of the SSA (Figure 8). Turn the Cable End CW until the Red Band on the SSA Connector is no longer visible. The SSA can be tilted down if necessary to improve access.



**Figure 8. M249 Solenoid Cable.**

9. Push the spring-loaded Cocking Bracket Releaser Arm in and turn CCW to the M249 position if necessary (Figure 9).



**Figure 9. Cocking Bracket Releaser.**

**END OF TASK**

**Prepare the MASC and M249 for Mounting**

1. Push the spring-loaded MASC Mounting Pin (1) in and rotate 1/4 turn CCW before pulling out as far as it goes (Figure 10).
2. Pull the Trigger Pin (2) out as far as it goes.



**Figure 10. MASC Mounting Pin.**

3. Pull the weapon Charging Handle to the rear (TM 9-1005-201-10).

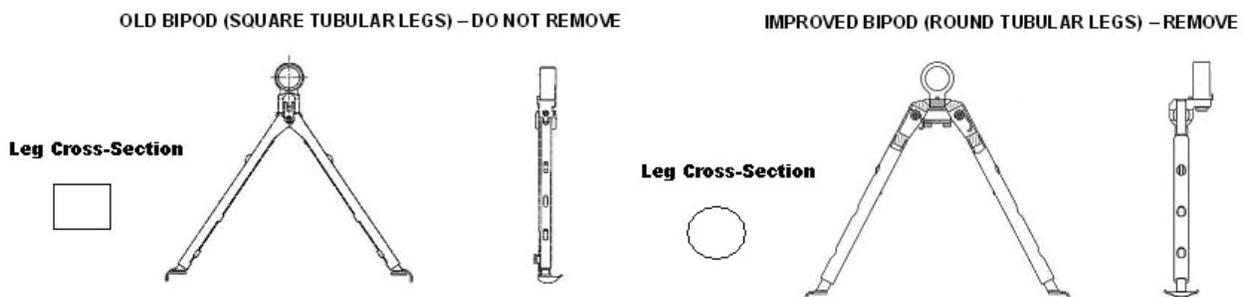
**END OF TASK**

**Identify the M249 Bipod**

**CAUTION**

Old Style Bipods may still be used with the M249. Do not use the M249 Improved Bipod with CROWS to prevent damage to equipment.

1. Old Bipods have square tubular legs; improved Bipods have round tubular legs (Figure 11). Identify the Bipod furnished with the weapon.



**Figure 11. M249 Bipods.**

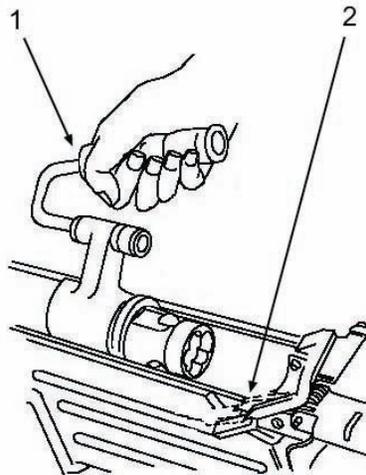
**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Install the M240 on the M240/M249 MASC - Cont**

2. If the weapon uses the Old Bipod, hold the Bipod Legs together, fold them to the rear, and continue with Install M249 on M240/M249 MASC. If the weapon uses the Improved Bipod, perform the following Improved Bipod Removal Procedure.

**END OF TASK****Improved Bipod Removal****NOTE**

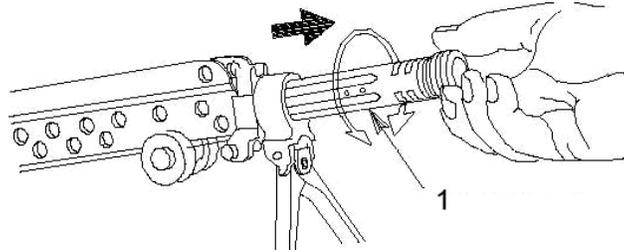
Perform the Improved Bipod Removal Procedure only if the Improved Bipod is used with the weapon.

1. Clear the weapon (TM 9-1005-201-10).
2. Ensure the Bolt is to the rear (TM 9-1005-201-10).
3. Ensure the Cover is closed and the Carrying Handle on the Barrel (1) is in the carrying (up) position (Figure 12).
4. While depressing the Locking Lever (2) with the left hand, grip the Carrying Handle (1) with the right hand, lift up, and push the Barrel forward.



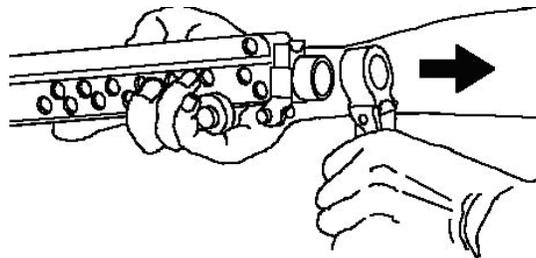
**Figure 12. Locking Lever and Carrying Handle.**

5. Turn the Gas Cylinder (1) to the left or right to release the Locking Spring and pull out (Figure 13).



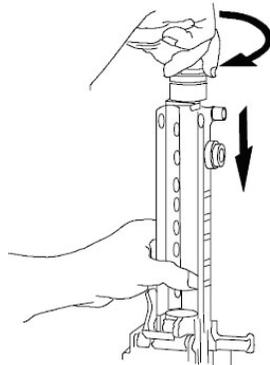
**Figure 13. Remove Gas Cylinder.**

6. After removal of the Gas Cylinder, the Improved Bipod can be separated from the Receiver (Figure 14).



**Figure 14. Remove Bipod.**

7. Insert the Gas Cylinder into the Receiver (Figure 15). Push the Gas Cylinder to the rear while countering the pressure of the Locking Spring and guiding the end of the Gas Cylinder into the Receiver with the other hand applying downward pressure. Turn the Gas Cylinder CW until the Spring clicks into the recess at the rear of the Gas Cylinder.



**Figure 15. Insert Gas Cylinder.**

**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Improved Bipod Removal - Cont**

8. Depress the Locking Lever with the left hand (2) (Figure 16). Holding the Carrying Handle with the right hand (1), pull the Barrel rearward, push downward, and lock by releasing the Barrel Locking Lever.

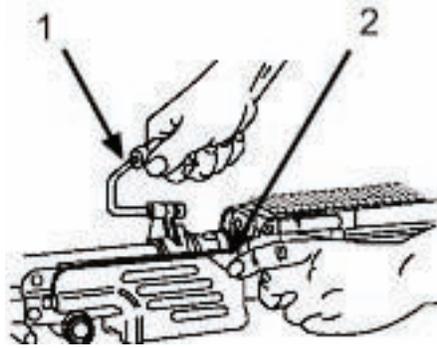


Figure 16. Install Barrel.

**NOTE**

The M249 Improved Bipod must remain with the weapon at all times.

9. Store the Improved Bipod in a safe location easily accessible on the Host Vehicle or other platform in case dismantled operation is required.

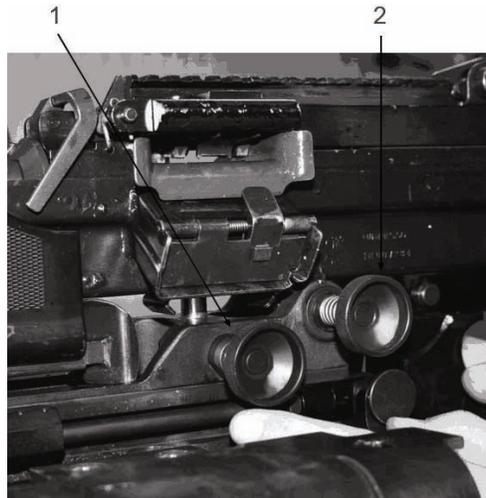
**END OF TASK****Install M240 on M240/M249 MASC**

1. Slide the M249 Front Receiver Bushing into the Front Fork Grooves of the MASC and pull the weapon backward to align the Rear Mounting Holes (Figure 17).



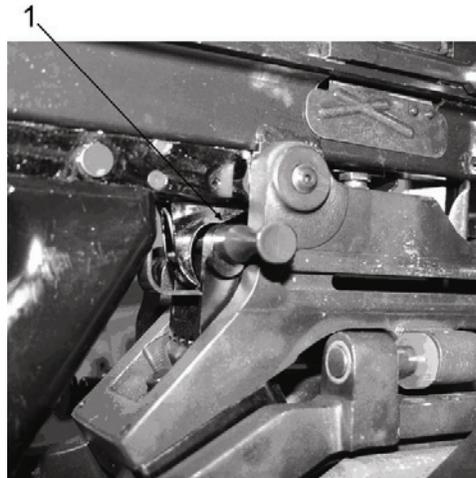
Figure 17. M249 and MASC.

2. Insert the spring-loaded Mounting Pin (2), push in, and rotate 1/4 turn CW to locked position (Figure 18).
3. Turn the Tightening Screw (1) CW until the weapon is firmly fastened to the MASC.



**Figure 18. M249 and MASC Mounting Pin.**

4. Push the Trigger Pin (1) completely in until locked in front of the Trigger (Figure 19).

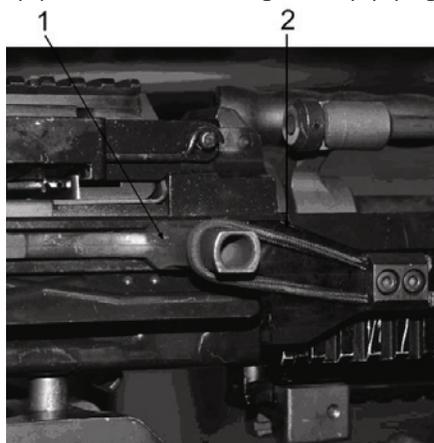


**Figure 19. Trigger Pin.**

**INSTALLATION OF THE M249 5.56MM MACHINE GUN - Cont****Install M240 on M240/M249 MASC - Cont****CAUTION**

Remove the Push Bracket Band to cock the weapon manually. Ensure the Band is reattached before firing with CROWS to prevent unnecessary wear and tear on the Charging Handle.

5. Pull the Push Bracket Band (2) over the Cocking Arm (1) (Figure 20).

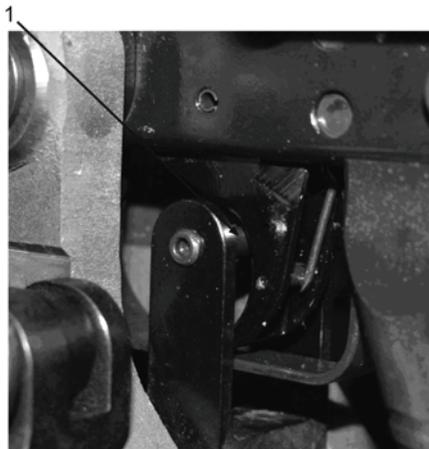


**Figure 20. Push Bracket Band.**

**NOTE**

Verify that there is a gap between the Trigger Arm and the Trigger. The Gap must be small enough that the weapon fires when the Trigger is pressed but large enough that the gun does not fire unintentionally.

6. Perform the Solenoid Adjustment Procedure (WP 0021) until the proper gap is set (1) (Figure 21).



**Figure 21. M240/M249 Firing Solenoid Gap.**

**END OF TASK**

### Install the M249 Ammunition Feed

1. Fasten the M249 Ammo Feed Assembly (2) onto the Ammo Feed Bracket (1) of the MASC with the Latch (3) (Figure 22).

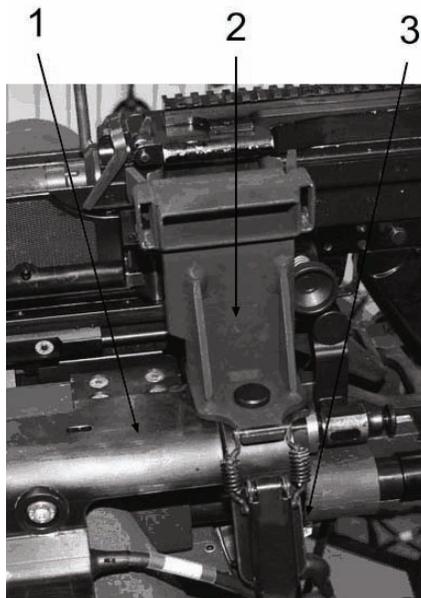


Figure 22. M249 Ammo Feed Assembly.

2. Slide the M240/M249 Ammo Guide (3) underneath the three Ammunition Box Lid Rivets and fasten with the Latch (1) (Figure 23).

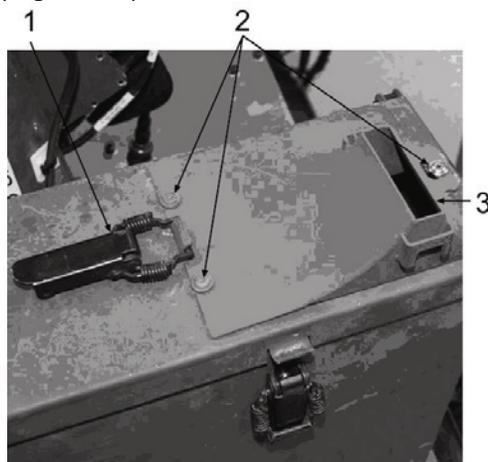
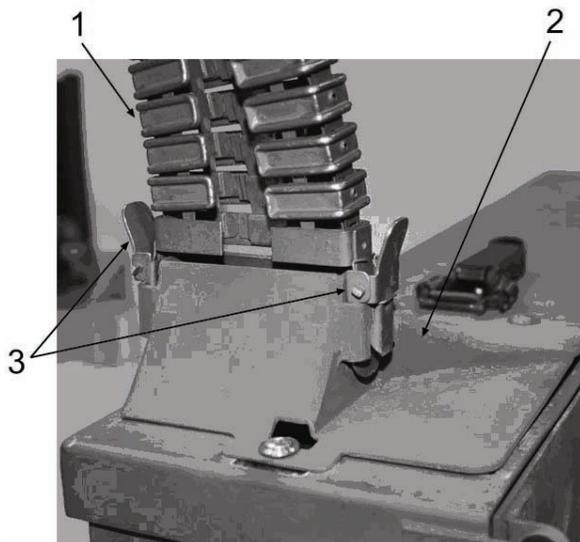


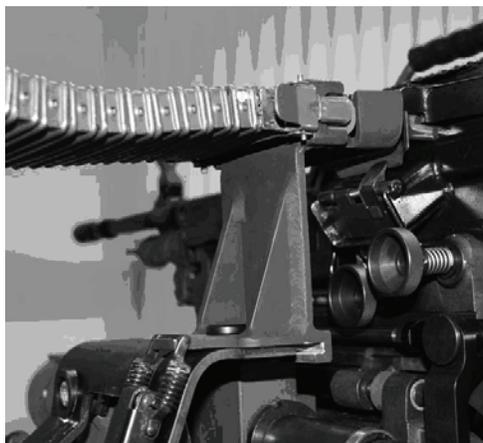
Figure 23. M249 Ammunition Feed Guide.

3. Push the Ammunition Chute (1) onto the Ammunition Guide (2) with the slot to the top until it locks with a click (Figure 24).



**Figure 24. M249 Ammunition Chute.**

4. Push the Ammunition Chute onto the M249 Ammunition Feed Assembly until it locks with a click (Figure 25).



**Figure 25. M249 Ammunition Feed Assembly.**

5. Ensure the Front Casing Collector Bag is installed (WP 0047).
6. Adjust the Firing Solenoid (WP 0021).
7. Boresight the weapon (WP 0029).
8. Load the weapon (WP 0026).

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
LOAD M249 5.56MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Loading the M249 5.56mm Machine Gun

---

**INITIAL SETUP:****Tools and Special Tools**

Work Gloves (WP 0051, Item 7)

**Personnel Required:** Two

**References**

TM 9-1005-201-10  
WP 0025  
WP 0034

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1005-201-10)  
Weapon maintenance performed  
(TM 9-1005-201-10)  
All Accessories present and serviceable  
(TM 9-1005-201-10)  
Weapon Installed (WP 0025)

---

**LOAD THE M249 5.56MM MACHINE GUN****Load the Ammunition into the Ammunition Box****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**LOAD THE M249 5.56MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNING****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

**CAUTION**

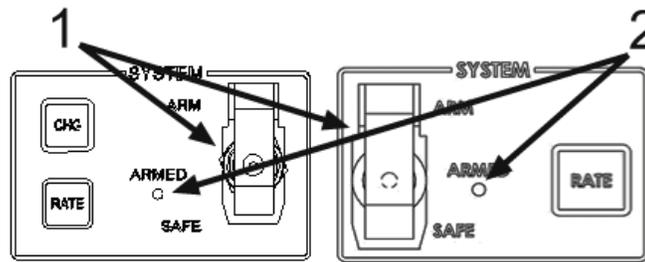
Before installing Ammunition Belt in to Ammunition Box, check that ammunition is of correct type, metallic links are clean and rounds are properly linked. Doing so prevents damage to equipment.

Empty the Front Casing Collector Bag if necessary before reloading the installed weapon to prevent damage to equipment.

**NOTE**

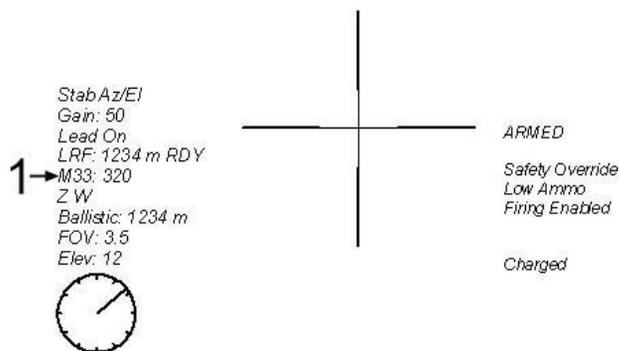
If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

1. Power up CROWS (WP 0006) if necessary.
2. Verify that the SYSTEM Switch Guard (1) is down on the DCP (left side of figure) or FCU (right side of figure) (Figure 1). The ARMED LED (2) should not be lit.



**Figure 1. SYSTEM ARM/SAFE.**

3. Ensure the Charging Handle Assembly is fully forward in the locked position (TM 9-1005-201-10).
4. Verify that the correct type of Ammunition is selected. The selected Ammunition displays in the Ammunition Field (1) on screen (Figure 2).



**Figure 2. Ammunition Field.**

**LOAD THE M249 5.56MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont**

5. Select the correct type of Ammunition if necessary (Figure 3).
  - a. Press MENU ON/OFF on the DCP or FCU to display the Main Menu.
  - b. Press MENU R (Right) twice to highlight the AMMO menu option.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the available Ammunition Types.
  - d. Press MENU D (Down) until the correct Ammunition Type is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the Ammunition. The correct Ammunition Type displays in the Ammunition Field.
  - f. Press MENU ON/OFF to remove the Main Menu from the display.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
		M855 BALL	
		M856 TRACER	
		MILES	

**Figure 3. Main Menu, AMMO.****CAUTION**

Do not overload the Ammunition Box. Allow at least 2.75 inches (approximately 70mm) between the loaded 5.56mm Ammunition and the Ammunition Box Cover to permit free movement of Ammunition to the Receiver. Overloading the Ammunition Box can damage or jam equipment.

**NOTES**

The Ammunition Box holds 1,600 rounds of 5.56mm Ammunition.

If the Last Round on the Ammunition Belt is installed opposite the Activation Plate, the LOW AMMO signal appears on screen before all the Ammunition has been used. Ensure that the Last Round is installed over the Activation Plate.

6. Remove the Ammunition Guide (3) from the Ammunition Box Lid if necessary by releasing the Ammunition Box Lid Clip (2) and pulling the Ammunition Guide from underneath the three Ammunition Box Lid Rivets (Figure 4). The Ammunition Guide (3) is above the Low Ammo Actuator Plate (4).
7. Release the two Ammunition Box Lid Latches (1) and open the Ammunition Box Cover.

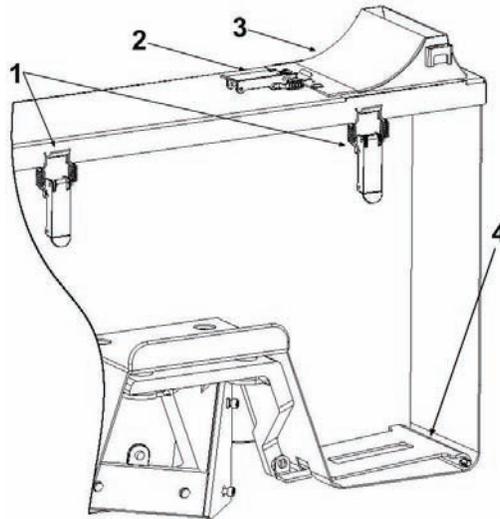


Figure 4. Ammunition Guide and Cover Locks.

**WARNING**



**SHARP OBJECT**

The Ammunition Insertion Cassette (AIC) has sharp metal edges. Wear Work Gloves (WP 0051, Item 7) when installing AIC to prevent injury.

8. Insert the Ammunition Insertion Cassette (AIC) into the Ammunition Box (Figure 5) ensuring that the M249 label faces away from the system.

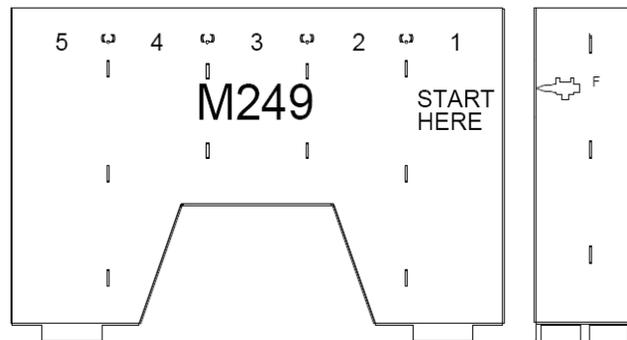
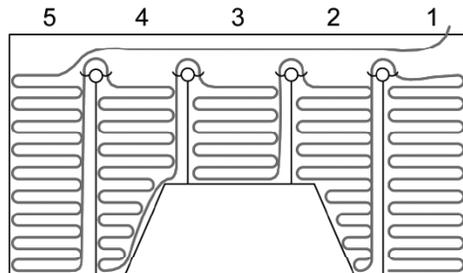


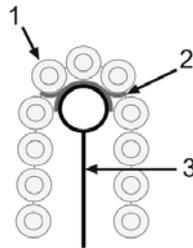
Figure 5. Ammunition Insertion Cassette.

**LOAD THE M249 5.56MM MACHINE GUN - Cont****Load the Ammunition into the Ammunition Box - Cont**

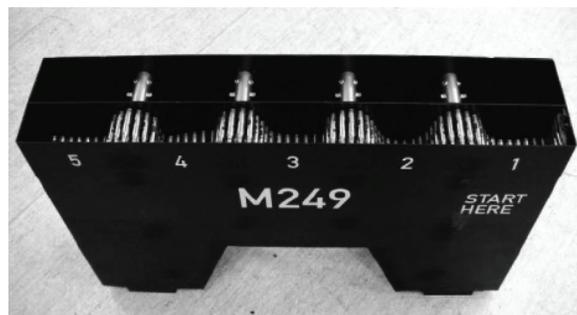
9. Insert the Ammunition Belt into the first chamber of the AIC with the last link (first link in box) resting on the Low Ammo Actuator Plate (Figure 6).

**Figure 6. Distribution of Ammunition.**

10. Continue inserting Ammunition into the first chamber of the AIC until the Ammunition is no less than 2.75 inches (approximately 70mm) from the Ammo Box lid.
11. When the first chamber has been filled, fold the Ammunition Belt over the baffle (3). Ensure the wings (two on each side) of the Ammo Retainers (2) are inserted between rounds (1) (Figure 7).

**Figure 7. Ammo Retainers.**

12. Fill each chamber in turn (no less than 2.75 inches from the Ammo Box Lid) and fold the Ammunition Belt over the next baffle with the wings of the Ammo Retainers properly inserted between rounds until the fifth chamber is filled.
13. Place the remaining Ammunition over the top of the baffles as illustrated (Figure 8).

**Figure 8. Fully Loaded AIC.**

14. Close and latch the Ammunition Box Lid.

### END OF TASK

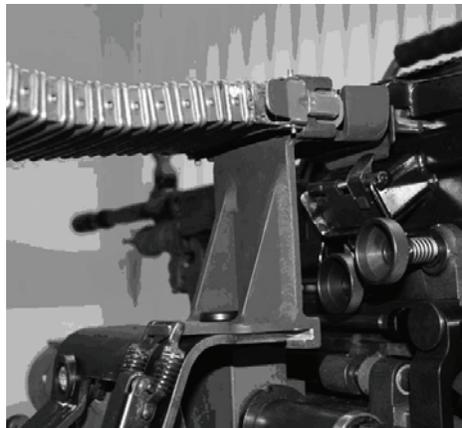
### Threading the Ammunition through the Ammo Guide and Chute

1. Reach into the Ammunition Box through the hole for the M249 Ammunition Guide in the Lid and lift the end of the Ammunition Belt out of the Ammunition Box.
2. Thread the Ammunition Belt through the bottom and out the top of the Ammunition Guide.
3. Install the Ammunition Guide underneath the three Rivets on the Ammunition Box Lid and fasten with the Latch.
4. Thread the Ammunition into the Ammunition Chute and push the Chute onto the Ammunition Guide until it locks with a click.
5. Pull the Ammunition to the labeled end of the Ammunition Chute.

### END OF TASK

### Load the Weapon

1. Push the labeled end of the Ammo Chute onto the Gun End Adapter until it locks with a click (Figure 9).



**Figure 9. Ammo Chute and Gun End Adapter.**

2. Squeeze the Latches to open the M249 Gun Cover Assembly (TM 9-1005-201-10).
3. Raise the Feed Tray Assembly and inspect the Chamber to ensure that the weapon is clear (TM 9-1005-201-10).

## LOAD THE M249 5.56MM MACHINE GUN - Cont

## Load the Weapon - Cont

- Lift the SYSTEM and REMOTE SAFE Switch Guards (1) on the DCP (top of figure) or FCU (bottom of figure) and set REMOTE SAFE to CHARGE and the SYSTEM Switch to ARM (Figure 10). ARMED appears on screen, and both the DISABLED LED (2) and the ARMED LED (3) should be lit.

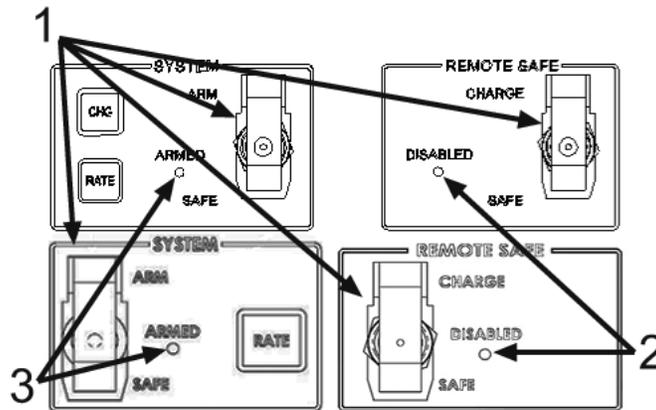


Figure 10. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.

## WARNING



## HEAVY PARTS

Personnel must stay clear of Bolt when Weapon is charged and fired to avoid possible injury.

- Fire the weapon by holding the Palm Switch, raising the Trigger Cover, and squeezing the Trigger on the CG to place the Bolt in the forward position.
- Place the Link Belt in the Feed Tray Assembly with the first Round (2) against the Cartridge Stop (1) and hold the Belt in position (Figure 11).

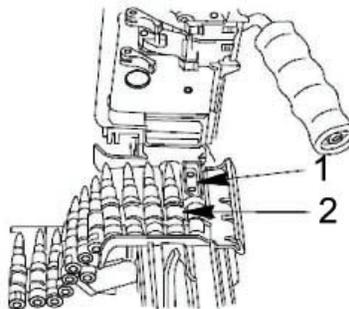


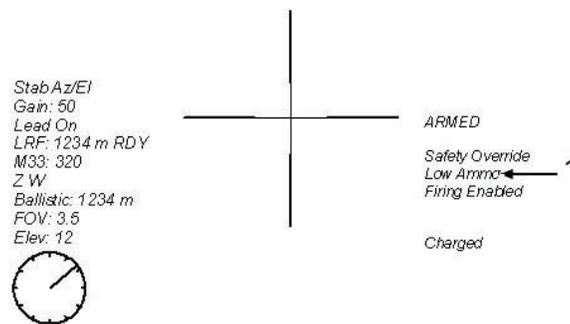
Figure 11. M249 Top Cover.

7. Close the Cover Assembly.



All personnel must leave WS area immediately after the weapon is loaded to avoid possible injury.

8. Verify that all of the Host Vehicle Hatches are closed and evacuate the WS platform.
9. Lower the Switch Guards on REMOTE SAFE and the SYSTEM Switch.
10. Verify that LOW AMMO (1) disappeared from the Ammunition Status Field on screen (Figure 12).



**Figure 12. Ammunition Status Field.**

11. Reset the number of rounds loaded in the AMMO COUNTER submenu under SETTING if different from the default (Default value: 1,000 rounds) (Figure 13).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Ensure SETTING is highlighted and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING options.
  - c. Press MENU D (Down) five times until the AMMO COUNTER is highlighted.
  - d. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the AMMO COUNTER.
  - e. Press MENU U (Up) or D (Down) until the correct Ammunition Count is highlighted.
  - f. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the Ammunition Count.
  - g. Press MENU ON/OFF to exit the Main Menu.

**LOAD THE M249 5.56MM MACHINE GUN - Cont****Load the Weapon - Cont**

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b>	<b>MAINTENANCE</b>
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 13. Main Menu, AMMO.**

12. To fire the weapon, refer to WP 0034.

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
UNLOAD M249 5.56MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Unloading the M249 5.56mm Machine Gun

---

**INITIAL SETUP:**

**Personnel Required:** Two  
CROWS Operator and Assistant

**References**  
TM 9-1005-201-10  
WP 0006  
WP 0025  
WP 0036

**Equipment Conditions**  
CROWS Powered Up (WP 0006)  
Weapon Ammo Clear (TM 9-1005-201-10)  
Weapon maintenance performed  
(TM 9-1005-201-10)  
All Accessories present and serviceable  
(TM 9-1005-201-10)  
Weapon Installed (WP 0023)

---

**REMOVE AMMUNITION****WARNINGS****EXPLOSION**

Ammunition or components containing explosives must be handled with appropriate care at all times. The explosive elements in primers and fuses are particularly sensitive to shock and high temperature. Ammunition must not be dropped, thrown, tumbled, or dragged to prevent serious injury or death to personnel.

Check that ammunition is in proper condition and of correct type to prevent injury to personnel or damage to equipment.

Do not expose ammunition to direct sun to prevent injury to personnel or damage to equipment.

Do not oil or grease ammunition. Oiled cartridges produce excessive chamber pressure and can injure personnel or damage equipment.

**REMOVE AMMUNITION - Cont****WARNING****HEARING PROTECTION**

Hearing protection must be worn when firing weapon to prevent injury to personnel.

**WARNINGS****HEAVY PARTS**

Ensure CROWS is clear of obstacles before powering up. Doing so can prevent injury to personnel or damage to equipment.

**WARNINGS****WEAPON FIRE**

Always treat weapon as loaded with live ammunition and stand clear of muzzle to avoid unnecessary accidents.

Before troubleshooting, loading, or unloading the installed weapon, ensure that gun is pointed in a safe direction, SYSTEM ARM/SAFE switch is set to SAFE, and personnel and equipment are clear of line of fire. Failure to do so may cause death or injury to personnel or damage to equipment.

1. Power up CROWS (WP 0006) if necessary.

**NOTE**

If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle the REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

- Verify that the SYSTEM and REMOTE SAFE Switch Guards (1) are down on the DCP (top of figure) or FCU (bottom of figure) (Figure 1). Both the DISABLED LED (2) and the ARMED LED (3) should not be lit.

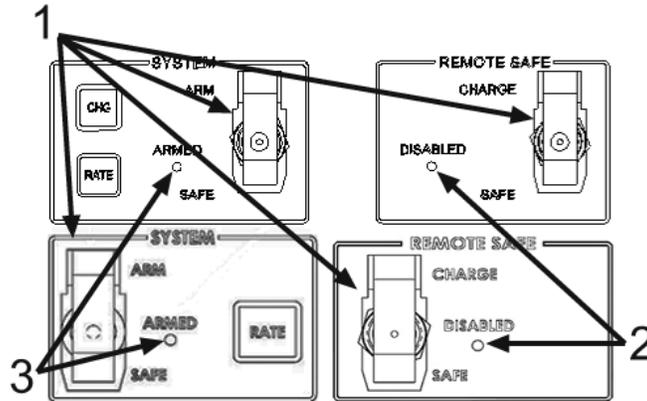


Figure 1. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.

### WARNING

Chamber may be hot. Use caution when inspecting T-slot to avoid burns.

- Push in the Latches to open the Weapon Cover Assembly (TM 9-1005-201-10).
- Remove the Ammunition Belt from the Feed Tray and push it back down the Ammunition Chute and into the Ammunition Box.
- Raise the Feed Tray Assembly to verify the Chamber is clear of Ammunition (TM 9-1005-201-10).
- Remove the Ammunition Chute from the weapon.
- Close the Weapon Cover Assembly.
- Release the two Ammo Box Latches and open the Ammunition Box.
- Remove the AIC and close and latch the Ammunition Box.

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
REMOVE M249 5.56MM MACHINE GUN**

---

**THIS WORK PACKAGE COVERS:**

Removal of the M249 5.56mm Machine Gun.

---

**INITIAL SETUP:****Tools and Special Tools**

3mm Hex Key (WP 0049, Table 3, Item 7)

**Personnel Required:** Two

**References**

TM 9-1005-201-10  
Vehicle Operator Manual  
WP 0021  
WP 0025  
WP 0036

**Equipment Conditions**

Vehicle Wheels Chocked and Engine  
Shutdown (Vehicle Operator  
Manual)

CROWS Shutdown (WP 0036)

Weapon clear of Ammo  
(TM 9-1005-201-10)

Weapon maintenance performed  
(TM 9-1005-201-10)

All Accessories present and serviceable

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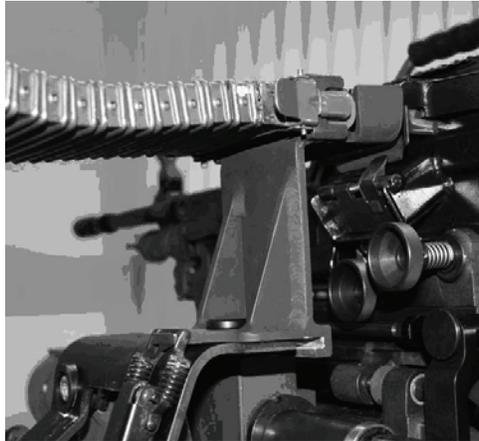
**REMOVAL OF THE M249 5.56MM MACHINE GUN****WARNINGS****WEAPON FIRE**

Clear M249 5.56mm Machine Gun of ammunition prior to installation. Failure to do so may result in death or injury to personnel.

Make sure CROWS power is switched off prior to installing weapon. If power is switched on, Cocking Actuator will move when connecting Firing Solenoid Cable possibly injuring personnel.

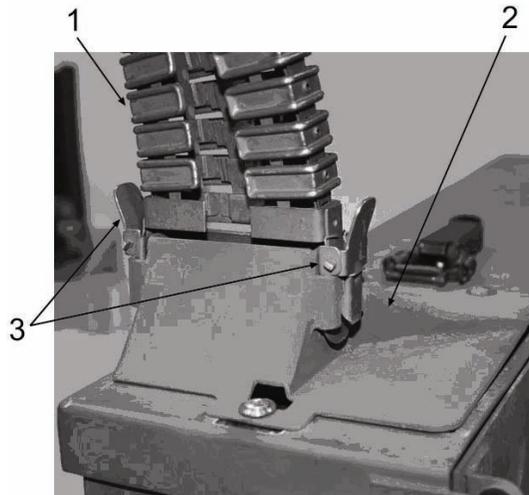
**REMOVAL OF THE M249 5.56MM MACHINE GUN - Cont****Remove the M249 Ammunition Feed**

1. Power CROWS off if necessary (WP 0036).
2. Verify the weapon is clear of Ammunition (TM 9-1005-201-10).
3. Remove the Ammunition Chute by squeezing the Clips on each side of the Chute End and pulling the Chute away from the Ammunition Feed Assembly (Figure 1).



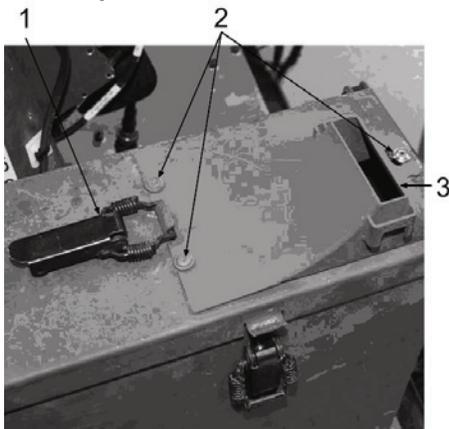
**Figure 1. M249 Ammunition Feed Assembly.**

4. Remove the Ammunition Chute (1) from the Ammunition Guide (2) by squeezing the Chute Clips (3) on each side of the Chute End and pulling the Chute End away from the Ammunition Guide (Figure 2).



**Figure 2. M249 Ammunition Chute.**

5. Remove the Ammunition Guide (3) if necessary by unfastening the Guide Latch (1) and pulling the Ammunition Guide away from the Latch and three Rivets (2) (Figure 3).



**Figure 3. M249 Ammunition Feed Guide.**

6. Unfasten the Latch (2) and pull the M249 Ammunition Feed Assembly (1) away from the Ammunition Feed Bracket (3) of the MASC (Figure 4).



**Figure 4. M249 Ammunition Feed Assembly.**

## **END OF TASK**

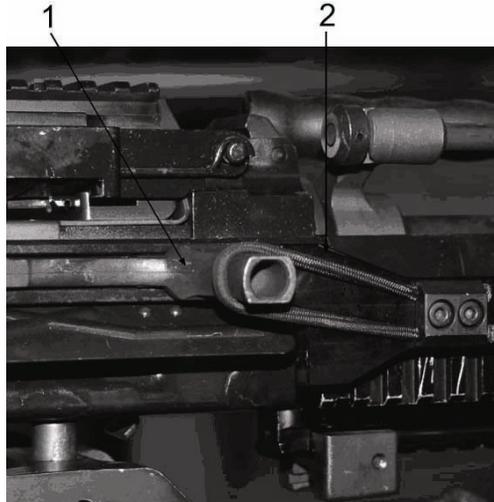
**Remove the M249 from the MASC**

## **CAUTION**

Remove the Push Bracket Band to cock the weapon manually. Ensure the Band is reattached before firing with CROWS to prevent unnecessary wear and tear to the Charging Handle.

