FCLIP

Boresight tester of fused vision clip ons

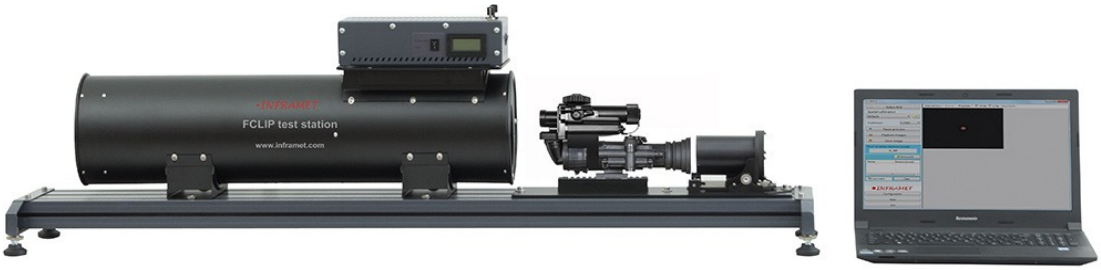

Fig. 1. Photo of FCLIP test station

BASIC INFORMATION:

Fused vision clip on is a detachable, dual channel (thermal channel and visible channel) afocal electro-optical system of optical magnification equal to one that generates output image to be seen by a telescopic sight. The combined system (fused vision clip on and telescopic sight) can be used to generate clear image of observed scenery at night or low visibility conditions. In this way a soldier/hunter can shoot using a rifle with a telescopic sight at day conditions, and after adding fused vision clip on he can shoot at night/low visibility conditions. Fused vision clip on is built by combining afocal visible imager (typically night vision monocular) with an afocal thermal imager and can generate three types of images: thermal image, visible image, fused image.

Fused vision clip on can be considered perfect when there is no noticeable shift between image generated by the telescopic sight cooperating with fused vision clip on and the image generated by the telescopic sight looking directly to the target. This requirement is valid for all three work modes of fused clip on: fused mode, visible only, thermal imaging only and any distance to the target. Badly aligned fused vision clip, when attached to the rifle, produces some image shift (can be different in different channels or image shift depends on distance) and then the shooter can miss the target even after a perfect aiming. Boresight problems with clip ons are quite common as it is extremely difficult to manufacture clip ons that could keep perfect alignment after mechanical shocks and for any distance shooter-target.

FCLIP is a computerized test station developed to for testing fused clip ons, thermal clip ons and night vision clip ons. In detail, this station enables measurement of several boresight parameters that precisely characterize earlier mentioned image shift.

Test concept is based on an idea to project image of a reference target located at variable distance to input of tested fused clip on and to analyze images generated by two imaging channels of tested fused clip on. In detail the reference images are generated by BTG broad band target generator and are projected by CRI reflective collimator into direction of tested fused clip on. Next, copies of the reference images are captured by IM50 visible camera and send to PC. Finally image analysis is done by specialized software.

Tested fused vision clip on is attached to the test station using the standard Picatinny (MIL-STD 1913) rail like in case of real rifles. Other rails are possible, too.

Following parameters can be measured using FCLIP station:

1. Deflection angle of night vision channel (angle between optical axis of input optics and optical axis of output optics of night vision channel)
2. Deflection angle of thermal vision channel (angle between optical axis of input optics and optical axis of themal channel).
3. Dual channel boresigth error (angle of optical axis of night channel and optical axis of thermal channel)
4. Resolution of visible channel (spatial angular frequency of minimal resolvable target)
5. Resolution of thermal channel (spatial angular frequency of minimal resolvable target)
6. Channel rotation difference (angle between axis of visible channel relative to thermal channel)
7. Rotation of visible channel (rotation angle between image from visible channel relative to image generated by telescopic sight)
8. Rotation of thermal channel (rotation angle between image from thermal channel relative to image generated by a telescopic sight)
9. Boresight error of focusing mechanism of night vision channel (angle between optical axis of night vision channel for infinity distance and the same axis of the channel focused at finite distance of interest)

10. Boresight error of focusing mechanism of thermal channel (angle between optical axis of thermal channel for infinity distance and the same axis of the channel focused at finite distance of interest).

All parameters of clip ons listed above give valuable information on quality of clip ons or how to make boresight errors negligible during production or repairing process. Parameters no 1-3 are considered as crucial.

BLOCKS OF FCLIP STATION

FCLIP is a modular station build from following blocks:

1. BTG target generator (different form depending on station version)
2. CRI760 of axis reflective collimator (different form depending on station version)
3. MP1913 mechanical platform (simulates standard Picatinny rail)
4. IM50 camera
5. BP rail
6. laptop
7. BOR computer program (different form depending on station version)

SPECIFICATION

Parameter	Value
Acceptable diameter of output optics of clip on	Up to 70mm (option 110mm or more)
Fixing position to test station	standard Picatinny rail
Range of measurement of alignment errors	Up to 40 mrad
Resolution of measurement of the alignment errors	Not worse than 0.03 mrad
Range of measurement of rotation error	Up to 5°
Resolution of measurement of rotation angle	0.25°
Simulated distance clip on-target	approximately 50m, 100m, 200m, 400m, 1000m and infinity
FOV of tested clip on	<12° (recommended case) < 30° (optional case)
Minimal required brightness gain of night vision channel	500 lm/lm
Maximal thermal resolution of thermal channel	200 mK
Retictle	Cross with graduations in X and Y (software generated)
Emission bands of BTG target generator	LWOR/MWIR and Visible
Simulated illuminance range	At least from 1 mlx* to 100 lx
Simulated temperature difference range	At least up to 20K
Focal length of CRI collimator	600mm (option 1000 mm)
Aperture of CRI collimator	70 mm (option 110 mm)
Resolution of CRI collimator	At least 60 lp/mrad (option 80 lp/mrad)
Sensitivity of IM50 camera	Not worse than 0.1 lx
Spectral band of IM50 camera	400-700 nm
Resolution of IM 50 camera	Not worse than 0.05 mrad

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VERSIONS

Inframet offers FCLIP in four main versions of different test capabilities.

FCLIP-A station can measure only deflection angles of both imaging channels for a case of target located at optical infinity. It can be assumed that distance longer than two thousand of focal length of optical objective of tested clip on can be considered as optical infinity. Therefore it can be considered that version FCLIP-A is acceptable for great majority of requirements on clip ons.

FCIP-B station offers the same test capabilities as FCLIP-A and additionally measurement resolution of both imaging channels. It is an useful feature to evaluate image quality generated by tested fused clip ons.

FCIP-C station offers the same test capabilities as FCLIP-B and additionally measurement of image rotation errors.

FCIP-D station offers measurement boresight errors of both imaging channels for a target located at finite distance (step variable distance: approximately 50m, 100m, 200m, 400m, 1000m and infinity). FCLIP-D is a valuable tool when testing high performance clip ons to be used to cooperate with long range telescopic sights.

WHY FCLIP?

Errors of fused vision clip ons can be measured using non computerized methods. However, these methods can work but are sensitive to human subjectivity errors and real measurement accuracy is low.

FCLIP is a new generation test station that use fully achievements of modern computer technology. This computerization significantly improved accuracy of measurement of the alignment errors, shortened measurement time, eliminated human subjectivity error and made possible to archive test results.

FCLIP stations are used by a series of manufacturers/users of used fused clip ons, thermal clip ons, night vision clip ons and have very positive opinion as a near perfect tool for final quality evaluation or as manufacturing/repairing support tool.

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