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APPENDIX B

M21 SNIPER WEAPON SYSTEM

The National Match M14 rifle (Figure B-1) and its scope makeup the M21 sniper weapon system. The M21 is accurized IAW United States Army Marksmanship Training Unit specifications and has the same basic design and operation as the standard M14 rifle (FM 23-8), except for specially selected and hand-fitted parts.

Section I

M21 SNIPER WEAPON SYSTEM

This section describes the general characteristics of the M21 SWS. The M21 has been replaced by the M24 (Chapter 2); however, the M21 is still in use throughout the US Army.

B-1. M21 DIFFERENCES

Significant differences exist between the M21 SWS and M24 SWS. These differences are as follows:

- a. The barrel is gauged and selected to ensure correct specification tolerances. The bore is not chromium plated.
- b. The stock is walnut and impregnated with an epoxy.
- c. The receiver is individually custom fitted to the stock with a fiberglass compound.
- d. The firing mechanism is reworked and polished to provide for a crisp hammer release. Trigger weight is between 4.5 to 4.75 pounds.
- e. The suppressor is fitted and reamed to improve accuracy and eliminate any misalignment.
- f. The gas cylinder and piston are reworked and polished to improve operation and to reduce carbon buildup.
- g. The gas cylinder and lower band are permanently attached to each other.
- h. Other parts are carefully selected, fitted, and assembled.

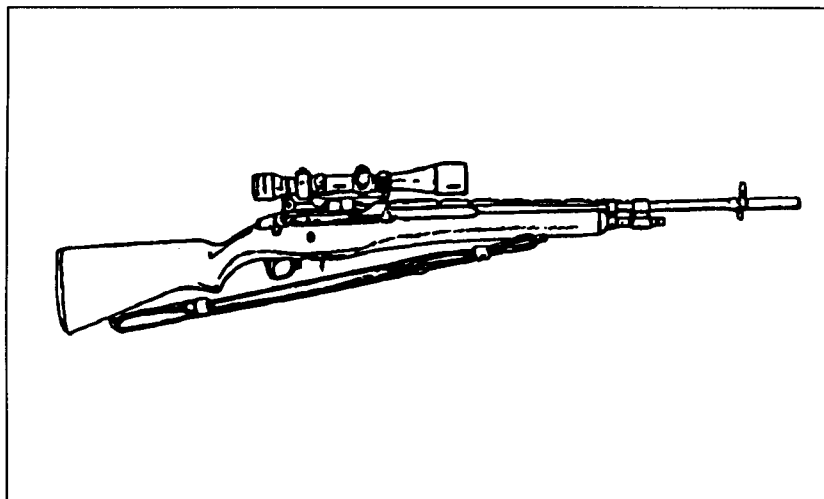


Figure B-1. National Match M14 rifle.

B-2. INSPECTION

If the sniper discovers a deficiency while inspecting the rifle, he reports it to the unit armorer. The following areas should be inspected:

- a. Check the appearance and completeness of all parts. Shiny surfaces should be treated.
- b. Check the flash suppressor for misalignment, burrs, or evidence of bullet tipping. The suppressor should be tight on the barrel.
- c. Check the front sight to ensure that it is tight, that the blade is square, and that all edges and comers are sharp.
- d. Check the gas cylinder to ensure it fits tightly on the barrel. The gas plug should be firmly tightened.
- e. Check the forward band on the stock to ensure it does not bind against the gas cylinder front band.
- f. Check the handguard. It should not bind against the receiver, the top of the stock, or the operating rod.
- g. Check the firing mechanism to ensure the weapon does not fire with the safety "on," and that it has a smooth, crisp trigger pull when the safety is "off."
- h. Check the rear sight tension by turning the aperture up to the "10" position. Then press down on top of the aperture with a thumb. If the aperture can be pushed down, the tension must be readjusted.
- i. Check the stock for splits or cracks.