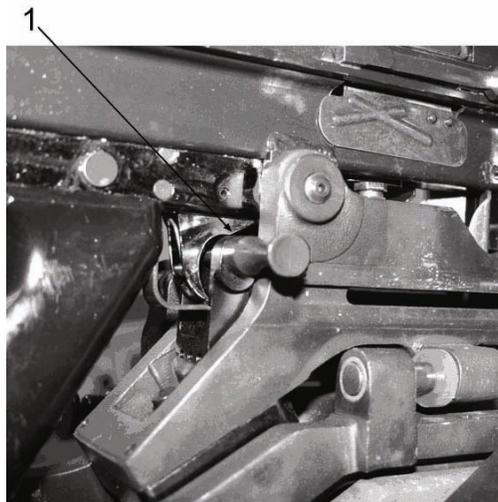
**REMOVAL OF THE M249 5.56MM MACHINE GUN - Cont****Remove the M249 from the M240/M249 MASC - Cont**

1. Remove the Push Bracket Band (2) (Figure 5) from the Cocking Arm (1).



**Figure 5. M249 Push Bracket Band.**

2. Pull the Trigger Pin (1) completely out of the Trigger (Figure 6).



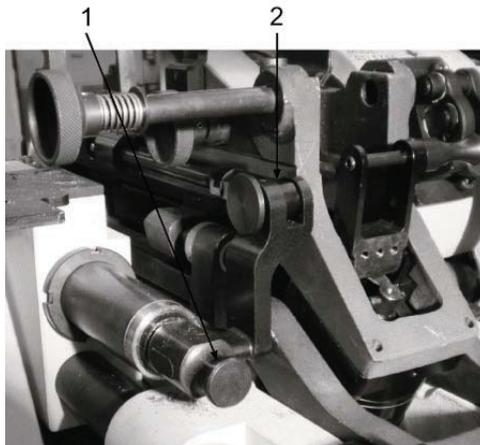
**Figure 6. Trigger Pin.**

3. Turn the Tightening Screw (4) CCW until the Screw releases the weapon from the MASC (Figure 7).
4. Push the Mounting Pin (3) in and rotate 1/4 turn CCW before pulling out as far as it goes.



**Figure 7. MASC Mounting Pin.**

5. Disconnect the Cocking Bracket from the Cocking Arm by pulling the Cocking Bracket Pin (2) from the end of the Cocking Arm (Figure 8). Pull the Cocking Arm from the Cocking Bracket.
6. Pull out the Cocking Bracket Lock (1) and move the Cocking Bracket into the Cocking Actuator Arm and away from the weapon.



**Figure 8. Cocking Bracket Lock.**

**REMOVAL OF THE M249 5.56MM MACHINE GUN - Cont****Remove the M249 from the M240/M249 MASC - Cont**

7. Remove the M249 from the MASC by raising the rear of the weapon and pushing forward (Figure 9).



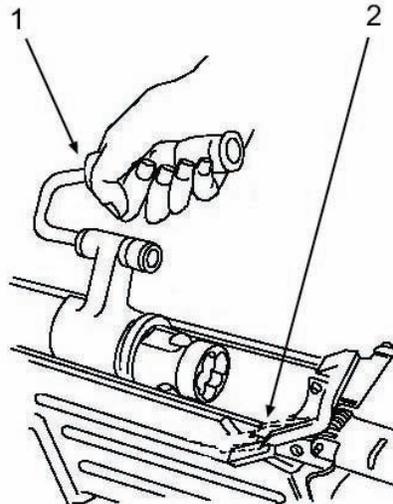
**Figure 9. M249 and MASC.**

**END OF TASK****Reinstall the M249 Improved Bipod****NOTE**

Reinstall the M249 Improved Bipod if the bipod was removed during weapon installation (WP 0025). If reinstallation of the M249 Improved Bipod is not required, continue removal of the M249 with Remove M240/M249 MASC from Soft Mount Procedure.

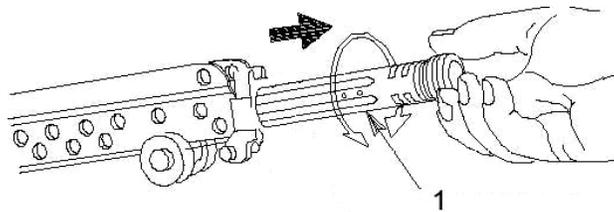
1. Clear the weapon (TM 9-1005-201-10).
2. Ensure the Bolt is to the rear (TM 9-1005-201-10).

3. Ensure the Cover is closed and the Carrying Handle on the Barrel (1) is in the carrying (up) position (Figure 10).
4. While depressing the Locking Lever (2) with the left hand, grip the Carrying Handle (1) with the right hand, lift up, and push the Barrel forward.



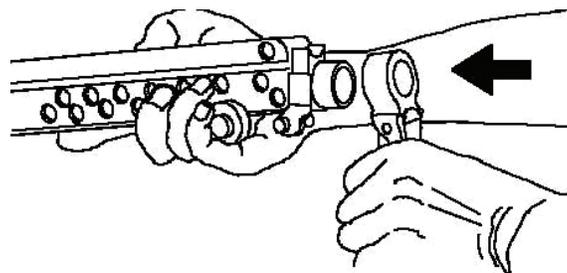
**Figure 10. Locking Lever and Carrying Handle.**

5. Turn the Gas Cylinder (1) to the left or right to release the Locking Spring and pull out (Figure 11).



**Figure 11. Remove Gas Cylinder.**

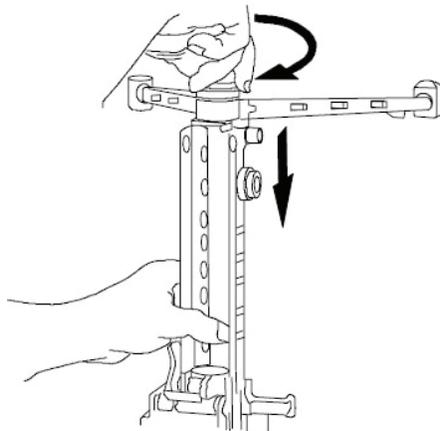
6. After removal of the Gas Cylinder, the Improved Bipod can be reattached to the Receiver (Figure 12).



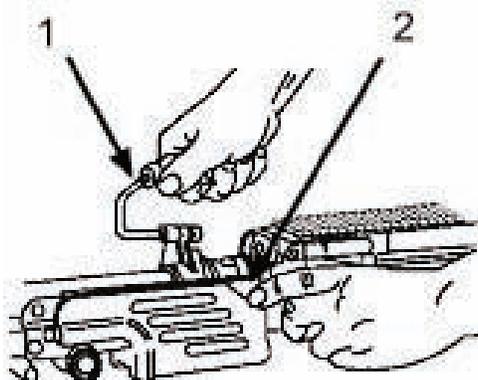
**Figure 12. Reinstall Improved Bipod.**

**REMOVAL OF THE M249 5.56MM MACHINE GUN - Cont****Reinstall the M249 Improved Bipod - Cont**

7. Insert the Gas Cylinder into the Receiver (Figure 13). Push the Gas Cylinder to the rear while countering the pressure of the Locking Spring and guiding end of the Gas Cylinder into the Receiver with the other hand applying downward pressure. Turn the Gas Cylinder CW until the Spring clicks into the recess at the rear of the Gas Cylinder.

**Figure 13. Insert Gas Cylinder.**

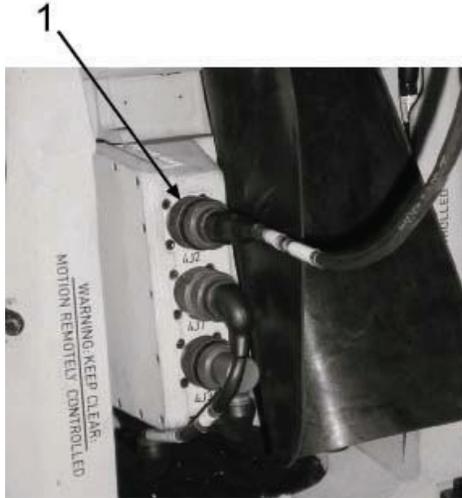
8. Depress the Locking Lever with the left hand (2) (Figure 14). Holding the Carrying Handle with the right hand (1), pull the Barrel rearward, push downward, and lock by releasing the Barrel Locking Lever.

**Figure 14. Install Barrel.****END OF TASK**

**Remove the M240/M249 MASC from the Soft Mount****CAUTION**

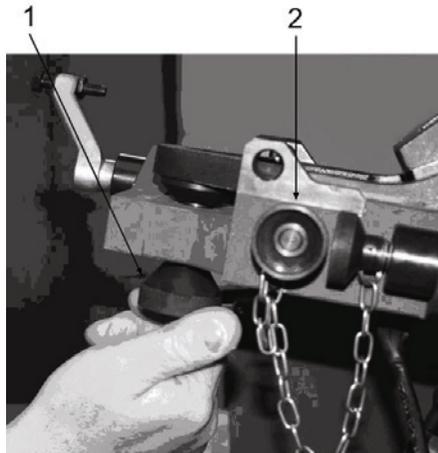
Ensure that CROWS is powered off when connecting/disconnecting the Electrical Cables to prevent damage to equipment.

1. Disconnect the Solenoid Cable W7 (1) from the SSA Connector 4J2 at the rear of the SSA by turning CCW (Figure 15). The SSA can be tilted downward to improve access.



**Figure 15. M249 Solenoid Cable.**

2. Loosen the Straining Screw (1) from the Bottom Plate of the MASC by turning CCW (Figure 16).
3. Remove the spring-loaded Mounting Pin (2) by pushing in and rotating 1/4 turn CCW to the unlocked position.



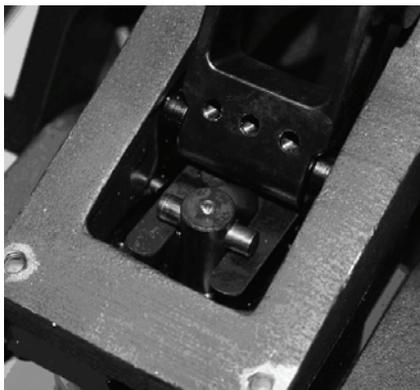
**Figure 16. Straining Screw.**

4. Push the MASC forward until unfastened from the Soft Mount and raise the MASC off the Soft Mount.

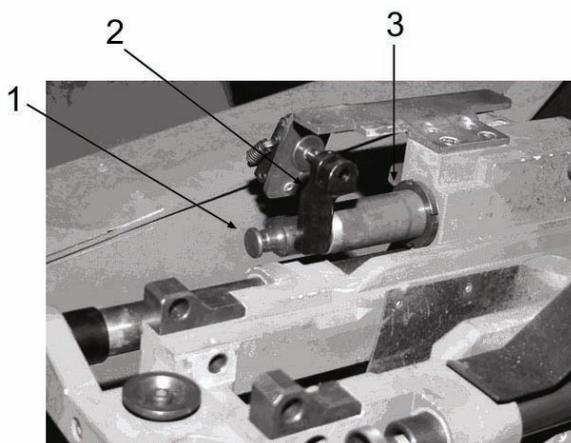
**END OF TASK**

**REMOVAL OF THE M249 5.56MM MACHINE GUN - Cont****Remove the Firing Solenoid and Cocking Bracket**

1. Turn the MASC upside down.
2. Rotate the Solenoid 90 degrees and pull it out of the Trigger Lever Fork (Figure 17).

**Figure 17. M249 Firing Solenoid.**

3. Verify that the Cocking Bracket Lock is out (1) and remove the Cocking Bracket (2) from the Cocking Actuator Arm (3) (Figure 18).

**Figure 18. M249 Cocking Bracket.**

4. Store the Firing Solenoid in the Storage Bag. Reconnect the Cocking Bracket to the Cocking Arm for storage with the MASC.

**END OF TASK****END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
BORESIGHTING**

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**THIS WORK PACKAGE COVERS:**

Boresighting using the Distant Aiming Point or the Boresight Target Method.

---

**INITIAL SETUP:****Tools and Special Tools**

Boresight Kit (WP 0049)  
Weapon Alignment/Boresight Poster  
(WP 0049)

**Personnel Required:** Two  
CROWS Operator and Assistant

**References - Cont**

WP 0020  
WP 0023  
WP 0025  
WP 0027  
WP 0030  
WP 0049

**References**

Vehicle Operator Manual  
TM 9-5860-226-13&P  
WP 0006  
WP 0007  
WP 0011  
WP 0014  
WP 0016  
WP 0018

**Equipment Conditions**

Engine Shut Down (Vehicle Operator  
Manual)  
CROWS Powered Up (WP 0006)  
Weapon Installed (WP 0011,  
WP 0016, WP 0020 or WP 0025)  
Weapon Ammo Cleared (WP 0014,  
WP 0018, WP 0023, WP 0027)

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**GENERAL**

Boresighting aligns the sights with the Axis of Bore. CROWS stores this value for later use when positioning the installed weapon according to the ballistics calculated for the defined target range and the Ammunition in use. If no position is stored, the default values are used.

There are two main methods of boresighting:

- a. Distant Aiming Point (Distant Method): This method uses a single Aiming Point or target at a known distance or range. The accuracy of this method relies on the precision of the Aiming Point Range. Ranges greater than 1,000 meters are recommended to improve accuracy.

**GENERAL - Cont**

- b. Boresight Target (Short Method): This method uses a Boresight Target (alignment poster) at a range of 15 meters (49.2 feet). The Boresight Target Range is specified on the Boresight Target Poster. A separate Boresight Poster is provided and is required for each Weapon Type.

Perform the Boresighting Procedure when any of the following system components have been replaced: the Weapon, Weapon Barrel, Soft Mount, weapon adaption items, FCU, DCP, MPU, VIM, TIM, or SSA.

**WARNING****WEAPON FIRE**

Ensure that the installed weapon is clear of Ammunition before performing the Boresighting Procedure. Accidental firing of the weapon can kill or injure personnel.

**WARNING****HEAVY PARTS**

Operate CROWS at the slowest speed while performing the Boresighting Procedure to prevent injury to personnel and damage to equipment.

**CAUTION**

Do not use excessive force when inserting a Mandrel or Adapter into the Weapon Barrel. The Borescope and LBS have sensitive optics that can be damaged with rough handling.

**NOTES**

Ensure the Host Vehicle or other platform is positioned on level ground for the Boresighting Procedure.

If one sensor is boresighted, all sensors are boresighted. For example, if the VIM is used for boresighting, the TIM is also boresighted.

**END OF TASK**

**BORESIGHT ADJUSTMENT USING A DISTANT AIMING POINT**

1. Press the SPEED Minus (-) button three times on the FCU/DCP to ensure the WS is set to the slowest speed.
2. Press the SIGHT RTCL SEL to select the preferred reticle for the Boresighting Procedure.

**NOTE**

MILES ammunition must be used for boresighting so that the Line of Sight is not affected by adjustments to the elevation for specific Ammunition Types.

3. Select MILES Ammunition for boresighting (Figure 1).
  - a. Press MENU ON/OFF on the FCU/DCP to display the Main Menu.
  - b. Press MENU R (Right) twice to highlight the AMMO menu selection.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the Ammunition Types available for the installed weapon.
  - d. Press MENU D (Down) until MILES Ammunition is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select MILES Ammunition. MILES displays in the Ammunition Status Field on screen.
  - f. Press MENU ON/OFF to exit the Main Menu.

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b> Ammo Type 1 Ammo Type 2 Ammo Type 3 Ammo Type X <b>MILES</b>	<b>MAINTENANCE</b>
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**Figure 1. Main Menu, AMMO.**

4. Ensure WS Stabilization is disabled for the Boresighting Procedure. STAB AZ/EL appears on screen when the Palm Switch is held and WS Stabilization is active. Press STAB on the CG to disable this function if necessary.
5. Ensure Video Image Stabilization is disabled for boresighting. IMAGE STAB appears on screen when Video Stabilization is active. Disable Video Stabilization from the Main Menu if necessary (Figure 2).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Highlight SETTING (use MENU L or R on FCU/DCP if needed) and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the SETTING submenu.
  - c. Press MENU D nine times to highlight VIDEO IMAGE STAB. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**BORESIGHT ADJUSTMENT USING A DISTANT AIMING POINT - Cont**

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 2. Main Menu, Video Image Stab.**

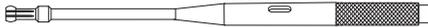
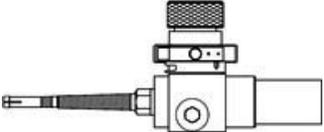
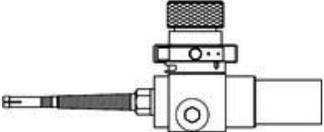
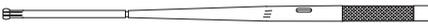
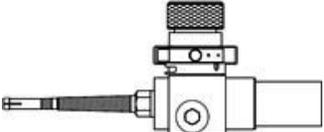
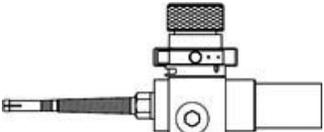
6. Select a Distant Aiming Point that is a clearly defined object at a distance greater than 1,000 meters (3,281 feet). Use the LRF to obtain the distance to the object and record this figure.

**NOTE**

Graflex 8X Borescopes do not require a separate M240 (7.62mm) Mandrel because it is part of the Borescope, but use of the separate Mandrel is recommended. Also, other Borescopes might require this Mandrel.

7. Match the Borescope to the appropriate Mandrel for the installed weapon (Table 1).

**Table 1. Borescope and Mandrels.**

Weapon	Mandrel	Boresight Telescope
M2 .50 Cal Machine Gun		
Mk19 40mm Machine Gun		
M240 7.62mm Machine Gun		
M249 5.56mm Machine Gun		

**WARNING****HEAVY PARTS**

Personnel must be clear of weapon before exiting boresight mode since weapon immediately elevates. To prevent injury to personnel, ensure that adequate communication occurs while boresighting the installed weapon.

**WARNING****EYE PROTECTION**

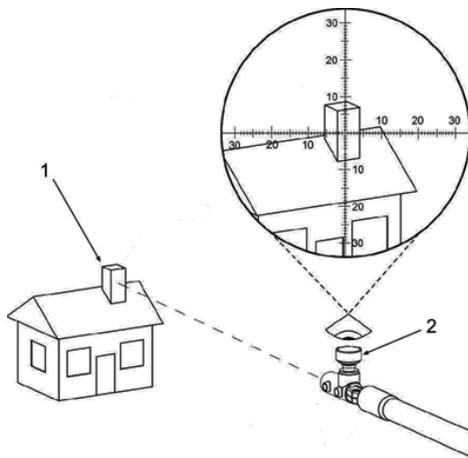
While performing boresighting operations, personnel must wear approved Safety Glasses and avoid looking into the borescope when the WS is moved to prevent personal injury.

8. Attach the Streamer to the end of the weapon barrel.
9. Insert the Borescope and the appropriate Mandrel into the Weapon Barrel.

**NOTE**

Once the Borescope is precisely aimed at the Distant Aiming Point, rotate the Borescope 180 degrees CW and check whether the Borescope Reticle has moved from the target. If the Reticle moved, the Borescope and Mandrel are not true, and the Borescope must be collimated according to the Manufacturer's Operation Manual or another Borescope and Mandrel must be used for boresighting.

10. Sight through the Borescope Eyepiece (2) and lay (elevate and traverse, WP 0007) the WS to get the Borescope Reticle aimed precisely at the Distant Aiming Point (1) (Figure 3).



**Figure 3. Using Borescope.**

**BORESIGHT ADJUSTMENT USING A DISTANT AIMING POINT - Cont****NOTE**

Before selecting BORESIGHTING, the Operator should leave the vehicle and look through the Borescope to ensure the assistant is using the same target position.

11. Select BORESIGHTING from the Main Menu (Figure 4).
  - a. Press MENU ON/OFF on the FCU/DCP once to display the Main Menu.
  - b. Highlight SETTING using MENU L (left) or R (right) if needed.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING submenu.
  - d. Press MENU D (down) eight times until BORESIGHTING is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to start Boresighting.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
<b>Boresighting</b>			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 4. Main Menu, Boresighting.**

12. CROWS displays the first Boresighting text prompt (Figure 5). Enter the range to the Distant Aiming Point obtained during step 6 by pressing RANGE -/+. The Ballistic updates automatically.

**Set range to target,  
then press 'SEL.'**

**Figure 5. Boresighting, Set Range.**

13. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU), and CROWS displays the second Boresighting prompt (Figure 6).

**Move bore scope/weapon  
To target, then press 'SEL.'**

**Figure 6. Boresighting, Move Line of Bore.**

14. Without touching the weapon, sight through the Borescope Eyepiece and aim the Borescope Reticle precisely at the Distant Aiming Point by moving the WS.
15. When the Borescope is precisely aimed, press MENU SEL (DCP) or MENU SEL/ZERO (FCU), and CROWS displays the last boresighting prompt (Figure 7).

**Move reticle to target,  
then press 'SEL.'**

**Figure 7. Boresighting, Move Line of Sight.**

16. Lay the Screen Reticle onto the Distant Aiming Point using the CG.
17. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU).
18. Press the MENU ON/OFF button to exit the Main Menu.

#### **END OF TASK**

#### **VERIFICATION OF THE BORESIGHT PROCEDURE**

1. To verify Boresight accuracy, aim the Screen Reticle precisely at a Distant Aiming Point. The same Distant Aiming Point obtained during step 7 of the Boresight Adjustment using Distant Aiming Point Procedure can be used.
2. Use the LRF to measure the exact range to the Distant Aiming Point. Insert this figure by pressing RANGE +/-.
3. Look through the Borescope. The Reticle should be aimed precisely at the Distant Aiming Point. If not, repeat the Boresight Adjustment Using Distant Aiming Point Procedure.

**VERIFICATION OF THE BORESIGHT PROCEDURE - Cont****WARNING****HEAVY PARTS**

Personnel must be clear of the installed weapon before exiting boresight mode since the WS immediately elevates. To prevent injury to personnel, ensure that adequate communication occurs while boresighting the installed weapon.

4. When Boresighting has been completed successfully, remove the Streamer, Borescope, and Mandrel from the Weapon Barrel and evacuate the WS area.
5. Perform the Zeroing Procedure to ensure accuracy of the weapon (WP 0030).

**END OF TASK****BORESIGHT ADJUSTMENT USING THE BORESIGHT TARGET METHOD**

The Boresight Target Method is used when visibility is limited, terrain prevents use of a Distant Aiming Point, or work is being performed within a maintenance facility.

Four full-size Boresight Target Boards are provided with the Boresight Alignment Kit (WP 0049).

Four templates are available to assist fabricating Boresight Targets, one target for each weapon: M2 (Figure 21), MK19 (Figure 22), M240 (Figure 23), and M249 (Figure 24). Additionally, the Boresight Target Symbol Dimensions are provided at Figure 24. If necessary, request that Field Maintenance construct Boresight Target Boards from the four templates and the Boresight Target Dimensions.

**NOTE**

The Borescope can be used in place of the Laser Borelight to perform this procedure if necessary. If the Borescope is used, place the Objective Lens Cover on the Borescope for better focus, ensure the Borescope is properly collimated, and do not perform the Laser Module Adjustment Procedure.

**Boresight Target Placement**

1. Press the SIGHT RTCL SEL button to select the most appropriate reticle for the Boresighting Procedure.

**NOTE**

MILES ammunition must be used for boresighting so that the ballistics computation is not affected by specific ammunition types.

2. Select MILES Ammunition for Boresighting (Figure 8).
  - a. Press MENU ON/OFF on FCU/DCP to display the Main Menu if necessary.
  - b. Press MENU R (Right) twice to highlight the AMMO menu option and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the ammunition types available for the installed weapon.
  - c. Press MENU D (Down) until MILES ammunition is highlighted.
  - d. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select MILES ammunition. MILES displays in Ammunition Status Field on screen.
  - e. Press MENU ON/OFF to remove the Main Menu from the display.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
		Ammo Type 1	
		Ammo Type 2	
		Ammo Type 3	
		Ammo Type X	
		<u>MILES</u>	

**Figure 8. Main Menu, AMMO.**

3. Ensure WS Stabilization is disabled for boresighting. STAB AZ/EL appears on screen when WS Stabilization is active. Press STAB on the CG to disable this function if necessary.
4. Ensure Video Image Stabilization is disabled for boresighting. IMAGE STAB appears on screen when Video Stabilization is active. Disable Video Stabilization from the Main Menu if necessary (Figure 9).
  - a. Press MENU ON/OFF to display the Main Menu.
  - b. Highlight SETTING (use MENU L or R on FCU/DCP if needed) and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) or MENU D (down) to display the SETTING submenu.
  - c. Press MENU D nine times to highlight VIDEO IMAGE STAB. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**BORESIGHT ADJUSTMENT USING THE BORESIGHT TARGET METHOD - Cont****Boresight Target Placement - Cont**

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
<b>Video Image Stab</b>			
Graphics Level			
CG Shaping			

**Figure 9. Main Menu, Video Image Stab.****NOTE**

The Boresight Target Method does not require the target to be precisely 15 meters from the WS. This is a nominal distance, and slight variations will not adversely affect the accuracy of the process.

5. Mount the correct Boresight Target (depending on the installed weapon) on a vertical object (e.g., a wall) 15 meters (approximately 49 feet) from the end of the Weapon Barrel. Use the Distance Gage (10-meter string) included with the Laser Borelight to measure this distance (one and one half Distance Gage length). Level and adjust target placement as accurately as possible (a more precise target alignment will be performed later). The boresight target position must be visible from the Operator's seat to perform these tasks without assistance.

**END OF TASK****Laser Borelight Adjustment****NOTE**

For more detailed zeroing instructions, refer to the LBS Manual (TM 9-5860-226-13&P).

1. Attach the Streamer to end of the Weapon Barrel.
2. Insert the appropriate Mandrel (depending on the weapon installed, Table 1) (1) with the Laser Adapter (2) and Laser Borelight (3) into the Weapon Barrel (CROWS Boresight Alignment Kit, WP 0049) (Figure 10).



Figure 10. Laser Borelight, Laser Adapter, and Mandrel.

3. Turn the Laser Borelight on.
4. Use the CG to point the LBS at the specified position (1) on the Boresight Target (Figure 11).

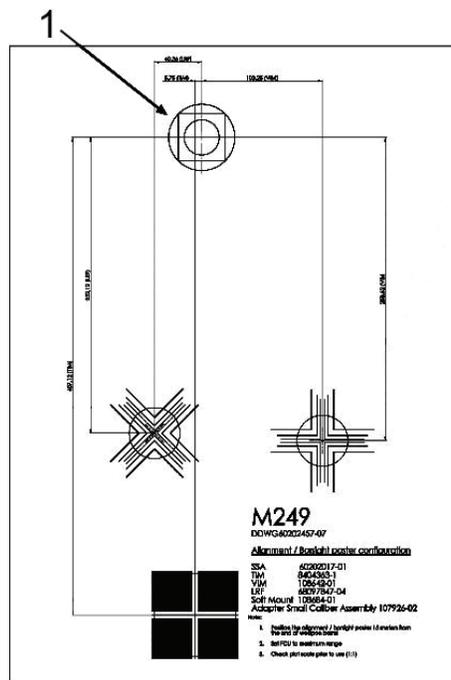


Figure 11. Example of Boresight Target.

5. Focus and zoom the Sight as necessary.

#### NOTE

Do not rotate the Laser Borelight CCW in the Weapon Barrel or the Laser Adapter can unscrew from the LBS affecting Boresight results.

6. While observing the position of the Laser Dot displayed on Boresight Target, rotate the Laser Borelight carefully 180 degrees CW.

**BORESIGHT ADJUSTMENT USING THE BORESIGHT TARGET METHOD - Cont****Laser Borelight Adjustment - Cont**

7. If the Laser Dot moves from the original position after rotation, adjust the Laser Module with up, down, left, and right controls (1) until the laser can be rotated 180 degrees CW without affecting the position of Laser Dot (Figure 12).



**Figure 12. Laser Borelight and Laser Adapter.**

8. Rotate Laser 180 degrees CW back to start position.

**END OF TASK****Alignment of Boresight Target with the WS**

1. Use the CG to point the LBS at the specified position (1) on the Boresight Target (Figure 13).
2. Focus and zoom the Sight as necessary.
3. Use the CG to move the Laser Dot up and down the Boresight Target (2) and observe the relationship to the specified line on the Boresight Target (3). Move the dot as vertically as possible.
4. Rotate the Boresight Target (4) until the Dot (2) tracks parallel to the line on the Boresight Target (3).

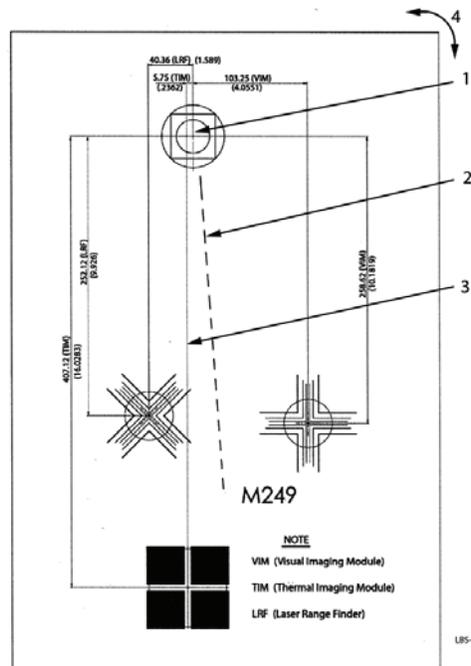


Figure 13. Boresight Target Alignment.

## END OF TASK

### Boresight Adjustment

1. Select BORESIGHTING from the Main Menu (Figure 14).
  - a. Press MENU ON/OFF on the FCU/DCP once to display the Main Menu.
  - b. Highlight SETTING using MENU L (left) or R (right) if needed.
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING submenu.
  - d. Press MENU D (down) eight times until Boresighting is highlighted.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to start Boresighting.

**BORESIGHT ADJUSTMENT USING BORESIGHT TARGET METHOD - Cont**

**Boresight Adjustment - Cont**

SETTING	DEFINITIONS	AMMO	MAINTENANCE
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
<b>Boresighting</b>			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 14. Main Menu, Boresighting.**

2. CROWS displays the first boresighting prompt (Figure 15). Set the range to the ballistic maximum for the installed weapon by pressing RANGE +/- . Table 2 shows the maximum ballistic range for each weapon. The CROWS ballistic calculation updates automatically.

**Set range to target,  
then press 'SEL.'**

**Figure 15. Boresighting, Set Range.**

**Table 2. Maximum Ballistic Range of Weapons.**

Weapon	Max Range (meters)
M2 .50 cal	4,900 (5,359 yards)
MK19 40mm	1,500 (1,640 yards)
M240B 7.62mm	3,000 (3,281 yards)
M249 5.56mm	2,500 (2,734 yards)

3. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU), and CROWS displays the second boresighting prompt (Figure 16).

**Move bore scope/weapon  
to target, then press 'SEL.'**

**Figure 16, Boresighting. Move Line of Bore.**

4. Look at the Laser Dot to lay (elevate and traverse) the Dot to the specified point on the Boresight Target (1) (Figure 17).

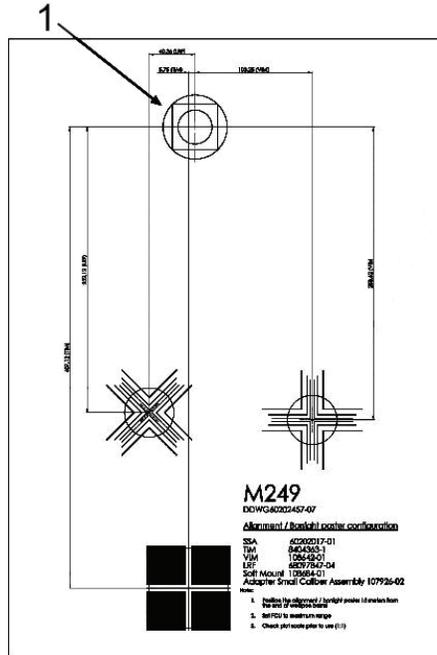


Figure 17. Example of Boresight Target.

5. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU), and the last Boresighting message displays (Figure 18).

Move reticle to target,  
then press 'SEL.'

Figure 18. Boresighting, Move Line of Sight.

## BORESIGHT ADJUSTMENT USING BORESIGHT TARGET METHOD - Cont

### Boresight Adjustment - Cont

- Aim the Reticle at the Boresight Target VIM (2), TIM (3), or LRF (4) symbol (as appropriate) using the CG (Figure 19).

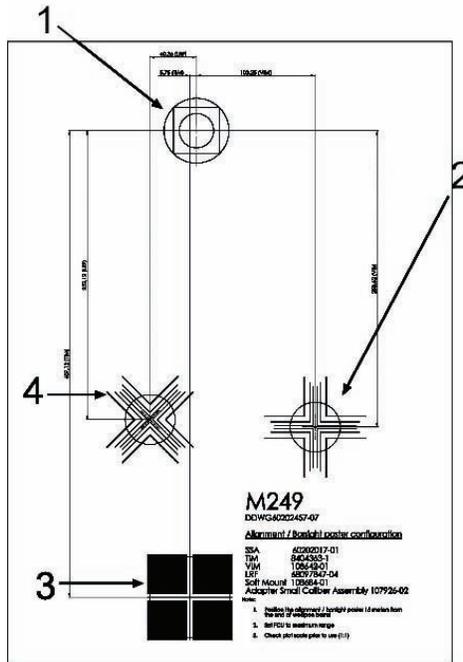


Figure 19. Example of Boresight Target.

- Press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

### END OF TASK

#### Verification of Boresight Procedure

- To verify that CROWS is properly boresighted, use the CG to aim the Screen Reticle precisely at the VIM or TIM symbol on the Boresight Target as appropriate.
- Set the range to the maximum for the installed weapon by pressing RANGE +/-.
- Observe the position of the Laser Dot on the Boresight Target. The Laser Dot should be pointing to the position designated for the installed weapon (1). If not, repeat the Boresight Adjustment Procedure.

**WARNING****HEAVY PARTS**

Personnel must be clear of the installed weapon before exiting boresight mode since the WS immediately elevates. To prevent injury to personnel, ensure that adequate communication occurs while boresighting the installed weapon.

4. When Boresighting has been completed successfully, remove the Streamer, Laser Borelight, and Adapter from the Weapon Barrel and evacuate the WS area.
5. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU).
6. Press the MENU ON/OFF button to exit the Main Menu.
7. Perform the Zeroing Procedure to ensure the accuracy of the weapon (WP 0030).

**END OF TASK****RESTORE BORE VALUES****NOTE**

Perform Restore Bore Values to remove invalid settings from a failed boresighting. Default Boresight and Zeroing values are restored, and Windage is set to zero.

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 20).
2. Highlight SETTING (use MENU L or R on FCU/DCP if needed) and press MENU SEL (DCP), MENU SEL/ZERO (FCU) or MENU D (down) to display the SETTING submenu.
3. Press MENU D two times to highlight Restore Bore Values function and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**RESTORE BORE VALUES - Cont**

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b>	<b>MAINTENANCE</b>
Surveillance			
LRF Min Range			
Restore Bore Values			
Zeroing			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 20. Main Menu, Restore Bore Values.**

**END OF TASK**

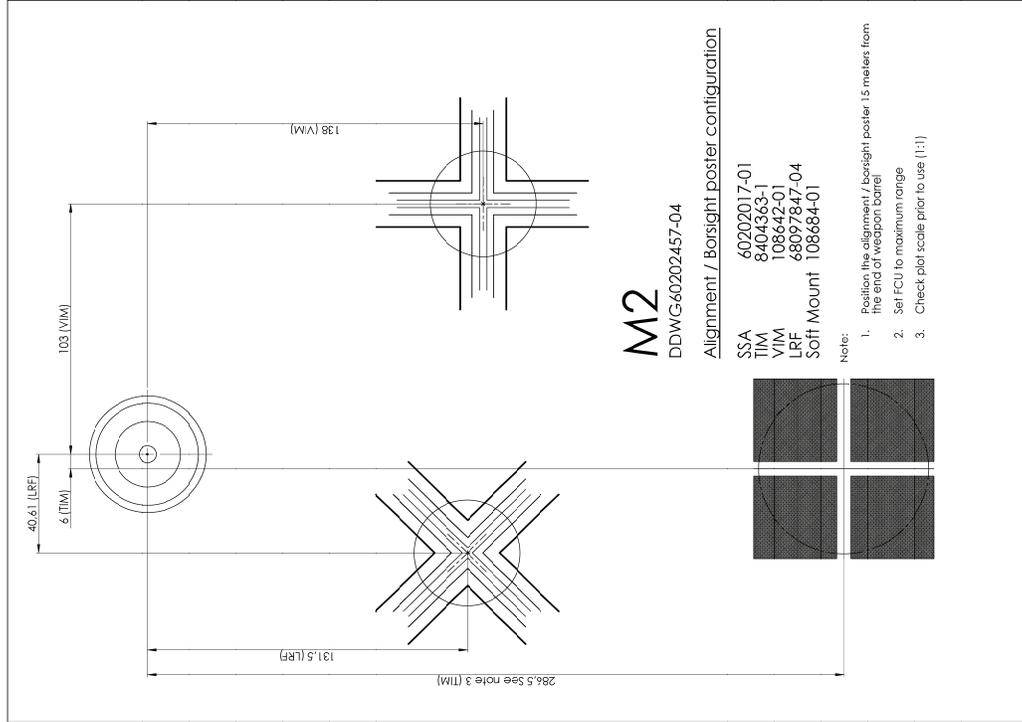


Figure 21. M2 Boresight Target.

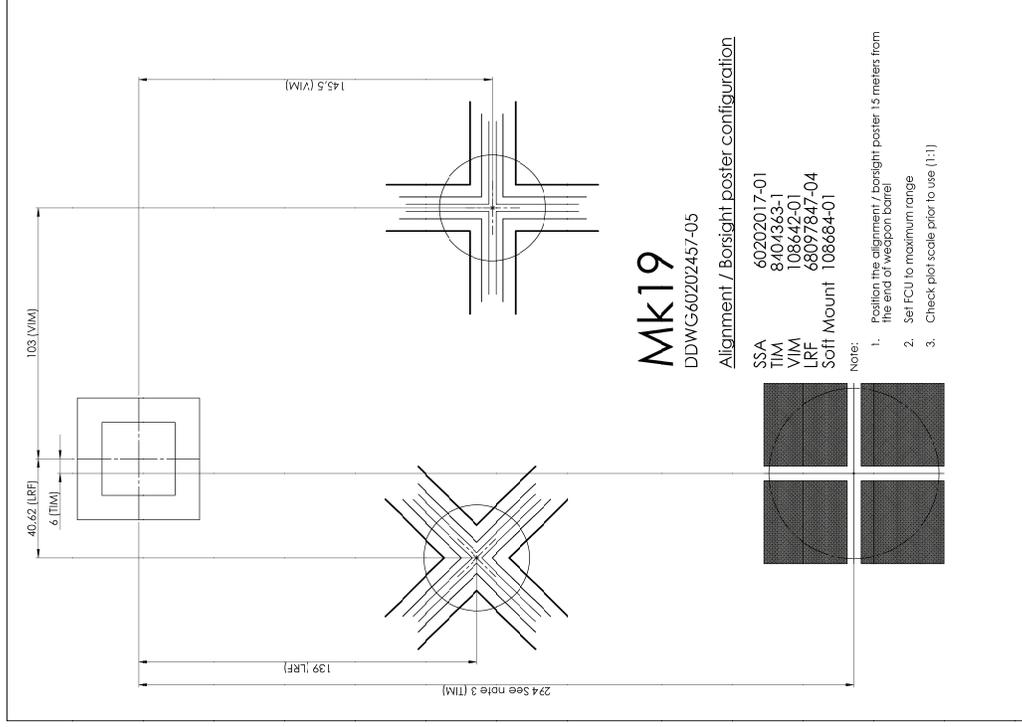


Figure 22. MK19 Boresight Target.

