LTF test station

Mobile tester of laser range finders

Fig. 1. Photo of the LTF test station

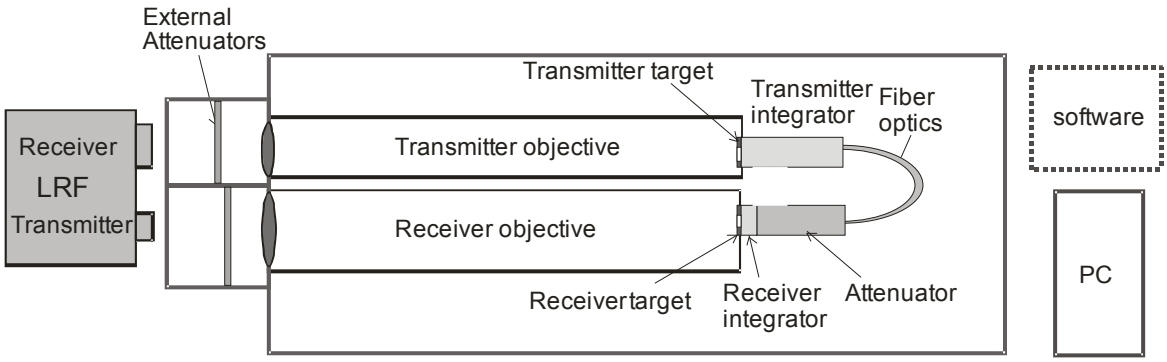

Fig. 2. Block diagram of LTF test station

BASIC INFORMATION:

Final performance tests of laser range finders are typically done at field tests by shooting the LRF into direction of a target placed at some distance (typically about 0.5-1 km), attenuating radiation emitted by the LRF, and checking at what attenuation level the LRF stops giving proper distance indications. If target is significantly bigger than divergence angle of tested LRF then so called Extinction Ratio can be measured. This parameter can be understood as an maximal attenuation (in dB) when tested LRF is still capable to work properly for a case of large target. If tests are done for a small target (angular size comparable to divergence angle) then boresight errors (alignment error between transmitter and aiming; alignment error between receiver and aiming) can be checked. Finally, if tests are carried out for several small targets of short distance difference then additionally target discrimination is measured.

LTF station is a compact, mobile test station based on a concept of a test station that would imitate such field tests in laboratory/depot conditions. We must also remember that field tests are sometimes non-reliable due to unpredictable behavior of atmosphere that generate situation when field tests of the same LRF carried out at different time generate often significantly different measurement results.

LTF test station enables performance tests of virtually all laser range finders. It particularly recommended for final tests of laser range finders due to capability of fast determination of real performance of tested laser range finders.

LTF test stations belongs to a family of test stations offered by Inframet for testing laser systems.

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LTF design

The LTF station is built from two main blocks: LTF main block and PC with software. The LTF main block is built from external attenuator module, receiver objective, receiver target, receiver integrator, receiver attenuator, fiber optics, transmitter attenuator, transmitter integrator, transmitter target and transmitter objective. When transmitter of tested LRF emits optical pulse the receiver objective focuses incoming laser radiation at plane of the receiver target plate. The latter module simulates the small reflector target used during ER measurement – only radiation that hits the target can be transmitted. Next, the receiver integrator converts incoming directional radiation into diffuse radiation that is latter attenuated using receiver attenuator module. After this the fiber optics transmits incoming radiation with some temporal delay. At the end of fiber channel is located transmitter attenuator that reduces again power of laser pulse. Next, the transmitter integrator improve conversion of incoming directional radiation into diffuse radiation. Finally, the transmitter optics emits collimated beam into direction of receiver of the tested LRF. Divergence angle of emitted beam is by size of transmitter target.

Both targets (receiver target, transmitter target) emit visible light. Therefore it is easy to test team to align tested LRF with optical axis of LTF station if tested LRF is equipped with optical viewer or cooperate with a TV camera.

It should be also noted that LTF station use symmetrical design. Therefore the convention transmitter/receiver is only for clarification of method of work presented earlier. In fact both channels of LTF can work as receiver channel or transmitter channel depending on design of tested LRF.

Tab. 1. Basic technical parameters

Parameter	Value
Spectral range	700-1700nm
Calibrated wavelengths	Typical: 1060nm, 1550 band (1540, 1550, 15570), 910 nm
Number of simulated targets	One (option up to three)
Simulated target distance	About 1200 m
Simulated attenuation range	At least 40dB
Attenuation regulation method	Motorized, PC control
Max target size	4 mrad
Minimal target size	0.25 mrad
Regulation of target size	Step regulation, five values
Control of target size	Motorized, PC control
Ability to simulate boresight errors	Yes, simulation of non parallel axis of transmitter and receiver
Max acceptable diameter of transmitter optics	50 mm (models with bigger optics can be delivered)
Max acceptable diameter of receiver optics	50mm (models with bigger optics can be delivered)
Design optimisation	Testing LRFs having two separate channels (LRFs having coaxial optics can be optionally tested)
Location of tested LRF relative to test station	LTF optics must overlap optics of tested LRF
Work temperature range	5°C to 40°C
Storage temperature range	-5°C to 60°C
Humidity range	up to 95% (non condensing)
Voltage power	AC 110-230 V
Dimensions	1360x 320x280 (main module) plus typical PC dimensions
Mass	32 kg