B-3. CARE AND MAINTANCE

Extreme care has been used in building the sniper rifle. A similar degree of attention must be devoted to its daily care and maintenance.

a. The rifle should not be disassembled by the sniper for normal cleaning and lubrication. Disassembly is performed only by the armorer during the scheduled inspections or repair. The armorer thoroughly cleans and lubricates the rifle at that time.

b. The following materials are required for cleaning the rifle

- (1) Lubricating oil, general purpose (PL special).
- (2) Lubricating oil, weapons (for below zero operation).
- (3) Rifle bore cleaner.
- (4) Rifle grease.
- (5) Patches.
- (6) Bore brush.
- (7) Shaving brush.
- (8) Toothbrush.
- (9) Cleaning rags.

c. The recommended procedures for cleaning and lubricating the rifle are as follows:

- (1) Wipe old oil, grease, and external dirt from the weapon.
- (2) Clean the bore by placing the weapon upside down on a table or in a weapon cradle. Then, push a bore brush dipped in bore cleaner completely through the bore. Remove the bore brush and pull the rod out. Repeat this process four or five times.
- (3) Clean the chamber (Figure B-2) and bolt face with bore cleaner and a chamber brush or toothbrush.

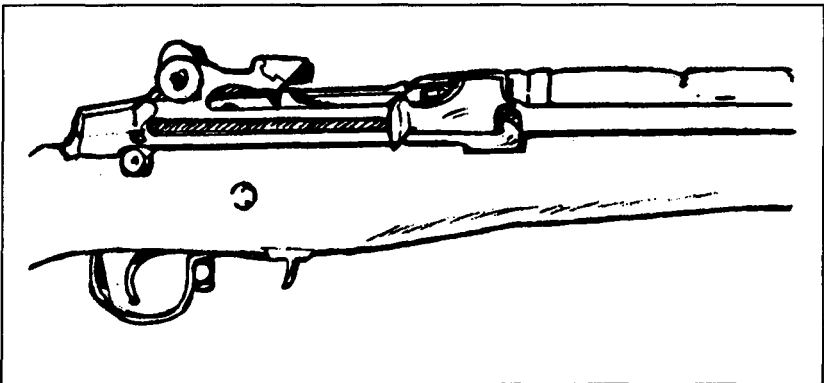


Figure B-2. M21 chamber.

(4) Clean the chamber, receiver, and other interior areas with patches dipped in RBC.

(5) Clean the bore by pulling clean patches through the bore until they come out of the bore clean.

(6) Wipe the chamber and interior surfaces with patches until clean.

(7) With the bolt and gas piston to the rear, place one drop of bore cleaner in between the rear band of the gas system and the lower side of the barrel. **DO NOT PUT BORE CLEANER** in the gas port. It will increase carbon buildup and restrict free movement of the gas piston.

(8) Lubricate the rifle by placing a light coat of grease on the operating rod handle track, caroming surfaces in the hump of the operating rod, the bolt's locking lug track, and in between the front band lip of the gas system and the metal band on the lower front of the stock.

(9) Place a light coat of PL special on all exterior metal parts.

B-4. LOADING AND UNLOADING

To load the M21, the sniper locks the bolt to the rear and places the weapon in the **SAFE** position. He inserts the magazine into the magazine well by pushing up, then pulling the bottom of the magazine to the rear until the magazine catch gives an audible click. To chamber a round, the sniper pulls the bolt slightly to the rear to release the bolt catch, then releases the bolt. To unload the M21, he locks the bolt to the rear and places the weapon in the **SAFE** position. Then he depresses the magazine release latch, and moves the magazine in a forward and downward motion at the same time.

B-5. REAR SIGHTS

The M21 sniper weapon system is equipped with National Match rear sights (Figure B-3). The pinion assembly adjusts the elevation of the aperture. By turning it clockwise, it raises the point of impact. By turning it counterclockwise, it lowers the point of impact. Each click of the pinion is 1 MOA (minute of angle). The hooded aperture is also adjustable and provides .5 MOA changes in elevation. Rotating the aperture so that the indication notch is at the top raises the point of impact .5 MOA. Rotating the indication notch to the bottom lowers the strike of the round. The windage dial adjusts the lateral movement of the rear sight. Turning the dial clockwise moves the point of impact to the right and turning it counterclockwise moves the point of impact to the left. Each click of windage is .5 MOA.

