

INFORMATION RELATING TO THE LTI 20.20 LASER SPEED MEASURING EQUIPMENT.

LTI 20.20 laser speed measuring equipment is required, as with all such devices, to be Home Office Type Approved for enforcement use, by the Secretary of State.

To acquire Home Office Type Approval, equipment needs to be independently tested to extremely high standards of measuring accuracy and assessed for the effects of interference from Radio frequency and Electromagnetic fields and must comply with the requirements in the Home Office Speedmeter Handbook.

It also needs to meet high standards in environmental factors such as extreme heat, cold and waterproofing. It meets all the standards in respect of the environmental factors.

It is Type Approved for use within the measurement ranges specified by the Manufacturer as 0 – 999.9 metres and 0 – 299 mph

The LTI 20.20 speed measuring equipment operates on laser light frequencies and is therefore unaffected by Radio frequency and Electromagnetic fields. In all respects, its accuracy conforms to those laid down in the Home Office Speedmeter Handbook 4th edition (available on the HOSDB website or via the link below).

<http://scienceandresearch.homeoffice.gov.uk/hosdb/publications/road-policing-publications/15-05-Speedmeter-Handbook12835.pdf?view=Binary>

The device uses as its measuring medium a beam of infrared laser light which has been approved to Class One laser standards and presents no health hazards.

The 3-milliradian beam, which has a range in excess of 1 kilometre in the United Kingdom version, has a width of approximately 0.3 metres at a range of 100 metres, 0.6 metres at a range of 200 metres, 0.9 metres at a range of 300 metres and 1.2 metres at a range of 400 metres and is thus narrow and precise. At these ranges, however, the 'active' portion of the beam is somewhat smaller. The calculations carried out by the equipment use the speed of light as the constant value.

The beam is aimed at the vehicle to be measured by means of a Sighting Scope mounted on the top of the equipment. The Scope has a 2 times magnification. Contained in the scope is a red sighting dot that is aligned to the axis of the beam. The operator has an audio/visual test procedure to ensure that the beam and red dot are accurately aligned. This is the scope alignment test and is detailed below. Scope alignment is set at the factory. The only reason that the scope might ever go out of alignment would be as the result of a heavy blow. The red dot is an optical device that can only be seen through the scope by the operator. It is not visible to an approaching driver.

The scope alignment is completed by placing the device in test mode. The display will read "tt". The instrument will emit an audible tone when the trigger is depressed. This will change pitch when the laser acquires a target. A telephone pole is an excellent target because the device can be aimed skyward to eliminate other objects. When scanning across the pole, the highest pitch or "on target" tone will be heard when the instrument's laser beam is hitting the pole. At this point the red dot in the scope should be centred on the pole. The same procedure should be followed both vertically and horizontally. This test ensures the accuracy of the targeting mechanics in the LTI 20.20. The manufacturer recommends this be done once during each period of enforcement.

The combination of the beam width and scope alignments ensures that only the vehicle upon which the operator sights the equipment will be measured.

Pre-Use Checks

When the LTI 20.20 is switched on, the internal software will conduct self-diagnostic checks to ensure that all systems are functioning and that calibration is accurate. The successes of these checks are indicated to the operator by audible tones. Should any one of these checks fail then the equipment will display an 'ERROR' message, will not function and thus cannot be used for speed measurement.

Additionally during this check, the display is tested to ensure that all segments of the display are working correctly. When tested, the display will show 8888.

In addition to these self diagnostic checks, the camera system is sent to the manufacturer for annual calibration in accordance with Type Approval requirements. Subsequent to this, certificates of conformity and calibration are issued thus confirming that the equipment meets the criteria laid down by the Home Office Type Approval.

Operation of the Speed Measuring Device

In accordance with the manufacturer's instructions the operator will sight the 'red dot' upon the target vehicle and holding the device steady, press the trigger on the LTI 20.20. The equipment will then fire a stream of laser light pulses at the vehicle and take a series of measurements. Once the measurements are completed, the laser beam then reverts to an inert state until the operator wishes to measure the speed of another vehicle or, indeed, the same vehicle again.

The time taken to obtain those measurements and for refined software in the device to compute the results and present a speed-reading to the operator on the digital display is 0.32 seconds (320 milliseconds). At the same time it will compute and display the distance (range) from the operator at which the speed was measured. This latter value is of course, the range of the direct line of sight between the measuring device and the target vehicle. In theory it is therefore possible to make three measurements per second.

