

UNITED STATES MARINE CORPS
WEAPONS TRAINING BATTALION
MARINE CORPS COMBAT DEVELOPMENT COMMAND
QUANTICO, VIRGINIA 22134-5040

INSTRUCTOR GUIDE

ZERO A RIFLE COMBAT OPTIC (RCO) TO A SERVICE RIFLE

0300-M16-1005
0300-M16-1008
0300-M16-1017 (REV.)

ANNUAL RIFLE TRAINING POI

APPROVING SIGNATURE _____ DATE _____

(SLIDE #1)

INTRODUCTION

(3 MIN)

1. **GAIN ATTENTION**. The bottom line for the rifleman is to develop skills that will enable them to become combat effective. It is essential for an individual to know how to zero the Rifle Combat Optic (RCO) to the service rifle. Zeroing is the adjusting of the elevation and windage adjusters on the RCO to cause the shots to impact where the individual aims. Zeroing the optic compensates for the effects of weather and other external influences upon where the bullet impacts. The ability to analyze a shot group and apply zeroing fundamentals is an essential skill which will ensure consistent accuracy of your rounds hitting the target while qualifying on the rifle range during recruit training and your rounds hitting the enemy in a combat environment.

Notes: _____

(SLIDE #2)

2. **OVERVIEW**. Good morning/afternoon my name is _____. This lesson will cover mounting and understanding the elements to establish a sound zero, the RCO sighting system, zeroing procedures, factors affecting a zero and the Table 1A course of fire. The purpose of this lesson is to provide you with the knowledge and skills necessary to effectively zero your optic to hit what you are aiming at.

INSTRUCTOR'S NOTE:
HAVE SELECTED SHOOTERS READ ALOUD THE LEARNING OBJECTIVES FROM THEIR HANDOUTS.

(SLIDE #3)

3. **INTRODUCE LEARNING OBJECTIVES**

a. **TERMINAL LEARNING OBJECTIVE:**

(1) Given a service rifle, Rifle Combat Optic (RCO), sling, individual field equipment, magazines, cleaning gear, ammunition, and a target, zero a Rifle Combat Optic (RCO) to a service rifle to ensure Point of Aim (POA) equals Point of

Impact (POI) at 100 meters. (0300-M16-1005)

b. **ENABLING LERANING OBJECTIVES:**

(SLIDE #4)

(1) Given a service rifle, Rifle Combat Optic (RCO), load bearing vest, magazine pouch, common weapon sling, (2) magazines, cleaning gear, ammunition, and a target, mount and understand the elements necessary to establish a sound zero in accordance with MCRP 3-01A. (0300-M16-1005a)

(2) Given a service rifle, Rifle Combat Optic (RCO), load bearing vest, magazine pouch, common weapon sling, (2) magazines, cleaning gear, ammunition, and a target, understand the RCO sighting system in accordance with MCRP 3-01A. (0300-M16-1005b)

(SLIDE #5)

(3) Given a service rifle, Rifle Combat Optic (RCO), load bearing vest, magazine pouch, common weapon sling, (2) magazines, cleaning gear, ammunition, and a target, establish pre-zero sight settings with the service rifle in accordance with MCRP 3-01A. (0300-M16-1005c)

(4) Given a service rifle, Rifle Combat Optic (RCO), load bearing vest, magazine pouch, common weapon sling, (2) magazines, cleaning gear, ammunition, and a target, understand the factors affecting a zero in accordance with MCRP 3-01A. (0300-M16-1005d)

INSTRUCTOR'S NOTE:

ASSIGN SPECIFIC SHOOTERS TO FILL OUT INSTRUCTIONAL RATING FORMS (IRFS). HAVE THEM SET ASIDE AND FILL THEM OUT AFTER THE COMPLETION OF THE CLASS.

(SLIDE #6)

4. **METHOD/MEDIA.** This lesson will be taught utilizing the informal lecture and demonstration methods, along with supporting media.

5. **EVALUATION.** You will be evaluated during the Zero a Rifle

Combat Optic (RCO) to a Service Rifle Performance Examination

6. **SAFETY CEASE/TRAINING (CT) BRIEF.** There are no safety hazards identified with this lesson. However, cease training can be called by an instructor or student who identifies or observes any unsafe condition. The lead instructor will then evaluate the situation.