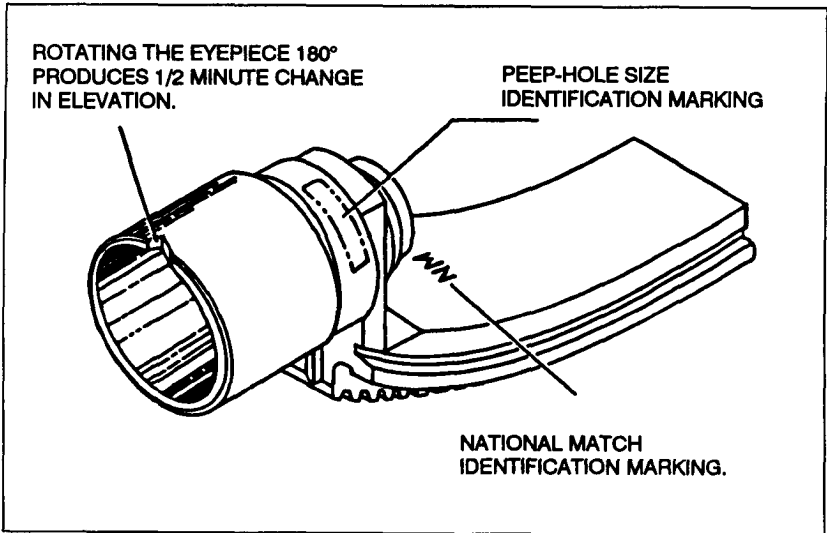


Figure B-3. National Match rear sight.

B-6. MALFUNCTIONS AND CORRECTIONS

Table B-1 contains pertinent information for the operator and serves as an aid to personnel who are responsible for restoring worn, damaged, or inoperative materiel to a satisfactory condition. If the weapon becomes unserviceable, it must be turned in for service by a school-trained National Match armorer.

MALFUNCTION	CAUSE	CORRECTION
FAILURE TO LOAD	DIRTY OR DEFORMED MAGAZINE	1. CLEAN OR REPLACE
	DAMAGED MAGAZINE TUBE	2. REPLACE MAGAZINE
	DIRTY MAGAZINE	3. CLEAN
	DAMAGED OR BROKEN MAGAZINE SPRING	4. REPLACE MAGAZINE
	DAMAGED OR BROKEN FOLLOWER	5. REPLACE MAGAZINE
	LOOSE OR DAMAGED FLOOR PLATE	6. REPLACE MAGAZINE

Table B-1. M21 malfunctions and corrections.

MALFUNCTION	CAUSE	CORRECTION
MAGAZINE INSERTS WITH DIFFICULTY	BENT OR DAMAGED MAGAZINE	7. REPLACE MAGAZINE
	EXCESSIVE DIRT IN RECEIVER	8. CLEAN
	ROUND NOT COMPLETELY SEATED IN MAGAZINE	9. REMOVE ROUND; INSERT PROPERLY
	DEFORMED OR OPERATING ROD SPRING GUIDE	10. EVACUATE TO AUTHORIZED ARMORER
	DAMAGED MAGAZINE LATCH	11. EVACUATE TO AUTHORIZED ARMORER
	MAGAZINE LATCH MOVEMENT RESTRICTED	12. CHECK MOVEMENT; CLEAN IF NECESSARY; IF BENT OR DISTORTED, EVACUATE TO AUTHORIZED ARMORER
MAGAZINE CANNOT BE RETAINED IN WEAPON	MAGAZINE LATCH DAMAGED	13. EVACUATE TO AUTHORIZED ARMORER.
	MAGAZINE LATCH SPRING DAMAGED	14. EVACUATE TO AUTHORIZED ARMORER
	MAGAZINE LATCH PLATE DAMAGED OR MISSING	15. REPLACE MAGAZINE
	DEFORMED OR DAMAGED OPERATING ROD SPRING GUIDE	16. EVACUATE TO AUTHORIZED ARMORER
	LOCKING RECESS AT TOP FRONT OF	17. REPLACE MAGAZINE
	MAGAZINE NOT FULLY INSTALLED	18. REMOVE; INSTALL CORRECTLY (MAKE SURE LATCH CLICKS)
FAILURE TO FEED	WEAK OR BROKEN SPRING	19. REPLACE MAGAZINE
	DAMAGED MAGAZINE	20. REPLACE MAGAZINE

Table B-1. M21 malfunctions and corrections (continued).

