Generic
Operators Manual

for

Boresight Camera Equipment

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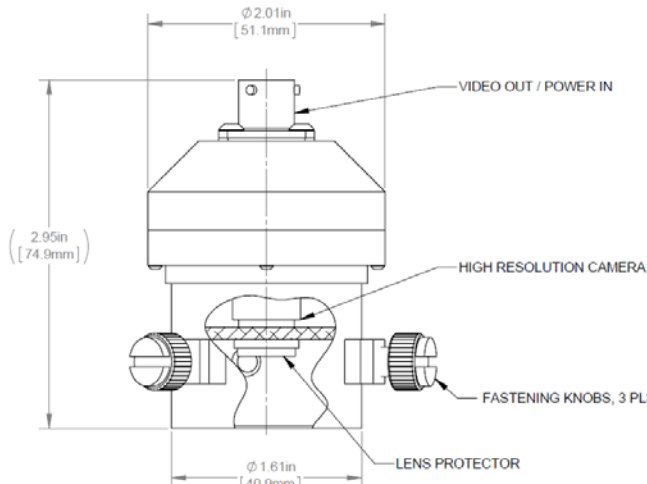
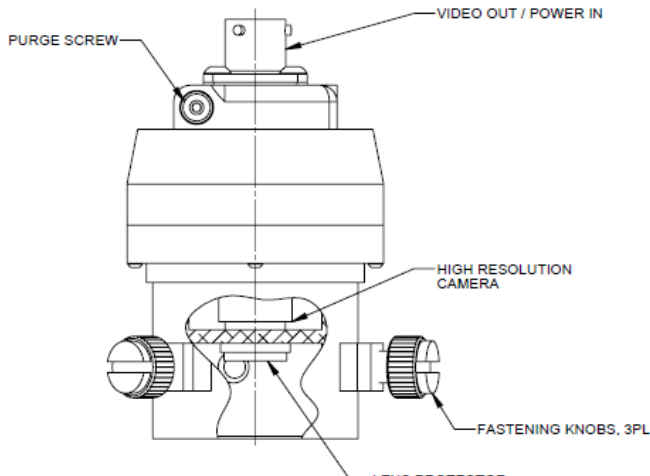
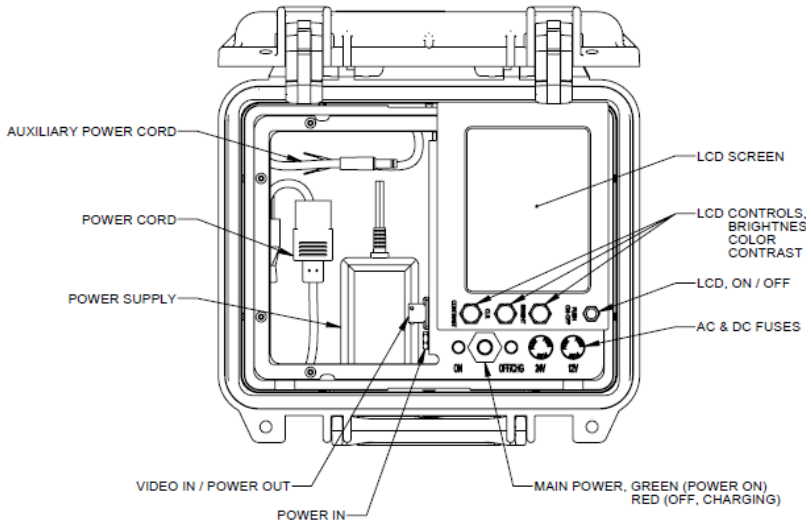


BCA-1001 Standard Boresight Camera



BCA-1001N Nitrogen Purgeable Boresight Camera



BCA-1002 Control Box

1.1 Purpose and Function: **The Graflex Boresight Camera Equipment (BCA) provides a fast, easy and accurate means of aligning the gunner's sight with the axis of the gun tube. The BCA equipment is an accessory to any Graflex Boresight. The Boresight Camera Equipment provides a means of reducing any uncertainty in the collimation process while reducing the reliance upon a team of as opposed to a single operator.**