(SLIDE #7)

TRANSITION: Are there any questions on the learning objectives, how the lesson will be taught, or how you will be evaluated? If not, there are five basic elements involved in zeroing a rifle. Let's begin by discussing these elements.

NOTES: _____

(SLIDE #8)

BODY

(25 MIN)

(6 MIN)

1. **MOUNTING AND UNDERSTANDING THE ELEMENTS TO ESTABLISH A SOUND ZERO.**

a. Definition of a Zero. A zero is the elevation and windage settings required to place a single shot, or the center of a shot group, in a pre-designated location on a target at 100 yards/meters, from a specific firing position, under ideal weather conditions (i.e., no wind). A zero is the sight settings placed on your optic for combat.

(SLIDE #9)

b. Elements. To accurately engage targets, the strike of the bullet must coincide with your point of aim on the target. This must be done while compensating for the effects of weather and the range to the target. This is accomplished by adjusting the adjusters on your RCO to achieve point of aim/point of impact. This process is called zeroing and it is a critical element of accurate target engagement.

(1) Line Of Sight. Line of sight is a straight line beginning at the center of the eye, passing through the center

of the optic to the point of aim on the target.

(2) Aiming Point. The aiming point is the precise point where the tip of the chevron in the RCO reticle pattern is placed in relationship to the target.

(3) Centerline Of Bore. Centerline of the bore is an imaginary straight line beginning at the chamber end of the barrel, proceeding out of the muzzle, and continuing on indefinitely.

(4) Trajectory. A bullet does not follow a straight line to the target. Instead, a bullet travels in a curved path, or arc, which is called the bullet trajectory.

(a) As the bullet exits the muzzle, it immediately starts to fall because of gravity. The rate of this curvature increases as the bullet's speed decreases.

(b) To compensate for that fall, the sights are set to elevate muzzle. As the bullet exits the muzzle it intersects the line of sight, because the sights are above the muzzle. As the bullet travels farther, it re-enters the line of sight to intersect with it again.

(c) As the bullet exits the muzzle, it immediately starts to fall because of gravity. The rate of this curvature increases as the bullet's speed decreases.

(5) Range. Range is the known distance from the rifle to the target.

TRANSITION: Now that we have discussed mounting and understanding the elements to establish a sound zero, are there any questions? I have one for you.

QUESTION: What is trajectory?

ANSWER: The curved path that the bullet travels while in its flight.

Notes: _____

Let's move on to discuss the sighting system for the service

rifle.

(SLIDE #10)

(6 MIN)

2. THE RCO SIGHTING SYSTEM/WINDAGE & ELEVATION RULES

a. The RCO Sighting System. The RCO is optically centered when it leaves the manufacturer. Windage and elevation adjusters are used to zero the optic. The adjusters can be moved with a coin, bladed screwdriver, or the extractor rim of the 5.56mm casing.

(SLIDE #11)

b. The RCO Windage and Elevation Adjustments.

(1) To adjust for windage, move the windage adjuster clockwise to move the strike of the round to the right; move it counterclockwise to move the strike of the round left.

(2) To adjust for elevation, move the elevation adjuster clockwise to move the strike of the round up; move it counter-clockwise to move the strike of the round down.

(3) When the adjuster begins to tighten, do not force in that direction because damage will result.

(4) Often, the RCO may require a shot or two to set the prism into the newly selected adjustment position. Do not damage the RCO by striking with brute force. Cycling the weapon three times will suffice for setting the prism.

(5) Once the RCO is zeroed, do not remove the adjuster caps. Ensure the caps are tightened to ensure water tight integrity of the RCO. The RCO should not be adjusted for elevation or wind changes. The turrets on the RCO should only be adjusted during zeroing. For wind corrections during firing, offset aiming is employed.

(SLIDE #12)

c. Windage and Elevation Rules. The windage and elevation rules define how far the strike of the bullet will move on the target for each click of elevation or windage for each 100 yards/meters of range to the target.

(1) Principles. The easiest way to understand the windage and elevation rules is to first analyze where the bullet

struck the target. If an adjustment needs to be made up or down to hit the center of the target, adjust the elevation on your RCO. If an adjustment needs to be made right or left to hit the center of the target, adjust the windage.