MALFUNCTION	CAUSE	CORRECTION
FAILURE TO FEED (CONTINUED)	DAMAGED OR DEFORMED STRIPPING LUG ON BOLT SHORT RECOIL DIRTY AMMUNITION AND/OR MAGAZINE WEAK OR BROKEN OPERATING ROD SPRING RESTRICTED MOVEMENT OF, OR DAMAGED OPERATING ROD ²⁵ .	21. EVACUATE TO AUTHORIZED ARMORER 22. (SEE SHORT RECOIL) 23. CLEAN AMMUNITION AND/OR MAGAZINE 24. EVACUATE TO AUTHORIZED ARMORER 25. EVACUATE TO AUTHORIZED ARMORER
BOLT FAILS TO LOCK	CARTRIDGE CASE HOLDING BOLT OUT OF BATTERY DIRTY CHAMBER EXTRACTOR DOES NOT SNAP OVER RIM OF CARTRIDGE CASE FROZEN OR BLOCKED EJECTOR SPRING AND PLUNGER RESTRICTED MOVEMENT OF, OR DAMAGED OPERATING ROD SPRING BOLT NOT FULLY ROTATED AND LOCKED IN RECEIVER WEAK OR BROKEN OPERATING ROD SPRING DAMAGED RECEIVER	26. PULL BOLT CLOSE ASSEMBLY TO REAR AND REMOVE DEFORMED CARTRIDGE; CLEAN AMMUNITION AND/OR BARREL AND CHAMBER 27. CLEAN CHAMBER 28. EVACUATE TO AUTHORIZED ARMORER 29. EVACUATE TO AUTHORIZED ARMORER 30. EVACUATE TO AUTHORIZED ARMORER 31. EVACUATE TO AUTHORIZED ARMORER 32. EVACUATE TO AUTHORIZED ARMORER 33. EVACUATE TO AUTHORIZED ARMORER
FAILURE TO FIRE	BOLT NOT FULLY FORWARD AND LOCKED	34. (SEE BOLT FAILS TO LOCK)

Table B-1. M21 malfunctions and corrections (continued).

MALFUNCTION	CAUSE	CORRECTION
FAILURE TO FIRE (CONTINUED)	DEFECTIVE AMMUNITION	35. REMOVE AMMUNITION
	FIRING PIN WORN, DAMAGED, OR MOVEMENT RESTRICTED	36. EVACUATE TO AUTHORIZED ARMORER
	BROKEN HAMMER	37. EVACUATE TO AUTHORIZED ARMORER
	WEAK OR BROKEN HAMMER SPRING	38. EVACUATE TO AUTHORIZED ARMORER
	HAMMER AND TRIGGER LUGS OR SEAR WORN OR BROKEN, CAUSING HAMMER TO RIDE THE BOLT ASSEMBLY FORWARD	39. EVACUATE TO AUTHORIZED ARMORER
SHORT RECOIL	GAS PLUG LOOSE OR MISSING	40. TIGHTEN PLUG IF LOOSE; EVACUATE TO AUTHORIZED ARMORER IF MISSING
	RESTRICTED MOVEMENT OF OPERATING ROD ASSEMBLY	41. EVACUATE TO AUTHORIZED ARMORER
	BOLT BINDING	42. CLEAN
	GAS CYLINDER LOCK NOT FULLY INSTALLED	43. EVACUATE TO AUTHORIZED ARMORER
	GAS PISTON RESTRICTED	44. EVACUATE TO AUTHORIZED ARMORER
	DAMAGED CONNECTOR ASSEMBLY	45. EVACUATE TO AUTHORIZED ARMORER
	PARTIALLY CLOSED SPINDLE VALVE	46. EVACUATE TO AUTHORIZED ARMORER
DEFECTIVE AMMUNITION	47. REPLACE AMMUNITION	
FAILURE TO EXTRACT	SPINDLE VALVE CLOSED	48. EVACUATE TO AUTHORIZED ARMORER
	CARTRIDGE SEIZED IN CHAMBER	49. REMOVE

Table B-1. M21 malfunctions and corrections (continued).

MALFUNCTION	CAUSE	CORRECTION
FAILURE TO EXTRACT (CONTINUED)	SHORT RECOIL	50. (SEE SHORT RECOIL)
	DAMAGED OR DEFORMED EXTRACTOR	51. EVACUATE TO AUTHORIZED ARMORER
	WEAK, DEFORMED, OR FROZEN EXTRACTOR PLUNGER ASSEMBLY	52. EVACUATE TO AUTHORIZED ARMORER
FAILURE TO EJECT	RUPTURED OR SEPARATED CARTRIDGE	53. EVACUATE TO AUTHORIZED ARMORER
	SHORT RECOIL	54. (SEE SHORT RECOIL)
	WEAK, DEFORMED OR FROZEN EXTRACTOR PLUNGER ASSEMBLY	55. EVACUATE TO AUTHORIZED ARMORER
FAIL TO HOLD BOLT REARWARD	DAMAGED OR DEFORMED MAGAZINE FOLLOWER	56. REPLACE MAGAZINE
	DAMAGED BOLT LOCK	57. EVACUATE TO AUTHORIZED ARMORER
	BOLT LOCK MOVEMENT RESTRICTED	58. EVACUATE TO AUTHORIZED ARMORER
	WEAK OR BROKEN MAGAZINE SPRING	59. REPLACE MAGAZINE

Table B-1. M21 malfunctions and corrections (continued).