1.2 Capabilities: **Graflex BCA Cameras are available is most any video format while the Control Box includes auto-switching capabilities. The Cameras are fully sealed and will perform in any environment while the Control Box (in storage position) provides the same level of capability. The optional nitrogen purgeable Camera insures a sealed and protected environment far into the future.**

1.3 Performance Characteristics:

(a) The BCA Cameras eliminate parallax.
(b) The BCA Equipment may be used with any and all Graflex Boresight equipment.
(c) The BCA design approach retains a fully optical Boresight system.
(d) The nighttime capability of the standard Boresight system remains intact.
(e) The BCA Cameras may be used in any environment while due care should be applied when using the Control Box; the Control Box is not fully waterproof with lid open.
(f) The BCA Cameras allow for a direct interface to the Fire Control System eliminating the need for the Control Box.
(g) The integrated system of BCA Camera and Control Box is self-supporting. The Control Box includes a rechargeable battery system capable of powering BCA Camera.
(h) The BCA Equipment does not degrade the capability of the Boresight equipment.

IMPORTANT: **This manual refers to the Graflex BTA (Boresight Telescope Assembly) throughout. Steps may be applied no matter the boresight type or size.**

SECTION II - SAFETY PRECAUTIONS

WARNING

Failure to remove BCA or Boresight Telescope Assembly (BTA) from the gun tube when weapon is fired will cause injury to personnel and/or damage to equipment. Immediately after use of BCA or Boresight Equipment, remove from gun tube and place/store in carrying case.

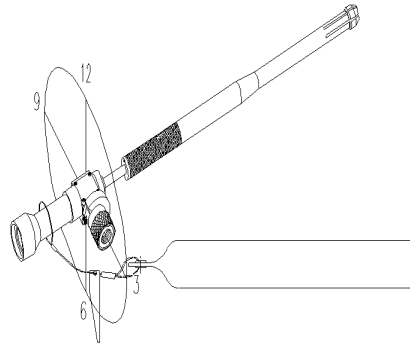
SECTION III - GENERAL THEORY OF OPERATION

General: **Boresighting is an alignment process by which the gun tube centerline and gunner's optical sighting system are referred to the same aiming point. Combat readiness is dependent upon the fire control system being collimated to ensure maximum first round hit capability. The BCA equipment reduces the need for additional personnel (while performing the collimation process) outside of the primary user. The BCA equipment reduces any uncertainty in communicating the exact point upon which the gun tube axis should be referenced.**

SECTION IV - COLLIMATION PROCEDURES

Note: The following procedures describe the generic procedures for using any BTA and the BCA Camera. For specific instructions pertaining to each vehicle system, see the appropriate Field Manual.

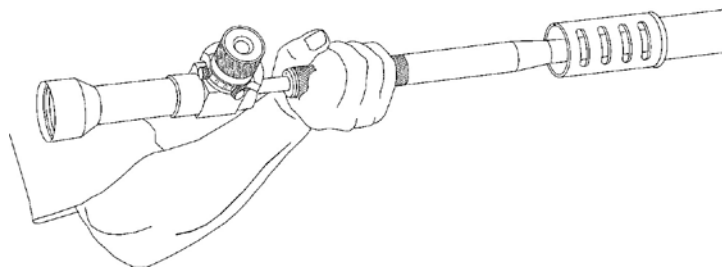
1. **Position the tank on as level terrain as possible with the gun tube over the front slope. Select target with a distance of approximately 1200 meters to the vehicle. If forced to use a target at a distance of 200 meters or less, do not remove the objective lens cap as the hole will minimize eyesight parallax.**
2. **Move gun select switch to trigger safe, clear gun. Put fire control system into manual or boresight mode. Consult vehicle technical manual for general boresighting procedures.**
3. **Clean foreign material from gun tube and insure tube is clean. Even small particles of dirt and dust will affect your readings and result in poor and inconsistent boresights.**



