TELE - TRAFFIC (UK) LIMITED

LTI 20.20 TS/M SPEEDSCOPE

OPERATIONS MANUAL 2004

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OPERATIONS MANUAL

LTI 20.20 TS/M
SPEEDSCOPE

HAND HELD SPEED MEASUREMENT EQUIPMENT

INTRODUCTION

Following the recommendation of the Road Traffic Law Review and the subsequent provisions in the Road Traffic Act 1991, speed detection devices used for road traffic enforcement are required to be type approved by the Secretary of State.

The Road Traffic Offenders (Prescribed Devices) Order 1993 prescribed devices 'designed or adapted for recording a measurement of the speed of motor vehicles activated by means of a light beam or beams'. In plain terms this means light beam or laser devices.

Following a period of rigorous testing and evaluation the **LTI 20.20 TS/M Speedscope** was type approved by the Secretary of State on **20th March 1996.** (ROAD TRAFFIC - Light Beam Speed Measuring Device Approval 1993).

During the testing procedures the device was found to have a theoretical accuracy in its laser speed measuring mode of +/- 0.35km/h which in any practical operational sense equates to +/- 0mph.

In addition to its laser speed measuring function the device will also measure and display a range to target, a facility which can be utilised for other measuring requirements. It also has a function which allows the measurement of speed by time/distance using a pre-fed check distance provided by the laser facility.

The device is capable of enhancement by a series of peripherals. These include download of data into a data collector, video capture of offences to video film and prints for hard evidence.

All these options utilise the standard **LTI 20.20 TS/M Speedscope** for the measuring device.

This Operations Manual has been designed to meet the requirements of the Traffic Committee of the Association of Chief Police Officers and will provide all the detail that a trainer will need.

CONTENTS

SECTION 1

LASERS - A TECHNICAL DESCRIPTION

CONTENTS:

LASERS: AN OVERVIEW

Light is a form of electromagnetic radiation the same as radio and microwaves. The difference is that light has a much higher frequency than either radio or microwaves. The light emitted by a laser is no different from that emitted by any other source but a LASER has a unique method of generating light.

The word LASER is actually an acronym that stands for "Light Amplification by Stimulated Emission of Radiation". In its simplest form a LASER is made by sandwiching a piece of active material, the lasing medium, between two mirrors. The two mirrors and the lasing medium form an optical resonator that allows the generation of laser light. The atoms of the lasing medium are put into an excited state by an external energy source. That is they are made to store some of the energy. The atoms can be made to give up this stored energy as a light wave when another light wave interacts with the atoms. By making sure that the two mirrors are positioned exactly the right distance apart, the light that bounces back and forth forms a standing wave. Under these conditions the light waves emitted by the atoms of the lasing medium combine to increase the strength of the standing wave. Just having the light going back and forth in the optical resonator is not particularly useful in itself. So one of the mirrors is designed to allow a portion of the light to escape. LASERS can be made from a great many different materials including solids, liquids and gases. Also the design of the optical resonator and the method of exciting and lasing mediums can vary widely. But whatever form the laser takes the light is generated by the same basic mechanism.

The type of LASER used in the **LTI 20.20 TS/M Speedscope** is an infrared semi-conductor laser diode. The laser diode has several important properties that make it the ideal choice for speed measurement purposes:

1. The laser diode emits a narrow cone of radiation from a very small area. This allows the light to be collimated into the very narrow beam that gives the **LTI 20.20 TS/M Speedscope** pin-point targeting.

2. The laser diode switches on and off extremely quickly typically in less than one billionth of a second. This gives the **LTI 20.20 TS/M Speedscope** superior accuracy.

3. Like all LASERS the laser diode emits only a very narrow band of frequencies. This allows the detector to be "tuned" to the exact wavelength of the laser diode. This is why the **LTI 20.20 TS/M Speedscope** can operate during daytime when there is a lot of background radiation from the sun. (The instrument sees laser light, all other radiation is filtered out.)

4. The laser diode emits in the infrared position of the electromagnetic spectrum so it is invisible to the human eye and cannot be a distraction to operators of vehicles.

LASERS AS APPLIED TO VELOCITY MEASUREMENT

PRINCIPLE OF OPERATION

The **LTI 20.20 TS/M Speedscope** determines speed by measuring the time of flight of very short pulses of infrared light. This method is fundamentally different from Doppler frequency shift measurements and in its simplest form can be described as follows.