Section II M21 SIGHTING DEVICES

A scope mounted on the rifle allows the sniper to detect and engage targets more effectively. The target's image in the scope is in focus with the aiming point (reticle). This allows for a more focused picture of the target and aiming point at the same time. Another advantage of the scope is its ability to magnify the target. This increases the resolution of the target's image, making it clearer and more defined. Keep in mind, a scope does not make a soldier a better sniper, it only helps him to see better.

B-7. AUTO-RANGING TELESCOPE

Auto-ranging telescopes are part of the M21 system. The two types of ARTs on the M21 system are the ART I and ART II. The basic design and operating principle of both scopes are the same. Therefore, they will be described together, but their differences will be pointed out.

B-8. ART I AND ART II SCOPES

The ART has a commercially procured 3- to 9-variable-power telescopic scopesight, modified for use with the sniper rifle. This scope has a modified reticle with a ballistic earn mounted to the power adjustment ring on the ART I (Figure B-4). The ART II (Figure B-5) has a separate ballistic cam and power ring. The ART is mounted on a spring-loaded base mount that is adapted to fit the M14. It is transported in a hard carrying case when not mounted to the rifle. The scopes on the M21 sniper weapon system can also be used for rough range estimation. Once the sniper team is familiar with the M21 and is accustomed to ranging out on targets, it makes a mental note of where the power adjust ring is set at various distances.

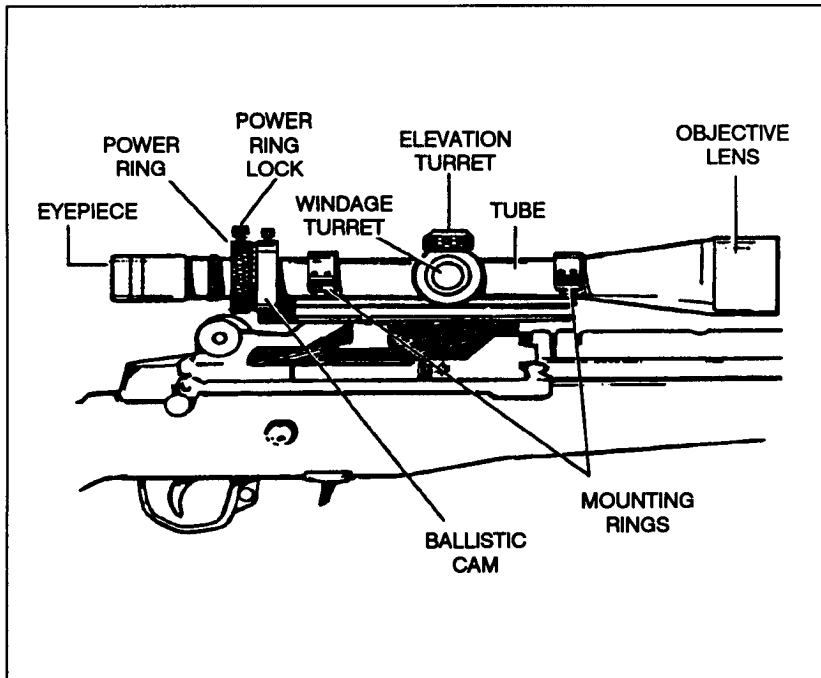


Figure B-4. ART I scope.