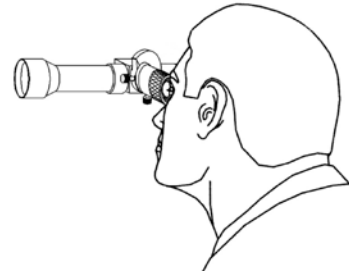
4. **Open carrying case by rotating turnbuckle latches counter-clockwise and remove case and remove case end cap. Remove telescope and adapter. Insert tapered stem of telescope snugly into the female tapered hole of adapter positioning the red index mark of the adapter at 12 o'clock while the telescope eyepiece is at 3 o'clock.**
   Note: It is absolutely essential that the tapered telescope stem is tightly seated in the tapered adapter hole. This can be checked by attempting to "wobble" the telescope stem in the adapter hole.
5. **Remove objective and eyepiece lens caps.**

Note: Objective cap need not be removed if boresighting at distances of 200 meters or less.

6. **Insure that the red warning flag is unfolded and hanging from the objective barrel so that it is clearly visible by others on the firing line.**
7. **Insert the adapter/telescope into the gun tube with the adapter index mark at 12 o'clock making sure that the tapered muzzle cone is firmly seated on the rim of the muzzle.**
   NOTE: It is now critical that the user not lean or pull on the gun tube or BTA as the slightest movement will result in poor and inaccurate readings.

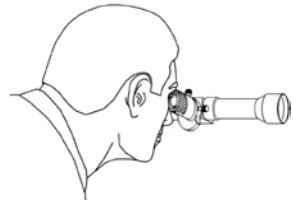


8. **View target through eyepiece and adjust eyepiece (± 4 diopters) for individual preference; reticle and target should be in sharp focus. Have gunner manually and carefully move gun tube, using G pattern center the telescope reticle crosshair to the designated target point. The reticle adjustment knobs can be used in order to make fine adjustments in positioning the reticle crosshairs on the exact target position.**



9. **Once you have positioned the reticle crosshairs on the target, slightly disengage the BTA and rotating in a clockwise direction 180 degrees (the red index mark will now be at 6 o-clock and the eyepiece at 9 o'clock). Insure the tapered muzzle cone in seated against the rim of the muzzle. The cross hairs have now moved off the original target. Using the recticle adjustment knobs (azimuth and elevation), split 1/2 the difference between this position and the previous position (*Do not reposition on the target*). Make a mental note of this new position.**

NOTE: Turn the BTA using the knurled section of the adapter only. Turn the adapter within the gun tube – do not the telescope within the adapter.



10. **Rotate the BTA 180 degrees to its' original position and again split the difference between the current reticle position and the previous reticle position using the reticle adjustment knobs.**
    NOTE: Turn the BTA using the knurled section of the adapter only. Turn the adapter within the gun tube – do not turn telescope within the adapter.
11. **Repeat these steps until there seems to be no discernible movement from one position to the next (should normally take 3-5 cycles).**
12. **If the BCA-1002 Control Box is to be used, it should be powered "ON" and the BCA-1001-CBL-XX connected to the BCA-1001-XX BCA Camera.**
13. **The BCA-1001-XX Camera should be gently slid onto the telescope eyepiece. NOTE: Orient the camera so imagery is correct.**

    IMPORTANT: It is very important when applying camera the telescope (and collimated point) be disturbed as little as possible. The telescope is very sensitive and small changes at the gun tube will equate to major changes at the target.