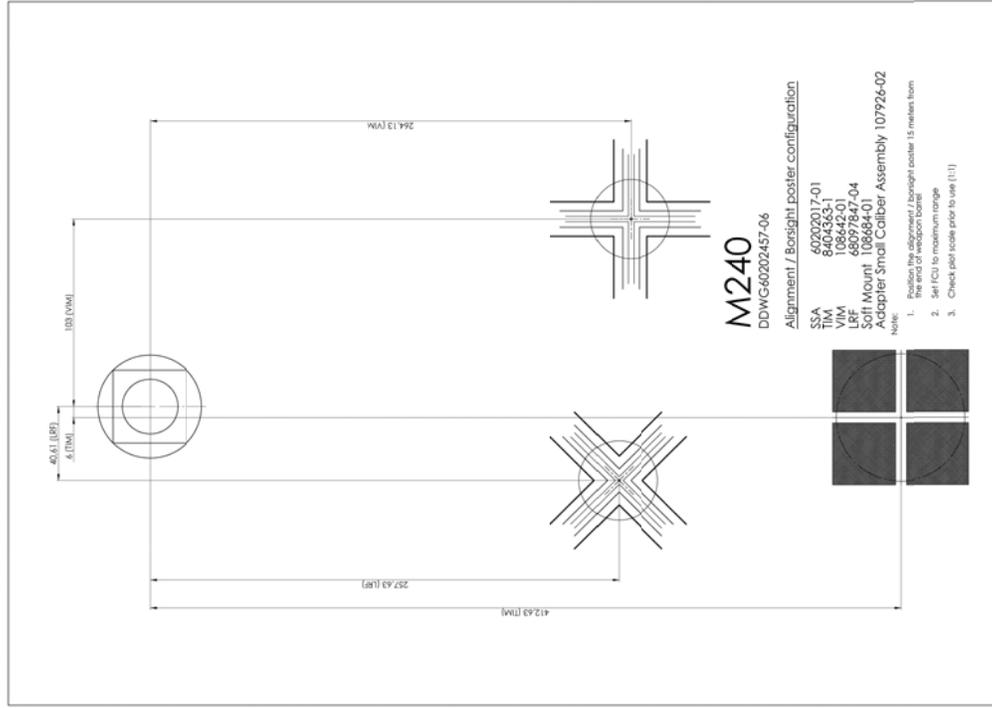


Figure 23. M240 Boresight Target.

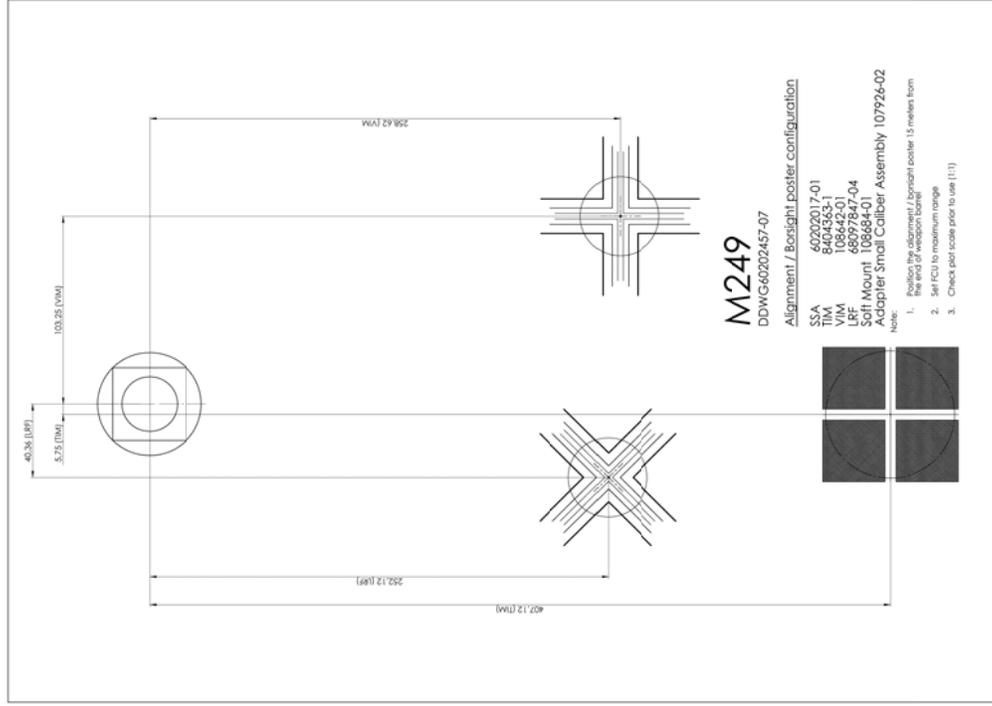


Figure 24. M249 Boresight Target.

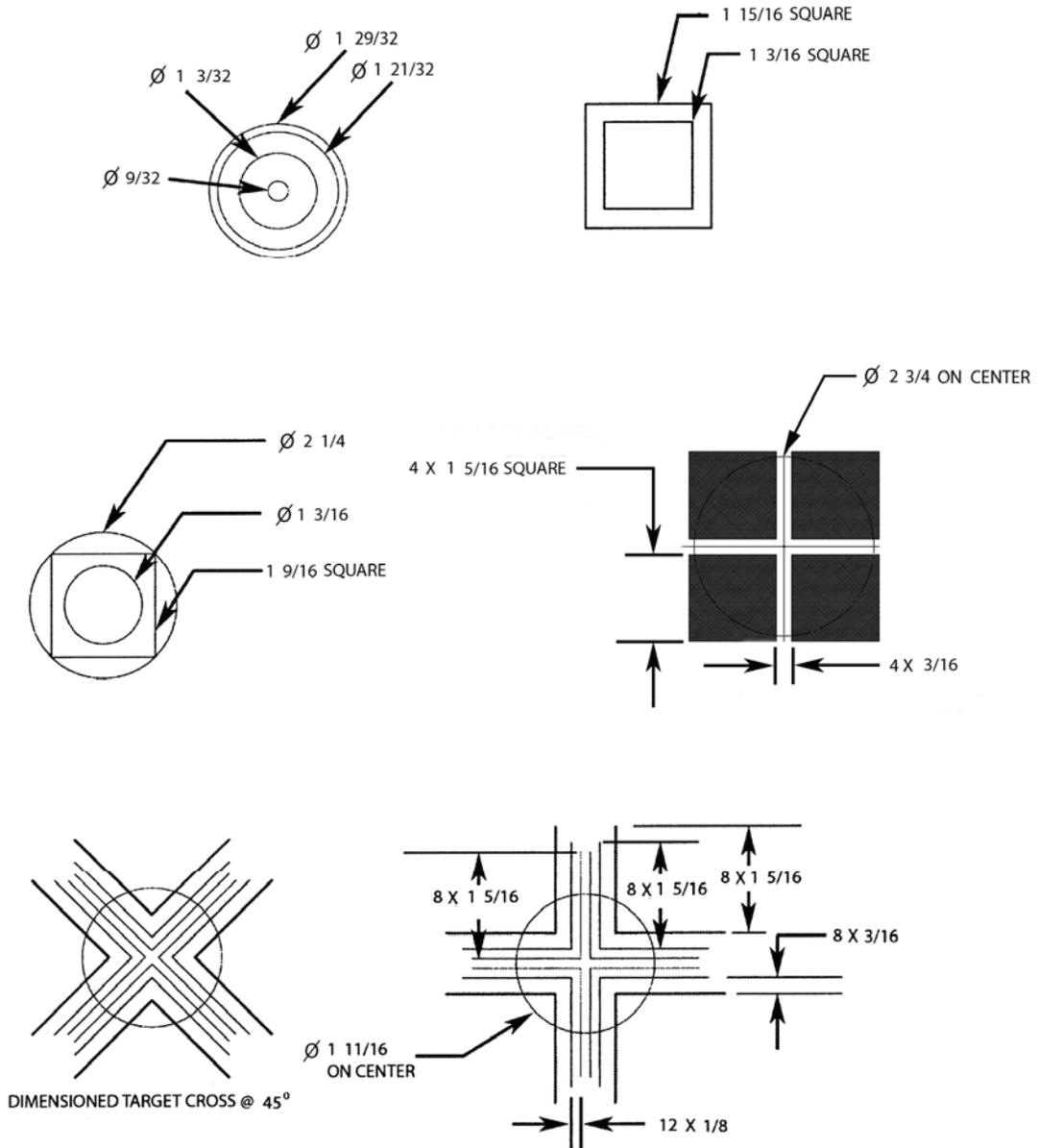


Figure 25. Boresight Target Symbol Dimensions.

END OF WORK PACKAGE



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
ZEROING**

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**THIS WORK PACKAGE COVERS:**

Zeroing CROWS.

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**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020  
WP 0022  
WP 0025  
WP 0026  
WP 0029  
WP 0033  
WP 0034

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Installed (M2-WP 0011,  
MK19-WP 0016, M240-WP 0020,  
M249-WP 0025)  
Weapon Boresighted (WP 0029)  
Weapon Loaded (M2-WP 0013,  
MK19-WP 0017, M240-WP 0022,  
M249-WP 0026)

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**CHECK IF ADJUSTMENT IS REQUIRED**

**WARNINGS**



**WEAPON FIRE**

To prevent injury to personnel or damage to equipment, ensure CROWS is clear of obstacles before powering up.

Shut CROWS down prior to exiting vehicle to prevent injury to personnel and damage to equipment.

**CHECK IF ADJUSTMENT IS REQUIRED - Cont**

**NOTES**

CROWS does not store Zeroing values and might require adjustment each time the system is started.

The VIM is the preferred sight for Zeroing.

Zeroing during windy condition may produce less accurate results. When zeroing during windy conditions is necessary, ensure that Windage values are correctly input. When zeroing in still conditions, ensure the Windage value is set to zero. Restarting CROWS returns Windage to the default value, zero.

1. Select or place a target at a known distance.
2. Mark the center of the target.
3. Draw a circle around the center of the target using the radius specified (Table 1). For example, if the target range is 900m, the length of a line from the center to any point on the circle will be 27.17 inches or 69 cm.

**Table 1. Zeroing Ranges.**

<b>Range (m)</b>	<b>Radius (in/cm)</b>	<b>Range (m)</b>	<b>Radius (in/cm)</b>
50	1.51/3.83	600	18.11/46.00
100	3.01/7.67	700	21.13/53.67
150	4.53/11.50	800	24.15/61.33
200	6.04/15.33	900	27.17/69.00
250	7.55/19.17	1,000	30.19/76.67
300	9.05/23.00	1,100	32.20/84.33
350	10.56/26.83	1,200	36.22/92.00
400	12.07/30.67	1,300	39.24/99.67
450	13.58/34.50	1,400	42.26/107.33
500	15.09/38.33	1,500	45.28/115.00

4. Select the VIM by holding the Palm Switch and pressing DAY/NT on the CG if necessary and observe the target.

**NOTES**

Alert the crew that the Installed Weapon will be fired.

When firing the Weapon for Zeroing, use 10-round bursts.

5. Engage the target, prepare the Weapon for firing, and fire at the center of the target (WP 0034).

**NOTE**

The Mean Point of Impact (MPI) should be calculated based on all rounds fired, not just those hitting the target. If the MPI cannot be estimated because some rounds did not hit the target, then move the target closer or use a larger target and start the Zeroing procedure again.

6. Calculate the MPI. If the MPI is not within the circle, perform the adjustment (ADJUSTMENT REQUIRED).
7. If the MPI is within the circle, Zeroing is not required, and no adjustment is needed. Close the SYSTEM and REMOTE SAFE Switch Guards.

**END OF TASK****ADJUSTMENT REQUIRED**

1. Ensure that the SYSTEM Switch is set to SAFE. The ARMED LED must not be lit.
2. Lay the Reticle on the center of the target.

**NOTE**

Zeroing cannot be performed when WS stabilization is on. Use the STAB ON/OFF button on the CG or the STAB function key on the DCP to disable WS stabilization before selecting Zeroing from the Main Menu or CROWS displays the following message:

**Zeroing not allowed due to:  
- Stabilization Activated**

3. Select Zeroing from the Main Menu.
  - a. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 1).
  - b. Highlight SETTING (using MENU L or R if needed).
  - c. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display the SETTING submenu.
  - d. Press MENU D three times to highlight Zeroing.
  - e. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to start Zeroing.

**ADJUSTMENT REQUIRED – Cont**

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b>	<b>MAINTENANCE</b>
Surveillance			
LRF Min Range			
Restore Bore Values			
<u>Zeroing</u>			
Windage			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 1. Main Menu, Zeroing.****NOTE**

When Zeroing is started, ZEROING displays in the status field, and Z displays in the Zeroing field on screen. A Z always displays when Zeroing values are being taken into account in CROWS ballistic calculations.

4. CROWS displays the first Zeroing message (Figure 2). Using the CG, move the Reticle to the MPI and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Move reticle to point of impact,  
then press 'SEL'.**

**Figure 2. Move Reticle, Zeroing.****NOTES**

Alert the crew that the Installed Weapon will be fired.

When firing the Weapon for Zeroing, use 10-round bursts.

5. Engage the target, prepare the Weapon for firing, and fire at the center of the target (WP 0034).

**NOTE**

The Mean Point of Impact (MPI) should be calculated based on all rounds fired, not just those hitting the target. If the MPI cannot be estimated because some rounds did not hit the target, then move the target closer or use a larger target and start the Zeroing procedure again.

6. If the calculated MPI is not within the circle after performing the adjustment four times or after using 40 rounds, notify Field Level Maintenance.
7. When the calculated MPI is within the circle, Zeroing is complete, and no adjustment is required. Close the SYSTEM and REMOTE SAFE Switch Guards.

**END OF TASK****FAST ZEROING****NOTE**

Fast Zeroing may lead to less accurate zeroing and could also require zeroing to be performed again to regain accuracy; however, Fast Zeroing may be required during operations where time and/or conditions do not allow the full procedure to be performed.

1. Select or place a target at a known distance.
2. Engage the target, prepare the Weapon for firing, and fire at the center of the target (WP 0034).
3. Hold the ZERO function key on the DCP or the MENU SEL/ZERO button on the FCU rather than releasing the button when starting Zeroing.
4. While holding the button, move the on-screen reticle to the calculated MPI.
5. Release the DCP ZERO key or the FCU MENU SEL/ZERO button.
6. Zeroing is complete. Press MENU ON/OFF to exit the Main Menu.

**END OF TASK****END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
NO-FIRE ZONES**

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**THIS WORK PACKAGE COVERS:**

No-Fire Zones and Motion Inhibit Zones.

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**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Vehicle Engine Running (Vehicle  
Operator Manual)

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**GENERAL**

**WARNING**



**WEAPON FIRE**

To prevent death or injury to personnel and damage to equipment, do not rely only on software to detect Safety Zones. Ensure activation of Safety Zones is visually verified and that personnel and equipment are clear before firing or traversing CROWS.

A Safety Zone is a factory-set or user-defined safety feature that restricts firing or WS movement. CROWS is equipped with two types of Safety Zones: No-Fire Zones and No-Traverse Zones.

- a. No-Fire Zones (NFZs) limit the firing of the installed weapon in preset areas when activated. NFZs can be activated by opening a hatch and cannot be overridden if predefined as permanent.
- b. No-Traverse Zones (NTZs) limit azimuth (horizontal) or elevation movement of the WS when activated. NTZs can be activated by opening a hatch and cannot be overridden if predefined as permanent.

**GENERAL - Cont****NOTE**

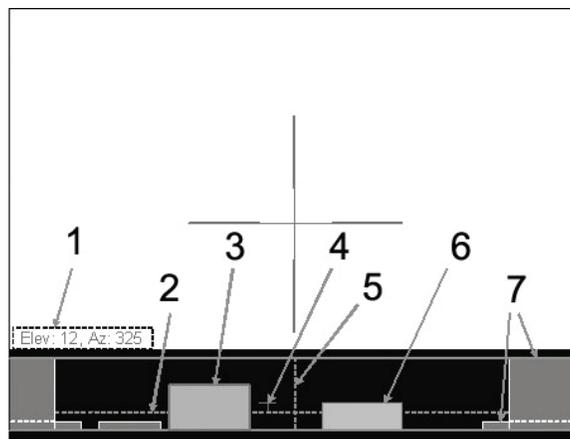
CROWS is connected to the Hatch Interrupt Unit (HIU) in the vehicle. The HIU reports the open/closed state of the personnel hatches of the Host Vehicle or other platform. Different platforms have different sets of hatches and require different Safety Zones. Because accurate Safety Zones are crucial to system safety, an unknown or illegal Platform ID freezes WS movement and disables firing. The Platform ID is only read by CROWS during power up.

Built in software safety secures the system from incorrect sector protection or firing in the inhibit zones. All user-configured zone limitations and exceptions can be changed within NO TRAVERSE ZONE and NO FIRE ZONE submenus, but factory-set, vehicle-specific zones cannot be altered.

**ZONE DEFINITION SCREEN**

The Zone Definition Screen is used when defining, modifying, and deleting User-defined Safety Zones as well as when defining Target Reference Points and Scan Sector. The different Safety Zones are represented graphically at the bottom of the screen (Figure 1).

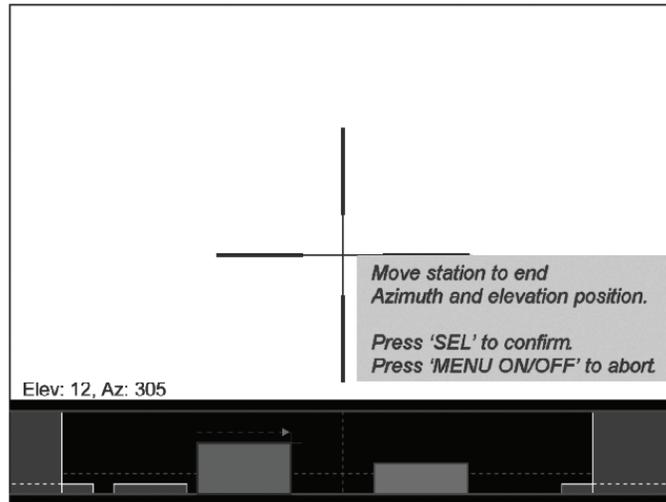
- a. Vehicle-dependent Zones (7) are dark gray with a light gray border.
- b. User-defined Zones (6) are light gray with a dark gray border.
- c. Selected User-defined Zones (3) are pink with a red border.
- d. The border is dashed if the Safety Zone can be overridden with the SAFETY OVERRIDE switch on the FCU or DCP.
- e. The elevation field is replaced by a WS position field showing the current WS Elevation and Azimuth position (1). All (other) text fields above are blanked.
- f. The 0 degrees Elevation (2) and Azimuth (5) are dashed blue lines.



**Figure 1. Zone Definition Screen.**

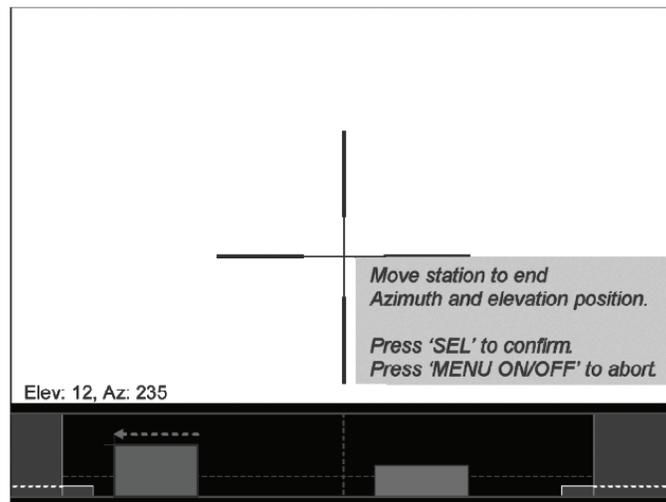
As a new Safety Zone is defined or an existing zone is modified, changes to the Safety Zone are displayed at bottom of the screen.

If the WS is moved clockwise (CW) from the start azimuth position, the Safety Zone will be defined as shown in Figure 2.



**Figure 2. Define Safety Zone, CW Movement.**

If the WS is moved counter-clockwise (CCW) from the start azimuth position, the Safety Zone will be defined as shown in Figure 3.



**Figure 3. Define Safety Zone, CCW Movement.**

**ZONE TABLE SCREEN**

The Zone Table Screen (Figure 4) manages the User-defined Safety Zones using a table. Use the arrow buttons (MENU U/D/L/R) to move the yellow frame around the table. Select a cell for editing by pressing the MENU SEL (DCP) or MENU SEL/ZERO (FCU) button. A selected cell is shown in yellow.

The value in a selected cell is changed by using the arrow buttons. Pressing MENU U or D changes the value +/- 10 degrees; pressing MENU R or L changes the value +/- one degree. The range is changed in steps of 10m (33 feet) and 100m (328 feet). The SafeOv (Safety Override) and Hatch columns traverse lists of available options.



**Figure 4. Zone Table Screen.**

**SET NO-FIRE ZONE**

1. Press MENU ON/OFF on the FCU/DCP once to display the Main Menu if necessary (Figure 5).
2. Highlight DEFINITIONS by pressing MENU R (right) once and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display options.
3. Press MENU D (down) three times to highlight NO FIRE ZONE.
4. With NO FIRE ZONE highlighted, press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU R (right) to open the submenu.

**SETTING**

**DEFINITIONS**  
 Target Ref Points ->  
 Auto Sector Scan  
 No Traverse Zone ->  
 No Fire Zone ->

**AMMO**

**MAINTENANCE**

**Figure 5. Main Menu, No-Fire Zone.**

5. Press MENU D (down) once to highlight NEW if necessary, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 6):

**Protect: Own Vehicle**  
**Use the 'U'/D' buttons to change setting.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 6. No-Fire Zone, Protect.**

6. Press MENU U/D to toggle between Protect options (Own Vehicle, or Peripheral Object), and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 7).

**Move station to start azimuth and elevation position.**  
**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 7. No-Fire Zone, Start Position.**

#### **NOTE**

While all No-Traverse Zones extend to minimum elevation, No-Fire Zones begin at the elevation specified.

7. Using the CG, move the WS to the lower left corner of the intended No-Fire Zone, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 8).

**Move station to end azimuth and elevation position.**  
**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 8. No-Fire Zone, End Position.**

**SET NO-FIRE ZONE - Cont**

8. Move the WS to the upper right corner of the No-fire Zone, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). If PROTECT OBJECT rather than OWN VEHICLE was chosen, CROWS prompts with the following message (Figure 9).

**Protected Object Range: 700 m**  
**Use the laser or range buttons to alter range.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 9. No-Fire Zone, Protected Object Range.**

9. Use MENU U/D to set the estimated object range, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 10).

**Safety overridable: No**  
**Use the 'U/'D' buttons to change setting.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 10. No-Fire Zone, Safety Overridable.**

**WARNING**



**HEAVY PARTS**

When the definition of a Peripheral Object No-Fire Zone is completed, CROWS aims the WS at the object and lazars for the ballistic solution. Alert personnel, and ensure the area is clear. Moving CROWS may cause injury to personnel and damage to equipment.

10. Use MENU U/D to indicate whether the No-Fire Zone can be overridden (Yes or No), and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to complete the No-Fire Zone.

**NOTE**

If the new No Fire Zone End Position is less than one degree from the start position, the zone must be redefined, and CROWS displays the following message:

**Zones can not be more narrow than 1 degree.**

11. Repeat steps five through ten to create additional No-Fire Zones, or press MENU ON/OFF to exit.

**END OF TASK****DELETE NO-FIRE ZONE**

1. Open the NO-FIRE ZONE submenu under DEFINITIONS if necessary.

**NOTE**

If there are no Zones available for deletion, press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to continue. CROWS displays the following message:

**There are no userdefined zones.**

2. Press MENU D (down) two times to highlight DELETE, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). If user-defined, no-fire zones have been defined, CROWS prompts with the following message (Figure 11).

**Select zone (red) by moving the station, or by using the 'L'/'R' buttons.**

**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 11. Delete No-Fire Zone.**

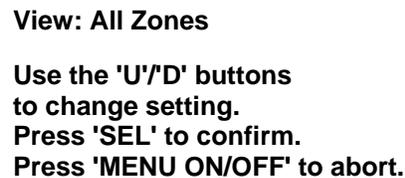
3. Select the Safety Zone to be deleted by moving the WS or pressing MENU L/R until the zone is highlighted in red.

**DELETE NO-FIRE ZONE - Cont**

4. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to delete the selected zone.
5. Repeat steps two through four to delete additional Zones, or press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to exit.

**END OF TASK****VIEW NO-FIRE ZONE**

1. Open the NO FIRE ZONE submenu under DEFINITIONS if necessary.
2. With VIEW highlighted, press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 12).

A rectangular box with a black border containing the following text:

**View: All Zones**  
**Use the 'U'/D' buttons**  
**to change setting.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 12. View No-Fire Zone.**

3. Select the Safety Zones to be viewed (All Zones, Vehicle Zones, User Zones, or Active Zones) by pressing MENU U/D, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to activate the display. The selected zones are represented graphically within the Zone Definition Area at the bottom of the screen.
4. Press MENU ON/OFF to exit when finished.

**END OF TASK****NO-FIRE ZONE TABLE**

1. Open the NO FIRE ZONE submenu under DEFINITIONS if necessary.
2. Press MENU D (down) three times to highlight TABLE, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display (Figure 13).

**No Fire Zones**

Vehicle Specific Zones							User defined Zones							
St.Az	EndAz	MinEl	MaxEl	SafeCv	Hatch		Zone	St.Az	EndAz	MinEl	MaxEl	SafeCv	Hatch	Range
200	350	-20	60	Yes	Left door		Del	350	5	-20	50	Yes	None	0 m
10	350	-20	60	No	Right door		Del	30	65	0	40	No	None	1210 m
170	190	-20	10	No	Back door		New							

**Figure 13. No-Fire Zones Table.**

**NOTE**

Factory-set, vehicle-specific Safety Zones cannot be modified or deleted.

3. Highlight the cell to be modified by pressing MENU L/R/U/D. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the cell. The selected cell appears with a solid yellow background.
4. Adjust the cell value by pressing MENU L/R/U/D. Pressing MENU U or D changes the value by 10 degrees (100 meters for the range value); pressing the MENU R or L buttons changes the value by one degree (10 meters for the range value).
5. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to store the new value.
6. Repeat steps three through five to modify additional values, and press MENU ON/OFF to exit when finished.

**END OF TASK**

**SET NO-TRAVERSE ZONE**

1. Press MENU ON/OFF on the FCU/DCP once to display the Main Menu if necessary (Figure 14).
2. Highlight DEFINITIONS by pressing MENU R (right) once, and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display options.
3. Press MENU D (down) twice to highlight NO TRAVERSE ZONE.

**SET NO-TRAVERSE ZONE - Cont**

4. With NO TRAVERSE ZONE highlighted, press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU R (right) to open the submenu.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
	Target Ref Points ->		
	Auto Sector Scan		
	<b>No Traverse Zone -&gt;</b>		
	No Fire Zone ->		

**Figure 14. Main Menu, No-Traverse Zone.**

5. Press MENU D (down) once to highlight NEW if necessary, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 15).

**Move station to  
start azimuth position.**

**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 15. New Traverse Zone, Start Position.**

6. Using the CG, move the WS to the left side of the new Traverse Zone, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 16).

**Move station to end azimuth  
and elevation position.**

**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 16. New Traverse Zone, End Position.**

**NOTE**

If the new Traverse Zone End Position is less than one degree from the start position, the zone must be redefined, and CROWS displays the following message:

**Zones can not be more  
narrow than 1 degree.**

7. Move the WS to the upper right corner of the new Traverse Zone, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 17).

**Hatch: None**

Use the 'U'/D' buttons to change setting.  
Press 'SEL' to confirm.  
Press 'MENU ON/OFF' to abort.

**Figure 17. No-Traverse Zone, Protected Object Range.**

8. Use MENU U/D to indicate whether the new Zone protects a Host Vehicle Hatch. If the Zone is for a Hatch, assign the Zone a predefined name (Hatch one through 10). If the new Zone is not for a Hatch, ensure Hatch is set to None. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 18).

**Safety overridable: No**

Use the 'U'/D' buttons to change setting.  
Press 'SEL' to confirm.  
Press 'MENU ON/OFF' to abort.

**Figure 18. No-Traverse Zone, Safety Overridable.**

9. Use MENU U/D to indicate whether the No-Traverse Zone can be overridden (Yes or No), and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to complete the No-Traverse Zone.
10. Repeat steps five through nine for each additional Zone desired or press MENU ON/OFF to exit.

#### **NOTE**

If the WS is positioned within a Safety-Overridable, No-Traverse Zone when SAFETY OVERRIDE is turned off, the WS cannot be moved. Set Safety Override to ON to move out of the Safety Zone.

11. Observe that the WS cannot be moved into the No-Traverse Zone unless SAFETY OVERRIDE is ON and the Zone is Safety Overridable.

**END OF TASK**

**DELETE NO-TRAVERSE ZONE**

1. Open the NO TRAVERSE ZONE submenu under DEFINITIONS if necessary.
2. Press MENU D (down) two times to highlight DELETE, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 19).

**Select zone (red) by moving the Station, or by using the 'L'/R' buttons.**

**Press 'SEL' to continue.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 19. Delete No-Traversal Zone.**

3. Select the Zone to be deleted by moving the WS or pressing the MENU L/R buttons until the zone is highlighted in red.
4. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to delete the selected Zone.
5. Repeat steps three and four to delete additional zones or press MENU ON/OFF to exit.

**END OF TASK****VIEW NO TRAVERSE ZONE**

1. Open the NO TRAVERSE ZONE submenu under DEFINITIONS if necessary.
2. With VIEW highlighted, press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS prompts with the following message (Figure 20).

**View: Active Zones**

**Use the 'U'/D' buttons to change setting.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 20. View No-Traversal Zone.**

3. Select the Zones to be viewed (All Zones, Vehicle Zones, User Zones, or Active Zones) by pressing MENU U/D for the intended option, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to confirm the action. The selected Zones are represented graphically within the Zone Definition Area at the bottom of the screen. Press MENU ON/OFF to exit when finished.

**END OF TASK**

**NO-TRAVERSE ZONE TABLE**

1. Open the NO-TRAVERSE ZONE submenu under DEFINITIONS if necessary.
2. Press MENU D (down) three times to highlight TABLE, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to display (Figure 21). The Zone Definition Area appears at bottom of the Zone Table Screen.

Vehicle Specific Zones							User Defined Zones						
St Az	End Az	Min El	Max El	DefOn	Hkth	Zone	St Az	End Az	Min El	Max El	DefOn	Hkth	Range
0	360	-20	61	Yes	Tip Hkth	See...							

**Figure 21. No-Traverse Zone Table.**

**NOTE**

Factory-set, vehicle Specific Safety Zones cannot be modified or deleted.

3. Highlight the cell to be modified by pressing MENU L/R/U/D. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to select the cell. The selected cell appears with a solid yellow background.
4. Adjust the cell value by pressing MENU L/R/U/D. Pressing MENU U or D once changes the value by 10 degrees; pressing MENU R or L once changes the value by one degree.
5. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to store the new cell value.
6. Repeat steps three through five to modify additional cells, or press MENU ON/OFF to exit.

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
SECTOR SCANS, TARGET REFERENCE POINTS, AND TARGET TRACKING**

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**THIS WORK PACKAGE COVERS:**

Procedures for using Sector Scans, Target Reference Points (TRPs), and Target Tracking.

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**INITIAL SETUP:**

**References**

WP 0006  
WP 0007  
WP 0008  
WP 0009  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020  
WP 0022

**References - Cont**

WP 0025  
WP 0026

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Installed (WP 0011, WP 0016,  
WP 0020 or WP 0025)  
Weapon Loaded (WP 0013, WP 0017,  
WP 0022 or WP 0026)

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**GENERAL**

CROWS provides three capabilities to assist when acquiring and monitoring prospective targets, Auto Sector Scan, Target Reference Points (TRPs), and Target Tracking. Sector scans sweep a specified area for prospective targets, TRPs monitor up to 200 prospective targets by moving the Sight Sensors from point to point as specified, and Target Tracking automatically follows designated targets in both azimuth and elevation while the target and the Host Platform are moving. Sector scans and Target Tracking can be utilized while the Host Platform is stationary or moving, but TRPs are only used from a stationary position.

## USING AN AUTO SECTOR SCAN

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 1).
2. Highlight DEFINITIONS by pressing MENU R (right) once.
3. Press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the DEFINITIONS submenu.
4. Press MENU D (down) once to highlight Auto Sector Scan.
5. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to define the sector.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
	Target Ref Points ->		
	<b>Auto Sector Scan</b>		
	No Traverse Zone ->		
	No Fire Zone ->		

**Figure 1. Main Menu, Sector Scan.**

6. The first Auto Sector Scan message displays on screen (Figure 2). Move the reticle to the upper left of the sector to be scanned.
7. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the starting point.

**Move WS to start position.**

**Press 'SEL' to continue.**

**Press 'MENU ON/OFF' to abort.**

**Figure 2. Sector Scan, Start.**

8. The Next message displays (Figure 3). Aim the WS to the right of the scan sector.

### NOTE

When the start and end scan positions are not at the same elevation, CROWS scans the area designated in a zigzag pattern.

9. Press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to set the designated end point and start the Sector Scan.

**Move WS to diagonal end position.**

**Press 'SEL' to continue.**

**Press 'MENU ON/OFF' to abort.**

**Figure 3. Sector Scan, End.**

## NOTES

An Auto Sector Scan can be interrupted at any time by pressing the Palm Switch on the CG.

Adjust the speed of the Auto Sector Scan by pressing SPEED +/-.

10. Press the Palm Switch on the CG or MENU ON/OFF to stop the Auto Sector Scan.

### END OF TASK

### USING TARGET REFERENCE POINTS

#### Define a Location

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 4).
2. Highlight DEFINITIONS by pressing MENU R (right) once.
3. Press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the options.
4. With TARGET REF POINTS highlighted, press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU R (right) to open the TRP submenu.

#### SETTING

#### DEFINITIONS

#### AMMO

#### MAINTENANCE

Target Ref Points ->  
 Auto Sector Scan  
 No Traverse Zone ->  
 No Fire Zone ->

**Figure 4. Main Menu, Target Ref Points.**

5. Press MENU D (down) twice to highlight DEFINE LOCATION, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).
6. CROWS displays the first Define Location message (Figure 5). Press MENU U (up) or D (down) to adjust Location Number to Location desired, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Select Location: 1**

**Use the 'U'/'D' buttons to change setting.**

**Press 'SEL' to confirm.**

**Press 'MENU ON/OFF' to abort.**

**Figure 5. Target Ref Points, Define Location.**

**USING TARGET REFERENCE POINTS - Cont****Define a Location - Cont**

7. CROWS displays the next Define Location message (Figure 6). Press MENU U (up) or D (down) to adjust the Platform Heading in degrees, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Set Platform Heading: 0.0 deg**  
**Use the 'U'/'D' buttons**  
**to change setting.**  
**Press 'SEL' to confirm.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 6. Define Location, Vehicle Heading.**

**NOTES**

CROWS stores and scans up to 200 TRPs saved in sets as locations.

Press MENU U or D to adjust the Current Halt Time, how long CROWS pauses at each TRP. Each TRP can be assigned a separate Halt Time.

8. CROWS displays the next Define Location message (Figure 7). Move the reticle to the first prospective target, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Move Weapon Station to.**  
**Target Reference Point 1**  
**Current halt time: 05**  
**Press 'SEL' to select.**  
**Hold 'SEL' to start.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 7. Define Location, TRP 1.**

9. CROWS displays the next TRP message (Figure 8). Move the reticle to the next prospective target, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Move Weapon Station to.**  
**Target Reference Point 2**  
**Current halt time: 05**  
**Press 'SEL' to select.**  
**Hold 'SEL' to start.**  
**Press 'MENU ON/OFF' to abort.**

**Figure 8. Define Location, TRP 2.**

10. Repeat step 9 until all desired TRPs are set.
11. Hold MENU SEL (DCP) or MENU SEL/ZERO (FCU) to begin scanning all TRPs saved with the selected Location. Create additional Locations by repeating the Define Location Procedure and adjusting Select Location to an unused number.
12. Press the Palm Switch to end the TRP Scan if desired.

## END OF TASK

### Select a Location

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 9).
2. Highlight DEFINITIONS by pressing MENU R (right) once, and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the options.
3. With TARGET REF POINTS highlighted, press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to open the TRP submenu.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
	Target Ref Points ->		
	Auto Sector Scan		
	No Traverse Zone ->		
	No Fire Zone ->		

**Figure 9. Main Menu, Target Ref Points.**

4. Press MENU D (down) once to highlight SELECT LOCATION and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).
5. CROWS displays the first Select Location message (Figure 10). Press MENU U (up) or D (down) to adjust the Location Number to the Location desired and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Select Location: 2**

Use the 'U'/D' buttons  
to change setting.  
Press 'SEL' to confirm.  
Press 'MENU ON/OFF' to abort.

**Figure 10. Target Ref Points, Start.**

## USING TARGET REFERENCE POINTS - Cont

### Select a Location - Cont

6. CROWS displays the next Select Location message (Figure 11). Press MENU U (up) or D (down) to adjust the Platform heading in degrees and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Set Platform Heading: 0.0 deg**

Use the 'U'/'D' buttons  
to change setting.  
Press 'SEL' to confirm.  
Press 'MENU ON/OFF' to abort.

Figure 11. Target Ref Points, Vehicle Heading.

## END OF TASK

### Delete a Location

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 12).
2. Highlight DEFINITIONS by pressing MENU R (right) once and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the options.
3. With TARGET REF POINTS highlighted, press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU R (right) to open the TRP submenu.

SETTING	DEFINITIONS	AMMO	MAINTENANCE
	Target Ref Points ->		
	Auto Sector Scan		
	No Traverse Zone ->		
	No Fire Zone ->		

Figure 12. Main Menu, Target Ref Points.

4. Press MENU D (down) three times to highlight DELETE LOCATION, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

## NOTE

When there are no locations to delete, CROWS displays the following message:

**No locations to delete**

Press 'MENU ON/OFF' to abort.

5. CROWS displays the DELETE LOCATION message (Figure 13). Press MENU U (up) or D (down) to change the Location Number to the Location desired, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Select Location: 2**

**Use the 'U'/D' buttons to change setting.**

**Press 'SEL' to confirm.**

**Press 'MENU ON/OFF' to abort.**

**Figure 13. Target Ref Points, Delete Location.**

## **END OF TASK**

### **Activate a TRP Scan**

1. Press MENU ON/OFF once to display Main Menu if necessary (Figure 14).
2. Highlight DEFINITIONS by pressing MENU R (right) once, and press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the options.
3. With TARGET REF POINTS highlighted, press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU R (right) to open the TRP submenu.

#### **SETTING**

#### **DEFINITIONS**

#### **AMMO**

#### **MAINTENANCE**

**Target Ref Points ->**  
**Auto Sector Scan**  
**No Traverse Zone ->**  
**No Fire Zone ->**

**Figure 14. Main Menu, Target Ref Points.**

### **NOTE**

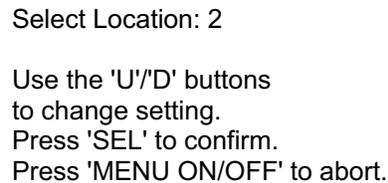
A TRP Scan can be interrupted at any time by pressing the Palm Switch on the CG.