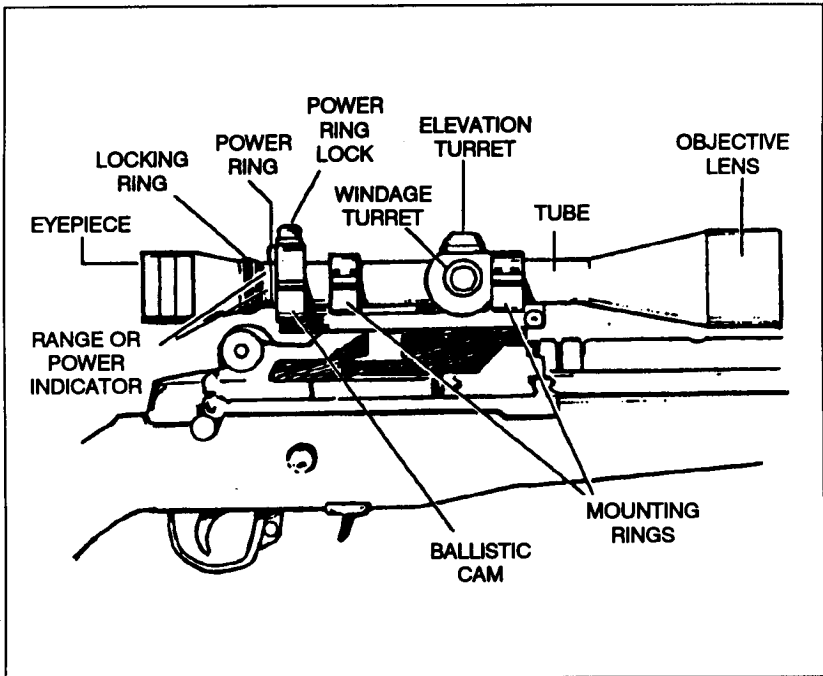


Figure B-5. ART II scope.

a. **Magnification.** The ART's increased magnification allows the sniper to see the target clearly.

(1) The average, unaided human eye can distinguish detail of about 1 inch at 100 meters (1 MOA). Magnification, combined with well-designed optics, permit resolution of this 1 inch divided by the magnification. Thus, a 1/4 MOA of detail can be seen with a 4-power scope at 100 meters, or 1 inch of detail can be seen at 600 meters with a 6-power scope.

(2) The lens surfaces are coated with a hard film of magnesium fluoride for maximum light transmission.

(3) The elevation and windage turrets have dials on them that are located midway on the scope barrel and are used for zeroing adjustments. These dials are graduated in .5 MOA increments.

(4) These telescopes also have modified reticles. The ART I scope has a basic cross hair design with two horizontal stadia lines that appear at target distances, 15 inches above and 15 inches below the horizontal

line of the reticle (Figure B-6). It also has two vertical stadia lines that appear at target distance, 30 inches to the left and 30 inches to the right of the vertical line of the reticle. The ART II scope reticle (Figure B-7) consists of three posts: two horizontal and one bottom vertical post. These posts represent 1 meter at the target's distance. The reticle has a basic cross hair with two dots on the horizontal line that appear at target distance, 30 inches to the left and 30 inches to the right of the vertical line.

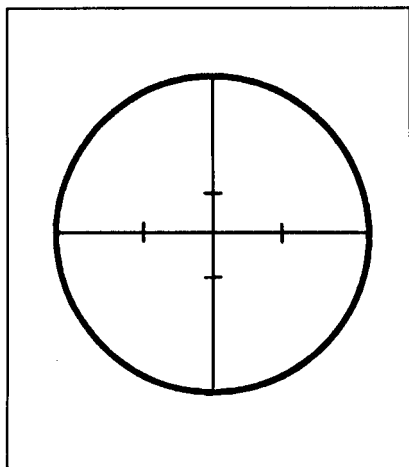


Figure B-6. ART I reticle.

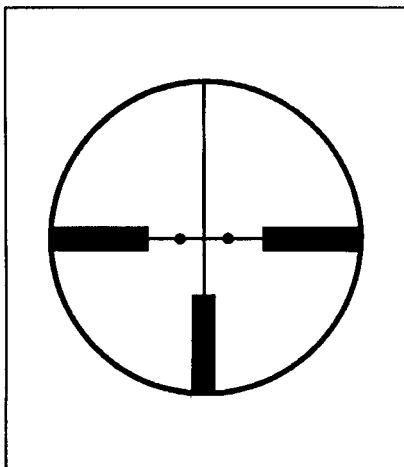


Figure B-7. ART II reticle.

(5) A ballistic cam is attached to the power adjustment ring on the ART I scope. The ART II scope has a separate power ring and ballistic cam.

(6) The power ring on both scopes increases and decreases the magnification of the scope, while the ballistic cam raises and lowers the scope to compensate for elevation.

(7) Focus adjustments are made by screwing the eyepiece into or away from the scope barrel until the reticle is clear.

b. Scope Mounts. The ART mounts are made of lightweight aluminum consisting of a side-mounting plate and a spring-loaded base with scope mounting rings. The scope mount is designed for low-profile mounting of the scope to the rifle, using the mounting guide grooves and threaded hole(s) on the left side of the receiver. The ART I has one thumbscrew that screws into the left side of the receiver (Figure B-8). The ART II mount has two thumbscrews; one is screwed into the left side of the receiver, and the other is screwed into the cartridge clip guide in front of the rear sight (Figure B-9).