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Modes of work

LTF station can work in four different modes depending on size of simulated targets in both its channels:

A) targets in both channels of LTF station are significantly bigger than divergence angle of transmitter and bigger than FOV of receiver of tested LRF,
B) target in LTF station opposite to receiver channel of tested LRF is significantly bigger than FOV of the receiver; the second target opposite to transmitter is barely bigger than divergence angle of the transmitter in LRF,
C) target in LTF station opposite to transmitter channel is significantly bigger than divergence angle of LRF; the second target opposite to receiver is barely bigger than FOV of receiver in LRF,
D) target in LTF station opposite to receiver channel is barely bigger than FOV of the receiver; target in LTF station opposite to transmitter channel is barely bigger than divergence angle of LRF.

Tests done in mode A can be used to measure absolute value of ER of tested LRF or to detect reduced pulse peak power of transmitter or reduced receiver sensitivity comparing to a reference LRF.
Tests done in mode B are used to detect non acceptable level of boresight error transmitter to aiming device.
Tests done in mode C are used to detect non acceptable level of boresight error receiver to aiming device.
Tests done in mode D are used to detect all types of earlier mentioned defects.

Attenuation in channels of LTF station during tests is determined in two ways:

1. user knows what absolute attenuation is to be simulated for chosen type of LRF,
2. attenuation is regulated to achieve situation when signal is x% higher over threshold of a reference LRF.

The method 2 is more typical. Practically it means that typically user first tests a reference perfect LRF and determines what is maximal attenuation in LTF station when tested LRF is still working properly in mode A. Next he determines what target sizes are optimal for tested LRF type. Later he decreases slightly attenuation and does tests in modes A-D of real LRFs to be tested. There is no rule how much attenuation should be decreased for different modes to give proper tolerances. Different manufacturers/repairing workshops use different rules.

Recommended market

- Final users of laser range finders for demanding applications due to its simplicity of operation and capability of fast determination of real performance of tested laser range finders.
- Manufacturers of laser range finders that needs fast, effective tool for final quality control.
- Repair workshop as service tools.

Test limitations

LTF test station is optimized for testing laser range finders built using two separate optical channels: transmitter and receiver. Tests of LRF built using coaxial optics are possible but please contact Inframet with optical diagram of LRF to be tested.

Versions of LTF test station

LTF test station can be delivered in form of a many different versions. Five digit code shown in Table 1 is used to describe version parameters.
LT series test stations are laboratory class test stations optimized for extensive tests of laser range finders and measurement of earlier mentioned parameters. LTF test stations presented in this data sheet are compact, mobile test sets optimized for simplified crucial performance tests both laboratory or depot conditions.
The performance based test concept makes the LTF test station a optimal choice for applications when quick, easy tests are needed to determine possible field performance.
In most advanced version the LTF test station enable measurement of absolute values of ER extinction ratio. If simplified version is used then relative measurement can only be done (information that ER (or performance range) is lower or higher than value set by the LTF test station.

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Tab. 2. Definitions of the five digit code (ABC-DE) used to describe versions of LTF test system

	A	B	C	D	E
Code	**Attenuation**	**Size of simulated target**	**Type of tested LRF**	**Number of Calibrated Wavelengths**	**Number of simulated targets**
1	Non-regulated (binary performance tests: working/not working)	Fixed size of simulated reflective target (optimized to simulate one type LRF)	Multipulse LRF (LED LRF)	1	1
2	Flexible regulation of attenuation	Motorized step regulation of size of the reflective target (up to 5 different values)	Monopulse LRF	2	2
3			Both types	3	3
4				Up to 5	

Example versions:
LTF 111-11: fixed non regulated attenuation, fixed size of simulated target, optimized for testing LED LRF, calibration for one wavelength, simulated reflection from one target.
Attention: the attenuation can be manually regulated by Inframet/customer engineers but attenuation settings are supposed not to be regulated during normal use.
LTF 22332: Flexible regulation of attenuation (possible measurement of ER of tested LRF), Motorized step regulation of size of the reflective target (up to 5 different values), optimized for testing both LED LRFs and monopulse LRFs, calibrated at 1060 nm, 1550 band, 910 nm (other wavelengths possible), simulates two targets separated by short distance.
LTF 111-11 is recommended for simplified tests of a single type of laser range finder. LTF 22332 is recommended to be used as an universal performance tester of wide groups of laser range finders.

Advantages of LRF test station

- Efficient, user friendly tool for final performance evaluation of laser range finders,
- Ability to measure Extinction Ration at lab/depot conditions,
- Compact design suitable for both laboratory, depot or field applications.

In case of any questions please contact us.

Version 3.2

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