4. With ACTIVATE SCAN highlighted, press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

## USING TARGET REFERENCE POINTS - Cont

### Activate a TRP Scan - Cont

5. CROWS displays the ACTIVATE SCAN message (Figure 15). Press MENU U (up) or D (down) to adjust the Location Number to the Location desired and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). CROWS scans the Location selected.



Select Location: 2

Use the 'U'/'D' buttons  
to change setting.  
Press 'SEL' to confirm.  
Press 'MENU ON/OFF' to abort.

**Figure 15. Target Ref Points, Activate Scan.**

6. Press the Palm Switch or MENU ON/OFF to end the scan.

## END OF TASK

## TARGET TRACKING

Target Tracking is an advanced feature designed to automatically follow designated targets in both azimuth and elevation while the target and Host Platform are moving so that the aimpoint can be easily placed. Tracking processes images from a single video source at a time, either VIM or TIM, and remains locked on target even if the Line of Sight is blocked briefly as when a vehicle passes in front of the target. Currently, Target Tracking works best with a target of a simple geometric shape and uniform color traveling at a consistent speed in one direction. When CROWS is unable to maintain Target Tracking, Tracking is automatically aborted.

## NOTES

Do not use Target Tracking on a target of varying speed and direction. Tracking accuracy will be impaired, and the target will not be reliably tracked.

The target that is being tracked must be within a wide open field of view with only a few or no other objects obstructing the direct Line of Sight to that target for more than ten seconds. If not, tracking accuracy will be impaired, and the target will not be reliably tracked.

Five distinct target tracking boxes can appear on screen to represent different phases of the Target Tracking Procedure. A solid box shows that Target Tracking is in Acquisition Mode and is working to acquire a target. A dashed box indicates that the system is in Tracking Mode and is actively tracking a target. A blue or red box specifies a good lock on the target while a yellow box signifies that Target Tracking is not locked on the target. Finally, a dashed green box means the weapon has been fired while CROWS was actively tracking. Firing terminates Target Tracking.

**NOTE**

When firing is initiated, CROWS aborts Target Tracking. Instead the system moves according to the speed and direction of the WS just prior to pulling the trigger. CROWS will not automatically compensate for changes in speed or direction of the tracked target during firing.

The five Target Tracking Boxes are summarized in Table 1.

**Table 1, Target Tracking Boxes**

Solid Blue	Solid Yellow	Dashed Yellow	Dashed Red	Dashed Green
				
Acquisition Mode Target Lock	Acquisition Mode No Target Lock	Tracking Mode No Target Lock	Tracking Mode Target Lock	Dead Reckoning Firing

**NOTES**

Select a small stationary object such as a bottle or metal can for a target while becoming familiar with the Target Tracking feature.

The RATE button within the SYSTEM field of the FCU/DCP should be set to a limited rate of fire such as BURST during Target Tracking to limit the possibility of a large number of rounds being fired away from the intended target.

1. Use the CG to acquire the target (WP 0007).
2. Focus and zoom the image until the target is sharply defined (WP 0008 or WP 0009).

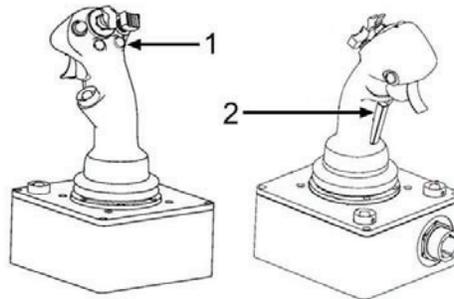
**NOTES**

A blue box indicates that Target Tracking is locked on target while a yellow template shows that Target Tracking cannot lock on target. A dashed box indicates that CROWS is in Target Tracking mode.

When CROWS is ARMED and the Trigger is pressed to fire the installed weapon, the template turns green (dead reckoning).

**TARGET TRACKING - Cont**

3. Start Target Tracking by holding the Palm Switch (2) and pressing the TRACK button (1) (Figure 16). A blue or yellow rectangle or template appears on screen.



**Figure 16. Track Button.**

**NOTE**

Adjusting zoom (magnification) and focus may cause CROWS to lose the target, and the template rectangle will turn yellow and jump around the center of the screen.

4. Adjust the MAG and FOCUS buttons on the CG until the target is within the template. The template becomes static, and the template color changes to blue.
5. If necessary, use the MENU U, D, R, and L buttons to precisely frame the target with template. MENU U increases the size of the template vertically while MENU D reduces the vertical size of the template. MENU R expands the template horizontally, and MENU L contracts the template horizontally.
6. When the template precisely frames target and is a solid blue box, hold the Palm Switch and press the TRACK button. The template turns to a dashed red rectangle indicating that the system is in Target Tracking mode. The reticle centers on the target with the installed weapon aimed precisely at the target.

**NOTES**

Target Tracking actively tracks a target only when the Palm Switch is held. To stop active tracking at any time, release the Palm Switch.

If an object blocks the target for more than ten seconds or the target cannot be identified, CROWS aborts Target Tracking.

7. While still holding the Palm Switch, have an object such as a target board placed in front of the target for no more than ten seconds. The template changes to yellow and jumps around the center of the screen. When the obstacle is removed, the template settles back on target and turns blue to indicate standby mode.

**NOTE**

CROWS maintains Target Tracking while the reticle is moved to another point (no more than half a screen from tracked target).

8. Move the WS around the target but no more than a half screen from the target. Observe that the blue template remains centered on the target.
9. Double click the TRACK button twice to turn Target Tracking off. The template disappears from the screen and Target Tracking is terminated.

A Summary of Target Tracking Controls is at Table 2.

**Table 2, Summary of Target Tracking Controls**

Control	Action
Hold Palm Switch and Single Click Track Button	Target Tracking is started
Hold Palm Switch and Double Click Track Button	Target Tracking is stopped
MENU U (Up)	Template enlarges vertically
MENU D (Down)	Template contracts vertically
MENU R (Right)	Template enlarges horizontally
MENU L (Left)	Template contracts horizontally

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
WINDAGE, DRIFT COMPENSATION, AND LEAD ANGLE COMPENSATION**

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**THIS WORK PACKAGE COVERS:**

Windage, Drift Compensation (Nulling), and Lead Angle Compensation.

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**INITIAL SETUP:****References**

Vehicle Operator Manual  
WP 0006  
WP 0007  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020  
WP 0022  
WP 0025  
WP 0026

WP 0029

WP 0034

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Installed (M2-WP 0011,  
MK19-WP 0016, M240-WP 0020,  
M249-WP 0025)  
Weapon Boresighted (WP 0029)  
Weapon Loaded (M2-WP 0013,  
MK19-WP 0017, M240-WP 0022,  
M249-WP 0026)

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**WINDAGE****WARNING****HEAVY PARTS**

Before elevating, depressing, or traversing WS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS unexpectedly can injure personnel and damage equipment.

**NOTE**

A value for Windage allows CROWS to consider the direction and speed of the wind in ballistic calculations. The value is not stored, and Windage is always zero when CROWS is started.

**WINDAGE - Cont**

1. Press MENU ON/OFF once to display the Main Menu if necessary (Figure 1).
2. Highlight SETTING (using MENU L or R if needed).
3. Press MENU SEL (DCP), MENU SEL/ZERO (FCU), or MENU D (down) to display the SETTING submenu.
4. Press MENU D four times to highlight Windage, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

<b>SETTING</b>	<b>DEFINITIONS</b>	<b>AMMO</b>	<b>MAINTENANCE</b>
Surveillance			
LRM Min Range			
Restore Bore Values			
Zeroing			
<b>Windage</b>			
Ammo Counter			
Sniper Detection			
Camera ->			
Boresighting			
Video Image Stab			
Graphics Level			
CG Shaping			

**Figure 1. Main Menu, Windage.**

5. CROWS displays the first Windage message (Figure 2). Turn the WS with the CG to face into the wind and press MENU SEL (DCP) or MENU SEL/ZERO (FCU).

**Align WS towards the wind**

**Press 'SEL' to confirm.**

**Press 'MENU ON/OFF' to abort.**

**Figure 2. Windage, Align WS.**

6. CROWS displays the last Windage message (Figure 3). Use the MENU U (up) and D (down) buttons to set the reported wind speed in knots, and press MENU SEL (DCP) or MENU SEL/ZERO (FCU). The Windage value can also be set to zero in this way.

**Set headwind: 0 knots**

**Use the 'U'/D' buttons to change setting.**

**Press 'SEL' to confirm.**

**Press 'MENU ON/OFF' to abort.**

**Figure 3. Windage, Set Headwind.**

- Press MENU ON/OFF to exit the Main Menu. A W appears in the Zeroing, Windage field (1) on screen (Figure 4) to indicate that CROWS is using a Windage value in the ballistic calculations.

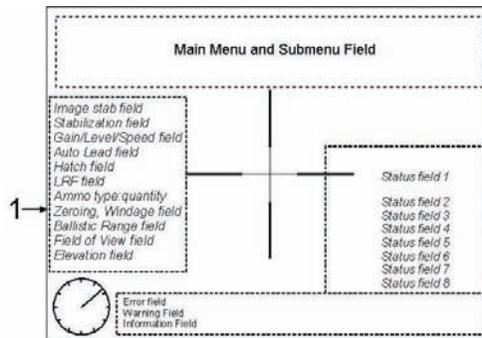


Figure 4. Zeroing, Windage Field.

**END OF TASK**

**DRIFT COMPENSATION (NULLING)**

**NOTES**

If WS Stabilization is on but the screen reticle still moves, the rate gyros drifted, and CROWS must be nulled.

Drift Compensation (nulling) takes 20 seconds to perform. Park the Host Vehicle on level ground, and ensure no platform movement occurs. Any movement measured by the gyros during nulling distorts the drift calculation.

- Compensate for drift (Nulling) if necessary by pressing the NULL button (2) on the CG with the Palm Switch (1) disengaged (Figure 5).

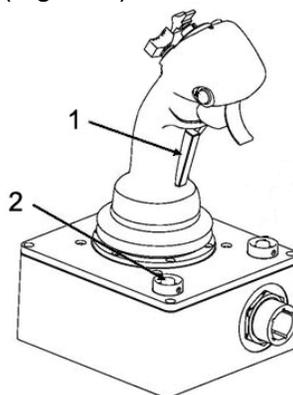


Figure 5. CG Null Button.

**DRIFT COMPENSATION (NULLING) - Cont****NOTE**

If the Palm Switch is pressed during Drift Compensation, nulling is aborted, and the drift calculated during the aborted calculation period is used.

2. When Drift Compensation is in progress, CROWS displays a status message (Figure 6). The Drift Compensation message disappears after the seconds remaining count down from 20 to zero.

<p>*****Warning***** Drift compensation: 20 Toggle PALM switch to abort</p>
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**Figure 6. Drift Compensation Message.**

**END OF TASK****LEAD ANGLE COMPENSATION****NOTES**

Lead Angle Compensation is off by default on CROWS startup.

Do not use Lead Angle Compensation when MILES is the selected Ammunition Type.

Lead Angle Compensation helps to keep the on screen reticle on target while the Host Platform, the target, or both are moving at a near constant speed and heading. CROWS allows for the installed weapon, the ammunition type, the target range, windage, and target movement before offsetting the installed weapon aimpoint accordingly. These adjustments will be made to both azimuth and elevation at the speed indicated by the CG or the Target Tracking function. Move the CG joystick smoothly to avoid uneven movement of the WS.

**NOTES**

When the limit of Lead Angle Compensation is reached, LEAD ANGLE LAG displays in the Auto Lead Field, and CROWS uses the maximum Lead Angle possible. The message remains on screen until the Lead Angle can be applied.

If the Lead Angle is greater than the selected camera FOV, ZOOM OUT appears over the on screen reticle. The message remains on screen until the hit point is no longer outside the viewing area.

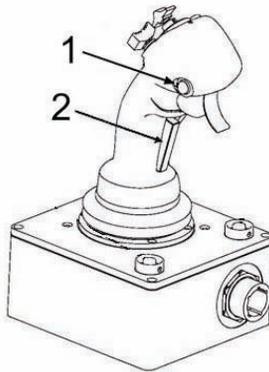
Do not use Lead Angle Compensation when the Host Platform or the target are moving faster than 25 mph (40 km per hour).

Activate Lead Angle Compensation with the following procedure:

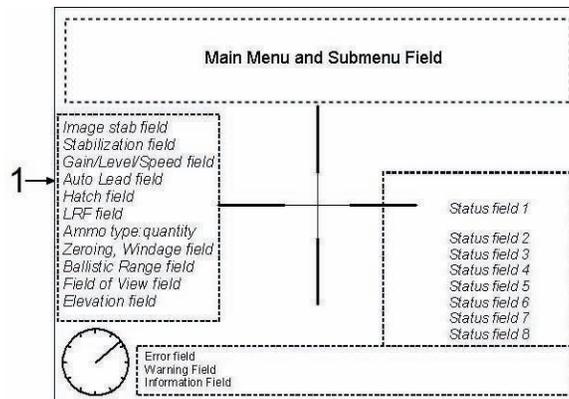
1. Elevate and traverse the WS (WP 0007) to acquire a target moving at a consistent speed.
2. Arm CROWS if necessary (WP 0034). ARM appears in the status field on screen.
3. Hold the Palm Switch (2) and press the LEAD button (1) on the CG (Figure 7) to start Lead Angle Compensation. LEAD ANGLE ON appears in the Auto Lead Field (1) (Figure 8).

**NOTE**

Sudden stoppage of WS movement from the release of the Palm Switch while actively moving in Lead Angle Compensation can leave the LoB and LoS misaligned without onscreen notification. The WS will take one or two seconds to realign LoB with LoS when depression of the Palm Switch is resumed. Do not fire the installed weapon while Lead Angle Compensation is realigning the LoB with the LoS.



**Figure 7. Lead Button.**



**Figure 8. Auto Lead Field.**

**LEAD ANGLE COMPENSATION – Cont****NOTE**

Use Lead Angle Compensation with care. The Lead Angle stays in effect until cancelled, and the absence of the LEAD ANGLE ON message does not mean that Line of Sight and Line of Bore are aligned. If Lead Angle Compensation is not cancelled, shots can hit 15 degrees away from the aimpoint even after CROWS has been powered off and restarted.

4. Hold the Palm Switch and press the LEAD button on the CG to stop Lead Angle Compensation. LEAD ANGLE disappears from the Auto Lead Field on screen. Cancel Lead Angle Compensation by pressing the Palm Switch with the CG in the neutral position.

**END OF TASK****END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
FIRE INSTALLED WEAPON**

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**THIS WORK PACKAGE COVERS:**

Firing the Installed Weapon.

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**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006  
WP 0007  
WP 0008  
WP 0009  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020  
WP 0022  
WP 0025  
WP 0026

**References - Cont**

WP 0029  
WP 0041

**Equipment Conditions**

CROWS Powered Up (WP 0006)  
Weapon Installed (M2-WP 0011,  
MK19-WP 0016, M240-WP 0020,  
M249-WP 0025)  
Installed Weapon Boresighted (WP 0029)  
Installed Weapon Loaded (M2-WP 0013,  
MK19-WP 0017, M240-WP 0022,  
M249-WP 0026)

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**FIRE THE INSTALLED WEAPON**

**WARNING**



**HEARING PROTECTION**

High noise levels from vehicle operation and/or weapon firing can cause damage to hearing. All on-vehicle personnel must wear serviceable CVC helmets or equivalent. Personnel within 115 feet (35 m) of vehicle during firing of the installed weapon must wear hearing protection.

**FIRE THE INSTALLED WEAPON - Cont****WARNINGS****WEAPON FIRE**

To prevent death or serious injury to personnel caused by discharge of weapon, ensure all firing range safety procedures are followed.

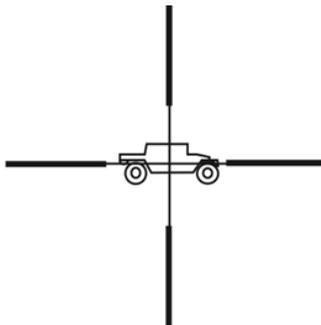
To prevent death or injury to personnel and damage to equipment, do not rely only on software to detect traverse and firing inhibit zones. Ensure activation of inhibit zones is visually verified and that personnel and equipment are clear before firing or traversing CROWS.

To prevent death or injury to personnel and damage to equipment, vehicle crew must report to Field Maintenance if SYSTEM ARMED LED remains illuminated when SYSTEM ARM/SAFE switch is set to SAFE.

**WARNING****HEAVY PARTS**

Before elevating, depressing, or traversing WS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS unexpectedly can injure personnel and damage equipment.

1. Engage the Palm Switch and lay the reticle on center of a target using the CG (Figure 1) (WP 0007).



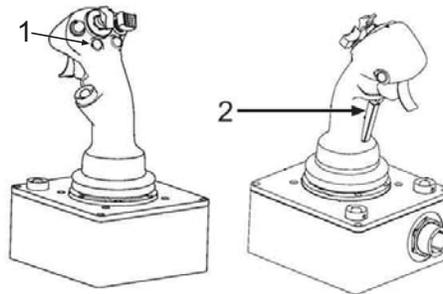
**Figure 1. Target.**

- Adjust the target image for clarity if necessary (WP 0008 or WP 0009).



Avoid prolonged use of LRF to reduce risk of detection by an enemy using Night Vision Goggles (NVGs). The infrared beam is more visible to an enemy using NVGs in smoke, fog, or rain.

- Hold the Palm Switch (2) and press the LRF button (1) (Figure 2) to fire the LRF and determine the range to the target (WP 0010).



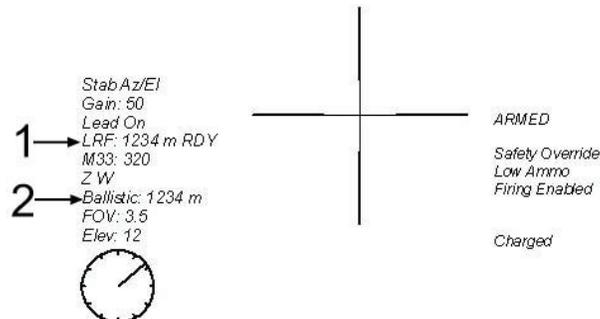
**Figure 2. LRF Button and Palm Switch.**

**NOTES**

A warning message displays in the Warning Field on screen if the Ballistic Range was exceeded.

If no range is measured, the Ballistic Range is unaffected.

- Observe that the range result displays in the LRF field (1) and Ballistic Range field (2) on screen (Figure 3).



**Figure 3. LRF and Ballistic Range Fields.**

**FIRE THE INSTALLED WEAPON - Cont**

- Verify that the measured range is within the maximum ballistic range of the installed weapon (Table 1).

**Table 1. Maximum Ballistic Range of Weapons.**

Weapon	Max Range (meters)
M2 .50 cal	4,900 (5,359 yards)
MK19 40mm	1,500 (1,640 yards)
M240B 7.62mm	3,000 (3,281 yards)
M249 5.56mm	2,500 (2,734 yards)

**WARNING**



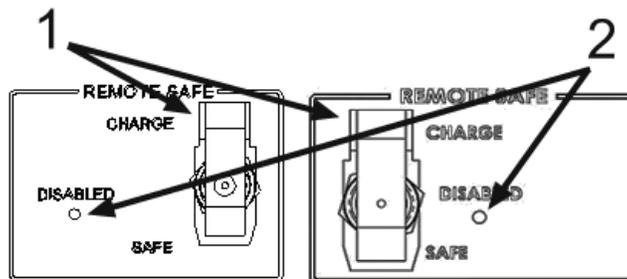
**WEAPON FIRE**

Ensure that the installed weapon is aimed in a safe direction where no personnel or equipment are in the Line of Fire. Doing so prevents death or injury to personnel and damage to equipment.

**NOTE**

If the Switch Guard is lowered, REMOTE SAFE and SYSTEM ARM/SAFE return to SAFE.

- Raise the REMOTE SAFE Switch Guard (1) on the DCP (left side of figure) or the FCU (right side of figure), and toggle REMOTE SAFE to CHARGE (Figure 4). The DISABLED LED (2) illuminates.



**Figure 4. REMOTE SAFE Fields.**

7. Raise the SYSTEM Switch Guard (1) on the DCP (left side of figure) or the FCU (right side of figure), and set the SYSTEM ARM/SAFE to ARM (Figure 5). The ARMED LED lights (2), and ARMED displays on screen unless the WS is aimed at a Safety Zone in which case Firing Inhibit displays.

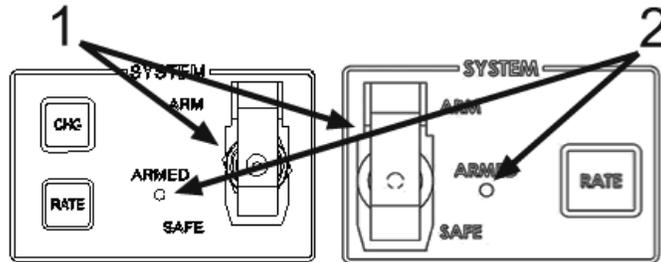


Figure 5. SYSTEM Fields.

#### NOTE

The SYSTEM ARMED LED will not illuminate and FIRING ENABLED will not be displayed until the Palm Switch on the CG is engaged and all firing conditions are met.

8. Alert the crew that the installed weapon is to be fired.
9. Hold the Palm Switch (2) on the CG (Figure 6). FIRING ENABLED displays on screen, and the SYSTEM ARMED LED illuminates.
10. While holding the Palm Switch (2), lift the Trigger Guard (1), and squeeze the Trigger on the CG.

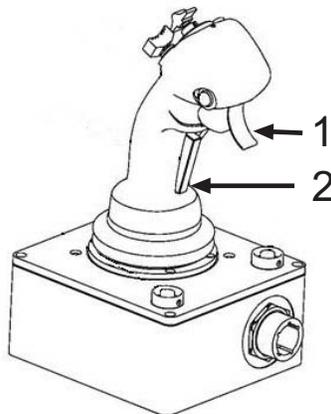


Figure 6. Control Grip, Trigger.

**FIRE THE INSTALLED WEAPON - Cont**

11. If the installed weapon stops firing or fails to fire, charge the installed weapon and fire again. If the weapon still fails to fire, consult the Troubleshooting Index (WP 0041) for required actions.

**NOTE**

The SYSTEM ARMED LED extinguishes once the Palm Switch is released.

12. After firing, close the REMOTE SAFE and SYSTEM Switch Guards.

**END OF TASK****END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
OPERATION UNDER UNUSUAL CONDITIONS**

---

**THIS WORK PACKAGE COVERS:**

Operating CROWS under unusual conditions.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
Operator and Assistant

**References**

TM 9-1005-213-10  
TM 9-1010-230-10  
TM 9-1005-313-10  
TM 9-1005-201-10  
WP 0006  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020

**References - Cont**

WP 0022  
WP 0025  
WP 0026  
WP 0037  
WP 0038  
WP 0040  
WP 0045  
WP 0046

**Equipment Conditions**

CROWS Powered Down (WP 0036)  
Engine Shut Down (Vehicle Operator  
Manual)

---

**OPERATION IN COLD WEATHER**

Operation in extreme cold weather can affect the FCU, DCP, MPU, and WS and requires extensive CROWS preparation. Generally, extreme cold will cause lubricants to thicken or congeal and insulation to crack which can cause electrical short circuits. Some materials become hard or brittle and may break easily. Snow or ice may form on latches, optical surfaces, locking brackets and arms, sliding surfaces, rotating mechanisms, etc. Ensure snow or ice does not obstruct system operation.

**NOTES**

The following procedures apply when CROWS is started up, powered down for more than 30 minutes, or left at idle (no servo axis operation) for more than 30 minutes at temperatures lower than 0 degrees F (-18 degrees C).

CROWS is not designed to be operated in temperatures below -50 degrees F (-46 degrees C).

**OPERATION IN COLD WEATHER - Cont**

**General Guidelines for Operation in Cold Weather**

All mechanical devices must be tested for proper operation, and a warm up procedure must be performed.

1. When the engine is off, CROWS can be operated manually to conserve battery power (see MANUAL OPERATION in this WP).
2. When CROWS is not in use, install the Protective Cover (WP 0038) to prevent build up of snow and ice.
3. When the installed weapon (M2, MK19, M240, or M249) is not in use, depress WS elevation to -20 degrees (maximum depression) to prevent ice build up in barrel.
4. Do not bend cables unnecessarily.

**CAUTION**

Do not rub or tap any ice from the glass surfaces of the optical sensors to avoid damage to the lens.

Table 1 summarizes CROWS operation considerations in extremely cold weather:

**Table 1. Care and Cleaning in Extremely Cold Weather.**

<b>Component</b>	<b>Instructions</b>
<b>Sights and LRF</b>	CROWS Sights and LRF surfaces must be checked if temperature drops below 32 degrees F (0 degrees C) and moisture freezes on the glass surfaces. Apply de-icer and wait until ice melts. When ice has melted, pat surface with a clean absorbent wiping cloth. Clean with a lens tissue when surface is dry. Avoid breathing on optical surfaces of sensors. Consult WP 0045 and WP 0046 for normal care and cleaning instructions.
<b>FCU, DCP, MPU, MFA, RSSA, and LSSA</b>	No special care or cleaning tasks are required. Consult WP 0045 and WP 0046 for normal care and cleaning instructions.

**END OF TASK**

## Preparation for Operation in Cold Weather

### NOTE

The FCU or DCP and MPU can be powered at temperatures lower than minimum operating temperature, but the display cannot function until internal temperature reaches -20 degrees F (-29 degrees C). At -40 degrees F (-40 degrees C), the waiting time is approximately 30 minutes.

1. Start the Host Vehicle if necessary and turn on the heater (Vehicle Operator Manual) to warm the vehicle.

### NOTE

CROWS should be powered off and the Azimuth and Elevation Release Mechanisms must be engaged to manually exercise the WS and prepare for operation in cold weather. Two people may be required to manually rotate the WS.

2. Grasp the buttstock of the installed weapon and rotate the WS a minimum of five complete rotations CW.
3. Rotate the WS at least five times CCW.
4. Manually elevate and depress the WS from -20 degrees to 60 degrees and from 60 degrees to -20 degrees at least ten times.

### CAUTION

To prevent damage to CROWS optics, move the Sight Servo Assembly by grasping the left and right sides of the Sight Bracket. Do not grab the VIM, TIM, or LRF.

5. Manually traverse and elevate/depress the Sight Servo Assembly (SSA) until the SSA moves smoothly to its mechanical limits.

## END OF TASK

### Starting CROWS in Cold Weather

1. Power up CROWS (WP 0006).
2. If the Startup/Status Screen fails to appear within 15 minutes, power CROWS off then on. If the Startup/Status Screen still fails to display, wait for the vehicle interior temperature to rise to the minimum display operating temperature (-20 degrees F or -29 degrees C) and repeat this step. If the Startup/Status Screen fails to appear after reaching the minimum display operating temperature, refer to Chapter 3, Troubleshooting Procedures.

**OPERATION IN COLD WEATHER – Cont****Starting CROWS in Cold Weather – Cont****WARNING****HEAVY PARTS**

Before elevating, depressing, or traversing WS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS may cause injury to personnel or damage to equipment.

**NOTE**

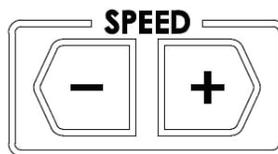
The SSA must move smoothly and without interruption to its mechanical extreme points in both axes.

3. After the Startup/Status Screen appears, press MENU SEL (DCP) or MENU SEL/ZERO (FCU) to observe the movement of the SSA during power-up calibration. If Sight Calibration does not complete successfully, repeat step 5, Preparation for Operation in Cold Weather.

**NOTE**

When CROWS is started, the WS operates at maximum speed, up to 100 degrees per second. The WS speed can then be adjusted down to the three remaining speed settings (50, 10, and two degrees per second).

4. Press the SPEED Minus (-) button (Figure 1) three times on the DCP or FCU to ensure the WS is set to the slowest speed.



**Figure 1. Speed Buttons.**

5. Use the CG to rotate the WS one complete rotation CW.
6. Press the SPEED Plus (+) button and repeat step 5 until the WS has been rotated once at each speed (2, 10, 50, and 100 degrees per second).
7. Rotate the WS CCW once at each available speed setting.

8. Use the CG to elevate the WS to the maximum and depress to the minimum once at each available speed setting.
9. CROWS is prepared for operation in cold weather when the WS moves smoothly and consistently at all speed settings. If the WS still fails to traverse smoothly, repeat this procedure beginning with step 4.

## **END OF TASK**

## **OPERATION IN DUSTY AND SANDY AREAS**

In climates where sand and dust can penetrate moving parts or coat the lenses of the optical devices, wipe moving parts and lenses clean at least once a day. Also, wipe any excess lubricants from exposed surfaces to prevent windblown sand from sticking and forming an abrasive. After leaving sandy terrain, clean (WP 0045) and lubricate (WP 0046) the specified parts. During sand or dust storms, protect the WS and the installed weapon with the CROWS Protective Cover (WP 0038) when possible, and install VIM, TIM, and LRF Lens Covers (WP 0037) when the optical devices are not in use. Perform a complete Startup Procedure (WP 0006), and test all mechanical devices for proper operation (WP 0040).

## **OPERATION IN HOT, HUMID, OR SALTY CONDITIONS**

Hot, humid, or salty atmospheric conditions require more frequent cleaning (WP 0045) and lubrication (WP 0046) of exposed metal surfaces. When CROWS is not in use, cover the exposed metal surfaces with a film of lubricating oil (WP 0046) and keep the CROWS Protective Cover (WP 0038) in place if possible.

## **OPERATION AFTER EXPOSURE TO WATER**

The seepage of water into lubricated parts can occur after prolonged exposure to rain. Drain, wipe dry, clean (WP 0045), and lubricate (WP 0046) the affected metal parts as soon as practical especially if CROWS is exposed to salt water.

## **OPERATION AFTER EXPOSURE TO NBC**

Following decontamination of the FCU or DCP and MPU using DS2 (decontamination following NBC exposure), CROWS will be functional, but there may be a small amount of decontamination spray inside the components. This is not critical for immediate operation but must be removed to prevent long-term adverse effects. After exposure to the decontamination spray, power up CROWS (WP 0006) as soon as possible. Keep CROWS powered on as long as possible to evaporate the spray, ideally for 72 hours. Driving the Host Vehicle while exercising the WS promotes drying.

## MANUAL OPERATION

### General

#### CAUTION

If the system is powered up and traversed manually, CROWS disables the servo system and remote firing. Ensure CROWS is powered off before attempting manual operation.

CROWS can be operated manually meaning that the installed weapon can be aimed, cocked, and fired by hand. This is done with power to CROWS switched off. A number of circumstances might require the installed weapon to be fired manually including failure of the Host Vehicle electrical system.

To fire the installed weapon manually, the following steps must be taken:

#### CAUTIONS

The Elevation Release Mechanism must be engaged in locked position during travel when power is off to prevent damage to equipment. Ensure the Elevation Release Mechanism is engaged after manual operation.

The Elevation Release Mechanism, Azimuth Lock, and Elevation Lock must be released in manual mode to prevent damage to equipment. Ensure that the WS is in proper azimuth alignment before powering CROWS up and returning to Normal Mode.

### Disengage the Elevation Release Mechanism

1. Push the spring-loaded Release Arm (2) completely down so the Lock Pin (1) can be easily pulled out to the right (Figure 2). Removing the Lock Pin frees the Release Arm for adjustment.
2. Pull the (swing) Release Arm up to the extreme position.

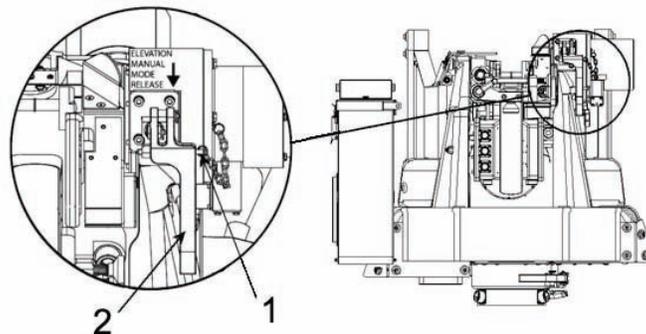
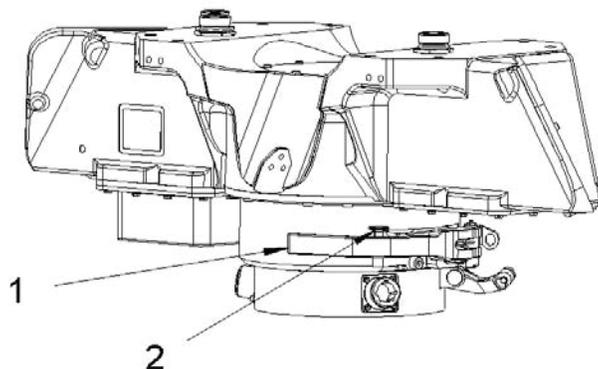


Figure 2. Disengage Elevation Release Mechanism.

### END OF TASK

**Unlock the Azimuth Release Mechanism**

1. Pull the Lock Pin (2) up against the protruding frame wall (Figure 3).
2. Push the Release Arm (1) completely in against the cylindrical frame wall.
3. Swing the Release Arm out.



**Figure 3. Unlock Azimuth Release Mechanism.**

**END OF TASK****Fire the Installed Weapon Manually**

To manually fire the installed weapon, refer to the appropriate manual:

- a. To manually fire the M2 .50 caliber machine gun, refer to TM 9-1005-213-10.
- b. To manually fire the MK19 40mm machine gun, refer to TM 9-1010-230-10.
- c. To manually fire the M240 7.62mm machine gun, refer to TM 9-1005-313-10.
- d. To manually fire the M249 5.56mm machine gun, refer to TM 9-1005-201-10.

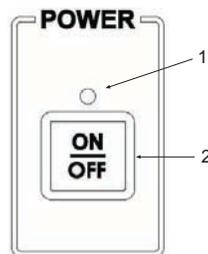
**END OF TASK**

**EMERGENCY POWER DOWN****WARNINGS****WEAPON FIRE**

Shut down CROWS prior to exit from vehicle to prevent injury to personnel and damage to equipment.

When CROWS is powered off, REMOTE SAFE deactivates. Check the condition of the installed weapon before powering off to prevent injury to personnel.

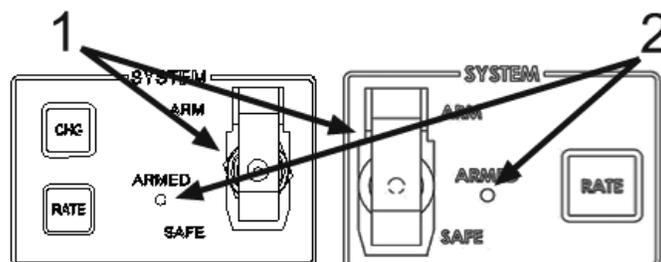
1. Press the POWER ON/OFF (2) button (Figure 4).
2. Ensure the POWER LED (1) extinguishes.



**Figure 4. Power Button.**

**END OF TASK****RUNAWAY GUN**

1. Ensure the installed weapon fires away from unintended targets.
2. Close the Protective Guard (1) to set the SYSTEM Switch to SAFE on the DCP (left side of figure) or FCU (right side of figure) (Figure 5). The ARMED LED (2) should not be illuminated.



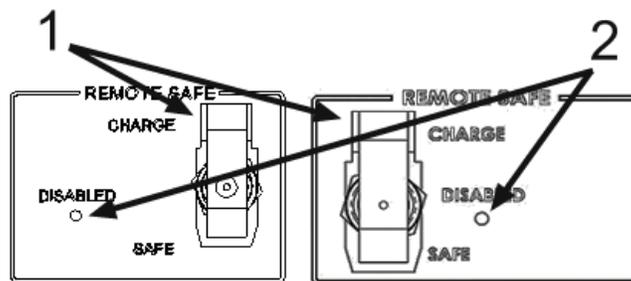
**Figure 5. SYSTEM Switches.**

**WARNINGS****WEAPON FIRE**

Do not power down system until firing has stopped and weapon has been cleared to prevent injury to personnel and damage to equipment.

Attempt to stop firing by activating REMOTE SAFE; however, REMOTE SAFE cannot always place the installed weapon in a safe position, and damage to equipment may result. Approach any weapon that has malfunctioned with extreme caution and ensure all personnel are under armor protection to prevent death or injury to personnel.

3. Close the Protective Guard (1) to set REMOTE SAFE to SAFE (Figure 6). The DISABLED LED (2) turns off, and the installed weapon should stop firing. If the installed weapon continues to fire, toggle the switch repeatedly to activate REMOTE SAFE.



**Figure 6. REMOTE SAFE.**

4. If the installed weapon continues to fire, deplete all Ammunition from the Ammunition Box while maintaining a safe aimpoint.
5. When firing has stopped, wait at least five minutes before exiting the Host Vehicle or other armored positions to guard against additional firing as a result of a "cookoff."
6. Clear the installed weapon as directed in the appropriate weapon manual (M2: TM 9-1005-213-10, MK19: TM 9-1010-230-10, M240: TM 9-1005-313-10, or M249: TM 9-1005-201-10).
7. Discontinue use of the weapon and system, and report the malfunction to Field Maintenance.

**END OF TASK**

**DEACTIVATE REMOTE SAFE MANUALLY**

1. Push the Cocking Actuator forward.
2. If this fails, power down the system (WP 0036) and repeat step 1.
3. If the installed weapon is an M2, charge the weapon manually (TM 9-1005-213-10).
4. Start the system up (WP 0006). If the problem persists, repeat steps 1-3.

**END OF TASK****END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

**Shutdown**

---

**THIS WORK PACKAGE COVERS:**

Shutdown of CROWS.

---

**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
WP 0006  
WP 0014  
WP 0015  
WP 0018  
WP 0019  
WP 0023  
WP 0024

**References - Cont**

WP 0027  
WP 0028  
WP 0037

**Equipment Conditions**

Engine Shut Down (Vehicle Operator  
Manual)  
CROWS Powered Up (WP 0006)

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**POWER DOWN**

**WARNINGS**



**WEAPON FIRE**

Shut down CROWS prior to exit from vehicle to prevent injury to personnel and damage to equipment.

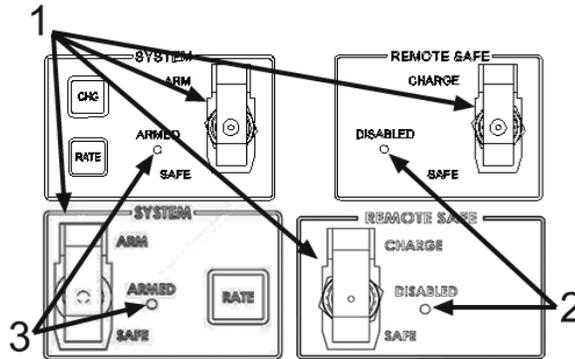
When CROWS is powered off, REMOTE SAFE deactivates. Check the condition of the installed weapon before powering off to prevent injury to personnel.

**NOTE**

If the DISABLED LED is lit when REMOTE SAFE is set to SAFE, toggle REMOTE SAFE to CHARGE and back to SAFE to enable REMOTE SAFE.