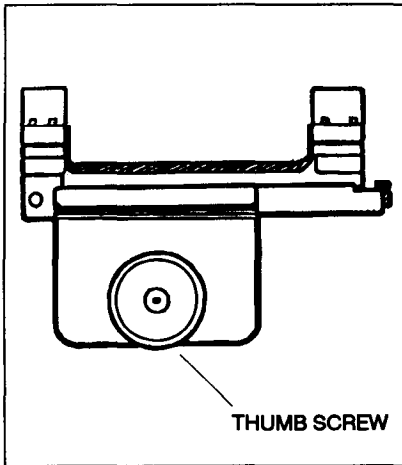


Figure B-8. ART I mount.

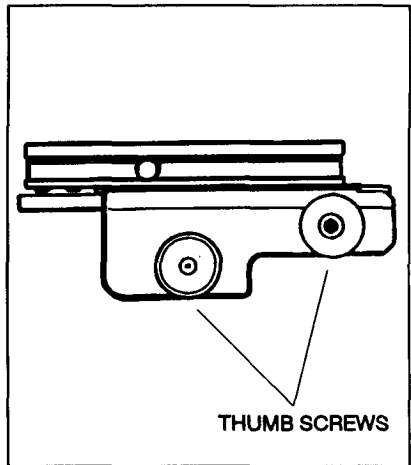


Figure B-9. ART II mount.

c. Design and Operation. The ART scopes are designed to automatically adjust for the needed elevation at ranges of 300 to 900 meters. This is done by increasing or decreasing the magnification of the scope until a portion of the target's image matches the represented measurement of the scope's reticle.

(1) For example, the power ring on the ART I scope can be adjusted until 30 inches of an object or a person's image (beltline to top of head) fits exactly in between the horizontal stadia lines (top stadia line touching top of the head and bottom stadia line on the beltline).

(2) Another example is to adjust the power ring on the ART II scope until 1 meter (about 40 inches) of a person's or an object's image appears equal to one of the posts in the reticle.

(3) When turning the power ring to adjust the target's image to the reticle, the sniper is also turning the ballistic cam. This raises or lowers the scope itself to compensate for elevation. Therefore, once the scope's magnification is properly adjusted in proportion to the target's image, the ballistic cam has at the same time adjusted the scope for the proper elevation needed to engage the target at that range.

(4) The ART II scope has a locking thumbscrew located on the power ring used for connecting and disconnecting the power ring from the ballistic cam. This allows the sniper to adjust the scope on target (auto-ranging mode), and then disengage the locking thumbscrew to increase magnification (manual mode) without affecting the elevation adjustment.

d. **Zeroing.** The ART scope should be zeroed at 300 meters. Ideally, this should be done on a known-distance range with bull's-eye-type targets. When zeroing the ART scope (Figure B-10), the sniper—

- (1) Removes the elevation and windage caps from the scope.
- (2) Turns the power adjustment ring to the lowest position. On the ART II scope, ensures that the locking thumbscrew is engaged and that the ballistic cam moves when the power ring is turned.
- (3) Assumes a good prone-supported position that allows the natural point of aim to be centered on the target.
- (4) Fires three rounds, using good marksmanship fundamentals with each shot.
- (5) Makes the needed adjustments to the scope after placement of the rounds has been noted. He is sure to remember—
 - (a) That each mark on the elevation and windage dials equals .5 MOA (.5 MOA at 300 meters equals 1.5 inches.)
 - (b) That turning the elevation dial in the direction of the UP arrow will raise the point of impact; turning it the other direction will lower it.
 - (c) That turning the windage dial in the direction of the R arrow will move the point of impact to the right; turning it the other direction will move it to-the left.