Since the speed of light is a constant, the time it takes the LASER pulse to travel to the target and back is directly proportional to the distance to the target. By firing two pulses a known time apart two distances can be calculated. The change in distance divided by the time interval between the two pulses gives the speed of the target.

In theory it is possible to make a speed measurement using only two pulses as described above. In practice this would be prone to errors such as a shift of the aiming point between pulses. To eliminate the possibility of such errors independent tests are applied to the pulse data and failure of any one of the tests results in an error being displayed. The actual speed calculation that the **LTI 20.20 TS/M Speedscope** uses is not the simple distance divided by time formula outlined above. The distance to the target is not used and the target speed is derived from the entire data set using the method of least squares. This gives the best possible result and the least chance of errors.

ADVANTAGES OF LASER SPEED MEASUREMENT

The pulse measurement process used in the **LTI 20.20 TS/M Speedscope** is inherently superior to the Doppler process used in radar guns. This is because the target speed is measured directly from the change in position of the target rather than by inference from a Doppler frequency shift.

So the **LTI 20.20 TS/M Speedscope** cannot be fooled by rotating or vibrating objects. Also the **LTI 20.20 TS/M Speedscope** can discriminate between approaching and departing targets and will give an accurate zero speed for stationary targets.

EYE SAFETY

The **LTI 20.20 TS/M Speedscope** is designed to meet stringent eye safety requirements and is classified as eye-safe to Class 1 limits. This means that there can be no risk of damage to the eye even after nearly three hours of continuous exposure. To comply with these limits the radiated light power must be extremely low. By comparison the **LTI 20.20 TS/M Speedscope** outputs only one twentieth the light power of the typical TV remote control.

SECTION 2

LTI 20.20 TS/M SPEEDSCOPE

CONTENTS:

EQUIPMENT DESCRIPTION

The **LTI 20.20 TS/M Speedscope** is a hand held device some 205mm x 130mm x 88mm and weighing approximately 2kg.

On the top of the equipment is a sighting scope with a polaroid filter on the front to assist the operator in variable light conditions.

On the bottom is a pistol grip containing the trigger mechanism.

It is powered by a 12v Dc source from a supplied battery.

At the rear is the control panel containing the function and control switches i.e. Power on/off, Display Intensity, Test Mode, Timing Mode and Speed/Range.

The readout display is also located on this face together with a serial port which facilitates connection to the peripheral equipment.

The device is calibrated in miles per hour and metres but can be re-calibrated by the supplier to any unit of measurement of Speed/Range.

On the front face are two lenses which transmit the laser beam and receive the return signal.

Further technical details can be found on the data sheet at page 30 of this manual.

The sighting scope mounted on the top of the device contains within it a red dot which is aligned with the beam and in use is placed by the operator on the target vehicle, thus ensuring that the beam hits only the target vehicle.

The 'red dot' is only visible to the operator and cannot be seen by and does not physically appear on the target vehicle. It is an optical effect for the operator only.

The laser pulse method of measurement can best be described as follows:

> Upon sighting the target the operator presses the trigger and activates a short burst of pulses which strike the target and provide a return signal having taken a number of measurements in a matter of milliseconds.
>
> The software in the **LTI 20.20 TS/M Speedscope** then constructs a profile of these measurements and makes comparisons to ensure consistency. If the measurements are consistent then the device will provide a speed and range reading in 0.3 seconds.

If any inconsistencies are found the software will trap the error and display only an error reading. It will not display a spurious or false reading.

SECTION 3

SIGHTING SCOPE

CONTENTS:

SCOPE ALIGNMENT

Scope alignment is set at the factory. The only reason the scope might ever go out of alignment would be from a heavy blow. Because verification of proper alignment is critical to intrument operation a test has been incorporated into the instrument. By following this test procedure the operator of the instrument can verify that the instrument's light beam is hitting the sighted target.

For evidential purposes it is recommended that this check is carried out at each enforcement session.

SCOPE ALIGNMENT TEST

A) Put the intrument in test mode by pressing the test button on the back panel of the instrument. The display will read "tt".

B) Select a target not less than 50 metres away. The instrument will emit an audible tone when the instrument trigger is depressed which will change pitch when the laser beam acquires a target. (A telephone pole is an excellent target because you can aim the instrument skyward eliminating anything in the background to interfere with the test.)