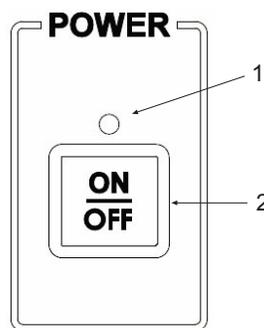
**POWER DOWN - Cont**

1. Verify that the SYSTEM and REMOTE SAFE Switch Guards (1) are down on the DCP (top of figure) or the FCU (bottom of figure) (Figure 1). The DISABLED LED (2) and the ARMED LED (3) should not be lit.



**Figure 1. SYSTEM ARM/SAFE and REMOTE CHARGE/SAFE.**

2. Unload the installed weapon, M2 (WP 0014), MK19 (WP 0018), M240 (WP 0023), or M249 (WP 0027), if necessary.
3. Remove the installed weapon, M2 (WP 0015), MK19 (WP 0019), M240 (WP 0024), or M249 (WP 0028), if necessary.
4. Traverse the WS to the 12 o'clock position (zero degrees azimuth so that the WS faces the front of the Host Vehicle or other platform and so that the Azimuth Traverse Lock is aligned but not engaged).
5. Press the POWER ON/OFF button (2) on the FCU/DCP (Figure 2) and verify that the POWER LED (1) extinguishes.



**Figure 2. POWER Field.**

6. If CROWS will be shipped or stored, perform the Preparation for Transportation or Storage Procedure (WP 0037).

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
PREPARATION FOR TRANSPORTATION OR STORAGE**

---

**THIS WORK PACKAGE COVERS:**

Preparation of CROWS for transportation or storage.

---

**INITIAL SETUP:**

**Personnel Required:** Two

**Equipment Conditions**

CROWS Powered Down (WP 0036)

Engine Shut Down (Vehicle operator manual)

Casing Collector Bags Removed (WP 0047)

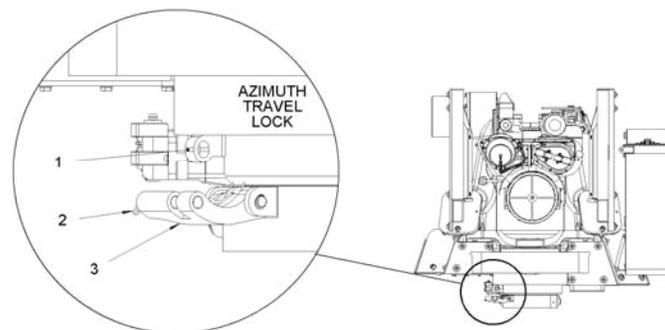
**References**

Vehicle Operator Manual  
WP 0036  
WP 0038  
WP 0047

---

**PREPARATION OF CROWS FOR TRANSPORTATION OR STORAGE**

1. Engage the AZIMUTH TRAVEL LOCK (Figure 1).
  - a. Rotate the WS to the 12 o'clock position (zero degrees azimuth so that the WS faces the front of the Host Vehicle or other platform) if necessary.
  - b. Pull out the spring-loaded Locking Pin (2) from the Locking Arm (3).
  - c. Lift the Locking Arm (3) up and onto the Locking Bracket (1).
  - d. Insert the spring-loaded Locking Pin (2).



**Figure 1. Azimuth Travel Lock.**

**PREPARATION OF CROWS FOR TRANSPORTATION OR STORAGE - Cont****NOTE**

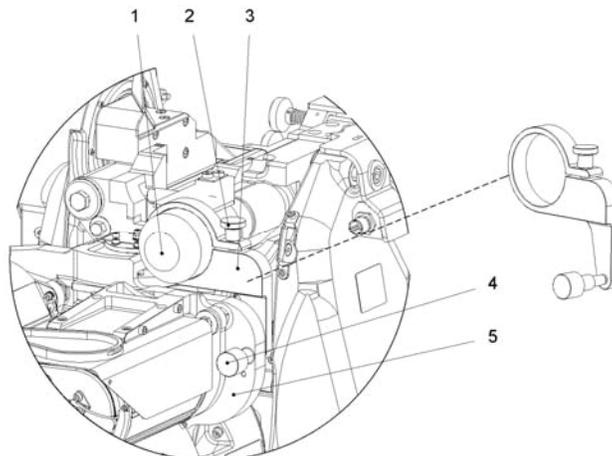
The Clamp Assembly is stored in the Storage Bag.

2. Slip the Clamp Assembly around the Cocking Actuator (1) aligning the threaded hole for the Clamp Assembly Screw (Figure 2).

**CAUTION**

To secure the Clamp Assembly, the SSA must be raised by the Sight Assembly Bracket to align the threaded hole and Clamp Assembly Screw. Do not lift the SSA by the Optical Devices (VIM, TIM, or LRF) or Sight Calibration can be affected. CROWS Sights must be calibrated by Maintenance Personnel only.

3. Tighten the Clamp Assembly Screw (4) by hand to secure the Clamp to the Sight Assembly Bracket (5).
4. Tighten the Thumb Screw (2) by hand to secure the Clamp to the Cocking Actuator (1).



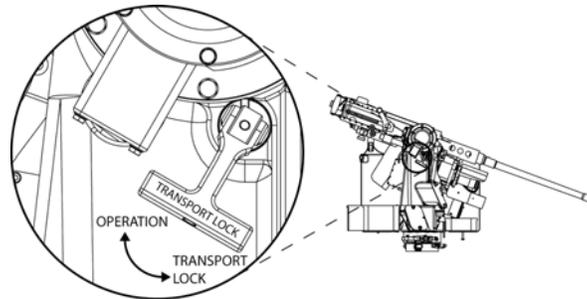
**Figure 2. Clamp Assembly.**

**NOTE**

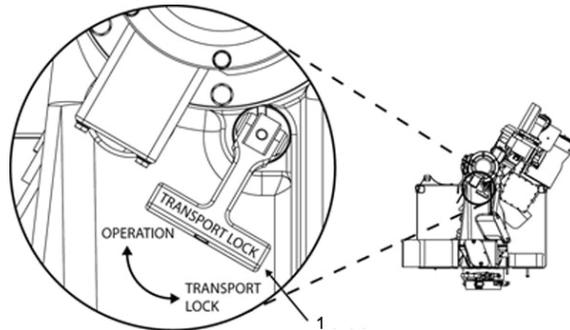
The Elevation Mechanism can be locked in two positions, -20 degrees for transportation and 60 degrees for maintenance.

5. Manually depress or elevate the WS for transportation (Figure 3) or maintenance (Figure 4).
  - a. Pull T-handle (1) up and out before turning 180 degrees in either direction until the TRANSPORT side of the handle shows.

- b. Move the Soft Mount by hand to the minimum or maximum elevation as required (-20 degrees or 60 degrees). A click sound indicates that the Soft Mount locked into position.
- c. Push the T-handle (1) back in against the side support with the TRANSPORT side of the handle showing.



**Figure 3. Elevation Lock, Minimum Elevation.**



**Figure 4. Elevation Lock, Maximum Elevation.**

6. Install the Lens Caps (Figure 5).
  - a. The VIM Lens Cap (8) unscrews from the storage position on the right side of the LRF Protective Cover (4). Turn the Cover CW to thread over the VIM lens.

#### **NOTE**

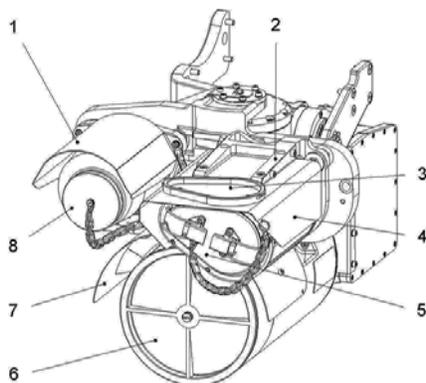
When the Host Vehicle or other platform is moving, the TIM Lens Cover can vibrate loose from the Ammunition Box Storage Ring. To prevent the loss of the Cover, store the TIM Lens Cover in the CROWS Toolbag.

- b. The TIM Lens Cap (6) unscrews from the storage position on the outside of the Ammunition Box and threads inside the TIM lens.

**PREPARATION OF CROWS FOR TRANSPORTATION OR STORAGE - Cont****NOTE**

To prevent the LRF Lens Cap Chain from hanging in front of the LRF during operation, loop the chain under the LRF Lens Cap Clip when the Cover is in storage position.

- c. The LRF Lens Cap (5) unclips from the top of the LRF Lens Cover Bracket (3) and clips onto the LRF.



**Figure 5. Lens Covers.**

7. Install the CROWS Protective Cover (WP 0038).

**END OF TASK**

**END OF WORK PACKAGE**

---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALLATION AND REMOVAL OF COVER**

---

**THIS WORK PACKAGE COVERS:**

Installation and Removal of CROWS Protective Cover.

---

**INITIAL SETUP:**

**Personnel Required:** Two

**Equipment Conditions**

CROWS Prepared for Transport or  
Storage (WP 0037)

**References**

WP 0037

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**INSTALLATION OF THE CROWS PROTECTIVE COVER**

**CAUTION**

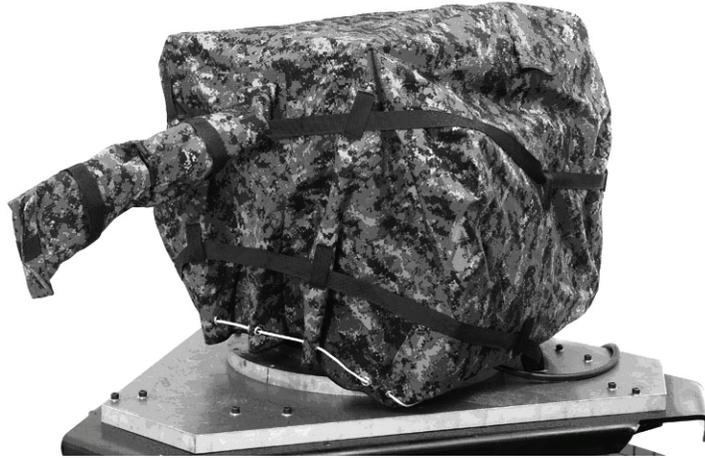
Do not install the CROWS Protective Cover when the weapon barrel is hot to prevent damage to equipment.

1. Fold the Protective Cover out.
2. Draw the barrel section of the cover over the barrel.
3. Fold the rest of the cover around the WS.
4. Draw the cord around the base of the WS and secure the cover properly with a half hitch knot. Place the remaining rope in the storage pocket of the Protective Cover.
5. Draw the Barrel Straps over and around the barrel, fasten them through the eyelets, and draw the Straps tight using the cinching mechanism.

**END OF TASK**

**REMOVAL OF CROWS PROTECTIVE COVER****NOTE**

Figure 1 depicts the CROWS cover properly installed.



**Figure 1. Protective Cover.**

1. Remove the Straps over and around the Barrel. The Straps are fastened through the eyelets.
2. Remove the Cord around the base of the WS.
3. Loosen the Straps at the top of the Cover and Barrel.
4. Remove the Protective Cover from the system and stow in the Host Platform.

**END OF TASK**

**END OF WORK PACKAGE**

## **CHAPTER 3**

# **TROUBLESHOOTING PROCEDURES**



---

**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
TROUBLESHOOTING INTRODUCTION**

---

## **GENERAL**

The Troubleshooting Index (WP 0041) is a quick reference for identifying and resolving common system malfunctions. Associated with each Fault is an Action and a Remedy. The Fault describes the system problem, the action recommends steps to diagnose the Fault, and the Remedy prescribes the solution. Should a Fault require more than one troubleshooting Action to arrive at the most likely Remedy, the Actions and Remedies are listed in order of probability.

This manual cannot list all of the malfunctions that may occur, all of the test and inspections required to locate faults, or all of the corrective actions needed to correct the fault. If the equipment malfunction is not listed or the actions listed do not correct the fault, notify Field Maintenance. You may also contact a Logistics Assistance Representative (LAR) for additional help. Disassemble only to the extent necessary to accomplish the required repair.

You are required to complete a DA Form 2028 to report the problem. Submit your form using a method described at the back of this manual. Faults found in this chapter are repairable at the field level and may be corrected by crew or maintenance personnel.

This manual provides many tools to aid the technician in isolating and correcting the faults encountered. Understanding the Theory of Operation, WP 0003, will enhance the troubleshooting process.

## **TROUBLESHOOTING INDEX**

The troubleshooting work packages contain charts listing the malfunctions, tests, inspections, and corrective actions required to return CROWS to normal operation. The most common malfunctions are listed. Perform the actions, remedies, and corrective actions in the order they appear.

Troubleshooting instructions are provided as an aid in isolating and correcting malfunctions that may be encountered during the operation of CROWS. The more common and/or representative faults are covered by similar methods of trouble analysis, and remedial action should be used to correct any specific faults not discussed.

## **TROUBLESHOOTING PROCEDURES**

These Troubleshooting Procedures (WP 0040) consist of functional checks/tests. These tests may be performed individually to check specific functions or may be run consecutively to provide a complete assembly test.

## **TROUBLESHOOTING TIPS**

Troubleshooting Procedures in this chapter are presented as a guide for locating and correcting malfunctions. Use of these Troubleshooting Procedures reduces delays and maintenance downtime and minimizes the unnecessary replacement of components. After recognizing a problem, locate the proper maintenance procedure to correct the deficiency.

### **CAUTION**

Before disconnecting and removing Line Replaceable Units (LRUs) and cables, ensure electrical power is OFF.

When a problem cannot be identified to a single section of the equipment by analyzing the trouble symptoms as in the above paragraph, the "half-splitting" technique may be used. Half-splitting is a logical method by which a piece of equipment, a single circuit, or even an entire system is repeatedly divided in half until the problem is isolated. By half-splitting, the number of measurements needed to isolate the faulty stage or component is reduced considerably.

Visually check cabling for damage and perform continuity checks (disconnect common plugends and test for continuity) before replacing a suspected faulty LRU.

## **TROUBLESHOOTING REMINDERS**

Read and use the Theory of Operation in WP 0003. The Theory of Operation enhances the troubleshooting process. Identification of the fault system is the important part of the troubleshooting process. One of the most precise ways to identify the fault symptoms is to perform a systems operational check. It is important that fault symptoms be identified as accurately as possible. Take the time to stop and think about the symptoms. The few moments spent can save hours later. Do not immediately start changing components. Check for simple things first. Make sure switches are in the correct positions. Check for tripped circuit breakers. Be thorough! Look for broken and loose wires, bad splices (wiggle them if necessary), and loose connector pins. Sometimes connector pins seem OK when making continuity checks; but, because they are not seated properly, they get pushed back when the connector is put in place.

**TROUBLESHOOTING PROCEDURES****DON'T START A TASK UNTIL:**

You understand the task.

You understand what you are to do.

You understand what is needed to do the work.

You have the things you need.

During troubleshooting, all faults should be recorded on the appropriate form in accordance with DA PAM 738-751 before making any attempts at repair. Next, all corrective actions or attempts should be recorded. This provides continuity and eliminates unnecessary duplication in the event of a change in technicians.

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
TROUBLESHOOTING PROCEDURES**

---

**THIS WORK PACKAGE COVERS:**

General Troubleshooting Procedures and Location of Faults.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
Operator and Assistant

**References**

Vehicle Operator Manual  
WP 0006  
WP 0007  
WP 0008  
WP 0009  
WP 0010  
WP 0011  
WP 0015  
WP 0016

**References - Cont**

WP 0019  
WP 0020  
WP 0024  
WP 0025  
WP 0028  
WP 0032  
WP 0033  
WP 0036

**Equipment Conditions**

Engine Running (Vehicle Operator  
Manual)

---

**FUNCTIONAL TESTS**

**WARNING**



**HEAVY PARTS**

Before elevating, depressing, or traversing CROWS, verbally warn personnel to evacuate WS platform and ensure area is clear. Moving CROWS can cause injury to personnel and damage to equipment.

**FUNCTIONAL TESTS - Cont****Verify CROWS Powers Up****WARNINGS****WEAPON FIRE**

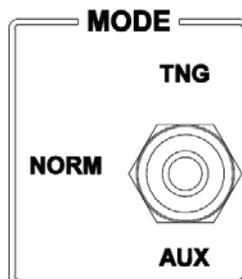
Prior to performing troubleshooting, maintenance, or embedded training procedures, ensure that the installed weapon is not loaded. Failure to do so may result in death or injury to personnel.

If a message is displayed on screen in red text, a system failure has occurred, and CROWS can no longer function properly under remote control. Manually operate CROWS to finish engagement before attempting to resolve this failure condition. Failure to do so may result in death or injury to personnel and/or damage to equipment.

**NOTE**

A fully charged AUX battery is required for CROWS to perform at full capacity.

1. When the mission permits, move the Host Platform to a safe place.
2. Ensure CROWS is powered down (WP 0036).
3. Check for all obstructions that may limit the operation of CROWS.
4. Ensure the Host Vehicle engine is running.
5. Verify that the AUX Battery Voltmeter indicates between 22 and 33 Vdc (Vehicle Operator Manual) if available.
6. Verify that the Host Vehicle Circuit Breaker for CROWS power is closed or reset if required (Vehicle Operator Manual).
7. On the DCP or FCU, ensure that the MODE Switch is set to NORM (Figure 1).



**Figure 1. Mode Switch.**

8. Press the POWER ON/OFF button (2) (Figure 2). Verify that CROWS powers up (WP 0006). The POWER LED (1) lights as CROWS powers up. If CROWS powers up, proceed to the next functional test procedure. If CROWS fails to power up, repeat this procedure. Alert Field Maintenance Personnel when CROWS continually fails to start up.

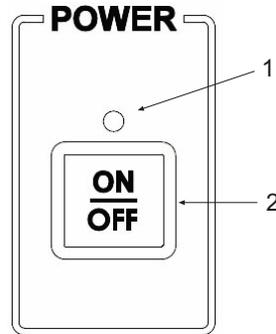


Figure 2. Power Switch.

## END OF TASK

### Verify Proper Functioning of CROWS

#### NOTE

On the FCU/DCP, the MODE Switch is toggled to select Training (TNG), Normal (NORM), or Auxiliary (AUX) modes of operation. During normal operation of CROWS, the MODE switch is set to NORM. When the MODE Switch is set to TNG, a message is displayed in the status field and a warning is also displayed on screen. When the MODE switch is set to AUX, the display will show AUX VIDEO in the status field.

1. Toggle the MODE Switch on the FCU or DCP to TNG, then to AUX, and back to NORM ensuring the FCU or DCP displays the changes as switch is toggled.
2. Press and hold the LAMP TEST button. Ensure all FCU/DCP LEDs illuminate when the Lamp Test is performed (Figure 3).

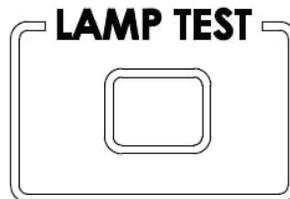
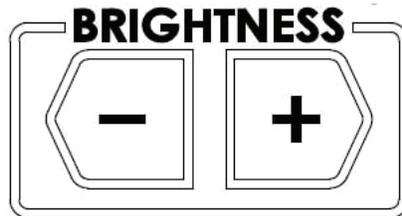


Figure 3. Lamp Test Button.

**FUNCTIONAL TESTS - Cont**

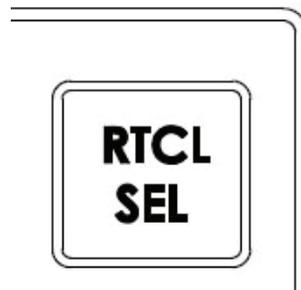
**Verify Proper Functioning of CROWS - Cont**

3. Press the BRIGHTNESS +/- buttons to ensure the brightness controls are functioning properly (Figure 4).



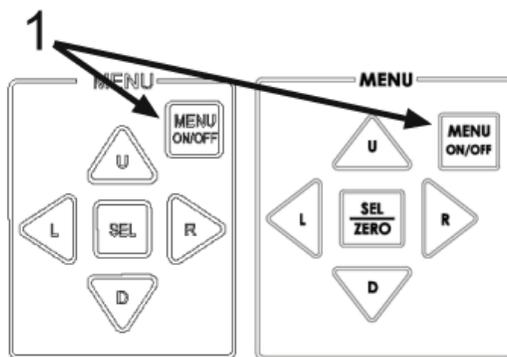
**Figure 4. Brightness Buttons.**

4. Press the SIGHT RTCL SEL button. Ensure each of the five reticle types are visible on screen (Figure 5).



**Figure 5. Reticle Select Button.**

5. Press the MENU ON/OFF button (1) on the DCP (left side of figure) or FCU (right side of figure) (Figure 6).



**Figure 6. Menu Fields.**

6. Ensure all screen elements (the reticle and clock face) and display menus (MAIN, STATUS and MESSAGE) are visible on screen (Figure 7).

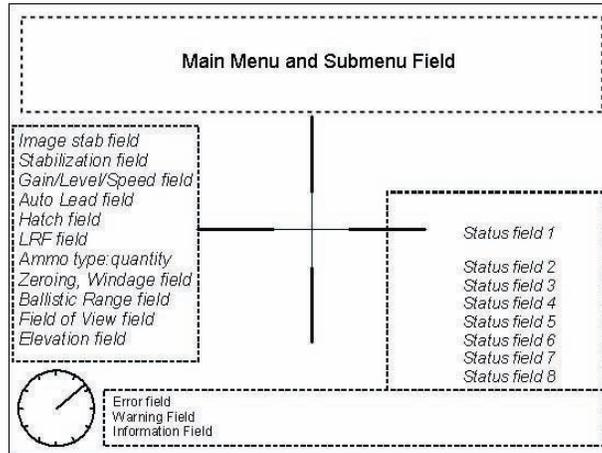


Figure 7. Display Menu.

7. If CROWS meets all functional requirements, proceed to next functional test procedure. If CROWS fails to meet any functional requirement, alert Field Maintenance Personnel.

**END OF TASK**

**Verify Proper Functioning of Traverse and Elevation Controls**

1. Press the RANGE and SPEED buttons on FCU/DCP to verify proper operation (Figure 8).

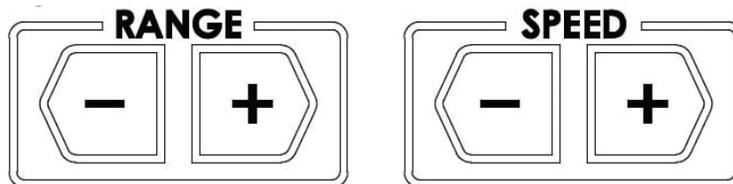


Figure 8. Range and Speed Buttons.

2. Traverse and elevate CROWS (WP 0007).
3. If traverse and elevation controls function properly, proceed to the next functional test. If CROWS fails to meet any functional requirement, alert Field Maintenance Personnel.

**END OF TASK**

**Ensure VIM, TIM, and LRF Work Properly**

**NOTE**

When CROWS starts up, the VIM is the default optical device.

1. Perform an operational check of the VIM, ensuring all functions are working properly (WP 0008).

**FUNCTIONAL TESTS - Cont****Ensure VIM, TIM, and LRF Work Properly - Cont**

2. Press SIGHT DAY/NIGHT button on the FCU/DCP to select the TIM (Figure 9).

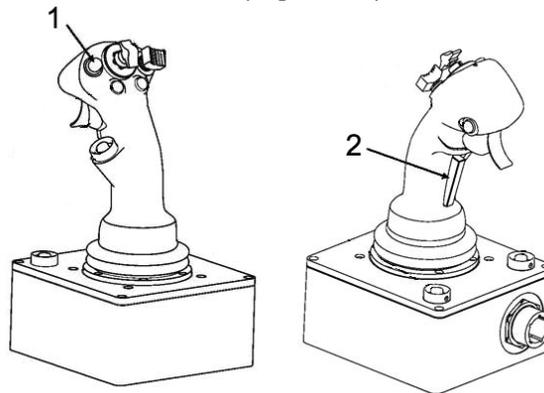


**Figure 9. Day/Night Button.**

**NOTE**

The TIM has four fields of view (FOVs).

3. While holding the Palm Switch (2), press the DAY/NIGHT button (1) on the CG twice to ensure the VIM and TIM can be selected (Figure 10).



**Figure 10. Day/Night Button on CG.**

4. Perform an operational check of the TIM, ensuring all functions are working properly (WP 0009).

**WARNING****LASER LIGHT**

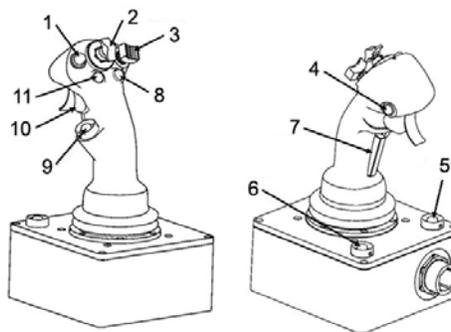
The LRF is classified as a Class 1 Laser and is safe in normal operations and conditions, but failure in the electrical system can cause the laser to violate safety requirements. Do not point at humans or stare into the laser beam as this can cause serious eye injury.

5. Perform an operational check of the LRF, ensuring all functions are working properly (WP 0010).
6. If the VIM, TIM, and LRF function properly, proceed to the next functional test. If the optical devices fail any functional requirement, alert Field Maintenance Personnel.

## END OF TASK

### Test Control Grip (CG)

1. Toggle and press the MAG button (2) to ensure full functionality (Figure 11). Refer to WP 007 and WP 008 if necessary.
2. Move the FOCUS button (3) left and right to ensure full functionality.
3. Engage/disengage the Palm Switch (7) to ensure full functionality.
4. Engage the Trigger Switch (10) to ensure full functionality.
5. Engage the DAY/NT (1) button to ensure full functionality.
6. Engage the LRF button (11) to ensure full functionality. Refer to WP 010 if necessary.
7. Engage the TRACK button (8) to ensure full functionality. Refer to WP 032 if necessary.
8. Engage the CHG button (9) to ensure full functionality. Ensure REMOTE SAFE is in the Charge position.
9. Engage the STAB button (5) to ensure full functionality.
10. Engage the LEAD button (4) to ensure full functionality. Refer to WP 033 if necessary.



**Figure 11. Test the CG.**

11. Traverse and elevate CROWS using the CG (WP 0007).
12. If the CG functions properly, proceed to the next functional test. If the CG fails any functional requirements, alert Field Maintenance Personnel.

## END OF TASK

**FUNCTIONAL TESTS - Cont****Test LOW AMMO Indicator, Sensor, and Actuator Plate****NOTE**

The Low Ammunition Actuator Plate inside the Ammunition Box indicates LOW AMMO status when approximately 12 to 15 rounds of .50 caliber ammunition are left in the Ammunition Box at 0 degrees elevation. A LOW AMMO condition is also indicated on screen when the Ammunition Box is empty.

1. With the Ammunition Box empty and a LOW AMMO condition displayed on screen, press down on the Ammunition Actuator Plate inside the Ammunition Box.
2. Verify that the display no longer indicates a LOW AMMO condition.
3. Release the Low Ammo Actuator Plate.
4. Verify that the LOW AMMO condition is again indicated on screen.
5. If the Ammunition Indicator, Sensor, and Actuator Plate function properly, proceed to the next functional test. If CROWS fails this functional requirement, alert Field Maintenance Personnel.

**END OF TASK****Test Soft Mount and Cocking Actuator****WARNING**

Ensure that the installed weapon is aimed in a safe direction and that no personnel or equipment are in the Line of Fire. Doing so prevents death or injury to personnel and damage to equipment.

1. Install a compatible weapon if necessary (M2 .50 Caliber Machine Gun (WP 0011), MK19 40mm Machine Gun (WP 0016), M240 7.62mm Machine Gun (WP 0020), or M249 5.56mm Machine Gun (WP 0025)).
2. Ensure CROWS is positioned at 0 degrees elevation.
3. Pull backward on the weapon handles and release the weapon.
4. Verify Soft Mount slides freely and the Friction Brakes stop the forward movement of the installed weapon upon release.
5. While holding the Palm switch, press the CHG button on the CG to check the Cocking Actuator electrical action.

**FUNCTIONAL TESTS - Cont****Test Soft Mount and Cocking Actuator - Cont**

6. Remove the installed weapon (M2 .50 Caliber Machine Gun (WP 0015), MK19 40mm Machine Gun (WP 0019), M240 7.62mm Machine Gun (WP 0024), or M249 5.56mm Machine Gun (WP 0028)) if not needed.
7. If the Soft Mount and Cocking Actuator function properly, proceed to the end of the tests. If CROWS fails this functional requirement, alert Field Maintenance Personnel.

**END OF TASK****End of Tests**

1. Power down CROWS (WP 0036).
2. Perform engine shutdown (Vehicle Operator Manual).
3. If CROWS failed any functional tests, notify Field Maintenance Personnel. If CROWS meets all functional requirements, resume operations.

**END OF TASK****END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
TROUBLESHOOTING INDEX**

---

**THIS WORK PACKAGE COVERS:**

General Troubleshooting Index.

---

**INITIAL SETUP:**

**Personnel Required:** Two  
Operator and Assistant

**Equipment Conditions**  
Engine Running (Vehicle Operator Manual)

**References**

Vehicle Operator Manual

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**GENERAL TROUBLESHOOTING**

When CROWS malfunctions, the fault can usually be limited by proper action and handling. Troubleshooting tables indicate general measures that must be taken to locate and identify the problem.

The following text appears within the MESSAGE MENU at the bottom of the screen during CROWS operation (Table 1):

**Table 1, Message Menu Text**

<b>Text</b>	<b>Reason</b>	<b>Action</b>
Red text in ERROR field on screen.	Fatal error on displayed component.	Use of CROWS is prohibited. Report to Field Maintenance.
Yellow text in WARNING field on screen.	Warning caused by a non-fatal error.	To be corrected as soon as tactical situation permits.
Green text in INFORMATION field on screen.	Information message.	None.

**GENERAL TROUBLESHOOTING - Cont**

Common system malfunctions can be diagnosed and remedied with the following table (Table 2).

**Table 2, General Troubleshooting**

<b>Fault</b>	<b>Action</b>	<b>Remedy</b>
No power when power button is pressed.	Check vehicle power and power cable to 1J3 connector on FCU or MPU.	Connect cable or, if faulty, replace.
Weapon fails to charge (cock).	Check CA cable (W4) connection between CA and 4J3 on SSA. If the CA cocks, check the release function of Cocking Brackets. Footscrew release device damaged due to increased cocking length. Cocking Bracket Releaser out of adjustment due to loose lock nut.	Connect cable or, if faulty, replace CA.  If faulty, adjust Cocking Bracket Releaser.  Replace the footscrew release device.  Adjust Cocking Bracket Releaser.
Erratic firing.	Check if Friction Brake is loose.	Adjust Friction Brake if loose.
Azimuth Release Mechanism does not work when engaged.	Check function of the release mechanism. Internal clutch/gear system might be disabled.	Check and engage internal clutch/gear system. Replace the Azimuth Release Mechanism if faulty.
Installed weapon moves up during firing.	Check if Elevation Release Mechanism is engaged.	Engage Elevation Release Mechanism if not engaged.
Elevation Release Mechanism does not work when engaged.	Check function of Elevation Release Mechanism. Internal clutch/gear system might be disabled.	Check and engage internal clutch/gear system. Replace the Elevation Release Mechanism if faulty.
Azimuth movement is sluggish.	Manually check movement of MFA. Verify that Azimuth Release Mechanism is released. Verify that Azimuth Servo is enabled.	Release Azimuth Release Mechanism and enable Azimuth Servo.

Fault	Action	Remedy
Installed weapon fails to fire (initial burst).	Check display for text messages.	Ensure MODE switch is set to NORM.
		Ensure ARM/SAFE switch is set to ARM.
		Ensure Palm Switch is pressed and Firing Enabled appears on screen.
		Step through Boresighting on SETTING Menu if boresight values are rejected.
	Check Ammo Box.	If empty, load Ammo Box.
	Check weapon.	Check Firing Solenoid Cable (W7) to ensure it is properly connected to Connector 4J2 of SSA.
		Attempt to fire manually.
	Unload weapon.	Re-time (adjust) weapon and M2 Firing Solenoid.
Installed weapon fails to fire (ARMED LED OFF).	Check System Armed Switch.	Set ARM/SAFE switch to ARM.
		ARMED LED illuminates only when ARM/SAFE Switch is set to ARM and Palm Switch is pressed.

**GENERAL TROUBLESHOOTING - Cont**

<b>Fault</b>	<b>Action</b>	<b>Remedy</b>
Installed weapon fails to fire (ARMED LED ON).	Check display for text messages:	Set SAFE/ARM switch to ARM.
		If ARMED LED is lit even when ARM/SAFE toggle switch is set to SAFE, Firing Circuit may be activated due to a malfunction. The system is unsafe and use of CROWS is prohibited.
		ARMED
		Check HATCH LED for Hatch Open. Close hatch or activate SAFETY OVERRIDE switch. Ensure OVRD LED is lit.
		If SAFETY OVERRIDE is set to ON, all firing and WS movement restrictions are removed.
		Press Palm Switch. Text should change to Firing Enabled.
		Charge installed weapon.
	LOW AMMO	Load ammunition.
	TRAVERSE INHIBIT	Activate SAFETY OVERRIDE switch. Check OVRD LED is lit.
		If SAFETY OVERRIDE is set to ON, all firing and WS movement restrictions are removed.
		Traverse out of Safety Zone.
Weapon fails to fire (TRAVERSE INHIBIT).	Hatch LED ON	Close hatch or select SAFETY OVERRIDE. Ensure OVRD LED is illuminated.
		If SAFETY OVERRIDE is set to ON, all firing and WS movement restrictions are removed.
		Traverse out of Safety Zone.

<b>Fault</b>	<b>Action</b>	<b>Remedy</b>
Installed weapon fails to fire (FIRING INHIBIT).	Traverse out of Safety Zone	Select SAFETY OVERRIDE. Ensure OVRD LED is lit.  If SAFETY OVERRIDE is set to ON, all firing and WS movement restrictions are removed.  Traverse out of Safety Zone.
WS will not traverse.	Check display for text messages.	Ensure travel/transport lock is disengaged.  Press Palm Switch.  Azimuth Servo Drive Mechanism might be faulty. Report to next higher maintenance level.
WS will not elevate/depress.	Check display for text messages.	Check elevation is not at maximum or minimum elevation angle.  Verify that manual Elevation Transport Lock is disengaged.  Check to ensure installed weapon is not in an Elevation Depression Zone.
LRF fails to fire.	Check display for text messages.	Confirm laser ready to fire (---m RDY) or LRF: Wait.
LRF fires but no range displayed.	Check display for text messages.	Check text for No Target. Laser was fired, but no return was received.  Replace LRF if faulty.
Ballistic and LRF range do not match.	Check display for text messages.	Laser has exceeded maximum range. LRF displays distance to target but no ballistic solution can be calculated.
ARMED LED is lit even if toggle switch is set to SAFE position.	Use of CROWS is prohibited as system is unsafe.	Firing Circuit is activated due to a malfunction. Report to Field Maintenance.

**GENERAL TROUBLESHOOTING - Cont**

<b>Fault</b>	<b>Action</b>	<b>Remedy</b>
OVRD LED on the SAFETY OVERRIDE function is lit when toggle switch is to OFF.	Use of CROWS is prohibited as system is unsafe.	Firing Circuit is activated due to a malfunction. Report to Field Maintenance.
Elevation of Soft Mount stops at approximately 50 degrees.	Remote operation prohibited. Manual operation only.	Faulty Elevation Servo Motor. Report to next highest maintenance level.
Soft Mount depresses so far down that it hits SSA.	Remote operation prohibited. Manual operation only.	Faulty Elevation Servo Motor. Report to next highest maintenance level.
LOW AMMO signal not displayed on screen when Ammo Activation Plate is in upper position.	Check LRF and Low Ammo Sensor cable connections to Connector 4J7 on SSA. Check Low Ammo Sensor.	Replace cable or Low Ammo Sensor if faulty.
LOW AMMO signal remains on screen when Ammo Activation Plate is in lower position.	Check ammunition load. Check LRF and Low Ammo Sensor cable connections to Connector 4J7 on the SSA. Check Low Ammo Sensor.	Reload ammunition. Replace cable or Low Ammo Sensor if faulty.

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
BUILT-IN TESTS (BIT)**

---

**THIS WORK PACKAGE COVERS:**

CROWS Built-in Tests.

---

**INITIAL SETUP:****Personnel Required:** Two**Equipment Conditions**

Engine Running (Vehicle Operator Manual)  
CROWS Powered Up (WP 0006)

**References**

Vehicle Operator Manual  
WP 0006  
WP 0029

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**GENERAL INFORMATION**

The FCS BIT reports CROWS failures by dedicated error codes. Common Information Text accompanies the error codes to explain the failure; however, the same Common Information Text can apply to more than one Error Code. The cause of a BIT error can be an operating error or a technical failure.

Currently, there are two types of BIT messages displayed by CROWS: the Startup BIT and the Continuous BIT. The Startup BIT runs when CROWS is powered up, and the Continuous BIT is processed continuously in real time to provide system status and report faults detected during operation. The Startup BIT errors display on the Startup/Status Screen while the Continuous BIT messages appear as "Fatal/Error/Information" text. The BIT error messages display as one of three severity levels (Table 1).

**CAUTION**

A red BIT error message halts operation of CROWS. Do not attempt to continue CROWS operation or equipment damage can result. Notify Maintenance Personnel immediately.

**Table 1. BIT Severity Levels.**

<b>Severity</b>	<b>Description</b>	<b>Text Color</b>
Fatal	Safety or mission critical errors.	Red
Warning	Error may cause a degraded system.	Yellow
Information	Cautions and information.	Green

**GENERAL INFORMATION - Cont**

BIT error message text displays in the following format:

<Unique ID>: System Effect: <Error> (or <Operator action>)

When the Fire Control System (FCS) generates more than one error, messages display for approximately ten seconds until the next error appears; however, fatal errors are permanently displayed. The BIT error messages have index numbers that determine their order of appearance. For example, if a Fire Circuit error is the second fault detected, the error has an index number of "2" and is the second error to appear.

"2 FCU: FIRE CIRCUIT ERROR"

Refer to Table 2 to identify BIT error messages, their underlying cause, and Operator actions required.