(2) Rules. Adjustment increments are 1/3 inch per click at 100 meters.

(a) Nine (9) clicks are required to move the strike of the bullet one inch at 36 yards/33 meters.

(b) Three (3) clicks are required to move the strike of the bullet one inch at 100 yards/meters.

d. Dimensions for Zeroing the RCO. To apply the windage and elevation rules accurately, you must know the dimensions of the targets used when zeroing. Sight adjustments are made by observing the strike of the rounds, determining their distance from the center of the target, and applying the windage and elevation rules to move the rounds to center.

(1) Zeroing is conducted at 100 meters/yards on the 'A' target. This contains a round black bull's-eye and a center '5V' ring scoring area. The "A" target dimensions are as follows:

(a) '5V' ring is 4 inches in diameter.

(b) The round, black bull's-eye is 12 inches in diameter.

(c) The 4-ring is 24 inches in diameter.

(d) The 3-ring is 36 inches in diameter.

TRANSITION: Now that have discussed the sighting system, are there any questions? I have one for you.

QUESTION: To move the strike of the round to the right, how do you adjust for windage?

ANSWER: Move the windage adjuster clockwise.

QUESTION: How many clicks on the RCO elevation adjuster does it take to move the strike of the round one inch at 100 yards/meters?

ANSWER: Three (3) clicks.

Notes: _____

We will now discuss the steps to zero your rifle.

3. **ZEROING PROCEDURES.** (6 MIN)

(SLIDE #13,14,15,16,17)

a. **Pre-zero Sight Setting.** Pre-zeroing can be accomplished with a small arms collimator (SAC).

b. **Zeroing.** Zeroing the RCO is conducted at 100 meters/yards. A zero is not established by simply getting a pre-zero sight setting. A zero established at 33 meters/36 yards is not nearly as accurate as a zero established at 100 meters. To zero the RCO:

(1) Place a suitable target with an aiming point 4 inches in diameter contrasting with the background (e.g., '5V' ring of an 'A' target) at a range of 100 meters and determine an aiming point. Use the 100-meter aim point on the reticle: Tip of the chevron center mass on the target.

(2) Fire five rounds to obtain a shot group.

(a) Triangulate the shot group to identify the center.

(b) Determine the vertical and horizontal distance in inches from the center of the shot group to the center of the target.

(3) Adjust the reticle to move the center of the shot group to the desired point of impact. 3 clicks move the strike of the round 1 inch at 100 meters for both windage and elevation.

(4) Fire five rounds to obtain a shot group.

(5) Adjust the reticle to move the center of the shot group to the desired point of impact.

(SLIDE #17)

(6) Fire five rounds to confirm the zero. The rifle is considered zeroed when a shot group is inside the 4-inch aiming area of the target.

(7) Record zero in data book.

TRANSITION: We have discussed zeroing procedures to determine proper adjustments to enable shots to be placed in the center of the target, are there any questions? I have one for you.

QUESTION: Zeroing the RCO is conducted at what distance?

ANSWER: At 100 meters/yards.

Notes: _____

We will now discuss the factors that can affect a zero.

(SLIDE #18)

4. **FACTORS AFFECTING A ZERO** (7 MIN)

a. **Factors Affecting An Accurate Zero.** There are several factors that can affect your ability to place accurate fire on a target, as well as maintain an accurate and stable zero. Anything the shooter changes from shot to shot affects the zero on their RCO. These are some of the common factors that, when applied inconsistently, affect your ability to maintain the accuracy of your zero:

(1) Placement of support hand

(2) Placement of the rifle buttstock in the pocket of the shoulder

(3) Grip of the firing hand

(4) Firing-side elbow

(5) Stock weld

(SLIDE #19)

- (6) Eye relief
- (7) Sight picture
- (8) Muscular control
- (9) Breathing
- (10) Trigger control
- (11) Sling tension

(SLIDE #20)

b. **Factors That Can Cause A Zero To Be Re-confirmed.** There are factors that cause a zero to be re-confirmed. When any of these factors are present, your zero should be reconfirmed.

(1) Maintenance. It is possible for the zero to change if qualified personnel perform maintenance on the rifle. If maintenance was performed, it is critical that the rifle be re-zeroed as soon as possible.

(2) Temperature. An extreme change in temperature (more than 20 degrees) will cause a change in the zero of the weapon; the elevation will need to be adjusted.