C) When scanning across the telephone 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 test target (telephone pole). This same procedure should be followed both vertically and horizontally. This test ensures the accuracy of the targeting mechanics in the **LTI 20.20 TS/M Speedscope.**

D) In the unlikely event that the scope goes out of alignment refer to the following instructions to realign the scope.

REALIGNMENT OF SCOPE

A) Remove the elevation and windage caps. Put the Laser Speed Detector in test mode.

B) With the LASER rested on a tripod support sight a small target at least 200 metres away by scanning the LASER until you hear the "on target" tone both horizontally and vertically.

C) Sight through the scope and use the elevation and windage adjustment screws to move the red aiming dot to the same target.

- To move the point of impact up, turn the elevation adjustment screw clockwise and vice versa to move the point of impact down.
- To move the point of impact to the left turn the windage adjustment screw clockwise and vice versa to move the point of impact to the right.

D) Use the test mode in the Laser Speed Detector to double check the new alignment.

E) Replace the elevation and windage caps.

SCOPE FILTER

The scope filter adjusts for brightness and contrast providing maximum versatility during extreme light conditions.

SECTION 4

SET UP

CONTENTS:

SET UP

In setting up to use the Laser Speed Detector it is important to keep two parameters in mind for proper use of the instrument. These two parameters are as follows:

1. **Clear line of sight to the section of roadway at which you will be targeting traffic.**

2. **Setting up to minimise the angular or cosine effect.** This process is identical to what you are accustomed to in setting up to use radar instruments.

LINE OF SIGHT

While setting up it is important that a position be chosen which has a clear view to the section of road that will be targeted. It is important that no trees, telephone poles, buildings, etc. are situated between the instrument and the section of the road that will be targeted.

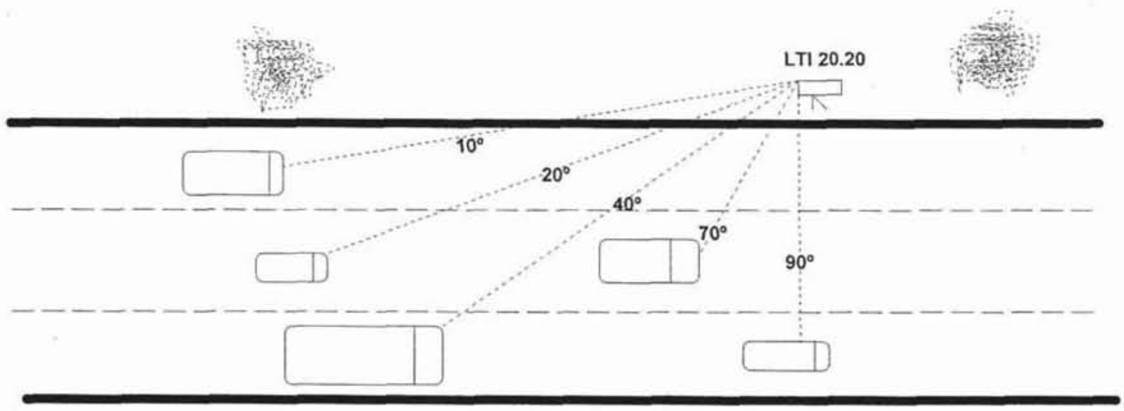
ANGULAR OR COSINE CONSIDERATIONS

The angular or cosine effect on the laser is identical to the manner in which radar is affected. Therefore set up to minimise this effect will be the same as it is with radar. Those not familiar with the angular or cosine effect should study this section very thoroughly. One item that should be emphasised here is that it is important to keep a constant aiming point or in other words keep the 'red dot' just above the aiming area of the vehicle for the full 0.3 second measurement period. If the aiming point is not kept constant the instrument will produce an error reading thus eliminating operator error.

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

When a target vehicle's direction of travel creates a significant angle with the position of the laser the relative speed will be less than the true speed. Since the time/distance calculation is based on the relative speed the laser speed 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 for 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 the lower the measured speed. This effect always works to the advantage of the driver of the vehicle.

Loosely speaking the angular effect is not significant as long as the angle itself remains small. The following table indicates how laser speed measurement can differ from true speed as a function of angle.

As can be seen in this table the angular effect does not become a factor until the angle reaches about 10°. When a target vehicle passes by at a 90° angle the laser is unable to perceive any of its speed because at an angle of 90° the target is getting neither closer to nor farther away from the laser. This can best be understood by imagining a target vehicle being driven in a perfect circle around a laser unit. Because the vehicle is getting neither closer to nor farther from the laser there is no way to measure time/distance. Because the distance part of the equation is not changing the speed measurement reading becomes "0".