**Table 2. BIT Error Messages.**

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0001	0001: FIRING DISABLED: Fire circuit error	FATAL SYSTEM FAILURE	Hardware error in fire circuit. Can be Armed/ Safe switch error, CG trigger error, or hardware error in electrical fire circuit (e.g., relays)	Firing Disabled	Shutdown CROWS; unload weapon. Check CG connectors. Turn system on. If failure persists, only sensors can be used. Do not load weapon
0004	0004: BATTLE OVERRIDE DISABLED: Switch error	WARNING	Hardware error in Battle Override/Safety Override switch: switch detected in undetermined state.	Safety Override function not activated.	Attempt to reactivate switch three times. Function temporarily blocked in case of temporary error
0005	0005: SAFETY OVERRIDE DISABLED: Switch error	WARNING	Hardware error in Battle Override/Safety Override switch: switch detected in undetermined state.	Safety Override function not activated.	Attempt to reactivate switch three times. Function temporarily blocked in case of temporary error
0101	0101: ACCEPTANCE REJECTED: Palm Switch not enabled	WARNING	Palm switch was not enabled before responding to Sniper Alert message	None	N/A
0102	0102: SNIPER POS BLOCKED BY NTZ	WARNING	Sniper position is unattainable (due to overridable NTZ)	None	N/A
0103	0103: SNIPER POS UNREACHABLE	WARNING	Sniper position unattainable (NTZ not overridable or exceeds min and max elevation)	None	N/A

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0104	0104: SNIPER ALERT REJECTED	WARNING	Sniper alert rejected due to Boresighting, Abs sensor calibration or Zeroing	Sniper alert rejected	N/A
0105	0105: SNIPER MOVEMENT ABORTED. Zone violation	WARNING	Movement blocked in one axis due to zone conflicts	Sniper tracking aborted	N/A
0201	0201: FIRING AND SERVO DISABLED: MPU/DCP Comm error	FATAL SYSTEM FAILURE	Communication between MPU and DCP broken	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required
0205	0205: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Video signal test indicates lost	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required.
0206	0206: FIRING and SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Test SPI (buttons) indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required.
0207	0207: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Control Grip +5V sensor indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required
0208	0208: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Switch 1.8V power indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required
0209	0209: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Switch 3.3V power indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required
0210	0210: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Switch 3.3V power indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required
0211	0211: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Display power indicates error	Firing and Servo Systems disabled	Shutdown CROWS; Maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0212	0212: FIRING AND SERVO DISABLED: DCP error	FATAL SYSTEM FAILURE	Test SPI for LEDs indicates error	Firing System disabled	Shutdown CROWS; Maintenance required
0301	THE PLATFORM ELEVATES : Calibrating sight axis	INFO	N/A	SSA calibration performed at start-up	N/A
0303	0303: FIRING and SERVO DISABLED: Servo sync error	FATAL SYSTEM FAILURE	Servo Position synchronized and verified with position sensors at startup if positions deviate more than 0.5 degrees.	Firing disabled; Servo not yet enabled	Shutdown CROWS; appears only at startup
0304	0304: FIRING DISABLED: Check Sight AZ for obstacles	FATAL SYSTEM FAILURE	Reduced sight movement detected at startup Sight calibration. Sight azimuth component < 14 degrees	Firing disabled; BORESIGHT VALUES REJECTED. REPEAT BORESIGHTING error appears	Shutdown CROWS; check for obstacles and Boresight CROWS. If failure persists, maintenance required
0307	0307: FIRING DISABLED: Check Sight AZ for obstacles	WARNING	Reduced Sight movement detected at startup sight calibration. Sight azimuth component more than three degrees smaller than previous startup.	Firing disabled; BORESIGHT VALUES REJECTED. REPEAT BORESIGHTING error appears	Shutdown CROWS; check for obstacles and Boresight CROWS. If failure persists, maintenance required
0308	0308: FIRING DISABLED: Check Sight EL for obstacles	WARNING	Reduced Sight movement detected at startup Sight calibration. Sight Elevation Component more than three degrees smaller than previous startup.	Firing disabled; BORESIGHT VALUES REJECTED. REPEAT BORESIGHTING error appears	Shutdown CROWS; check for obstacles and Boresight CROWS. If failure persists, maintenance required
0309	0309: INVALID BORESIGHT: Repeat Boresighting	WARNING	Either AZ or EL Boresight values not within acceptable limits	Firing disabled until valid boresight values established	Boresight CROWS
0310	0310: FIRING DISABLED: Incorrect ballistics	FATAL SYSTEM FAILURE	Range cannot be adjusted to value calculated	Firing disabled	Maintenance is required but Sensors available

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0311	0311: STAB DISABLED: AZ gyro error	WARNING	AZ MRU comm error. No messages received in last 200ms.	Stabilization of AZ axis disabled	Possible loss of stabilization. If failure persists, maintenance required
0312	0312: STAB DISABLED: AZ gyro error	WARNING	Invalid data from AZ MRU detected	Stabilization of AZ axis disabled	Possible loss of stabilization. If failure persists, maintenance required
0313	0312: STAB DISABLED: EL gyro error	WARNING	EL MRU comm error. No messages received in last 200ms.	Stabilization of EL axis disabled	Possible loss of stabilization. If failure persists, maintenance required
0314	0312: STAB DISABLED: EL gyro error	WARNING	Invalid data from EL MRU detected	Stabilization of EL axis disabled	Possible loss of stabilization. If failure persists, maintenance required
0315	0312: STAB DISABLED: AZ gyro error	WARNING	Roll MRU communication error. No messages received in last 200ms.	Stabilization of AZ axis degraded	Possible loss of stabilization. If failure persists, maintenance required
0316	0316: STAB DISABLED: Roll gyro error	WARNING	Invalid data from Roll MRU detected.	Stabilization of AZ axis degraded	Possible loss of stabilization. If failure persists, maintenance required
0317	TRP ABORTED: Motion envelope restriction	INFO	TRP Scan hit border of NTZ. Can occur if hatches in NTZ opened	TRP scan aborted	Restart TRP Scan with NTZ disabled
0318	0318: FIRING DISABLED: Check Sight EL for obstacles	FATAL SYSTEM FAILURE	Reduced Sight movement detected at startup Sight calibration. Sight Elevation Component < 12 degrees	Firing disabled; BORESIGHT VALUES REJECTED. REPEAT BORESIGHTING error appears	Shutdown CROWS; check for obstacles and Boresight CROWS. If failure persists, maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0322	0322: FIRING AND SERVO DISABLED: AZ position error	FATAL SYSTEM FAILURE	Deviation check – AZ System compares both AZ potentiometer values with motor encoder values continuously with a frequency equal to or higher than 20 Hz. Fault occurs if deviation between one of three sensors is outside +/-3 degrees	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0323	0323: FIRING AND SERVO DISABLED: EL position error	FATAL SYSTEM FAILURE	Deviation check – EL System compares both EL potentiometer values with motor encoder values continuously with a frequency equal to or higher than 20 Hz. Fault occurs if deviation between one of three sensors is outside +/-3 degrees	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0324	0324: FIRING AND SERVO DISABLED: AZ motion error	FATAL SYSTEM FAILURE	Runaway without PALM Check – AZ movement of WS detected after release of Palm Switch	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0325	0325: FIRING AND SERVO DISABLED: EL motion error	FATAL SYSTEM FAILURE	Runaway without PALM Check – EL movement of WS detected after release of Palm Switch	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0326	0326: FIRING AND SERVO DISABLED: AZ motion error	FATAL SYSTEM FAILURE	AZ encoder speed exceeds three rad/s	Firing and Servo disabled	Shutdown CROWS; Maintenance required

Table 2. BIT Error Messages - Cont.

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0327	0327: FIRING AND SERVO DISABLED: EL position error	FATAL SYSTEM FAILURE	EL encoder speed exceeds three rad/s	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0328	0328: FIRING AND SERVO DISABLED: EL motion error	FATAL SYSTEM FAILURE	Speed exceeds two percent plus three degrees per second of max speed in EL axis during boresight	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0329	0329 FIRING AND SERVO DISABLED: AZ motion error	FATAL SYSTEM FAILURE	Speed exceeds two percent plus three degrees per second of max speed in AZ axis during boresight	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0332	0332: UNRELIABLE BALLISTIC: Inclinometer error	WARNING	Message from inclinometer not received	Reduced hit probability	Assess Risk
0333	0333: FIRING AND SERVO DISABLED: AZ position error	FATAL SYSTEM FAILURE	Encoder scale out of range for one of four axis	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0335	0335: FIRING AND SERVO DISABLED: EL position error	FATAL SYSTEM FAILURE	Uncommanded EL motion detected during powerup	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0336	0336: FIRING AND SERVO DISABLED: AZ position error	FATAL SYSTEM FAILURE	Uncommanded AZ motion detected during powerup	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0337	0337: FIRING AND SERVO DISABLED: Sight EL motion error	FATAL SYSTEM FAILURE	Speed exceeds two percent plus three degrees per second of max speed in Sight EL axis during boresight	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0338	0338: FIRING AND SERVO DISABLED: Sight AZ motion error	FATAL SYSTEM FAILURE	Speed exceeds two percent plus three degrees per second of max speed in Sight AZ axis during boresight	Firing and Servo disabled	Shutdown CROWS; Maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0365	0365: FIRING AND SERVO DISABLED: AZ position error	FATAL SYSTEM FAILURE	Position conflict between AZ sensors	Firing disabled; Servo not yet enabled	Restart CROWS; error appears only at startup
0366	0366: INVALID BORESIGHT: Repeat Boresighting	WARNING	Attempt to arm CROWS before BIT Error 0309 resolved	Firing disabled until valid boresight values established	Boresight CROWS
0367	0367: INVALID BORESIGHT: Repeat Boresighting	WARNING	Attempt to arm CROWS before BIT Error 0304, 0307, 0308 or 0318 resolved	Firing disabled until valid boresight values established	Boresight CROWS
0368	0368: FIRING AND SERVO DISABLED: Sight AZ position error	FATAL SYSTEM FAILURE	Sight AZ encoder speed exceeds three rad/s	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0369	0369: FIRING AND SERVO DISABLED: Sight EL position error	FATAL SYSTEM FAILURE	Sight EL encoder speed exceeds three rad/s	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0401	0401: FIRING AND SERVO DISABLED: Sight AZ position error	FATAL SYSTEM FAILURE	Sight EL encoder error detected; commanded movement not registered	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0402	0402: FIRING AND SERVO DISABLED: System com. Error	FATAL SYSTEM FAILURE	Message from servo controller not received	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0405	0405: FIRING AND SERVO DISABLED: Sight EL position error	FATAL SYSTEM FAILURE	Sight EL encoder error detected; commanded movement not registered	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0406	0406: FIRING AND SERVO DISABLED: AZ motion error	FATAL SYSTEM FAILURE	AZ encoder reports commanded movement not registered	Firing disabled; Servo not yet enabled	Restart CROWS; error appears only at startup
0407	0407: FIRING AND SERVO DISABLED: EL motion error	FATAL SYSTEM FAILURE	EL encoder reports commanded movement not registered	Firing disabled; Servo not yet enabled	Restart CROWS; error appears only at startup

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0413	0413: SIGHT AZ BLOCKED: Check for obstacle	WARNING	Max torque threshold exceeded for required Sight AZ movement	Servo disables Sight AZ movement or allows only in steps	Shutdown CROWS, check for obstacles, restart CROWS, if failure persists, maintenance required
0414	0414: SIGHT EL BLOCKED: Check for obstacle	WARNING	Max torque threshold exceeded for required Sight EL movement	Servo disables Sight EL movement or allows only in steps	Shutdown CROWS, check for obstacles, restart CROWS, if failure persists, maintenance required
0418	0418: RANGE CHANGED: Mechanical limitation	WARNING	Ballistic calculation limited to range of installed weapon: M2 100-5,000m MK19 100-2,500m M240 10-3,000m M249 10-2,500m	Ballistic range reduced	Information
0430	0430: AZ BLOCKED: Check for obstacle	WARNING	Max torque threshold exceeded for required AZ movement	Servo disables Sight AZ movement	Shutdown CROWS, check for obstacles, restart CROWS, if failure persists, maintenance required
0431	0431: EL BLOCKED: Check for obstacle	WARNING	Max torque threshold exceeded for required EL movement	Servo disables Sight EL movement	Shutdown CROWS, check for obstacles, restart CROWS, if failure persists, maintenance is required
0455	0455: FIRING AND SERVO DISABLED: AZ position error	FATAL SYSTEM FAILURE	PISC FPGA detects main AZ encoder HW or comm error	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0456	0456: FIRING AND SERVO DISABLED: Sight EL position error	FATAL SYSTEM FAILURE	PISC FPGA detects main EL encoder HW or comm error	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0457	0457: FIRING AND SERVO DISABLED: Sight AZ position error	FATAL SYSTEM FAILURE	PISC FPGA detects Sight AZ encoder HW or comm error	Firing and Servo disabled	Shutdown CROWS; Maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0458	0458: FIRING AND SERVO DISABLED: Sight EL position error	FATAL SYSTEM FAILURE	PISC FPGA detects Sight EL encoder HW or comm error	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0459	0459: FIRING AND SERVO DISABLED: AZ motion error	FATAL SYSTEM FAILURE	Demanded Position Check - Variation between requested position and absolute AZ encoder position greater than 0.11rad in 250 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0460	0460: FIRING AND SERVO DISABLED: EL motion error	FATAL SYSTEM FAILURE	Demanded Position Check - Variation between requested position and absolute EL encoder position greater than 0.11rad in 250 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0461	0461: FIRING AND SERVO DISABLED: motion error	FATAL SYSTEM FAILURE	Runaway without PALM Check - PISC reports AZ/EL movement of WS after release of Palm Switch	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0465	0465: FIRING AND SERVO DISABLED: Calibrate system	FATAL SYSTEM FAILURE	CROWS detects calibration files error in AZ axis	Firing and Servo disabled	Calibrate AZ absolute sensor
0466	0466: FIRING AND SERVO DISABLED: Calibrate system	FATAL SYSTEM FAILURE	CROWS detects calibration files error in EL axis	Firing and Servo disabled	Calibrate EL absolute sensor
0470	0470: FIRING AND SERVO DISABLED: Calibrate system	FATAL SYSTEM FAILURE	Values from current sensor calibration not passed	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0554	0554: REMOTE SAFE DISABLED: Switch error	WARNING	HW error detected on remote safe switch	Remote safe function disabled	CROWS operational but Maintenance required

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0558	0558: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Number of subscribers exceeds ten	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0559	0559: REMOTE SAFE DISABLED: System error	WARNING	CA position failure detected while remote safe active	Remote safe function disabled	CROWS operational but Maintenance required
0601	0601: UNRELIABLE BALLISTIC: Inclinometer error	WARNING	Inclinometer values outside expected range, reset to zero	Reduced hit probability	Assess risk by size of deviation
0605	0605: FIRING DISABLED: Invalid weapon ID	WARNING	Invalid weapon ID	Firing disabled	Inspect Solenoid Connector for damaged/bent pins; replace Solenoid
0608	0608: VIM NOT OPERATIONAL	WARNING	VIM reports zoom error	CCD Camera functionality reduced	Information: System degraded; Maintenance required
0610	0610: CA BLOCKED: Check for obstacles	WARNING	CA fails to reach commanded position within two seconds during inward movement	Cocking and Remote Safe functions unavailable	Verify CA parked; retry cocking
0614	0614: TIM NON OPERATIONAL: Motor error	WARNING	TIM reports focus motor error	TIM degraded	TIM focus control degraded; Maintenance required
0615	0615: TIM NON OPERATIONAL: Motor error	WARNING	TIM reports FOV motor error	TIM degraded	TIM FOV control degraded; Maintenance required
0616	0616: TIM NON OPERATIONAL: Shutter error	WARNING	TIM reports FOV Shutter error	TIM degraded	TIM performance affected; Maintenance required
0617	0617: TIM NON OPERATIONAL: Image error	WARNING	TIM reports FOV image processing error	TIM degraded	TIM degraded; Maintenance required
0618	0618: TIM NON OPERATIONAL: Video error	WARNING	TIM BIT detects video out error	TIM degraded	TIM degraded; Maintenance required
0619	0619: TIM NON OPERATIONAL: Image error	WARNING	TIM BIT detects image conditioning or acquisition error	TIM degraded	TIM degraded; Maintenance required
0620	0620: FIRING DISABLED: System low voltage	WARNING	Voltage dropped below internal 17V	Firing and Servo disabled	N/A

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0621	0621: VIM NON OPERATIONAL: Com. error	WARNING	VIM fails to answer heartbeat messages	VIM degraded	Information: VIM degraded
0622	0622: TIM NON OPERATIONAL: Com. error	WARNING	TIM fails to answer heartbeat messages	TIM degraded	Information: TIM degraded
0626	0626: FIRING DISABLED: Sensor controller com. error	WARNING	Sensor controller fails to answer heartbeat message	Sensor Controller operations degraded	Restart CROWS, if failure persists, Maintenance required
0627	0627: SSA DEGRADED: Voltage error	WARNING	Sensor Controller BIT detects voltage error on Sensor Controller HW	Sensor Controller operations degraded	Restart CROWS, if failure persists, Maintenance required
0630	0630: LRF NON OPERATIONAL: Com. error	WARNING	LRF fails to answer heartbeat message	Data communication with LRF lost or unstable	LRF unavailable; range must be set manually; Maintenance required
0633	0633: LRF NON OPERATIONAL: Com. error	WARNING	LRF BIT reports receiver error	LRF performance degraded	LRF degraded; range must be set manually; Maintenance required
0634	0634: LRF NON OPERATIONAL: Com. error	WARNING	LRF BIT reports transmitter error	LRF performance degraded	LRF degraded; range must be set manually; Maintenance required
0635	0635: TIM TEMPERATURE CHANGE: Perform temp. calibration	WARNING	TIM requires temperature calibration	TIM degraded	Recalibrate TIM
0636	0636: REMOTE SAFE UNAVAILABLE	WARNING	Remote safe not available when switch set from CHARGE to SAFE	Remote safe unavailable	Retry Remote Safe after 5 seconds
0638	0638: CA BLOCKED: Check for obstacles	WARNING	CA fails to reach commanded position within five seconds	Retract arm to parked position; unable to fire	Try to cock weapon again
0640	0640: CA DEGRADED: Position error	WARNING	Difference between sensor and potentiometer values greater than two cm	CA unavailable; cannot charge weapon or activate remote safe	Maintenance required

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0641	0641: CA DEGRADED: Position error	WARNING	Parked switch reports parked position but hall position reports CA extended more than five cm	CA unavailable; cannot charge weapon or activate remote safe	Maintenance required
0642	0642: CA TEMP RECOVERED: CA operational	INFO	Cocking reduced cocking force required and recovered	CROWS operational	N/A
0643	0643: CA DISABLED: Overheated	WARNING	CROWS reduced CA force	Charging and remote safe disabled	Maintenance required
0644	0644: CA DEGRADED: Position error	WARNING	CROWS detects deviation greater than two cm between commanded and actual position	CA servo amplifier disabled until shutdown; Charging and remote safe unavailable	Restart CROWS, if failure persists, Maintenance required
0701	0701: FIRING AND SERVO DISABLED: Zone violation	FATAL SYSTEM FAILURE	WS inside NTZ and cannot exit (NTZ not overrideable or assigned to hatch)	Firing and Servo disabled	Shutdown CROWS and move WS out of NTZ; restart CROWS
0703	0703: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Motion calculation seizes more than 200 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0704	0704: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	NFZ handler seizes more than 250 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0705	0705: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	NFZ handler seizes more than 200 ms	Firing disabled	Shutdown CROWS; Maintenance required
0706	0706: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Firing circuit diagnostic seizes more than 220 ms	Firing disabled	Shutdown CROWS; Maintenance required
0707	0707: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Earth coordinates calculation loop seizes more than 202 ms	Firing disabled	Shutdown CROWS; Maintenance required
0708	0708: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Servo control loop seizes more than 5 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0709	0709: FIRING AND SERVO DISABLED: System position error	FATAL SYSTEM FAILURE	Position check notification not received in 320 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0710	0710: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Servo diagnostic seizes more than 300 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0711	0711: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Ballistic calculation loop seizes more than 220 ms	Firing disabled	Shutdown CROWS; Maintenance required
0712	0709: FIRING AND SERVO DISABLED: System position error	FATAL SYSTEM FAILURE	System watchdog delayed more than 230 ms or not functioning	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0713	0713: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	System inside Vehicle NTZ	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0714	0714: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Platform position update fails to notify system watchdog within 250 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0715	0715: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Error handling function fails to notify system watchdog within 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0716	0716: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Digital IO reading function seizes more than 300 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0717	0717: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Range update function seizes more than five seconds	Firing disabled	Shutdown CROWS; Maintenance required
0718	0718: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Video card handling function seizes more than three seconds	Firing disabled	Shutdown CROWS; Maintenance required

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0719	0719: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Graphic repaint function seizes more than 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0720	0720: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	CG diagnostic fails to report to system watchdog within 30 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0721	0721: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Zone deadlock function fails to report to system watchdog	Firing disabled	Shutdown CROWS; Maintenance required
0722	0722: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Lead angle function fails to report to system watchdog within 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0723	0723: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Notification of range change function fails to report to system watchdog within 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0724	0724: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Distribution of main axis speeds function fails to report to system watchdog within 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0725	0725: FIRING DISABLED: System error	FATAL SYSTEM FAILURE	Reticle handling function fails to report to system watchdog within 10 seconds	Firing disabled	Shutdown CROWS; Maintenance required
0727	0727: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Absolute position sensor fails to report to system watchdog within 420 seconds	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0728	0728: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Function transmitting speed commands to Serco Control loop fails to report to system watchdog within 280 ms	Firing and Servo disabled	Shutdown CROWS; Maintenance required

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0729	0729: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Uncommanded motion detected on startup	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0730	0730: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Firing disable ID not received at startup; internal software failure occurs when max clients for ID reached	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0807	0807: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Checksum error detected on servo handler	Firing and Servo disabled	Restart CROWS; not recoverable
0809	0809: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Hatch subscribing digital IO fails to return correct ID on startup; internal software failure occurs when max clients for ID reached	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0811	0811: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Buffer overflow between SBC and servo controller	Firing and Servo disabled	Shutdown CROWS; Maintenance required
0812	0812: FIRING AND SERVO DISABLED: System error	WARNING	Checksum error on ammo table detected	CROWS deletes ammo file	Reinstall or change weapon/ammo, remove from menu
0813	0813: FIRING AND SERVO DISABLED: Calibrate system	WARNING	AZ absolute sensor file cannot be opened or stored	Firing and Servo disabled	Calibrate AZ absolute sensor
0814	0814: FIRING AND SERVO DISABLED: Calibrate system	FATAL SYSTEM FAILURE	EL absolute sensor file cannot be opened or stored	Firing and Servo disabled	Calibrate EL absolute sensor
0815	0815: FIRING AND SERVO DISABLED: Adjust reticle center	WARNING	CROWS cannot store file after reticle adjustment	Firing disabled	Create new reticle file

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0816	0816: NO DATA FROM TRP 1; Recreate location	INFO	Checksum error for TRP location point 0	None	Delete file
0817	0817: NO DATA FROM TRP 2; Recreate location	INFO	Checksum error for TRP location point 1	None	Delete file
0818	0818: NO DATA FROM TRP 3; Recreate location	INFO	Checksum error for TRP location point 2	None	Delete file
0819	0819: NO DATA FROM TRP 4; Recreate location	INFO	Checksum error for TRP location point 3	None	Delete file
0820	0820: NO DATA FROM TRP 5; Recreate location	INFO	Checksum error for TRP location point 4	None	Delete file
0821	0821: NO DATA FROM TRP 6; Recreate location	INFO	Checksum error for TRP location point 5	None	Delete file
0822	0822: NO DATA FROM TRP 7; Recreate location	INFO	Checksum error for TRP location point 6	None	Delete file
0823	0823: NO DATA FROM TRP 8; Recreate location	INFO	Checksum error for TRP location point 7	None	Delete file
0824	0824: NO DATA FROM TRP 9; Recreate location	INFO	Checksum error for TRP location point 8	None	Delete file
0825	0825: NO DATA FROM TRP 10; Recreate location	INFO	Checksum error for TRP location point 9	None	Delete file
0826	0826: FIRING AND SERVO DISABLED: System error	FATAL SYSTEM FAILURE	Checksum error on absolute position data detected	Firing disabled; motion frozen	Calibrate sensors

## GENERAL INFORMATION - Cont

Table 2. BIT Error Messages - Cont

ID #	MESSAGE	STATUS	CAUSE	EFFECT	ACTION
0827	0827: USER DEFINED NFZ DELETED: Invalid data	WARNING	Checksum error on NFZ data detected	None	Delete file
0828	0827: USER DEFINED NTZ DELETED: Invalid data	WARNING	Checksum error on NTZ data detected	None	Delete file
0829	0829: COCKING DISABLED: System error	WARNING	Cocking device fails to report to system watchdog within three seconds	Charging and remote safe disabled; CA servo amplifiers disabled through digital IO handler	Shutdown CROWS; Maintenance required
0832	0832: FIRING DISABLED: Calibrate system	FATAL SYSTEM FAILURE	Checksum error on reticle file detected	Firing disabled	Calibrate EL absolute sensor
0901	0901: LOW AMMO NON OPERATIONAL: Com. error	WARNING	Low ammo sensor failed	Low ammo disabled	Maintenance required
1101	1101: FIRING AND SERVO DISABLED: Com. error	WARNING	VPU BIT reports external video input channel lost signal	Firing and Servo disabled	Information; only in AUX mode
1106	1106: FIRING AND SERVO DISABLED: Com. error	FATAL SYSTEM FAILURE	Data communication with VPU lost or unstable	Firing and Servo disabled	Shutdown CROWS; Maintenance required
1112	1112: FIRING AND SERVO DISABLED: Com. error	WARNING	VPU BIT reports VIM input channel lost signal	Firing and Servo disabled	Switch to TIM; Maintenance required
1113	1113: FIRING AND SERVO DISABLED: Com. error	WARNING	VPU BIT reports TIM input channel lost signal	Firing and Servo disabled	Switch to VIM; Maintenance required
1210	1210: FIRING AND SERVO DISABLED: CG com. error	WARNING	CG data communication lost or unstable	Firing and Servo disabled	None

END OF WORK PACKAGE

## **CHAPTER 4**

# **PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
INTRODUCTION**

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**THIS WORK PACKAGE COVERS:**

Introduction to Preventive Maintenance Checks and Services (PMCS) Procedures.

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**INITIAL SETUP:**

**References**

DA PAM 750-8	WP 0028
WP 0006	WP 0045
WP 0014	WP 0048
WP 0018	WP 0049
WP 0023	WP 0051

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**INTRODUCTION**

**NOTE**

The removal and replacement of a CROWS assembly/component is permitted if the operator/crew discovers an obvious problem during visual inspection and is directed to perform the task by higher level maintenance personnel.

Preventive maintenance consists of visual inspections for physical damage and cleanliness, and procedures to correct any faults found during those inspections. Preventive maintenance extends useful service and contributes to continued, uninterrupted operation of CROWS and its components or related parts.

PMCS means systematic caring, inspecting, and servicing of CROWS to keep it in good condition and to prevent breakdown. If CROWS is found to be defective during any checks, remove CROWS from service and make repairs. Pay attention to WARNING and CAUTION statements. A WARNING means someone could be hurt. A CAUTION means equipment could be damaged.

**INTRODUCTION - Cont****Designated Intervals****NOTE**

Designated PMCS intervals are performed under usual operating conditions. PMCS intervals must be performed more frequently when operating under unusual conditions.

Be sure to perform your PMCS each time CROWS is to be used. Always do the PMCS in the same order so it gets to be a habit. Once you have had some practice, you'll quickly spot anything wrong.

Do BEFORE PMCS just before placing CROWS in operation.

Do DURING PMCS while CROWS is being used.

Do AFTER PMCS immediately after completion of the CROWS mission.

Do MONTHLY PMCS every month to ensure no damage has occurred to CROWS during storage. Also, do the BEFORE and AFTER PMCS at the same time.

Use DA Form 2404 or DA Form 5988-E (electronic) to record any discrepancies discovered while doing the PMCS and report all malfunctions to unit maintenance at once.

**PMCS COLUMN DESCRIPTION**

PMCS procedures are contained in WP 0044, Table 1. The procedures are arranged in logical sequence requiring a minimum amount of time and motion to complete them.

ITEM NO. column. Numbers in this column are for reference. When completing DA Form 2404 (or DA Form 5988-E (electronic)), include the item number for check/service indicating the fault. Item numbers appear in the order that the checks and services must be performed.

INTERVAL column. This column contains the designated interval when each check/service is to be performed.

ITEM TO BE INSPECTED column. This column identifies the items to be inspected.

PROCEDURE column. This column contains a brief description of the procedures by which checks or services are to be performed as well as any information required to accomplish each check or service.

EQUIPMENT NOT READY/AVAILABLE IF column. This column contains a brief statement of condition (e.g., malfunction, shortage) that would cause covered equipment to be less than fully ready to perform its assigned mission.

## GENERAL PROCEDURES

A permanent record of the services, repairs, and modifications made to this system must be recorded IAW Army SOP. Refer to DA Pam 750-8, The Army Maintenance Management System (TAMMS) Users Manual, for a list of the forms and records required and how to complete them.

### WARNING

Follow all safety warnings and cautions. Failure to follow these instructions may result in personal injury or equipment damage.

### CAUTIONS

Do not remove cable connections for routine inspections; but, if the connection is loose or there is a suspected problem with a particular cable, remove and inspect at that time. When properly tightened, the threaded end of the cable covers the Red Band on the connector. If the Red Band is not visible, the Cable should be properly connected.

Ensure system power is off when connecting and disconnecting cables.

Ensure the installed weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on unloading weapons, refer to WP 0014 (M2), WP 0018 (MK19), WP 0023 (M240), and WP 0028 (M249).

Failure to follow these instructions may result in equipment damage and system inoperability.

1. Visually inspect cable assemblies for any evidence of internal or external damage as detailed below.
  - a. Ensure all identification (ID) tags are installed.
  - b. Ensure all back shell connectors are tight.
  - c. Check all connector pins and sockets for damage (for example, missing, bent, or loose pins).
  - d. Check for damaged threads on connectors.

**GENERAL PROCEDURES - Cont**

2. Return items to Maintenance for the following reasons:
  - a. Bent, broken, or missing pins or sockets.
  - b. Damaged threads on connectors or backshells.
  - c. Inoperative or damaged cables.

**NOTES**

Dirt, grease, oil, and debris may cover up a serious problem. Clean as you check. For cleaning procedures, refer to WP 0045, Clean CROWS.

For information on consumable, expendable, and durable materials, refer to WP 0051.

For weapon malfunctions or screen message problems, refer to Chapter 3, Troubleshooting Procedures.

3. Check all bolts, nuts, and screws. If loose, bent, broken, or missing, either tighten or report conditions to Maintenance.
4. Look for loose or chipped paint, and rust or cracks at welds. Remove rust and loose paint, and spot paint as required. Report all cracked weld(s) to Maintenance immediately.
5. Inspect electrical wires and connectors for cracked or broken insulation. Also, look for bare wires and loose or broken connections. Tighten loose connections. Report other problems to Maintenance.
6. Check data, caution, and warning plates for security and legibility.
7. If a system or subsystem is unable to perform the mission, the equipment will be reported as "Not Fully Mission Capable." Refer to DA Pam 750-8.

**Correct Assembly**

Check that each assembly has no missing parts and that each component is in the right place.

**Interconnection (Connectors and Cables)**

For interconnection procedures (before applying power), refer to WP 0006.

## Considerations Before and During PMCS

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- a. Follow all safety regulations, warnings, cautions, and notes.
- b. Ensure vehicle is positioned on level ground.
- c. Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed. Refer to the appropriate weapon operation and maintenance manuals as well as related CROWS manuals, detailed in WP 0048, References.
- d. Examine the equipment carefully to determine the cause of the failure before removing the defective or broken parts.
- e. Disassemble the equipment only to the point necessary to perform the required maintenance.
- f. Before disconnecting any electrical parts, ensure the parts are tagged for identification.
- g. When removing a connector, never pull the wires on the cable/wiring harness.
- h. Note the orientation of all the parts before removal.
- i. Retain the hardware for later use.
- j. Use Basic Issue Items (WP 0044) that are specific to CROWS when performing Preventive Maintenance Checks and Services (PMCS). Wiping cloths are needed to remove dirt or grease.
- k. Ensure that the diameter of any bends in the W1 Display Unit/CG cable (P/N 60202266-01) measures at least five inches.

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)**

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**THIS WORK PACKAGE COVERS:**

Preventive Maintenance Checks and Services (PMCS).

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**INITIAL SETUP:**

**References**

DA PAM 750-8  
Vehicle Operator Manual  
WP 0011  
WP 0013  
WP 0016  
WP 0017  
WP 0020  
WP 0022  
WP 0025

**References - Cont**

WP 0026  
WP 0045  
WP 0046

**Equipment Conditions**

Engine Shut Down (Vehicle Operator  
Manual)  
CROWS Shutdown (WP 0036)  
Installed Weapon Cleared (WP 0011,  
WP 0016, WP 0020 or WP 0025)

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**PMCS**

**WARNING**



**HEAVY PARTS**

Ensure no power is applied while performing BEFORE and AFTER PMCS operating procedures on system unless instructed to do so. Failure to do so may result in personal injury and equipment damage.

PMCS - Cont

**CAUTIONS**

Ensure system power is off when connecting and disconnecting cables.

Ensure the installed weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading weapons, refer to WP 0013 (M2), WP 0017 (MK19), WP 0022 (M240), and WP 0026 (M249).

Failure to follow these instructions may result in equipment damage and system inoperability.

Table 1 presents a detailed listing of specified Preventive Maintenance tasks based on intervals designated for each component/assembly.

**Table 1, Preventive Maintenance Checks and Services (PMCS)**

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
1.	Before	Soft Mount Assembly	1. Clean and lubricate properly. Clean and lubricate (WP 0045/46). 2. Ensure that Sleeve Collector has no physical damage. 3. Ensure that Link Guide, Link Deflector, and Link Cover have no physical damage. 4. Check that M2 and MK19 Mounting Pins are not bent and are secured to Internal Cradle using security chains. 5. Check that Straining Screw can be screwed up and down freely. 6. Ensure Rubber Buffer Disks are not cracked and do not have excessive wear. 7. Ensure Foot Screw and Lock Nut are not damaged (threads stripped or head deformed), Lock Nut is tight, and Releaser Arm is spring loaded when depressed and can be rotated freely.	Sleeve Collector damaged or missing  Link Guide, Deflector or Cover damaged or missing  Mounting Pins missing or damaged  Straining Screw damaged or missing  Buffers missing, cracked, torn, or worn  Foot Screw damaged or missing, Lock Nut damaged, missing, or loose. Releaser Arm damaged, missing, or cannot be depressed or rotated freely

Table 1, Preventive Maintenance Checks and Services (PMCS) - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			8. With weapon installed, pull/push internal cradle backward to observe smooth movement and compression of damping springs. Release when in backward position to observe proper counter-recoil action.	Internal Cradle won't recoil smoothly, is loose, or doesn't properly recoil

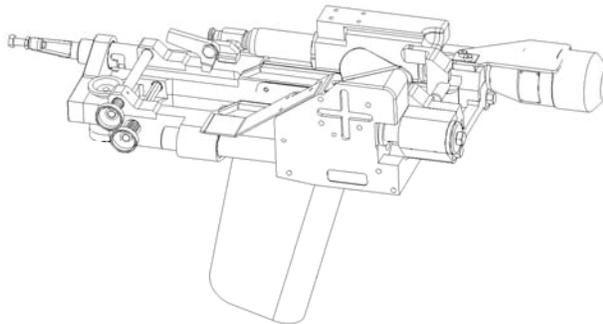


Figure 1, Soft Mount

2.	Before	Friction Brake	1. With weapon installed, pull Soft Mount backward.  2. Release carefully until it stops in forward position.  3. Check if opening between front face of internal cradle and rear face of Cocking Actuator is between 5 to 6mm. Make sure Soft Mount is in forward position.	Friction Brake out of adjustment
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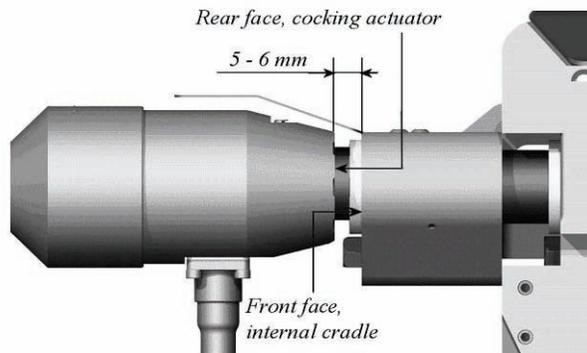


Figure 2, Check Friction Brake

PMCS FOR CROWS - Cont

Table 1, Preventive Maintenance Checks and Services (PMCS) - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
3.	Before	Cocking Brackets	<ol style="list-style-type: none"> <li>1. Check for burrs on Cocking Faces and check that they are undamaged.</li> <li>2. Check that Cocking Arm on M2 Cocking Bracket is spring loaded.</li> <li>3. Check that Brackets can be properly locked to Cocking Rod by spring-loaded Cocking Bracket Lock.</li> <li>4. Ensure that brackets are properly cleaned and lubricated (WP 0046).</li> </ol>	<p>Cocking Brackets damaged or missing</p> <p>Cocking Brackets not properly locked by spring-loaded Cocking Bracket Lock</p>

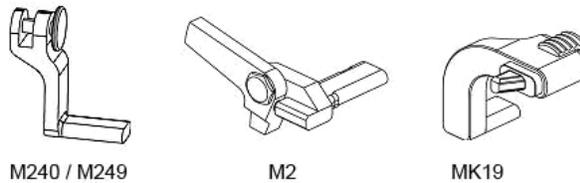


Figure 3, Cocking Brackets

NOTE

The Cocking Bracket Releaser is only required for the M2 .50 Cal Machine Gun.