14. **The gun tube may now be jogged placing the reticle cross-point on a target upon which the gunner will place the FCS (Fire Control System) reticle cross-point.**

15. **The mechanical centerline axis of the gun tube is now collimated to the gunner's (FCS) sight**
16. **The BTA and BCA equipment may now be removed from the gun tube and the telescope removed from the adapter.**

NOTE: The interface at the telescope and the adapter is very tight and does "lock-up". The BTA kit is supplied with a drift key to be inserted in the slotted hole of the adapter to break the "lock-up". *Do not wedge drive the drift pin as it will damage the end of the 7.62mm stem*; the user should use the drift key as a lever to "push" the stem from the adapter. <u>Do NOT rotate the telescope stem within the adapter.</u>

17. **If the vehicle is equipped with a Coax Machine Gun or like, please review these notes:**
    - **Do not move vehicle, previously collimated gun tube, or reset gunner's sights after collimating the same if one intends to also collimate the coax gun tube.**
    - **Follow same steps as described in Items 5-11 within this section of the Operators Manual.**
    - **After completing these previous steps and placing the cross hairs on the original target tighten knobs of the coax to lock in position.**

      NOTE: Do not reset gunner's sights.

Illustration #7

18. The coax machine gun is now collimated to the main gun and the gunner's sights at the distance of the target.

SECTION V – CARE & CLEANING

NOTE:

The BCA and BTA are delicate optical instruments and should be handled with care. Most importantly do NOT rotate the telescope stem within the adapter.

5.1 General

1. **Prior to conducting collimation or boresighting procedures, ensure target aiming point is clear and focused by rotating eyepiece left or right.**

2. **The (telescope) protective shroud is secured using an allen head screw. The shroud will be closed during normal boresighting operations, and only opened while collimating the BTA.**

3. **Whenever the BTA is inserted in a gun tube, ensure the red warning flag is attached to device.**

5.2 Unusual Conditions:

In addition to performing all normal preventive maintenance services, special care must be taken in cleaning and lubrication when extremes in temperature, humidity, and terrain conditions are present or expected. Proper cleaning, lubrication, and storage and handling of oil and lubricants not only ensure proper operation and functioning, but also guard against excessive wear of working parts and deterioration of material.

5.3 Extreme Cold Weather Conditions.

a) When not in use, BTA should be kept covered in the carrying case and properly stowed.

b) Do not let snow or ice accumulate on equipment. Moving parts must be kept free of moisture.

5.4 Operation in Hot, Damp and Salty Atmospheres.

a) If moisture is present in optics, notify support maintenance to purge and charge BTA.

b) Salt deposits are especially harmful to optical surfaces. Deposits should be loosened by sponging with a clean, non-abrasive wiping rag.

5.5 Unusual Terrain Conditions – Sand, Dust and Dirt.

a) Be careful to keep sand and dust out of mechanisms when operating or making adjustments and repairs.

b) **Shield parts from flying sand and dust with tarpaulins during disassembly and assembly operations.**

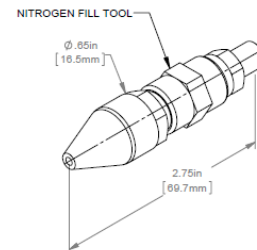
c) **When operating in sandy or dusty areas, remove lubricants from exposed lubricated parts. Lubricants will pick up sand and dirt, forming an abrasive which will cause rapid wear. With surfaces dry, there is less wear than when they are coated with lubricant contaminated with sand or dirt.**

SECTION VI - NITROGEN PURGING

The Graflex BCA-1001N-XX Camera and the boresight telescope are designed to allow the user to purge out moisture laden air and charge with clean nitrogen. The process of purging and charging eliminates the possibility of internal fogging of the optical elements of the telescope thus insuring the optimum performance of this instrument. The frequency of performing this process should coincide with other "purged" optics found on the users' vehicle or whenever internal fogging becomes apparent; as a general rule, purging and charging should be performed at least every 180 days.