TRUE SPEED AS AFFECTED BY ANGULAR EFFECT (COSINE)

TRUE SPEED (mph)	30	50	60	80	100	110
ANGLE TO TARGET						
0°	30	50	60	80	100	110
1°	29.99	49.99	59.99	79.99	99.99	109.99
3°	29.96	49.93	59.92	79.88	99.86	109.84
5°	29.89	49.81	59.77	79.69	99.62	109.57
10°	29.54	49.24	59.09	78.78	98.48	108.33
15°	28.98	48.30	57.94	77.28	96.58	106.24
20°	28.19	46.99	56.38	75.18	93.97	103.36
45°	21.21	35.36	42.43	56.57	70.71	77.78
90°	00.00	00.00	00.00	00.00	00.00	00.00

As can be seen in this table the angle effect is negligible until 10° is exceeded.

The angular effect decreases as the range to the target vehicle increases. At the maximum range of the LASER the vehicle is so far away the angle that exists between it and the LASER unit is very small and thus the perception of the LASER of the target speed is identical to its true speed. As the target vehicle approaches the LASER unit the angle between them increases. As soon as this angle becomes large enough the LASER unit will perceive the speed of the target as less than it really is.

To minimise the angular effect on the LASER the angle should be kept small by setting up the LASER as close to the road as possible without creating safety risks. The LASER should be targeted down the road at sufficient ranges so as not to create an angular effect.

For practical application the following chart is provided to indicate acceptable parameters for setup to minimise the angular effect. Given the distance the LASER is setup from the roadway and the range to the target vehicle, the following chart indicates the decrease in target speed from true speed. Multiplying the true speed by the appropriate number found in the chart will give you the resulting target speed.

RANGE TO TARGET VEHICLE IN METRES	30	100	150	300	600
SETUP DISTANCE FROM ROADWAY IN METRES					
3	**.9950**	.9995	.9998	.9999	1.0000
10	.9682	**.9950**	.9987	.9997	.9999
15	.8660	.9886	**.9950**	.9987	.9997
30	.0000	.9539	.9798	**.9950**	.9987
60	.0000	.7999	.9165	.9798	**.9950**

The diagonal created by bold faced numbers provides a boundary showing acceptable parameters v. unacceptable parameters. Everything above the diagonal represents acceptable parameters. Parameters below the diagonal begin to produce errors that would be unacceptable.

It should be stressed again that with the LASER the angular or cosine effect is always to the advantage of the driver of the vehicle.

SECTION 5

OPERATION

CONTENTS:

OPERATION

Operational procedures are as follows:

INSTRUMENT CONFIDENCE CHECK

Using the on/off switch on the back panel of the instrument turn the instrument on.

A) SELF TEST

When the instrument is initialised it puts itself through a self check. The Microcontroller in the instrument interrogates each circuit board. If everything tests positive the instrument display will go from "8.8.8.8." to dashes, i.e. "- - - -". If the instrument does not test positive, an error message (E 50) will appear in the display. If an error message does appear double check your power source. If the power source is not the problem contact **Tele-Traffic (UK) Limited** for assistance.

B) DISPLAY TEST

To test that all segments of the display are functioning properly press the "test" button and keep it depressed. When this button is pressed all segments of the display will light up with "8.8.8.8.". If any segment of the display is not functioning properly a flaw will be evident in one of the numbers displayed. If there is a problem the display will have to be replaced.

CALIBRATION

Because a radio frequency is not used there is nothing in the instrument that can drift out of frequency. **Therefore the tests mentioned above and the scope alignment test represent the majority of the calibration required.** The speed calculations are referred to a crystal control time base which is guaranteed to have less than 100 parts per million (PPM) error over the full operating temperature of the instrument. Therefore additional calibration is not necessary but if verification of calibration is desired the following steps can be followed to verify proper calibration of the range and timing accuracy of the instrument. These two functions are the two elements that calculate the speed measurement.

This can be done by following the procedures listed below:

a. Establish a known distance between two stationary points. For example this could be done with a metal tape measuring between a designated point on which the operator will stand and a sign or a telephone pole. The ranging accuracy of the Laser can be checked by having the operator stand on the designated point, aim the Laser at the target (whether it be a sign or telephone pole) pull the trigger and a "0" reading should be displayed for the speed measurement. By pressing the speed/range button the Laser should then display the correct distance. The timing accuracy of the instrument is verified by the "0" speed measurement. An accurate "0" reading of a stationary target is identical in nature to an accurate 50mph reading of a moving vehicle.