4.	Cocking Bracket Releaser	<ol style="list-style-type: none"> <li>1. Cock weapon to observe if Cocking Bracket pulls bolt sufficiently backward to cock weapon.</li> <li>2. Check that Cocking Rod moves fully forward after release from weapon Cocking Bolt.</li> </ol>	<p>Cocking Bracket does not pull bolt backward to cock weapon</p> <p>Cocking Rod does not move fully forward to release weapon from Cocking Bolt</p>
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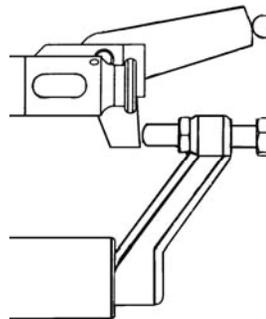


Figure 4, Cocking Bracket Releaser

**Table 39-1, Preventive Maintenance Checks and Services (PMCS) - Cont**

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
5.	Before	Cocking Actuator	<ol style="list-style-type: none"> <li>1. Ensure that Cocking Actuator is securely fastened to Soft Mount by lock nut.</li> <li>2. Check Cocking Actuator cable W4 is undamaged and properly connected to CA and Connector 4J3 on Sight Servo Assembly.</li> <li>3. Check that Rubber Buffers are not damaged.</li> </ol>	<p>Cocking Actuator or Lock Nut missing or damaged</p> <p>Cable W4 damaged, missing or improperly installed</p> <p>Rubber Buffers cracked, nicked, damaged, or missing</p>



**Figure 5, Cocking Actuator**

6.	Before	Firing Solenoids	<ol style="list-style-type: none"> <li>1. Ensure Firing Solenoid is properly installed and secured on installed weapon (M2, WP 0011 or MK19, WP 0016) or MASC (M240, WP 0020 or M249, WP 0025).</li> <li>2. Check that Cable and Connector Pins are undamaged and can be properly connected to J2 Solenoid Connector on Sight Servo Assembly (rear left side).</li> </ol>	<p>Firing Solenoid damaged, missing, or improperly installed</p> <p>Cable or Connector Pins are damaged, missing, or cable improperly installed</p>
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**Figure 6, Firing Solenoids**

PMCS FOR CROWS - Cont

Table 39-1, Preventive Maintenance Checks and Services (PMCS) - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
7.	Before	Azimuth Release	<ol style="list-style-type: none"> <li>1. With WS in Manual Mode, lift up Lock Pin and swing release arm out to ensure that WS can be rotated manually by turning MFA.</li> <li>2. Push Release Arm in and ensure that Lock Pin locks arm in position for remote operation. It should then be very difficult to turn WS manually.</li> </ol>	<p>WS cannot be rotated manually by turning MFA</p> <p>WS turns freely</p>

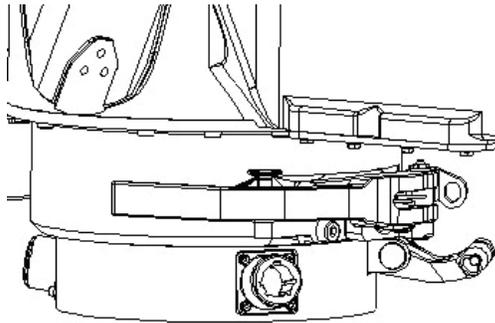


Figure 7, Azimuth Release

8.	Before	Azimuth Transport Lock	<ol style="list-style-type: none"> <li>1. Unlock AZIMUTH RELEASE MECHANISM.</li> <li>2. Turn WS to both azimuth travel position and azimuth transport position and check if it can be locked properly to Locking Bracket using locking arm.</li> <li>3. Ensure Lock is not damaged and operates freely.</li> </ol>	<p>WS cannot be locked properly to Locking Bracket using Locking Arm</p> <p>Lock damaged, missing, or does not operate freely</p>
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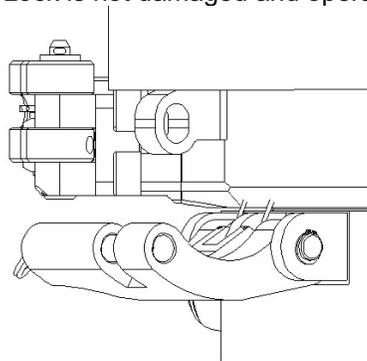
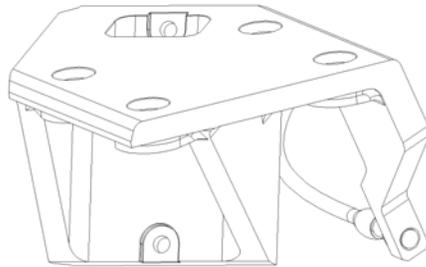


Figure 8, Azimuth Travel Lock

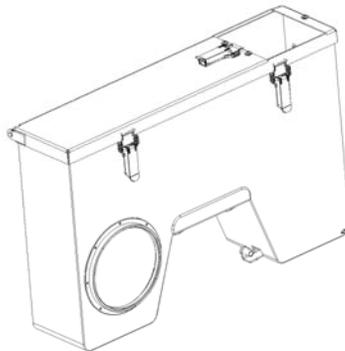
**Table 39-1, Preventive Maintenance Checks and Services (PMCS) - Cont**

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
9.	Before	Ammo Box Holder	<ol style="list-style-type: none"> <li>1. Ensure that Ammo Box Holder is securely fastened.</li> <li>2. Ensure that Low Ammo Sensor cable is securely fastened and not damaged.</li> </ol>	<p>Ammo Box Holder loose</p> <p>Low Ammo Sensor Cable loose or damaged</p>



**Figure 9, Ammo Box Holder**

10.	Before	Ammo Box	<ol style="list-style-type: none"> <li>1. Ensure that Lid Latches are functional and lock lid properly.</li> <li>2. Ensure that Ammo Box is undamaged and securely fastened to Ammo Box Holder.</li> <li>3. Check that Low Ammo Sensor Connector and Storage Ring for TIM Lens Cover are undamaged and operable.</li> </ol>	<p>Lid Latches are damaged, missing or dysfunctional</p> <p>Ammo Box damaged so Ammo cannot be stored, fed properly, or securely fastened to Ammo Box Holder</p> <p>Low Ammo Sensor connector is damaged or missing</p>
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**Figure 10, Ammo Box**

PMCS FOR CROWS - Cont

Table 1, Preventive Maintenance Checks and Services (PMCS) - Cont

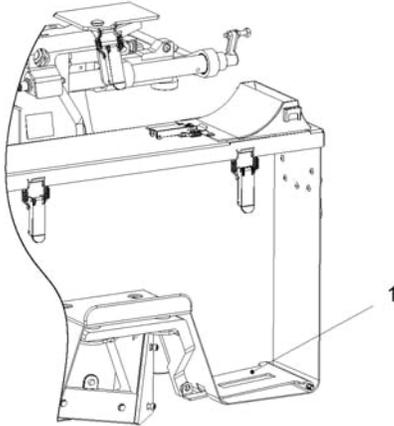
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
11.	Before	Low Ammo Sensor	<ol style="list-style-type: none"> <li>1. Power up CROWS to operation mode according to standard procedure.</li> <li>2. Verify that LOW AMMO is displayed in status field on screen.</li> <li>3. Push down Activation Plate (1) by hand for checking "Low Ammo" sensor functionality.</li> <li>4. Verify that LOW AMMO disappears from status field.</li> <li>5. Release pressure on plate and verify that LOW AMMO reappears on screen.</li> </ol>	Low Ammo Message does not appear or disappear when Activation Plate is depressed and released
				
<p><b>Figure 11, Low Ammo Sensor</b></p>				
12.	Before	Sight Servo Assembly	<ol style="list-style-type: none"> <li>1. Ensure VIM, TIM, and LRF lenses are clean.</li> <li>2. Ensure there are no scratches or moisture (fogging) inside lenses.</li> <li>3. Check for missing or damaged Lens Caps and chains.</li> <li>4. Check that Sight Protection Covers are securely fastened.</li> <li>5. Ensure that VIM and TIM are securely fastened to Sight Brackets.</li> </ol>	<p>Any lens cracked, fogged or scratched causing visual impairment</p> <p>Lens Caps damaged or missing</p> <p>Sight Protection Covers damaged causing visual impairment</p> <p>VIM, TIM, or LRF not securely fastened or loose</p>

Table 1, Preventive Maintenance Checks and Services (PMCS) - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
		Sight Servo Assembly Cont	<p>6. Ensure that LRF is securely fastened to its Mounting Bracket.</p> <p>7. Check that there is no visible damage to Servo Motor Housing and visually inspect that all screws are securely fastened.</p> <p>8. Check that all SSA connectors are undamaged and not corroded.</p> <p>9. Ensure VIM and LRF Lens Cap Brackets are securely fastened on top and left side of LRF Protection Cover.</p>	<p>Servo Motor Housing damaged, missing, or has loose screws</p> <p>Connectors damaged or corroded</p>

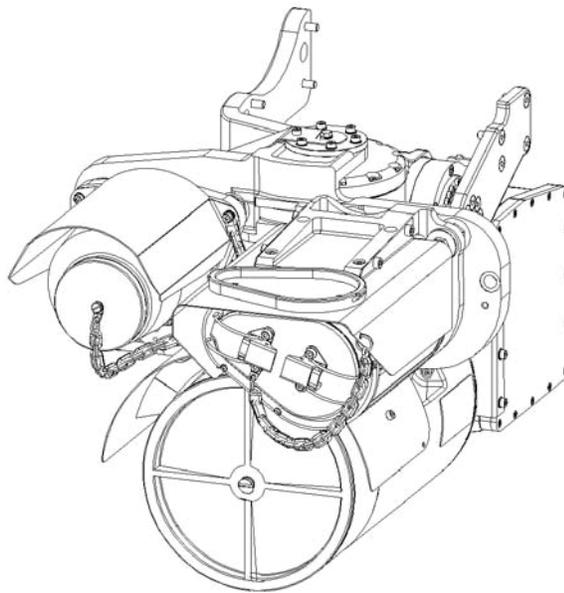


Figure 12, Sight Servo Assembly

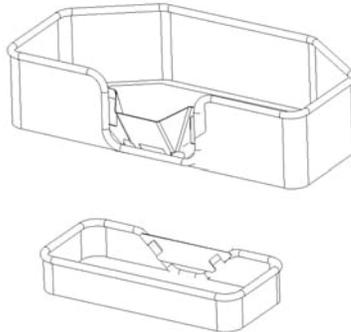
PMCS FOR CROWS - Cont

Table 1, Preventive Maintenance Checks and Services (PMCS) - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
13.	Before	Left Side Support Assembly	Check for visible cracks or damage on support bodies.	Visible cracks or damage
<b>Figure 13, Left Side Support Assembly</b>				
14.	Before	Right Side Support Assembly	<ol style="list-style-type: none"> <li>1. Check for cracks or damage on support bodies.</li> <li>2. Ensure that Elevation Release Arm is not damaged and operates freely by pulling out Lock Pin and checking that Arm disengages Elevation Servo Motor when in up position and engages it when in down position with Lock Pin pushed fully in.</li> <li>3. Ensure that Elevation Transport Lock is not damaged, operates freely, and can be set in transport mode, travel mode, and operation mode.</li> </ol>	<p>Cracks or damage visible</p> <p>Elevation Release Arm damaged, does not operate freely or does not disengage or engage Elevation Servo Motor</p> <p>Elevation Transport Lock is damaged or does not operate freely between modes</p>
<b>Figure 14, Right Side Support Assembly</b>				

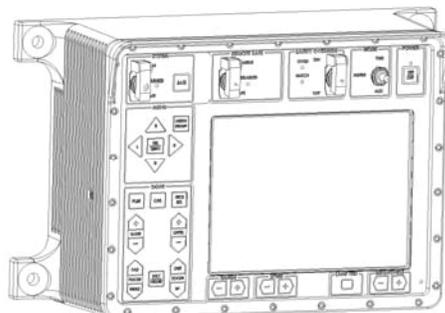
**Table 1, Preventive Maintenance Checks and Services (PMCS) for CROWS - Cont**

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
15.	Before	Front and Rear Casing Collector Bags	<ol style="list-style-type: none"> <li>1. Check for missing and damaged Casing Collector Bags, brackets and hardware.</li> <li>2. Ensure Casing Collector Bags are held securely to frame by Brackets and are operable.</li> </ol>	<p>Bags damaged or missing</p> <p>Bags loose or inoperable</p>



**Figure 15, Casing Collector Bags**

16.	Before	Fire Control Unit	<ol style="list-style-type: none"> <li>1. Ensure LCD screen is clean and there are no cracks or scratches that impair display.</li> <li>2. Check that CROWS powers up and that all cables are properly connected and undamaged.</li> <li>3. Check that all Switches and Security Caps are functioning properly.</li> <li>4. Check that FCU is properly fastened to the mounting device inside Host Vehicle or other platform.</li> <li>5. Check that all connectors are undamaged and not corroded.</li> </ol>	<p>Screen cracked or scratched so display is impaired</p> <p>CROWS does not power up or display either DAY (VIM) or NIGHT (TIM) sights</p> <p>Switches not functioning properly</p> <p>FCU is loose or insecurely fastened</p> <p>Connectors damaged, corroded, or missing</p>
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**Figure 16, Fire Control Unit**

PMCS FOR CROWS - Cont

Table 1, Preventive Maintenance Checks and Services (PMCS) for CROWS - Cont

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
17.	Before	Control Grip	<ol style="list-style-type: none"> <li>1. Check that Cable W1 and Connector Pins are undamaged and can be properly connected to Connector J2 on FCU/DCP.</li> <li>2. Ensure Trigger Guard is undamaged and operates freely.</li> <li>3. Verify Palm Switch is undamaged and operates properly.</li> <li>4. Ensure buttons are undamaged and operate properly.</li> <li>5. Check that grip is undamaged. No cracks are permitted.</li> </ol>	<p>Cable W1 damaged, missing, or corroded</p> <p>Trigger Guard damaged or missing</p> <p>Palm Switch damaged or missing</p> <p>Buttons damaged or missing</p> <p>Grip is damaged or missing</p>



Figure 17, Control Grip

18.	Before	M240/ M249 Multi Adapter Small Caliber	<ol style="list-style-type: none"> <li>1. Check that Cocking Bracket is undamaged.</li> <li>2. Check that Push Bracket Band on Cocking Bracket is undamaged.</li> <li>3. Check that Mounting Pin for small caliber weapons is undamaged.</li> </ol>	<p>Cocking Bracket damaged or cracked</p> <p>Push Bracket Band or Cocking Bracket damaged or missing</p> <p>Mounting Pin damaged or missing</p>
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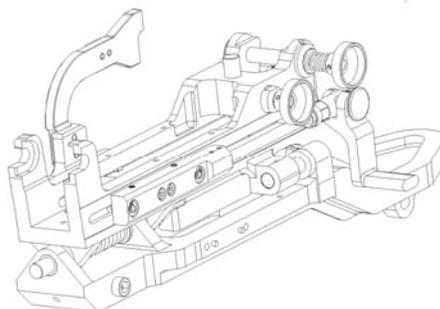
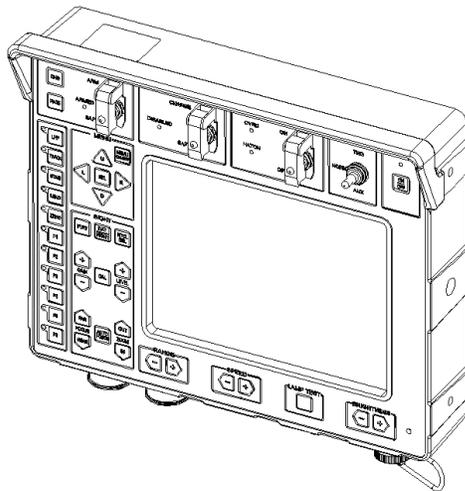


Figure 18, Multi Adapter Small Caliber

**Table 1, Preventive Maintenance Checks and Services (PMCS) for CROWS - Cont**

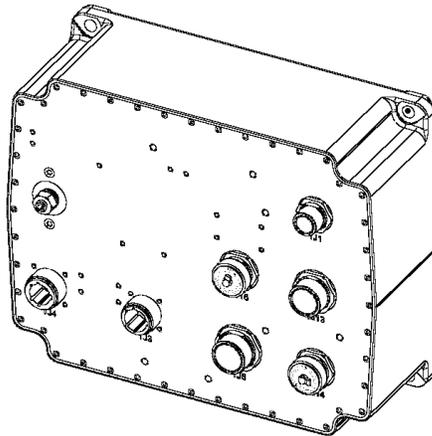
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
19.	Before	Display and Control Panel	<ol style="list-style-type: none"> <li>1. Ensure LCD screen is clean and there are no cracks or scratches that impair display.</li> <li>2. Check that CROWS powers up and that all cables are properly connected and undamaged.</li> <li>3. Check that all Switches and Security Caps are functioning properly.</li> <li>4. Check that the DCP is properly fastened to the mounting device inside Host Vehicle or other platform.</li> <li>5. Check that all connectors are undamaged and not corroded.</li> </ol>	<p>Screen cracked or scratched so display is impaired</p> <p>CROWS does not power up or display either DAY (VIM) or NIGHT (TIM) sights</p> <p>Switches not functioning properly</p> <p>DCP is loose or insecurely fastened</p> <p>Connectors damaged, corroded, or missing</p>



**Figure 19, Display and Control Panel**

**Table 1, Preventive Maintenance Checks and Services (PMCS) for CROWS - Cont**

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
20.	Before	Main Processing Unit	<ol style="list-style-type: none"> <li>1. Check that CROWS powers up and that all cables are properly connected and undamaged.</li>   <li>2. Check that MPU is properly fastened to the mounting device inside the Host Vehicle or other platform.</li>   <li>3. Check that all connectors are undamaged and not corroded.</li> </ol>	<p>CROWS does not power up or display either DAY (VIM) or NIGHT (TIM) sights</p> <p>MPU is loose or insecurely fastened</p> <p>Connectors damaged, corroded, or missing</p>



**Figure 20, Main Processing Unit**

**END OF TASK**

**END OF WORK PACKAGE**

## **CHAPTER 5**

# **MAINTENANCE INSTRUCTIONS**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
CLEAN CROWS**

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**THIS WORK PACKAGE COVERS:**

Cleaning exterior and interior of CROWS.

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**INITIAL SETUP:****Materials/Parts**

Applicator, Disposable (WP 0051, item 1)  
Brush, Dusting, Lens (WP 0049, item 2)  
Cleaning Compound, Optical Lens  
(WP 0051, item 3)  
Cloth, Cleaning (WP 0051, item 4)  
Detergent, General Purpose  
(WP 0051, item 5)  
Gloves, Disposable (WP 0051, item 6)  
Isopropyl Alcohol (WP 0051, item 9)  
Paper, Lens (WP 0051, item 13)  
Rag, Wiping (WP 0051, item 14)

**References**

Vehicle Operator Manual  
(WP 0036)  
(WP 0037)  
(WP 0051)

**Equipment Condition**

Vehicle Shut Down (Vehicle Operator  
Manual)  
CROWS Shut Down (WP 0036)

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**GENERAL**

CROWS should always be kept clean. Dirt and debris degrades performance, and relatively obvious defects can be hidden by dust or other foreign matter during visual inspection. Normally, cleaning is limited to removal of dust and dirt after use. In combat and extreme weather conditions, CROWS requires more frequent cleaning. The WS external components can be cleaned by pressurized water using a hose at a minimum range of 2 meters with a 1/2-inch water hose at 60 psi for a maximum of ten minutes.

**WARNING****CLEANING SOLVENTS**

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash exposed area immediately with soap and water.

**CLEAN EXTERIOR****CAUTION**

Make sure dry solvents or pressurized water are not applied directly to Cable Connectors, Cables, Camera Lenses, Cocking Actuator, Friction Brake, or Sliding Spindle sealing on Soft Mount to prevent electrical problems and performance degradation.

1. Remove all accumulated debris from the exterior of CROWS. Each component or system has specific requirements for cleaning that are identified within each procedure.

**NOTE**

During cleaning, rinse lint-free cloth frequently to prevent scratching. Replace cleaning cloth as required.

2. Remove grime and salt from metal, plastic, and rubber surfaces with a lint-free cleaning cloth (WP 0051, item 4) dampened with a clean, general purpose detergent (WP 0051, item 5) and/or fresh water.
3. Using clean Lens Paper (WP 0051, item 13) folded into a swab and moistened with Lens Cleaning Compound (WP 0051, item 3), clean VIM and TIM in a circular motion starting at center and working toward edges. Allow to air dry.
4. Remove loose dirt, dust, and foreign matter from exterior surfaces and Connector Contacts.
5. Dampen a lint-free cleaning cloth (WP 0051, item 4) with isopropyl alcohol (WP 0051, item 9) and remove grime from connectors. Use compressed air if available to blow out connectors.
6. Allow connectors to air dry or wipe dry with a lint-free cleaning cloth (WP 0051, item 4).
7. Clean CROWS exterior using clean water and general purpose detergent (WP 0051, item 5) to remove grease and grime.

The cleaning instructions for metal surfaces are summarized in Table 1.

**Table 1. Clean Exterior.**

Item	Instructions
<b>Metal Surfaces</b>	<p>The following instructions apply to the Soft Mount and the exterior surfaces of the WS. Ensure the Lens Caps are fitted on the VIM, TIM, and LRF prior to exposure to pressurized water.</p> <p>Use dry, clean Wiping Cloths of cotton (WP 0051, item 14) to remove dust, dirt, moisture, or other foreign matter from the surfaces.</p> <p>If the foreign matter cannot be removed using dry Wiping Cloths (WP 0051, item 14), caked mud or dirt can be removed with a Cleaning Cloth (WP 0051, item 4) dampened with water.</p> <p>Caked mud or dirt can also be removed by flushing with pressurized water.</p>

#### **CLEAN VIM, TIM, AND LRF**

#### **CAUTIONS**

The Lens Caps must be fitted on the VIM, TIM, and LRF prior to exposure to pressurized water to prevent damage to optical sensors.

Do not remove ice by tapping it loose from the lens. This can damage the lens surfaces.

Use only manufacturer and Army-prescribed cleaning materials when cleaning the lens surfaces to avoid damage to optical surfaces. Do not clean the lens surfaces with Cleaning Cloth, Toilet Tissue, Paper Towels, or other abrasive materials as they may scratch lenses and degrade system performance. Use only Lens Paper (WP 0051, item 13) to clean lens surfaces.

Cleaning optical surfaces requires care. Each cleaning operation risks damage to optical surfaces. Avoid unnecessary cleaning to lens surfaces.

**CLEAN VIM, TIM, AND LRF - Cont**

Cleaning instructions for the VIM, TIM, and LRF are summarized at Table 2.

**Table 2. Cleaning VIM, TIM, and LRF.**

Item	Instructions
<b>Lens Cap Threads</b>	<ol style="list-style-type: none"> <li>1. Remove loose dirt from Lens Cap Threads using a Lens Brush (WP 0051, item 2).</li> <li>2. Moisten dry dirt in threads with water.</li> <li>3. Loosen dirt with a Disposable Applicator (WP 0051, item 1).</li> <li>4. Rinse Threads with water.</li> <li>5. Dry Threads using a Clean Cloth (WP 0051, item 4).</li> </ol>
<b>Housing</b>	<ol style="list-style-type: none"> <li>1. Install the Lens Caps (WP 0037).</li> <li>2. Gently clean Sight Housing with a damp cloth (WP 0051, item 4).</li> </ol>
<b>Optics/Lenses</b>	<p>Wiping or rubbing a dirty lens damages the lens coating. Dirt can also be on wiping materials, and abrasives can be in cleaning liquids. Grains of sand or metal cause more damage than soft pieces of lint. The loss of image sharpness caused by surface dirt must be weighed against possibility of damage caused by the cleaning process.</p> <p>Use an optical/lens Brush (WP 0051, item 2) for removing loose dust.</p> <p>Use unpressurized water to remove mud or caked road dust. This must be removed before performing the next step. A spotlight may help to show contamination. Dry with Lens Paper (WP 0051, item 13).</p> <p>Wipe the lens surface in a circular motion using lens paper (WP 0051, item 13) preferably moistened with water or Lens Cleaning Compound (WP 0051, item 3). If dirt, lint, or smears remain on glass, wrap a piece of Lens Paper (WP 0051, item 13) to form a sponge. Beginning at the center of the surface, swab with a circular motion while applying light downward pressure. Gradually increase radius of area being cleaned until the entire surface has been covered.</p> <p>Fingerprints, oil, or water spots - If there are only a few spots, use a few disposable applicators (WP 0051, item 1) to clean a localized area rather than Lens Paper.</p> <p>Ice on lenses should be removed by spraying de-icer on ice cover or waiting for ice to melt. When ice has melted, pat surface with a clean absorbent Wiping Cloth. Clean with Lens Paper when surface is dry. Avoid breathing on optical surfaces.</p>

**CLEAN INTERIOR**

Remove all refuse from the Host Vehicle interior.

Cleaning instructions for FCU and DCP are summarized at Table 3.

**WARNING****WEAPON FIRE**

The FCU or DCP and MPU are not completely water tight and must not be sprayed with a hose. Water inside FCU or DCP and MPU causes immediate or latent damage to fire control circuits. Water-damaged fire control circuits cause inadvertent or erratic weapon operation. To prevent death or injury to personnel and damage to equipment due to water-damaged fire control circuits, ensure the FCU or DCP and MPU are bagged prior to cleaning hull interior with a hose.

**CAUTION**

Do not use an alcohol-based cleaner on an LCD screen. Such a cleaner clouds the display and damages the surface of the screen.

**Table 3. Clean Interior.**

<b>Item</b>	<b>Instructions</b>
<b>Cleaning of Screen and Buttons on FCU/DCP</b>	Clean using a Cleaning Cloth (WP 0051, item 4) slightly dampened with water. Wipe buttons clean using a damp cloth (WP 0051, item 4).

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
LUBRICATE CROWS**

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**THIS WORK PACKAGE COVERS:**

Lubrication of the system.

---

**INITIAL SETUP:****Materials/Parts**

Lubricant and Preservative Cleaner  
(WP 0051, item 3)  
Lubricating Oil (LSA) (WP 0051, item 9)  
Lubricating Oil (LSAT) (WP 0051, item 10)  
Lubricating Oil (WEA) (WP 0051, item 11)  
Wiping Rags (WP 0051, item 13)

**References**

Vehicle Operator Manual  
WP 0036  
WP 0043

**Equipment Condition**

CROWS Shut Down (WP 0036)  
Vehicle Shut Down (Vehicle  
Operator Manual)

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**GENERAL**

Lubrication of CROWS equipment at operator/crew level is limited to the following components using lubricants prescribed by the Army or manufacturer:

- a. Soft Mount Assembly
- b. Cocking Brackets
- c. Ammunition Box

**Lubricants**

The manufacturers of the Soft Mount recommend Valvoline 1299 WD fluid to be applied on working metal surfaces for lubrication and corrosion protection; however, ordinary Army lubricating oils and grease can also be used.

- a. Lubricating Oil, (LSA), MIL-L-46000 (NSN 9150-00-889-3522)
- b. Lubricating Oil, (LSAT), MIL-L-46150 (NSN 9150-01-109-7793)

**GENERAL - Cont****Cold weather (Below 0°C)**

Sub-zero weather causes lubricants to become thicker. In temperatures below 32 degrees F (0 degrees C), Lubricating Oil, WEA, MIL-L-14107 (NSN 9150-00-292-9687), is recommended.

**Lubrication of Soft Mount Assembly****CAUTION**

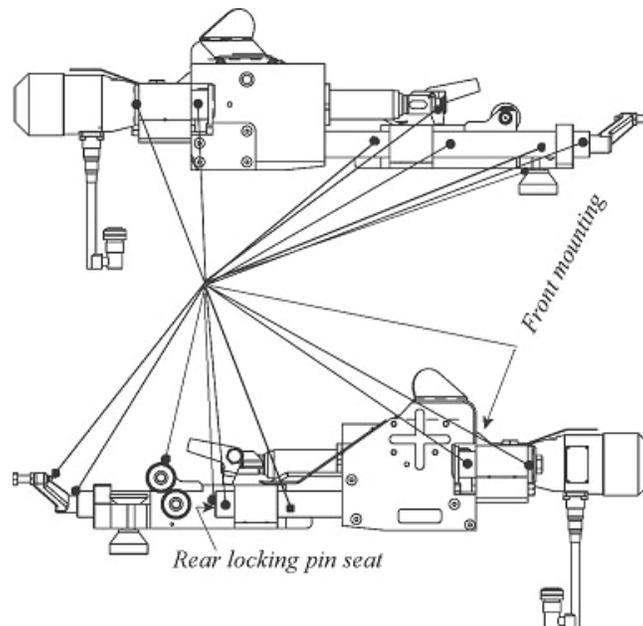
Do not apply lubricant on Friction Brakes to prevent damage to equipment.

**NOTE**

The Soft Mount is easier to move with a weapon installed.

The Soft Mount should be thoroughly cleaned and lubricated before exposure to extreme cold.

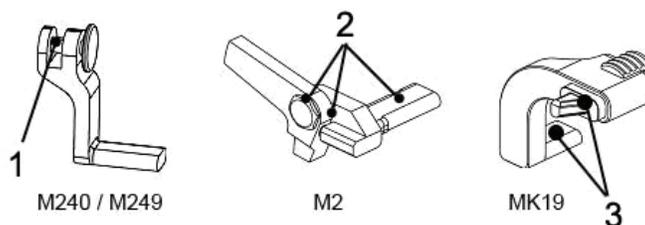
1. The arrows (Figure 1) indicate lubricating points for the Soft Mount Assembly. Lubricant should be applied on both sides of the Rubber Buffers on the Cocking Actuator. The Internal Cradle must be pushed forward to get oil at the rear of the Rubber Buffer and pushed backward to lubricate the front.
2. Push the Internal Cradle back and forth several times to make the oil work along the gliding surfaces.



**Figure 1. Soft Mount Lubrication.**

## Lubrication of Cocking Brackets

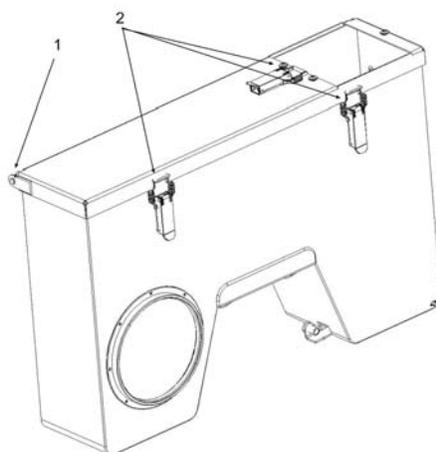
Cocking Bracket lubrication points for the M2 .50 caliber Machine Gun (2), MK19 40mm Grenade Machine Gun (3), M240 7.62mm Machine Gun, or M249 5.56mm Machine Gun (1) are shown in Figure 2.



**Figure 2. Cocking Bracket Lubrication.**

## Lubrication of Ammo Box

Lubrication of the Ammo Box is limited to both hinges (1) and all latches (2) (Figure 3).



**Figure 3. Ammo Box Lubrication.**

## Care and Cleaning During Unusual Conditions

In addition to normal preventive maintenance checks and services, special care should be taken to clean and lubricate WS when extreme temperature, humidity, or terrain conditions are present or anticipated. Properly cleaned and lubricated equipment ensures proper operation and functioning and guards against excessive wear and failure of CROWS.

**END OF TASK**

**END OF WORK PACKAGE**



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
INSTALLATION AND REMOVAL OF CASING COLLECTOR BAGS**

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**THIS WORK PACKAGE COVERS:**

Installation and Removal of Casing Collector Bags.

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**INITIAL SETUP:**

**References**

Vehicle Operator Manual  
(WP 0036)

**Equipment Conditions**

Engine Shut Down (Vehicle Operator  
Manual)  
CROWS Shut Down (WP 0036)

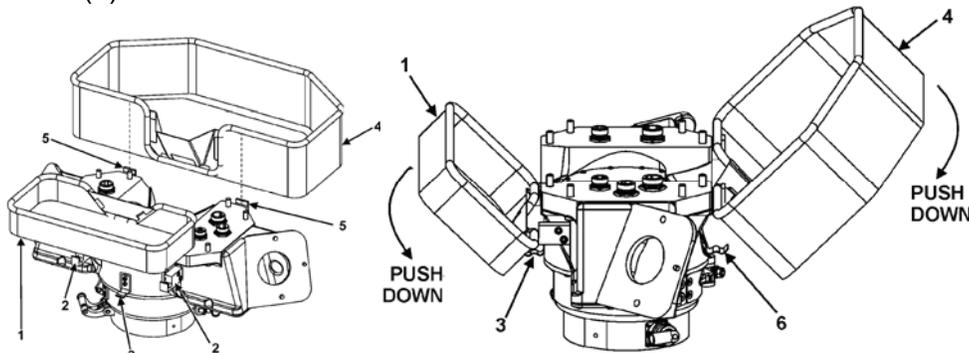
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**CAUTION**

Do not install rear Casing Collector Bag when using M240 or M249 to prevent damage to equipment.

**INSTALLATION OF FRONT AND REAR CASING COLLECTOR BAGS**

1. Hook upper rim of Front Collector Bag (1) onto two Front Locking Brackets (2) (Figure 1).
2. Push Front Collector Bag (1) down until Locking Clamp clicks in locked position on Spring Latch (3).
3. Hook upper rim of Rear Collector Bag (4) onto two Rear Locking Brackets (5).
4. Push Rear Collector Bag (4) down until Locking Clamp clicks in locked position on Rear Spring Latch (6).

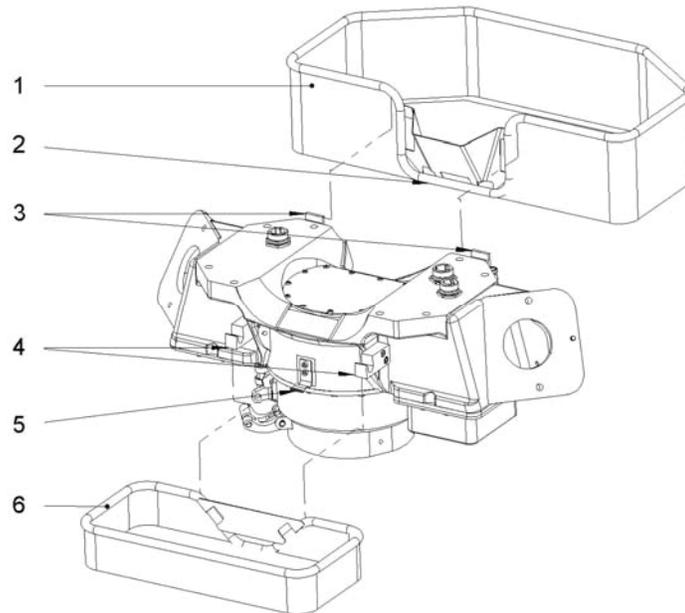


**Figure 1. Front and Rear Casing Collector Bags, Installation.**

**END OF TASK**

**REMOVAL OF FRONT AND REAR CASING COLLECTOR BAGS**

1. Pull Front Collector Bag (6) upward until Locking Clamp unlocks from Spring Latch (5) (Figure 2).
2. Unhook upper rim of Front Collector Bag (6) from two Front Locking Brackets (4).
3. Pull Rear Collector Bag (1) upward until Locking Clamp (2) unlocks from Rear Spring Latch.
4. Unhook upper rim of Rear Collector Bag (1) from two Rear Locking Brackets (3).



**Figure 2. Front and Rear Casing Collector Bags, Removal.**

**END OF TASK**

**END OF WORK PACKAGE**

## **CHAPTER 6**

### **SUPPORTING INFORMATION**



**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

**REFERENCES**

This work package lists publications referenced in this manual.

**REFERENCE LIST**

<b>PUBLICATION</b>	<b>TITLE/ADDITIONAL INFORMATION</b>
<b>DEPARTMENT OF ARMY PAMPHLETS AND FORMS</b>	
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 285	U.S. Army Accident Report
DA Form 5988-E	Equipment Inspection Maintenance Worksheet (EGA) - Electronic
DA PAM 738-751	Functional Users Manual for the Army Maintenance Management Systems-Aviation (TAMMS-A)
DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual
SF 368	Product Quality Deficiency Report
<b>MILITARY HANDBOOKS, SPECIFICATIONS, AND STANDARDS</b>	
MIL-STD-129P	Military Marking for Shipment and Storage
<b>MISCELLANEOUS PUBLICATIONS</b>	
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-909	Field and Garrison Furnishings and Equipment
CTA 50-970	Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
<b>RELATED PUBLICATIONS</b>	
DOD 4160.21-M	Defense Materiel Disposition Manual
<b>TECHNICAL MANUALS</b>	
TM 9-1005-201-10	Operator's Manual for Machine Gun, 5.56MM, M249 w/Equip (NSN 1005-01-127-7510) (EIC: 4BG)
TM 9-1005-213-10	Operator's Manual for Machine Guns, Caliber .50; M2, Heavy Barrel Flexible, W/E (1005-00-322-9715) (EIC: 4AG) M48 Turret Type (1005-00-957-3893) (EIC: 4BB) Soft Mount (1005-01-343-0747) (Navy) Fixed Type Right Hand Feed (1005-00-122-9339) (Navy) Fixed Type Left Hand Feed (1005-00-122-9368) (Navy)
TM 9-1005-313-10	Operator's Manual for Machine Gun, 7.62MM, M240 (1005-01-025-8095); M240B (1005-01-412-3129); M240C (1005-01-085-4758); M240D (1005-01-418-6995); M240E1 (1005-01-252-4288); M240G (1005-01-359-2714); M240H (1005-01-518-2410); M240N (1005-01-493-1666)

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**REFERENCE LIST – Cont**

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<b>PUBLICATION</b>	<b>TITLE/ADDITIONAL INFORMATION</b>
TM 9-1010-230-10	Operator's Manual for Machine Gun, 40MM, MK19, MOD 3 (1010-01-126-9063) (EIC: 4AE)

**ARMY REGULATIONS**

AR 75-1	Malfunctions Involving Ammunition and Explosives (RCS CSGLD-1961 (MI))
AR 385-10	The Army Safety Program
AR 700-138	Army Logistics Readiness and Sustainability

**FIELD MANUALS**

FM 4-25.11	First Aid
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**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII)**

---

**Scope**

This work package contains lists and procedures related to Components of End Item (COEI) and Basic Issue Items (BII) for CROWS.

**General**

The COEI list is for information purposes only and is not authority to requisition replacements. These items are part of CROWS. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. COEI items are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify items.

Bills are required to place CROWS in operation, operate it, and perform emergency repairs. Although shipped separately packaged, BII must be with CROWS during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of end item by TOE/MTOE. Illustrations are furnished to help you find and identify items.

**Explanation of Columns in COEI List and BII List**

Column (1) Illus Number. Provides the number of the illustrated item.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, Part Number/CAGEC. Identifies the Federal item name (in all CAPS) followed by a minimum description when needed. The last line below the description is the part number and Commercial and Government Entity Code (CAGEC).

Column (4) Usable On Code (UOC). When applicable, provides a code if the item you need is not the same for different models or configurations of equipment. The UOCs used are:

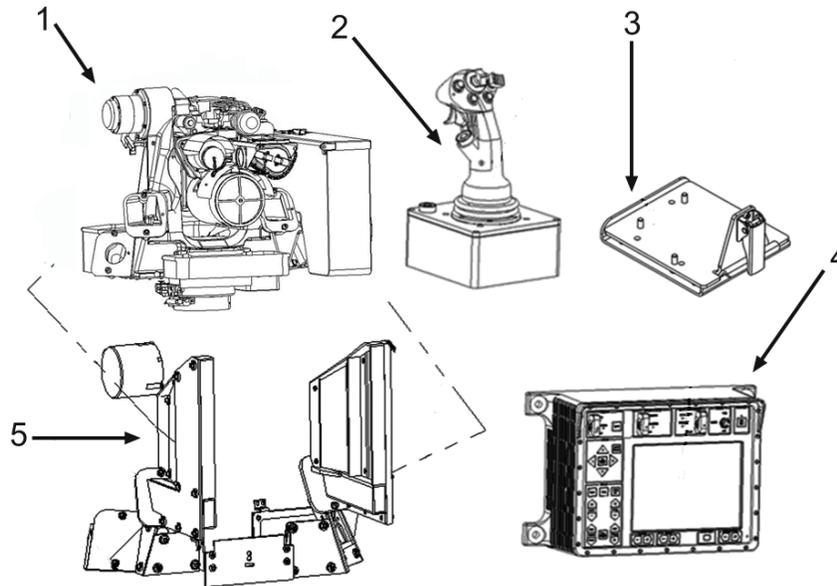
<b>Code</b>	<b>Used On</b>
CR2	FCU Configuration (PN 60201886-01)
CRS	DCP Configuration (PN 60201886-03)

Column (5) U/I. The Unit of Issue (U/I) specifies the count of an item as issued by the NSN shown in column (2).

Column (6) Qty Rqr. Indicates the quantity required.

**COMPONENTS OF END ITEM**

The major assemblies for the CROWS FCU configuration, PN 60201886-01 (Figure 1), are at Table 1; for down parts, go to TM 9-1090-219-10-HR.