Whilst making its calculations, the software also examines the measuring data for inconsistencies and should it find any within extremely narrow parameters it will reject the readings and display an 'ERROR' message and not a speed. Thus it will not measure and display spurious readings. Additionally because of the nature of the beam combined with the error trapping safeguards it is not possible to obtain speed from any other than the targeted vehicle.

Other parameters checked by the system prior to calculation include the power of the return signal, the frequency of the return signal, the timing interval and the optical path of that signal. Thus, if used in accordance with guidance, it will not measure and display spurious readings. Additionally because of the nature of the beam combined with the error trapping safeguards it is not possible, if used correctly, to obtain speeds from any other than the targeted vehicle. In more precise terms the error trapping algorithms as described above would never allow multiple target returns to skew a speed measurement.

Cosine Effect

The digital display on the equipment is in whole numbers only and the equipment will automatically 'round down' the measured reading to the nearest whole figure. Thus a speed measured at 34.9mph will display as 34mph to the advantage of the driver.

Within the parameters above, readings taken directly from the line of travel (towards or away) will result in true measurements of the vehicle speed. If readings are taken at an angle to the direction of travel, e.g. from the roadside, then in accordance with the trigonometric principles of cosine there is a slightly lower reading in favour of the driver.

To explain this: If the target vehicle is moving directly toward or away from the laser, the velocity calculation as measured by the laser will be equal to the true speed of the target vehicle. Very often however, this is not the case. For safety reasons, the laser will be set up a short distance from the travelled portion of the road. Therefore vehicles along the roadway will not be heading directly toward or away from the laser. In other words, some angle between the vehicles direction of travel in relation to the position of the laser is created.

When the direction of travel of the target vehicle creates a significant angle with the position of the laser, the relative speed of the vehicle will be less than the true speed. Since the time/distance calculation is based on the relative speed, the laser measurement may be less than the true speed of

the vehicle. This is known as the angular or cosine effect. (Cosine is a trigonometric function related to this principle).

The difference between the measured and true speeds depends upon the angle between the ideal location of the laser (the point at which the vehicle would be moving directly toward or away from the laser) and the actual position of the laser. The larger the angle between the vehicle and the laser, then the lower the measured speed will be. This effect always works to the advantage of the driver of the vehicle.

Thus from an extract from the table of cosine values it will be seen that a speed of 30mph measured from the direction of travel will measure as 29.54mph from a point 10 degrees from the direction of travel. When a target passes by at an angle of 90° the laser is unable to perceive any of its speed because at an angle of 90°, the target is getting neither closer nor farther away from the laser.

Calibration.

Annual calibration is a Home Office type approval requirement (but not a condition of type approval). The device is tested and the manufacturer certifies that the device continues to be accurate to within the tolerances it met when first type approved.

Calibration is performed by the manufacturer or their appointed agent who are classed as a third party in any disclosure issues.

The certificates of conformity and calibration indicate that when examined under test, the device conformed in all respects to the standards for calibration accuracy.

The test routines carried out and documented in that process are laid down by the Home Office in their publication 'A Guide to Calibration requirements for Traffic Enforcement Equipment - Police Scientific Development Branch - Home Office Police Policy Directorate - Publication No 18/98 which may be found via the following link:

<http://scienceandresearch.homeoffice.gov.uk/hosdb/publications/road-policing-publications/18-98-Guide-to-Calibratio12835.pdf?view=Binary>

In respect of range the publication requires: 'The device shall be used to make at least three different range measurements against 3 accurately measured distances of between 25 and 100 metres to a reflective target'.

It is therefore calibration verified by measured points at 25, 75, and 100 metres, the details of which appear on the data sheet attached to the Certificate of Conformity.

The LTI 20.20 is a linear measuring device utilising the speed of light as the constant value for calculation and employs the same calculation processes whatever the range and speed, be it 0 mph and 20 metres or 160 mph and 999 metres. ***Therefore if accurate at one measured point it will be accurate throughout the whole range. Thus three measured points are effectively a triple assurance. This is a well accepted scientific principle.***

In point of fact the LTI 20.20 will measure to ranges well in excess of three kilometres, although the Type Approval limitation is to 999.9 metres simply because the readout display is only capable of four digits.

In summary therefore the LTI 20.20 is an extremely accurate speed measuring device operating well within the parameters required for Type Approval. It will operate to the same level of accuracy throughout the whole range of 0 to 999.9 metres.

Further information regarding the Type Approval Process may be found at the following link: <http://scienceandresearch.homeoffice.gov.uk/hosdb/police-equipment-technology/road-policing/speed-cameras/indexe42d.html?version=1>