(3) Climate. Changing climates can mean changes in air density, moisture content, temperature, or barometric pressure. Reconfirm the zero as soon as possible.

(4) Ammunition. Inconsistencies in the production of ammunition lots can change a rifle's zero. A rifle should be re-zeroed if the type or lot of ammunition changes

(5) Ground Elevation. Drastic changes in ground altitude can create changes in air density, moisture content, temperature, or barometric pressure. Reconfirm the zero as soon as possible.

(6) Personal Protective Equipment (PPE). If your rifle is zeroed while in your utility uniform and fired in full battle gear, your zero may change. A zero must be established while wearing the PPE that will be worn while engaging targets.

TRANSITION: Now that we have just discussed the various factors that can affect a zero, are there any questions? I have one for you.

QUESTION: What factors can cause a zero to be re-confirmed?

ANSWER: Maintenance, temperature, climate, ammunition, ground elevation, and PPE.

Now that we have thoroughly discussed factors affecting a zero, let's talk about the Table 1A course of fire.

(SLIDE #21)

5. **TABLE 1A:** Training days of the Rifle Table 1A Course of Fire consist of the zeroing process, two training days and the evaluation day. The hold confirmation is there to ensure the optic is still functioning properly and weapon is in proper working condition.

Table 1A Training

a. Hold Confirmation (Day 1).

	Distance	Target	Time (min)	Rounds	Position
Hold Confirmation	200	"A"	1	3	Sitting
	200	"A"	1	3	Sitting
	200	"A"	1	4	Sitting

b. Table 1A Training (Days 1-2).

	Drill	Time (min)	Distance	Target	Rounds	Position
Stage One	Slow Fire	25	200	"A"	5	Sitting
			200	"A"	5	Kneeling
			200	"A"	5	Standing
			200	"A"	5	Choice of Above
Stage Two	Rapid Fire	1	200	"D"	10	Standing to Sitting
		1	200	"D"	10	Standing to Sitting
Stage Three	Slow Fire	5	300	"A"	5	Sitting
		1	300	"D"	10	Standing to Prone

Stage Four	Rapid Fire	1	300	"D"	10	Standing to Prone
Stage Five	Slow Fire	15	500	"B-MOD"	15	Prone
				Total	90	

c. Training Days (1-2). Requires more rounds fired than Qualification, in order to gain proficiency in all stages of fire. The 200 yard line rapid fire is reduced down to one string of fire, as is the 300 yard line rapid fire. Instructors are allowed to coach only before or after timed evolutions.

(SLIDE #22)

d. Table 1A Evaluation (Day 3).

	Distance	Target	Time (min)	Rounds	Position
Hold Confirmation	200	"A"	1	5	Sitting
	200	"A"	1	5	Sitting

	Drill	Time (min)	Distance	Target	Rounds	Position
Stage One	Slow Fire	20	200	"A"	5	Sitting
			200	"A"	5	Kneeling
			200	"A"	5	Standing
Stage Two	Rapid Fire	1	200	"D"	10	Standing to Sitting
Stage Three	Slow Fire	5	300	"A"	5	Sitting
Stage Four	Rapid Fire	1	300	"D"	10	Standing to Prone
Stage Five	Slow Fire	10	500	"B-MOD"	10	Prone
				Total	60	

(SLIDE #32)

TRANSITION: Now that we have thoroughly discussed the Table 1A course of fire, let's summarize.

Notes: _____

Let's summarize

(SLIDE #21)

SUMMARY

(2 MIN)

Throughout this period of instruction we have mounting and understanding the elements to establish a sound zero, the RCO sighting system, zeroing procedures, factors affecting a zero and the Table 1A course of fire. All the principles covered in this lesson are essential to becoming an effective marksman. Achieving a zero is the starting point to developing into a combat-ready marksman able to decisively engage the enemy. If you understand and apply the proper procedures for zeroing your service rifle, you will be a proficient marksman. The zeroing procedures remain the same, regardless of the field situation, to form the baseline for accurate target engagement.

INSTRUCTOR'S NOTE:

HAVE THOSE SHOOTERS WITH INSTRUCTIONAL RATING FORMS (IRFS) FILL THEM OUT AND TURN THEM IN AT THIS TIME.