**Figure 1. FCU Configuration.**

**Table 1. Components of End Item (COEI), FCU Configuration.**

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	1090-25-160-1150	ARMAMENT SUBSYSTEM, REMOTELY OPERATED (FCU Configuration), 60201886-01/N0013			
1	TBD	WEAPON STATION, 60201887-01/N0013		EA	1
4	1220-25-160-2187	ELECTRONIC UNIT, FIRE CONTROL COMPUTER (FCU w/Software), 60202303-01/N0013	CR2	EA	1
2	TBD	GRIP ASSEMBLY, CONTROL (CG), 502-G6582/N4277		EA	1
3	TBD	MOUNTING BASE, ELECTRIC (Quick Release for CG), 60207524-00/N0013		EA	1
5	TBD	ARMOR, SUPPLEMENTAL (Ballistic Protection Kit), 60201973-04/N0013		EA	1

Table 1. Components of End Item (COEI), FCU Configuration - Cont

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	1005-25-160-0299	ADAPTER, GUN MOUNTING (M2 weapon adaption items), 60202309-01/N0013		EA	1
	1005-25-160-0300	ADAPTER, GUN MOUNTING (MK19 weapon adaption items), 60202308-01/N0013		EA	1
	1005-25-160-0304	ADAPTER, GUN MOUNTING (M240 weapon adaption items), 60202310-01/N0013		EA	1
	1005-25-160-0303	ADAPTER, GUN MOUNTING (M249 weapon adaption items), 60202311-01/N0013		EA	1
	5995-25-160-0298	CABLE ASSEMBLY, SPECIAL PURPOSE (W1 FCU/CG), 60202266-01/N0013	CR2	EA	1
	5995-25-160-0295	CABLE ASSEMBLY, SPECIAL PURPOSE (W2 MFA/FCU), 60202496-01/N0013		EA	1
	5995-25-160-0296	CABLE ASSEMBLY, SPECIAL PURPOSE (W3 MFA/FCU), 60202497-01/N0013		EA	1
	5920-25-160-0291	CABLE ASSEMBLY, SPECIAL PURPOSE (W11 FCU/Power Supply w/fuse), 60202488-02/N0013		EA	1
	TBD	STORAGE BAG, 60203302-01/N0013		EA	1

The major assemblies for the CROWS DCP configuration, PN 60201886-03 (Figure 2), are at Table 2; for down parts, go to TM 9-1090-219-10-HR.

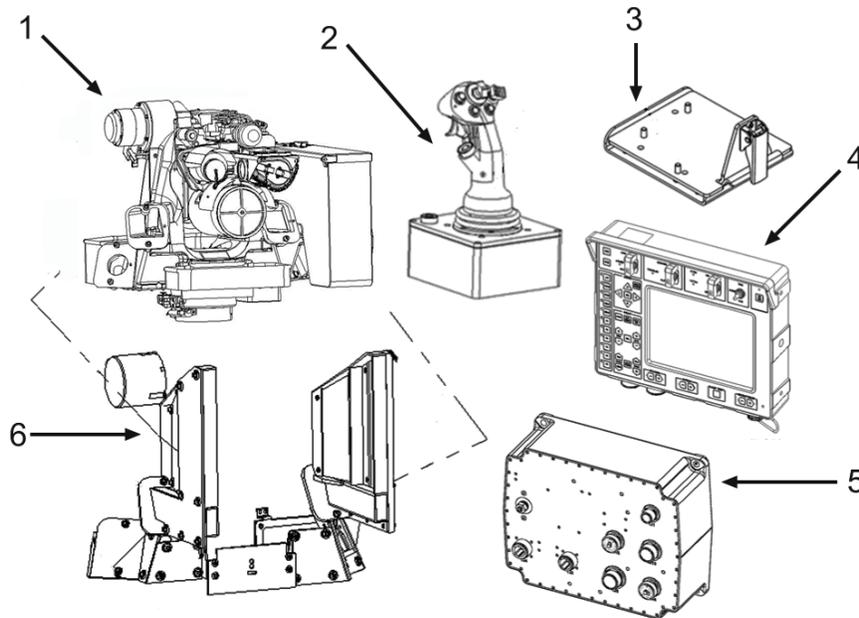


Figure 2. DCP Configuration.

Table 2. Components of End Item (COEI), DCP Configuration

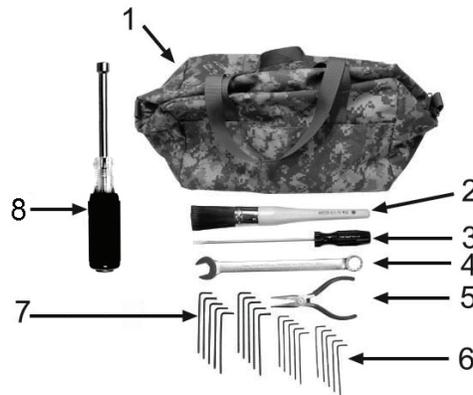
(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	1090-25-160-1292	ARMAMENT SUBSYSTEM, REMOTELY OPERATED (DCP Configuration) 60201886-03/N0013			
1	TBD	WEAPON STATION, 60201887-01/N0013		EA	1
4	TBD	DISPLAY UNIT (DCP), 68113473-02/N0013	CRS	EA	1
5	TBD	ELECTRONIC UNIT, FIRE CONTROL COMPUTER (MPU w/Software), 60209139-00/N0013	CRS	EA	1
2	TBD	GRIP ASSEMBLY, CONTROL (CG), 502-G6582/N4277		EA	1
3	TBD	MOUNTING BASE, ELECTRIC (Quick Release for CG, 60207524-00/N0013		EA	1
6	TBD	ARMOR, SUPPLEMENTAL (Ballistic Protection Kit), 60201973-04/N0013		EA	1

Table 2. Components of End Item (COEI), DCP Configuration - Cont

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	1005-25-160-0299	ADAPTER, GUN MOUNTING (M2 weapon adaption items), 60202309-01/N0013		EA	1
	1005-25-160-0300	ADAPTER, GUN MOUNTING (MK19 weapon adaption items), 60202308-01/N0013		EA	1
	1005-25-160-0304	ADAPTER, GUN MOUNTING (M240 weapon adaption items), 60202310-01/N0013		EA	1
	1005-25-160-0303	ADAPTER, GUN MOUNTING (M249 weapon adaption items), 60202311-01/N0013		EA	1
	TBD	CABLE ASSEMBLY, SPECIAL PURPOSE (W1 DCP/CG), 60202266-10/N0013	CRS	EA	1
	5995-25-160-0295	CABLE ASSEMBLY, SPECIAL PURPOSE (W2 MFA/MPU), 60202496-01/N0013		EA	1
	5995-25-160-0296	CABLE ASSEMBLY, SPECIAL PURPOSE (W3 MFA/MPU), 60202497-01/N0013		EA	1
	5920-25-160-0291	CABLE ASSEMBLY, SPECIAL PURPOSE (W11 MPU/Power Supply w/fuse), 60202488-02/N0013		EA	1
	TBD	CABLE ASSEMBLY, SPECIAL PURPOSE (W504 MPU/DCP), 60207988-05/N0013		EA	1
	TBD	STORAGE BAG, 60203302-01/N0013		EA	1

**BASIC ISSUE ITEMS**

CROWS Toolkit items (Figure 3) are at Table 3.



**Figure 3. Toolkit Items.**

**Table 3. CROWS Toolkit.**

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	5180-01-563-4025	TOOL KIT, CROWS, DFP TRI-012/19204			
1	5140-00-329-4306	POUCH, MECHANIC'S TOOLS, TP-279/58110		EA	1
2	7920-00-205-0565	BRUSH, DUSTING, LENS AND PHOTOGRAPHIC NEGATIVE, 61674/99592		EA	1
3	5120-00-260-4837	SCREWDRIVER, FLAT TIP, B107.15/05047		EA	1
4	5120-01-430-8192	WRENCH, OPEN END (19mm), 21117/08292		EA	1
5	5120-00-293-3481	PLIERS, B107.13/05047		EA	1
6	5120-01-431-7081	KEY, SOCKET HEAD SCREW (2mm), 57118/08292		EA	10
7	5120-01-431-7066	KEY, SOCKET HEAD SCREW (3mm), 57122/08292		EA	10
8	5120-01-278-6697	NUTDRIVER (7mm) 7MM/96508		EA	1

Items included in CROWS Boresight Alignment Kit (Figure 4) are at Table 4.

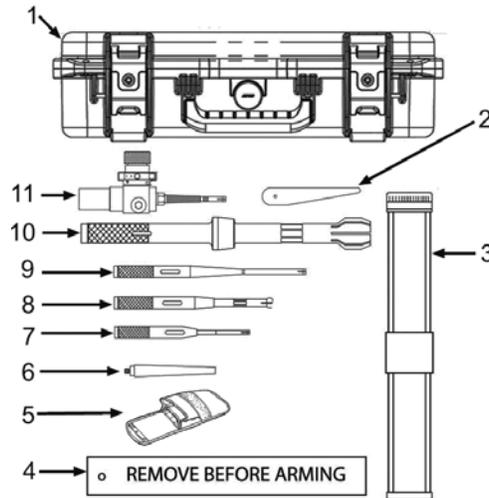


Figure 4. CROWS Boresight Alignment Kit.

Table 4. CROWS Boresight Alignment Kit.

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	1005-01-571-7212	BORESIGHT KIT (CROWS Boresight Alignment Kit) 11838954/19200		EA	1
1	1240-01-573-0377	CASE, OPTICAL INSTRUMENT (Carrying Case w/Foam) 1917A/0TJ49			
	8145-01-573-0373	CUSHIONING MATERIAL, PACKAGING (Carrying Case Foam) 1800AME001/0TJ49			
2	TBD	Wedge Tool 13023693/19200			
3	6920-01-572-6190	TARGET, BORESIGHTING (Table 7), 13022749/19200			
4	TBD	Streamer, Warning 11686403/19205			
5	5860-01-471-2091	BORELIGHT SYSTEM, LASER (Table 5) AN/PEM-1/80058			
6	4920-01-548-7633	BORESIGHT MANDREL ADAPTER 13017065/19200			

## BASIC ISSUE ITEMS – Cont

Table 4. CROWS Boresight Alignment Kit- Cont

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
7	4931-01-573-4106	MANDREL, BORESIGHT (M249) 13022750/19200			
8	4931-01-573-0374	ADAPTER, STEM (M2) 13022751/19200			
9	4931-01-573-4105	MANDREL, BORESIGHT (M240) 13023642/19200			
10	4931-01-573-4107	MANDREL, BORESIGHT (MK19) 13022752/19200			
11	1240-01-563-7476	SIGHT, BORE, OPTICAL (Borescope) 8-1001/1DBZ2			
	TBD	RING, TANG END 14375T9/39428			
	4020-01-577-0118	LANYARD, NYLON CORD 9137T72/39428			

Items included in the Alternate Boresight Alignment Kit (Figure 5) are at Table 5.

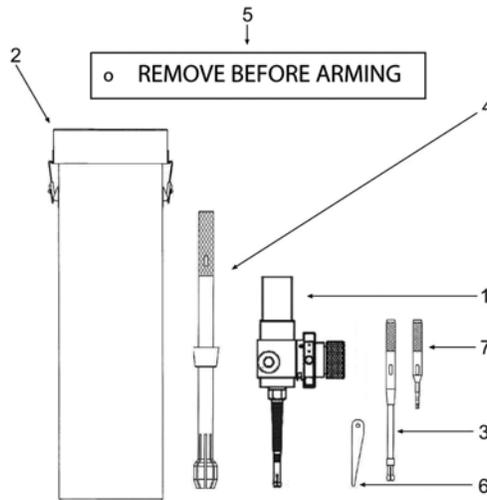


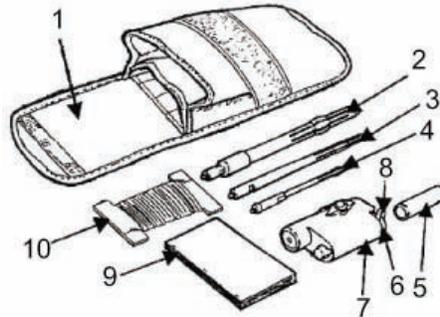
Figure 5. Alternate Boresight Alignment Kit.

Table 5. Alternate Boresight Alignment Kit.

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	6650-01-563-6732	BORESCOPE KIT 8-4556/1DBZ2		EA	1
1	1240-01-563-7476	SIGHT, BORE, OPTICAL (Borescope) 8-1001/1DBZ2			
2	1240-01-441-5411	CARRYING CASE 1-1003/1DBZ2			
3	4933-01-446-3816	ADAPTER STEM (M2) 1-1006/1DBZ2			
4	NONE	ADAPTER STEM (MK19) 1-1009/1DBZ2			
5	8345-01-441-6459	STREAMER, WARNING 1-1004/1DBZ2			
6	1240-01-441-5412	DRIFT KEY 1-1005/1DBZ2			
7	NONE	ADAPTER STEM (M249) 1-1556/1DBZ2			
	5860-01-471-2091	BORELIGHT SYSTEM, LASER (Table 5) AN/PEM-1/80058 (Added to Kit)			
	4920-01-548-7633	BORESIGHT MANDREL ADAPTER 13017065/19200 (Added to Kit)			
	6920-01-572-6190	TARGET BORESIGHTING (Table 7) 13022749/19200 (Added to Kit)			

**BASIC ISSUE ITEMS – Cont**

Items included in the Laser Borelight System (Figure 6) are at Table 6. The Laser Borelight System is included with the CROWS Boresight Alignment Kit and is added to the Alternate Boresight Alignment Kit.



**Figure 6. Laser Borelight System.**

**Table 6. Laser Borelight System.**

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	5860-01-471-2091	BORELIGHT SYSTEM, LASER AN/PEM-1/80058		EA	1
1	8465-01-562-5897	BAG, INDIVIDUAL EQUIPMENT, CARR LBS-849/0B107			
2	4933-01-518-6150	BORELIGHT SYSTEM, LASER (M2) LBS-076/0B107			
3	4933-01-474-1265	MANDREL, EXPANSION (M240) LBS-071/0B107			
4	4933-01-474-1114	BORESIGHTING EQUIPMENT (M249) LBS-070/0B107			
5	6135-00-985-7845	BATTERY, NONRECHARGEABLE (AA) AA ALKALINE SIX/06101			
	6135-01-333-6101	BATTERY, NONRECHARGEABLE (AA) L91/83740			
6	5999-01-515-2752	CAP, ELECTRICAL ITP-601/0B107			
7	NONE	Laser Boresight Assembly LBS-301-A7/0B107			
8	5340-01-555-8465	STRAP RETAINING 4B224/0B107			
9	NONE	Operator Manual (TM 9-5860-226-13&P) LBS-TM-L804/0B107			
10	4020-01-518-8663	CORD, FIBROUS (Distance Gauge) LBS-090/0B107			

CROWS Boresight Target items (Figure 7) are at Table 7.

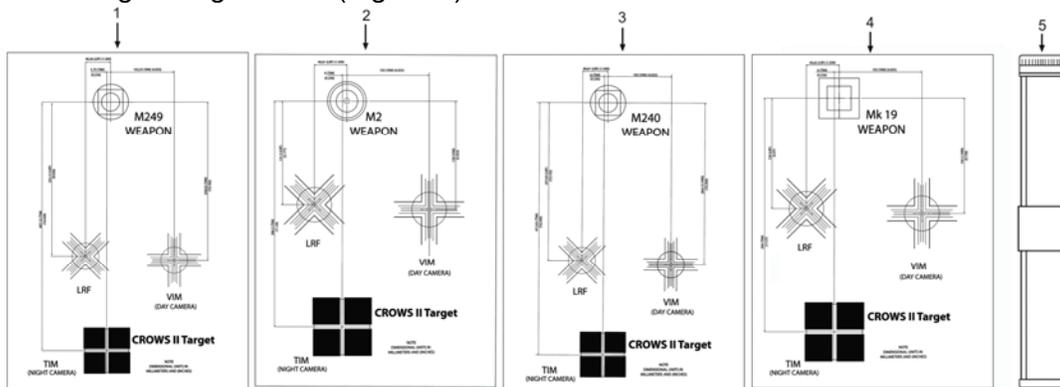


Figure 7. Boresight Target Set.

Table 7 Boresight Target Set.

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	6920-01-572-6190	TARGET, BORESIGHTING (Target Set), 13022749/19200			
1	4933-01-575-7787	TARGET, BORESIGHTING (M249), 13022749-1/19200			
2	4933-01-575-7822	TARGET, BORESIGHTING (M2), 13022749-2/19200			
3	4933-01-575-7816	TARGET, BORESIGHTING (M240) 13022749-3/19200			
4	4933-01-575-7829	TARGET, BORESIGHTING (MK19) 13022749-4/19200			
5	NONE	TARGET TUBE TS1/23366			

END OF WORK PACKAGE



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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)  
ADDITIONAL AUTHORIZED ITEMS (AAL)**

---

**Scope**

This work package contains the Additional Authorization List (AAL) for CROWS.

**General**

The AAL identifies items that do not have to accompany CROWS and that do not have to be turned in with it. These items are authorized by CTA, MTOE, TDA, or JTA.

**Explanation of Columns in the AAL**

Column (1) Illus Number. Provides the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, Part Number/CAGEC. Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

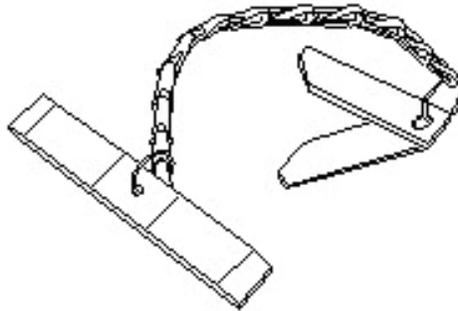
Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment.

Column (5) U/I. Unit of Issue (U/I) indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (1).

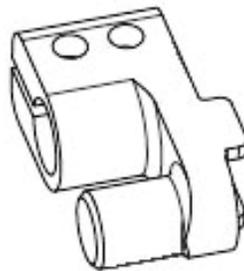
Column (6) Qty Recm. Indicates the quantity recommended.

**ADDITIONAL AUTHORIZATION LIST (AAL)**

Additional Authorization List is at Table 1.



**Figure 1. M2 Timing Gauges.**



**Figure 2. Adapter, Offset Charging Handle.**

**Table 1. Additional Authorization List (AAL).**

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/CAGEC	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	5220-00-535-1217	M2 Timing Gauges: GO/NO GO and FIRE/NO FIRE Gauges * 5351217/19200			1
2	5340-01-578-0847	Adapter, Offset Charging Handle (M240) 13021845/19200			1

\* Normally fielded as part of weapon support structure; issued with M2 as BII.

**END OF WORK PACKAGE**

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**OPERATOR'S MANUAL  
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COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

**EXPENDABLE AND DURABLE ITEMS**

---

This work package lists expendable and durable items that you will need to operate and maintain the CROWS.

**INTRODUCTION**

This list is for information only and is not authority to requisition listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items.

**EXPLANATION OF COLUMNS IN THE EXPENDABLE/DURABLE ITEMS LIST**

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., "Use acetone (WP 0038, item 1)").

Column (2) Level. This column includes the lowest level of maintenance that requires the listed item (C = Crew, O = Service, F = Field, H = Below Depot, D = Depot).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item used when you requisition the item.

Column (4) Item, Description, Commercial and Government Entity Code (CAGEC), and Part Number (P/N). This column provides the other information you need to identify the item. The item description comes first, followed by the CAGEC (in parentheses) and the P/N.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item such as gallon, dozen, gross, etc., as issued per the NSN shown in column (3).

**EXPENDABLE AND DURABLE ITEMS LIST**

Table 1 details consumable, expendable, and durable materials required for operational procedures.

**WARNINGS**

Follow all safety precautions and procedures when handling these materials.

Read all appropriate Material Safety Data Sheets (MSDS).

Follow all instructions and local standard operating procedures (SOPs) concerning use, storage, and disposal of items deemed "hazardous materials." For disposition of hazardous materials, contact your local hazardous material or safety office.

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash exposed area immediately with soap and water.

Failure to follow these instructions may result in personal injury or equipment damage.

**Table 1. Expendable and Durable Materials.**

(1) Item No.	(2) Level	(3) National Stock Number	(4) Item Name, Description, CAGEC, and Part Number	(5) U/I
1	C	6515-01-464-0432	APPLICATOR, DISPOSABLE (3Y857) 968382	PG
2	C	9150-01-054-6453	CLEANER, LUBRICANT AND PRESERVATIVE (65983) CLP-NC	PT
3	C	6850-00-227-1887	CLEANING COMPOUND, OPTICAL LENS (58536) AA59199-I	QT
4	C	7920-01-214-6083	CLOTH, CLEANING (09ZF6) 309A	LB
5	O	7930-00-559-9616	DETERGENT, GENERAL PURPOSE (81348) PD220	CN
6	C	8415-01-434-1781	GLOVES, DISPOSABLE (100 EA/BX) (0Z057) GRER-LG	BX
7	C	8415-00-559-5613	GLOVES, MEN'S (80244) A-A-1665 ST3	EA
8	C	4240-01-548-9078	GOGGLES, SAFETY (59678) 40651	EA
9	C	6505-00-655-8366	ISOPROPYL RUBBING ALCOHOL (55763) NDC00597-0067-16	BT
10	C	9150-00-889-3522	LUBRICATING OIL, SEMIFLUID (LSA) (19204) 8436793	CN
11	C	9150-01-109-7793	LUBRICATING OIL, SEMIFLUID (LSAT) (81349) MIL-L-46150	CN
12	C	9150-00-292-9687	LUBRICATING OIL, WEAPONS (81349) MIL-PRF-14107	CN
13	C	6640-00-285-4694	PAPER, LENS, 100-SHEET PACKAGE (81348) NNN-P-40	SH
14	C	7920-01-368-1622	RAG, WIPING (0LFR1) 1G	BX

**END OF WORK PACKAGE**



**OPERATOR'S MANUAL  
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COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

**GLOSSARY**

This work package contains two tables: Table 1 lists general abbreviations and terms and Table 2 lists units of measure.

Table 1 contains general abbreviations including acronyms and terms related to CROWS operation.

**Table 1, General Abbreviations and Terms**

<b>Term, Abbreviation (Acronym)</b>	<b>Definition</b>
.50-cal	M2 HB .50-caliber automatic machine gun listed by ammunition
7.62mm	M240 7.62mm automatic machine gun listed by ammunition
5.56mm	M249 5.56mm automatic machine gun listed by ammunition
40mm	MK19 40mm grenade machine gun listed by ammunition
A	SMR recoverability code
AAL	Additional Authorization List
AD	SMR source code
AEPS	Army Electronic Product Support
AF	SMR source code
AH	SMR source code
AIC	Ammunition Insertion Cassette
Aimpoint	Related to laser aimpoint and ballistic aimpoint
AL	SMR source code
Alphanumeric parameters	For data entry (Menu System), alphanumeric parameters represent operational functions (e.g., the selected ammunition or sensor settings).
AO	SMR source code
AUX	Auxiliary
Az, AZ, Azimuth	Horizontal movement or measurement
B	SMR maintenance code (fourth position)
Ballistic solution	After Operator aligns reticle on target and fires LRF, ballistic computer calculates a ballistic solution for engagement and generates a corrected ballistic aimpoint on screen.
BII	Basic Issue Items
BIT	Built-in-test
Black hot	Polarity option when using thermal camera.

**Table 1, General Abbreviations and Terms**

<b>Term, Abbreviation (Acronym)</b>	<b>Definition</b>
Boresighting Brt	Procedure to align bore and line of sight. Brightness
C	SMR maintenance code (third position)
CA	Cocking Actuator
CAGE Code, CAGEC	Commercial and Government Entity Code
CAL	Calibrate
CARC	Chemical Agent Resistant Coating (Governed by MIL-C-46168, MIL-C-53039, and MIL-DTL-64159)
<b>CAUTION</b>	Precedes text of any procedure involving a clear risk of damage to equipment.
CCD	Charge Coupled Device
CCW	Counterclockwise
CG	Control Grip
CHG	Charge
COEI	Component(s) of End Item
CPC	Corrosion Prevention and Control
Cradle or Cradle Assembly	Equipment used to hold the applicable weapon and adapter kit.
CROWS	Common Remotely Operated Weapon System
CSCI	Computer Software Configuration Item
CW	Clockwise
D	Depot, as in depot-level maintenance, also down also SMR maintenance code (third position and fourth position) also SMR recoverability code
DCP	Display and Control Panel
Dispersion	Scattered pattern of hits from fired projectiles
DSP	Digital Signal Processor
Dynamic Tracking	The ability to track a target while one or the other, or both, are in motion.
EI, EL, elevation	Vertical movement or measurement
EIR	Equipment Improvement Recommendation
EMI	Electromagnetic interference
EMP	Electromagnetic pulse
ELRF	Eyesafe laser rangefinder
ESD	Electrostatic discharge
ETM	Electronic Technical Manual
F	First
FCS	Fire Control System
FCU	Fire Control Unit
FGC	Functional Group Code
FOV	Field of view
FPGA	Field Programmable Gate Array

**Table 1, General Abbreviations and Terms**

Term, Abbreviation (Acronym)	Definition
GMG	Grenade machine gun
H	SMR maintenance code (third position and fourth position) SMR recoverability code
HB	Heavy barrel used with the M2 weapon
HCI	Human-computer interface also hardness critical item
HDI	Chemical compound in CARC; hexamethylene-1,6-diisocyanate
HIU	Hatch Interrupt Unit
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
Host Vehicle	The approved vehicle on which CROWS is installed
Hot, white or black	Polarity options when using the thermal camera
HW	Hardware
IBA	Improved body armor
ICD	Interconnect diagram
ICS	Interface cable set
ID	Identification
IO	Input/output
IPL	Illustrated parts list
IR	Infrared
JERRV	Joint Explosive Ordnance Disposal Rapid Response Vehicle
KB	SMR source code
KD	SMR source code
KF	SMR source code
L	Last also left also SMR maintenance code (third position and fourth position) SMR recoverability code
LAN	Local Area Network
LBS	Laser Borelight System also Unit of Measure, pounds
LCD	Liquid Crystal Display
LED	Light Emitting Diode
Lockwire, lock wire	See safety wire
LOS	Line of Sight
LRF	Laser Range Finder
LRU	Line Replacement Unit, equivalent to Field-level maintenance
LSSA	Left Side Support Assembly

Table 1, General Abbreviations and Terms - Cont

Term, Abbreviation (Acronym)	Definition
M2, M2 HB, M2 HB .50-cal	M2 Heavy Barrel (HB) .50-caliber automatic machine gun listed by model and ammunition caliber
M240B, M240B 7.62mm	M240B 7.62mm automatic machine gun listed by model and ammunition caliber
M249, M249 5.56mm	M249 5.56mm automatic machine gun listed by model and ammunition caliber
MAC	Maintenance Allocation Chart, defines maintenance tasks to be performed on designated components/assemblies, those responsible for performing the tasks, and tools/equipment needed to complete the task.
MAG	Magnify, zoom control on CG
MASC	Multi Adapter, Small Caliber
MD	SMR source code
Menu System	System of computer-based operational options shown on screen and used to operate CROWS.
MF	SMR source code
MFA	Main Frame Assembly
MH	SMR source code
MK19, MK19 40mm	MK19 40mm grenade machine gun listed by model and ammunition caliber
ML	SMR source code
MLT	Multiple Targets
MO	SMR source code
MOUT	Military Operations in Urban Terrain
MPI	Mean Point of Impact
MPU	Main Processing Unit
MRU	Motion Reference Unit
MSDS	Material Safety Data Sheet Contains information about components, usage, storage, safety issues/concerns, and disposal of materials.
NBC	Nuclear, Biological, and Chemical Refers to contamination conditions.
NFOV	Narrow field of view
NFZ	No Fire Zone
NHA	Next higher assembly
NIR	Near infra red
NMC	Not mission capable; the condition where the equipment is deadlined
NORM	Normal
<b>NOTE</b>	Highlights essential procedures, conditions or statements that follow.
NSN	National Stock Number
NTSC	National Television Standards Committee, a video formatting standard
NTZ	No Traverse Zone
Numeric value	For data entry (Menu System), a numeric value is a series of numbers representing system data (e.g., distance or temperature).

**Table 1, General Abbreviations and Terms – Cont**

<b>Term, Abbreviation (Acronym)</b>	<b>Definition</b>
NVG	Night vision goggles
O	SMR maintenance code (third position and fourth position) SMR recoverability code
OBIT	Operational BIT
Out-of-limit data	Related to default values in the Menu system. Data outside of permitted ranges, one type of invalid data from a sensor.
OVRD	Override
P	Pressure, see Pr also
PA	SMR source code
PAL	Phase Alternating Line, a video formatting standard
Parallax	The displacement of an object as seen from two different points that are not on a line with the object.
PB	SMR source code
PBIT	Power-on BIT
PC	SMR source code
PD	SMR source code
PE	SMR source code
PF	SMR source code
PG	SMR source code
PISC	Programmable Interface and Servo Controller
PLRT	Polarity
PMC	Partially mission capable; the condition where the equipment has deficiencies but may still accomplish a mission (depending on circumstances of mission).
PMCS	Preventive Maintenance Checks and Services
PN or P/N	Part Number
P/O	Part of
Polarity	See also "reverse polarity." Refers to the thermal camera (thermal imager); options include "white hot" and "black hot."
PQDR	Product Quality Deficiency Report (SF Form 368)
Pr	Pressure sensor
PSA	Power supply assembly
PSI	Pounds per square inch Pressure measurement related to compressed air and other items.
PWM	Pulse-width modulated
Qty	Quantity
R	Right
RD	Rounds

**Table 1, General Abbreviations and Terms – Cont**

<b>Term, Abbreviation (Acronym)</b>	<b>Definition</b>
RDY	Ready
Redundant	System functions that can be performed in two ways. Examples of functions that can be performed using switches on FCU/DCP or CG include FOCUS, DAY/NIGHT, CHARGE, and ZOOM (MAG).
Reticle	When related to aimpoint, it is the symbols that appear on screen for laser or ballistic aimpoint. When related to view in boresight tool, it is a grid of fine lines in the focus of an optical instrument used for determining scale or position of what is being looked at.
Reverse polarity	See also "polarity" Reverses polarity between "white hot" and "black hot" settings; "white hot" is the default.
RPSTL	Repair Parts and Special Tools List
RSSA	Right Side Support Assembly
RTCL	Reticle
RWS	Remote Weapon Station
S	Second
SAS	Sight Assembly Software
Safety wire	Material and method of securing attaching hardware and components/parts
SBC	Single Board Computer
Scan Rate	The speed that system/weapon mount moves.
SCS	Servo Control Software
SEL	Select
SG	Sensor group
SLAP	Saboted light armor penetrator
SLAP-T	Saboted light armor penetrator-tracer
Slew	To turn (something) on an axis; to rotate or pivot.
SM	Soft Mount
SMA	Soft Mount Assembly
SMR	Source, maintenance, and recoverability code describes manner of acquiring a part needed for maintenance, repair, or overhaul of an end item.
SPU	Switch panel unit
SRU	Shop replaceable unit, or equivalent to sustainment maintenance
SRWS	Stabilized remote weapon station, original (prototype) name for CROWS
SSA	Sight Servo Assembly
SSEA	Sensor support electronics assembly
SU	Sensor unit
SVGA	Super video graphics array (a computer display)
SW	Software
SWM	Stabilized Weapon Mount
Symbology	Text-and-graphics overlay generated by the EMU.

**Table 1, General Abbreviations and Terms - Cont**

Term, Abbreviation (Acronym)	Definition
Te	Temperature sensor
TFT	Thin Film Transistor
TIM	Thermal Imaging Module
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TNG	Training
Toggle	To move a switch back and forth (i.e., OFF, ON, OFF, ON).
TP	Temperature pressure, as in the sensor unit's temperature pressure sensor.
TRP	Target Reference Points
TX	Transmit
U	Up
VDD	Version Description Document
VIK	Vehicle Integration Kit
VIM	Visual Imaging Module (day sight/sensor)
VPU	Video Processing Unit
<b>WARNING</b>	Precedes text of procedure involving a clear danger to person doing procedure.
WFOV	Wide Field of View
White hot	Polarity option when using thermal camera.
WP	Work Package
WS	Weapon Station
XA	SMR source code
XB	SMR source code
XC	SMR source code
XD	SMR source code
Z	SMR maintenance code (fourth position) SMR recoverability code Zeroing indicator displayed when zeroing is being taken into account in calculating ballistics

Table 2 lists units of measure for reference purposes.

**Table 2, Symbols and Units of Measure - Cont**

---

<b>Symbol or Unit of Measure</b>	<b>Definition and Description</b>
mm	Millimeters
mmHg	millimeters of mercury; unit of atmospheric pressure
mph	miles per hour
m/s	meters per second
Nm	nautical mile
Rad	Radian
s, sec	Second
μm	Micrometers
X	Unit of magnification
Vdc, VDC	Volts direct current
Yd	Yard

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**END OF WORK PACKAGE**

**OPERATOR'S MANUAL  
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COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

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**OPERATOR'S MANUAL  
FOR THE  
ARMAMENT SUBSYSTEM, REMOTELY OPERATED: XM153  
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)**

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PUBLICATION NUMBER TM 9-1090-219-10				DATE 30 Oct 09			TITLE Common Remotely Operated Weapon Station (CROWS)	
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

**PART III – REMARKS** (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
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<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	<b>DATE</b>
For use of this form, see AR 25-30; the proponent agency is ODISC4.							
<b>TO: (Forward to proponent of publication or form) (Include ZIP Code)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630						<b>FROM: (Activity and location) (Include ZIP Code)</b>	
PUBLICATION/FORM NUMBER TM 9-1090-219-10						DATE 30 Oct 09	TITLE Common Remotely Operated Weapons Station (CROWS)
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).	
<i>*Reference to line numbers within the paragraph or subparagraph.</i>							
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<b>TO: (Forward direct to addressee listed in publication)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM: (Activity and location) (Include ZIP Code)</b>	<b>DATE</b>
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**PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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By Order of the Secretary of the Army:

Official:



JOYCE E. MORROW

*Administrative Assistant to the  
Secretary of the Army*

0928607

GEORGE W. CASEY, JR.  
*General, United States Army  
Chief of Staff*

Distribution:

To be distributed in accordance with the Initial Distribution Number (IDN) 401257 requirements for TM 9-1090-219-10.



**THE METRIC SYSTEM AND EQUIVALENTS**

**LINEAR MEASURE**

- 1 Centimeter = 10 Millimeters = 0.01 Meter = 0.3937 Inch
- 1 Decimeter = 10 Centimeters = 3.94 Inches
- 1 Meter = 10 Decimeters = 100 Centimeters  
= 1000 Millimeters = 39.37 Inches
- 1 Dekameter = 10 Meters = 32.8 Feet
- 1 Hectometer = 10 Dekameters = 328.08 Feet
- 1 Kilometer = 10 Hectometers = 1000 Meters  
= 0.621 Mile = 3,280.8 Feet
- Millimeters = Inches times 25.4
- Inches = Millimeters divided by 25.4

**WEIGHTS**

- 1 Centigram = 10 Milligrams = 0.154 Grain
- 1 Decigram = 10 Centigrams = 1.543 Grains
- 1 Gram = 0.001 Kilogram = 10 Decigrams  
= 1000 Milligrams = 0.035 Ounce
- 1 Dekagram = 10 Grams = 0.353 Ounce
- 1 Hectogram = 10 Dekagrams = 3.527 Ounces
- 1 Kilogram = 10 Hectograms = 1000 Grams = 2.205 Pounds
- 1 Quintal = 100 Kilograms = 220.46 Pounds
- 1 Metric Ton = 10 Quintals = 1000 Kilograms = 1.102 Short Tons

**LIQUID MEASURE**

- 1 Milliliter = 0.001 Liter = 0.034 Fluid Ounce
- 1 Centiliter = 10 Milliliters = 0.34 Fluid Ounce
- 1 Deciliter = 10 Centiliters = 3.38 Fluid Ounces
- 1 Liter = 10 Deciliters = 1000 Milliliters = 33.82 Fluid Ounces
- 1 Dekaliter = 10 Liters = 2.64 Gallons
- 1 Hectoliter = 10 Dekaliters = 26.42 Gallons
- 1 Kiloliter = 10 Hectoliters = 264.18 Gallons

**SQUARE MEASURE**

- 1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inch
- 1 Sq Decimeter = 100 Sq Centimeters = 15.5 Sq Inches
- 1 Sq Meter (Centare) = 100 Sq Decimeters  
= 10,000 Sq Centimeters = 10.764 Sq Feet
- 1 Sq Dekameter (Are) = 100 Sq Meters = 1,076.4 Sq Feet
- 1 Sq Hectometer (Hectare) = 100 Sq Dekameters = 2.471 Acres
- 1 Sq Kilometer = 100 Sq Hectometers = 1,000,000 Sq Meters  
= 0.386 Sq Mile

**CUBIC MEASURE**

- 1 Cu Centimeter = 1000 Cu Millimeters = 0.061 Cu Inch
- 1 Cu Decimeter = 1000 Cu Centimeters = 61.02 Cu Inches
- 1 Cu Meter = 1000 Cu Decimeters = 1,000,000 Cu Centimeters  
= 35.31 Cu Feet

**TEMPERATURE**

- 5/9 (°F - 32°) = °C
- 9/5 (°C + 32°) = °F
- 35° Fahrenheit is equivalent to -37° Celsius
- 0° Fahrenheit is equivalent to -18° Celsius
- 32° Fahrenheit is equivalent to 0° Celsius
- 90° Fahrenheit is equivalent to 32° Celsius
- 100° Fahrenheit is equivalent to 38° Celsius
- 212° Fahrenheit is equivalent to 100° Celsius

**APPROXIMATE CONVERSION FACTORS**

<b>TO CHANGE</b>	<b>TO</b>	<b>MULTIPLY BY</b>	<b>TO CHANGE</b>	<b>TO</b>	<b>MULTIPLY BY</b>
Inches	Centimeters	2.540	Meters	Feet	3.281
Feet	Meters	0.305	Meters	Yards	1.094
Yards	Meters	0.914	Kilometers	Miles	0.621
Miles	Kilometers	1.609	Square Centimeters	Square Inches	0.155
Square Inches	Square Centimeters	6.452	Square Meters	Square Feet	10.764
Square Feet	Square Meters	0.093	Square Meters	Square Yards	1.196
Square Yards	Square Meters	0.836	Square Kilometers	Square Miles	0.386
Square Miles	Square Kilometers	2.590	Square Hectometers	Acres	2.471
Acres	Square Hectometers	0.405	Cubic Meters	Cubic Feet	35.315
Cubic Feet	Cubic Meters	0.028	Cubic Meters	Cubic Yards	1.308
Cubic Yards	Cubic Meters	0.765	Milliliters	Fluid Ounces	0.034
Fluid Ounces	Milliliters	29.574	Liters	Pints	2.113
Pints	Liters	0.473	Liters	Quarts	1.057
Quarts	Liters	0.946	Liters	Gallons	0.264
Gallons	Liters	3.785	Grams	Ounces	0.035
Ounces	Grams	28.350	Kilograms	Pounds	2.205
Pounds	Kilograms	0.454	Metric Tons	Short Tons	1.102
Short Tons	Metric Tons	0.907	Newton-Meters	Pound-Feet	0.738
Pound-Feet	Newton-Meters	1.356	Kilopascals	Pounds per Square Inch	0.145
Pounds-Inches	Newton-Meters	0.11298	Kilometers per Liter	Miles per Gallon	2.352
Pounds per Square Inch	Kilopascals	6.895	Kilometers per Hour	Miles per Hour	0.621
Ounce-Inches	Newton-Meters	0.007062	° Fahrenheit	° Celsius	°C = (°F - 32) x 5/9
Miles per Gallon	Kilometers per Liter	0.425	° Celsius	° Fahrenheit	°F = (9/5 x °C) + 32
Miles per Hour	Kilometers per Hour	1.609			
Centimeters	Inches	0.394			

PIN: 085922-000