   By verifying the ranging and timing accuracy of the instrument with the above test the two elements used to measure velocity have been checked and proper "calibration" is verified.

b. If additional verification is desired the instrument can be checked against a calibrated speedometer by shooting a stationary target from a moving vehicle and comparing the speedometer of the vehicle against the Laser. The stationary target is subject to the normal cosine error limitations and must be within a 10° angle off the road.

The **LTI 20.20 TS/M Speedscope** is not susceptible to radio frequencies and electro-magnetic interference, therefore, checks are not required (as with radar) to identify such potential problems.

SPEED MEASUREMENT BY LASER

To measure the velocity of a vehicle using LASER follow the procedure below:

- Aim the Laser at the registration plate area of the target vehicle.

- Pull the trigger.

- Keep the Laser sighted on the target vehicle for approximately 0.3 second until a beep is heard which indicates the speed has been recorded. It is very important that the aiming point remains constant for the entire 0.3 second measurement period.

If the Laser moves off the target during this time the instrument will produce an error reading.

- A digital readout of the speed will then be displayed on the back panel of the instrument.

- This readout will remain on the display until the trigger is squeezed again or until the instrument is turned off.

There is no waiting period required between speed measurements, therefore if multiple readings are desired you simply keep the instrument sighted on the target vehicle and squeeze the trigger again. As many as 3 readings per second are possible.

LINE OF SIGHT

An important requirement of the Laser Speed Detector that must be adhered to at all times is that the operator must have a clear line of sight to the target vehicle. It is important that nothing intersects the Laser beam as it travels between the instrument and the target. If at any time an object does intersect the beam while a velocity measurement is being taken the instrument will display an error message.

TRAPPING OF ERRONEOUS READINGS

Various hardware and software traps have been incorporated into the instrument that make it very difficult to produce an erroneous reading. If anything intersects the beam of the instrument while a speed measurement is being taken the instrument will detect the intrusion and an error message will be displayed. Other improper uses of the instrument will result in error readings for example:

A) In the unlikely event that a car or a telephone pole was to pass between the instrument and the target vehicle during the 0.3 second required to measure the speed the instrument would display an error message.

B) If during the 0.3 second measurement period the instrument is panned off the target vehicle the instrument would display an error message.

Error messages and their definitions are as follows:

E01 The target was out of range or was too close.

EO2 Lost the target due to a beam interruption or the target goes out of range.

E03 Unstable reading due to poor aiming or panning off the target.

DOF-Indicates a measurement over the maximum set measurement distance, i.e. 999.9 metres.

LOB-Indicates low Battery and the LTI will stop working.

OPERATIONAL HANDLING TECHNIQUES

The time required to take a good reading is 0.3 second and although this seems small a certain steadiness of hand is necessary to hold the device steady for that period. It is a skill that is easily acquired with practise but it does require the development of a personal technique.

It is recommended that the provided shoulder rest is used and a position similar to that of holding a rifle is adopted. Some operators may find, however, that resting it on the crook of the other arm is an alternative approach.

Adopt a firm stance.

In the same way as using a firearm do not tense but try to adopt a relaxed but firm grip.

Try to allow the target to track into your sight without sudden or abrupt panning of the device.

Identify clearly in your mind the difference between the audible note emitted for an error reading and that for a good reading. In the event of an error reading try again as soon as possible. Remember that you can theoretically take three readings a second.

Try to aim the beam at as nearly vertical a surface on the target vehicle as possible and avoid the glass surfaces. The best area to aim for is in the vicinity of the registration plate. This is not because of the reflective properties (although that helps marginally) but because it is usually nearly vertical. The further from the vertical the more probable an error reading is likely to be generated.

Once you have a good reading it is automatically locked in until you touch the trigger again. Pressing the Speed/Range function button will toggle the reading between speed and range. The speed readout will always be a steady display whilst the range will flash.

The device can be used for targets travelling in either direction without any change of function. For approaching targets the speed will display as a positive figure whilst for receding traffic the speed display will be preceded by a negative (-) sign. The range function remains the same.

In accordance with current **ACPO Code of Practice** the equipment should not be used through glass.