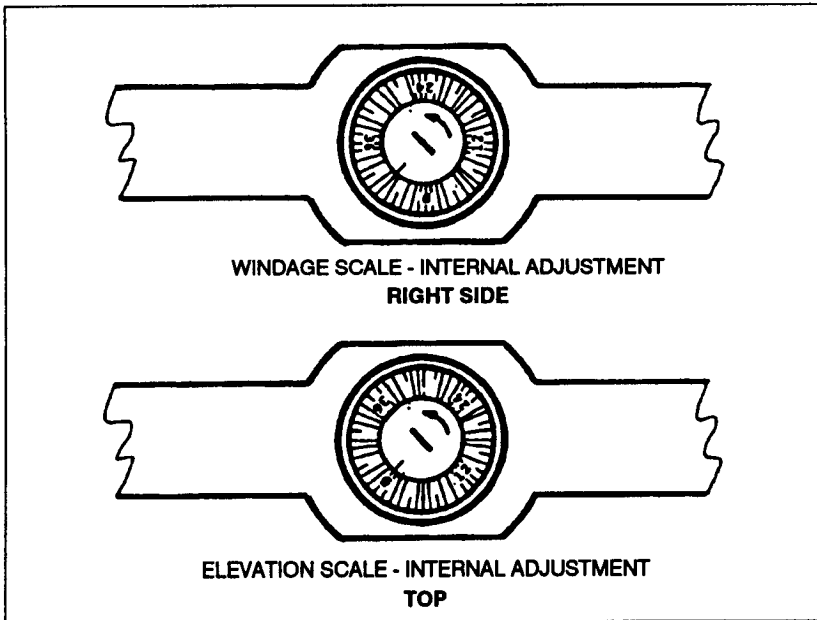


Figure B-10. Elevation and windage scales.

(6) Repeats the steps in paragraphs (4) and (5) above until two 3-round shot groups are centered on the target.

After the scope is properly zeroed, it will effectively range on targets out to 900 meters in the auto-ranging mode.

e. Zeroing and Calibrating of the M21 Iron Sights. If the telescope is damaged, the sniper must use his backup sighting system—iron sights. Due to time constraints, it may be impossible or impractical to search through the data book to determine the needed elevation setting to engage a target at a specific range. Once the elevation dial has been calibrated to the sniper's individual zero for that particular rifle, targets can be engaged anywhere between 0 and 1,080 meters by using index lines.

(1) The index lines on the elevation dial designate hundreds of yards to the target. Every other line is numbered with an even number, lines in between are the odd hundreds of yards—that is, the line marked with a number "2" is the 200-yard index line. The index line between the numbers 2 and 4 is the 300-yard index line. If the distance to the target is not in exact hundreds of yards, the elevation dial should be clicked between index lines to approximate the distance. If the target distance is less than 100 yards, the 100-yard setting should be used—the difference in impact is minimal.

(2) To calibrate the elevation dial, the sniper must first zero the rifle at a known distance that correlates to one of the index lines on the elevation dial. (The recommended distance is 300 yards.) Once zeroing is completed, calibration involves the following steps:

STEP 1: Turn the elevation dial forward (down, away from the sniper), and move the rear sight aperture assembly to its lowest setting (mechanical zero), counting the number of clicks. This number of clicks is elevation zero and must be remembered for use in the calibration process—for example, the number will be 10 clicks.

STEP 2: Loosen the screw in the center of the elevation dial using a dime or screwdriver (about one turn) until the dial can be rotated forward. Be careful not to loosen the screw too much or it may fall and become lost. It is critical that once the screw is loosened to never rotate the elevation dial clockwise (up or toward the sniper) during calibration. This could result in improper calibration.

STEP 3: Turn the elevation dial forward (down, away from the sniper) until the index line on the receiver lines up with the index line on the dial that correlates to the distance at which the rifle was zeroed—for example, 300 yards. This is the index line between 2 and 4.

If the setting is passed (even by one click), rotate the elevation dial counterclockwise (down, away from the sniper) until the index lines match up. Never rotate the dial in the UP direction (clockwise, toward the sniper) with the screw in the elevation dial loose.

STEP 4: Remember the number of clicks (for example, 10) when zeroing the rifle and begin rotating the elevation dial counterclockwise (down, away from sniper). Count the clicks until the elevation dial has been rotated the same number of clicks that were on the rifle when zeroed. If too many clicks are used, start over at Step 3.

STEP 5: Now, hold the elevation dial, being careful not to allow it to rotate, then tighten the screw in the center of the elevation dial as tight as possible. Hold the elevation dial carefully with a pair of pliers to ensure the screw is tight.

STEP 6: To check the calibration, rotate the elevation dial to mechanical zero (all the way down), then count the number of clicks to zero. This should result in the index line on the receiver being lined up with the correct index line on the elevation dial (between 2 and 4). If this happens, the rear sight is now calibrated for elevation. If not, repeat Steps 1 through 5.