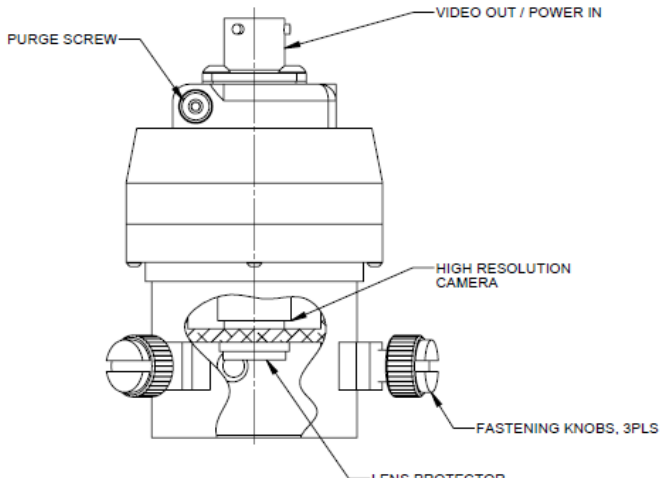
The instructions for purging the BCA-1001N Camera are as follows:

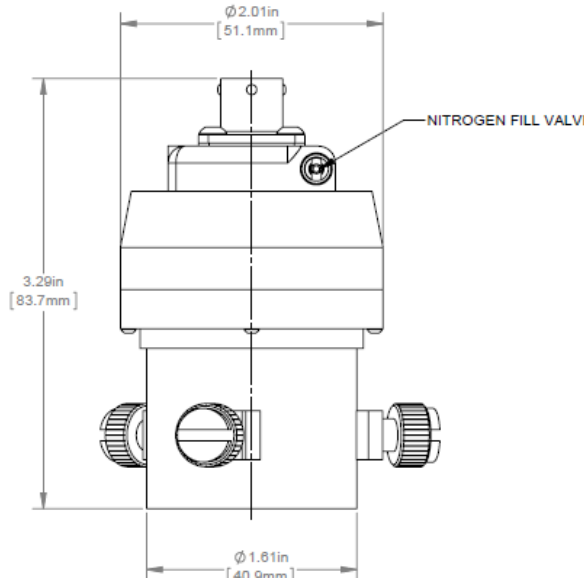
(a) Remove camera from carry case.
(b) Place camera on clean, flat work surface.
(c) Remove "purge screw" from camera taking acre to not misplace screw or washer.
(d) Apply nitrogen source to BCA-1001-NFVT fill tool.



(e) Apply fill tool to purge valve and allow nitrogen to flow freely through telescope for at least 30 seconds. Note: Source pressure must not exceed 2 PSI.
(f) Turn off nitrogen source.
(g) Place purge screw and tighten snugly but as not to deform teflon washer.
(h) Reapply nitrogen source and charge telescope to 2 PSI.

NOTE: Do not exceed 2 PSI pressure as it may cause damage to telescope internal seals.


VIDEO OUT / POWER IN
PURGE SCREW
HIGH RESOLUTION
CAMERA
FASTENING KNOBS, 3PLS
LENS PROTECTOR


Ø2.01in
[51.1mm]
NITROGEN FILL VALVE
3.29in
[83.7mm]
Ø1.61in
[40.9mm]

The instructions for purging and charging the telescope are as follows:

(a) Remove telescope from carrying case.
(b) Place on clean, flat work surface and unscrew valve assembly cap and purge screw.
(c) Adapt air chuck to valve stem from nitrogen source (use at least 99% Pure nitrogen) and allow nitrogen to flow freely through telescope for at least 30 seconds. Note: Source pressure must not exceed 5 PSI.
(d) Turn off nitrogen source.
(e) Place purge screw and tighten snugly but as not to deform teflon washer.
(f) Reapply nitrogen source and charge telescope to 5 PSI.

NOTE: Do not exceed 5 PSI pressure as it may cause damage to telescope internal seals.