Operators will find the range at which they are most comfortable but the operational range approximates to 1 kilometre. In practical terms you should have no difficulty in acquiring targets at 600 - 700 metres and with practice at greater distances.

The device can be used at night in the same way as in daylight hours. Try to individually identify the headlights and aim between them at the registration plate area. If the laser beam hits the headlight directly it may give an error reading.

Inclement weather as experienced in the United Kingdom should not present any problems but in conditions of rain or a high moisture content in the air there may be a marginal reduction in range.

SPEED MEASUREMENT USING TIME/DISTANCE BETWEEN TWO POINTS

Built into the **LTI 20.20 TS/M Speedscope** is a programmed computer interfaced with a laser range measurement function enabling the instrument to measure the speed of the vehicle utilising distance divided by time. The computer employs the mathematical formula for the determination of speed:

SPEED = DISTANCE / TIME

A) Mathematical Equation

An operator determines that the distance between two points is half a mile. A vehicle is checked travelling this distance in 20 seconds. The mathematical equation to arrive at miles per hour is as follows:

Time is $\frac{20 \text{ seconds logged in LTI 20.20}}{3600 \text{ second per hour}}$

Distance is .5000 miles

To calculate the vehicle's speed divide distance by time:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{.5000}{\frac{20}{3600}} = .5000 \times \frac{3600}{20} = 90\text{mph}$$

B) Actual Operation

Two methods may be used to determine the distance between two visible points using the range measurement function in the **LTI 20.20 TS/M.Speedscope**. Once the target distance is attained it is a simple procedure to time vehicles through the target area.

METHOD 1

From reference point A the operator sights the LASER on reference point B acquiring the distance between points A and B.

EXAMPLE

From a bridge over the roadway the operator sights the LASER on a sign up the road and acquires the distance between the bridge and the sign. This distance will then be used in conjunction with the timing mode function in the **LTI 20.20 TS/M Speedscope** to determine a vehicle's speed through these two points.

METHOD 2

From a position alongside the road the operator sights the LASER on a reference point acquiring a distance reading to that point. From the same position the operator then sights the LASER past the first point to another reference point acquiring the distance to this second point. **The LTI 20.20 TS/M Speedscope** timing mode computer will automatically determine the distance between these two reference points.

EXAMPLE

From the roadside the operator sights the LASER to a sign alongside the road and obtains the distance to the sign. Then from the same position the operator sights the LASER past the sign to a telephone pole obtaining the distance to the pole. **The LTI 20.20 TS/M Speedscope** computer then calculates the linear measurement between the sign and the telephone pole. This length of roadway between the sign and the telephone pole may be used as the target area to time vehicles through.

NOTE: When using the LASER to measure distance it is necessary that the section of road between the two reference points be straight. When using Method 2 it is important that the two reference points used are along the same line. Most operators will acquire the distance between two reference points and then drive to a position with a good viewpoint, off the road, to time and detect vehicles exceeding the speed limits.

OPERATIONAL SEQUENCE - METHOD 1

From reference point A the operator shoots to reference point B acquiring distance between point A and B.

1) Depress the **Timing Mode Button** on the back of the LASER. D1 appears on the display.

2) **Sight the LASER** on reference point B down the road and **pull the trigger.** Distance to reference point B is displayed.

3) **Depress the Timing Mode Button.** D2 appears.

4) **Depress the Timing Mode Button** again as a second distance is not necessary using Method 1 and **TOD appears** (Time over Distance) on the display. The timing mode feature of the LTI 20.20 is now ready to identify vehicle speed.To determine the speed of a vehicle the operator **pulls the trigger** when a vehicle **passes point A** and again **pulls the trigger** when the **vehicle passes point B.** This measures the time it took for the vehicle to drive the target distance and automatically the timing mode feature computes and displays the speed of the vehicle on the display readout.

OPERATIONAL SEQUENCE - METHOD 2

From the same position the operator targets separate reference points A and B setting up a speed enforcement zone between points A and B.

1) **Depress the Timing Mode Button on the back of the LASER.** D1 is displayed.

2) **Sight the LASER on point A** along the road and **pull the trigger.** Distance to reference point A appears on the display.

3) **Depress Timing Mode Button.** D2 is displayed.

4) **Sight LASER on point B** further down the road in line with point A and **pull the trigger.** Distance to reference point B appears on the display.

5) **Depress Timing Mode button.** Distance between reference point A and B appears on the display.

6) **Depress Timing Mode button.** **TOD appears** (Time over Distance) and the Timing Mode feature of the LTI 20.20 is ready to identify vehicle speeds between points A and B. To determine the speed of a vehicle the operator **pulls the trigger** when a target vehicle passes point A as before and **pulls the trigger again** when the same vehicle passes point B.

This computes the speed of the vehicle by measuring the time it took to travel the distance between points A and B and then the speed is automatically displayed.

Regardless of which method is used vehicles may be continuously checked between reference points. This distance initially measured is stored and utilised to determine each vehicle's velocity until a new location for speed enforcement is required. Pressing the timing mode switch will toggle to the actual time in seconds taken by the target vehicle between the check points. This display will flash. A further pressure on the timing mode switch will toggle back to the actual speed.

To clear the distance stored in the memory when moving to a new site press the speed/range switch and then return to the timing mode. New distances may then be inserted.

1. It should be noted that this form of speed measurement determines the average speed of the vehicle over a distance not the peak speed of the vehicle.
2. A reference point can be any visually detectable and stationary mark on or near the roadway. A flat surface such as a road sign will provide the greatest reflection of the laser beam and provide the longest range between two reference points.
3. It is important that whatever part of the target vehicle you use at the beginning of the check you use at the end.
4. The response time of the operator in hitting the trigger will be the same when the vehicle passes both reference points ensuring consistent vehicle speed measurement.

TRAPPING OF ERRONEOUS READINGS

(In Timing Mode)

In this mode you may see two further error readings:

E04 - The computed distance between your reference points is too short for accurate measurement.

E05 - The computed distance between your reference points is too long for accurate measurement.

LTI 20.20 TS/M
SPEEDSCOPE

SET UP

CHECK LIST

1. Connect to 12v DC power source (Battery or car)

2. Switch on and listen for the four tones

3. Press and hold 'TEST MODE' - Check that the 8.8.8.8. segment display operates

   (After a short time a four digit number will appear - that is the software version applicable to the equipment and is for technician's information only).

4. Release 'TEST MODE' - 'tt' should appear on the display

5 * Carry out checks for scope alignment

6. Press and release 'SPEED/RANGE'

7. ** Carry out checks for range accuracy

8. If displays other than E01, E02, E03 or correct data are seen refer to manual

9. If all checks are satisfactory then the equipment is ready to operate

NB * It is recommended that this check be carried out at each enforcement period on a site

** This check needs to be carried out twice daily in accordance with the **ACPO Code of Practice**

Once the above checks are carried out the LTI 20.20 TS/M Speedscope can be used in all its functions with confidence.

SECTION 6

MAINTENANCE

MAINTENANCE

The LTI 20.20 TS/M Speedscope is self calibrating. There are no moving parts or radio frequencies to go out of alignment. Standard power surge protection eliminates any concern over use of the 12v source of the vehicle. With the laser optics inset and interconnecting aluminium extrusion the **LTI 20.20 TS/M Speedscope** can withstand the roughest treatment and most extreme environments. **These features provide operators with virtually no user maintenance.**

* THERE ARE SOME DISPLAY MESSAGES WHICH ARE SYSTEM MESSAGES AND NORMALLY DO NOT APPEAR:

E50 - E53 Indicates error during self calibration.

E60 - E63 Indicates error under programme test.

Both these error messages will prevent the LTI 20.20 TS/M Speedscope from functioning operationally and indicate that it requires service.

For information regarding service or maintenance please contact:

Tele-Traffic (UK) Limited
LaserTec Centre
C2 Harris Road
Warwick CV34 5JU
Telephone No: 01926 407272
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SECTION 7

SPECIFICATIONS

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Power Requirement	12V DC Nominal
Maximum Range	999.9 metres
Minimum Range	9 metres
Maximum Speed Range	> 200mph
Minimum Speed Range	0
Acquisition Time	0.3 second
Beam Divergence	3 milliradians

(The instrument will give a positive speed reading for an approaching target and a negative reading for a departing target).

Temperature	-30°C / +60°C
Dimensions	3.5" x 5" x 8"
Weight	4.5lbs
Eye Safety	Class 1 IEC 825-84 + 1/90 CENELEC HD 482 S1 EN 60825 SSIFS 1980:2
Scope Filter System	Dual Polaroid Filters (Provides maximum versatility during extreme light conditions)

Red Dot scope targeting. Provides pinpoint accuracy while allowing full field of vision.