

# OPERATIONAL INSTRUCTIONS MANUAL

FOR THE

## LTI 20-20/MARKSMAN LASER SPEED DETECTION SYSTEM

MEGA-TECH  
10370-65 AVENUE  
EDMONTON, ALBERTA T6H 1T9  
1-800-700-7937  
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## V. TESTS AND CHECKS

The LTI 20-20 has been programmed to give the user the ability to test and check each aspect of the instrument that would have an effect on the accuracy and/or the proper and efficient use of the instrument.

The tests incorporated in the instrument are as follows:

- Self Test
- Display Test
- Scope Alignment Test
- Calibration Test

### A. SELF TEST

When the instrument is initialized it puts itself through a self check. The instrument's microcontroller interrogates each circuit board. If everything tests positive the instrument display will go from "8.8.8.8." to a blank display. If the instrument does not test positive error 50-55 will be displayed. Double check your power source, if the power source is not the problem contact an LTI 20-20 service center 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.

### C. SCOPE ALIGNMENT TEST

This test is designed to insure that the light beam of the LASER is directed precisely where the red dot of the scope indicates. If the scope is out of alignment, the light beam will not be hitting the target vehicle and the patrolman will get error messages when trying to target vehicles. This test should be performed before each shift begins to insure proper and efficient use of the instrument. A detailed description of this test is provided in Section IV.1 on page 7.

D. CALIBRATION TEST

Because the LASER is not a radio frequency there is nothing in the instrument that can drift out of frequency. 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 operation temperature of the instrument. But because it is necessary to verify the accuracy of the instrument periodically, a test to verify the calibration before starting a shift. There are several methods to accomplish this.

1. FIXED DISTANCE ZERO VELOCITY CHECK

In a convenient location establish a permanent known distance between two stationary points. For uniformity, the distance used should be 50 meters. If space is not available this distance is not an absolute requirement. To ensure the accuracy of the fixed distance use a metal tape. The target should be a sign, pole, wall or other permanent structure. On the target paint a bull's-eye or mark to aim at. Measure 50 meters from the target and mark the designated point with an "X" painted on the pavement. This painted "X" is where the Laser operator will always stand to test for verification of calibration. The orientation of the target surface should be perpendicular to the Laser beam. To verify calibration a horizontal distance should be used. A slope distance, depending on the angle, will create a longer distance. A distance measured to the base of a 10 meter light pole of 50 meters is a horizontal measurement. The distance measured from the same point to the top of a 10 meter light pole is a slope measurement and would be approximately 1 meter longer than on a ground or horizontal measurement.

Check Laser accuracy by having the operator stand on the painted "X" and aim at the target. Pull the trigger and acquire the target. A "0" kilometers per hour speed measurement should be displayed. Pressing the speed/range button will switch to the range mode and will display the correct distance., plus or minus .1 meters. There are two causes of the plus or minus .1 meters result. Holding the instrument at different locations, either in front of or behind the painted "X", and by the rounding of displayed ranges. If a precise measurement is needed, carefully position the instrument over the painted "X".

## **LTI 20-20 : RELATIVE VS ABSOLUTE ACCURACY**

The absolute distance accuracy of the LTI 20-20 is  $\pm 6$  inches (15 centimeters), however, its relative distance accuracy is better than .1 feet (3 centimeters). Absolute accuracy means that if the instrument is set up in any given circumstance and activated at a target the distance displayed will be within 6 inches (15 centimeters) of the actual distance to the target. This error is introduced by variations in atmospheric conditions, target surface variations and shifts in electronic component characteristics due to instrument temperature changes.

Relative accuracy is a measurement of the repeatability of consecutive distance measurements. This means that if the device is set up in any given circumstance and activated at a target the observed change in distance between consecutive measurements to that target will be less than  $\pm .1$  meter.

## **ADDENDUM TO FIXED DISTANCE / ZERO VELOCITY TEST**

TO PROPERLY MEASURE THE DISTANCE FOR THE FIXED DISTANCE / ZERO VELOCITY TEST FOLLOW THE INSTRUCTIONS AS DESCRIBED ON PAGE 19 OF YOUR LTI 20-20 / MARKSMAN OPERATORS MANUAL. BUT ENSURE THAT THE DISTANCE IS MEASURED FROM THE MIDPOINT OF THE LASER UNIT ( HALF WAY BETWEEN THE FRONT AND BACK OF THE LASER ALONG THE SIDE ).

By verifying the ranging and timing accuracy of the instrument with the above tests, the two elements used to measure velocity are checked. A 0 miles per hour speed measurement shows verification of instrument timing accuracy. A 0 miles per hour reading of a stationary target is identical in nature to an accurate speed reading of a moving vehicle at all speeds. Therefore, calibration verification is complete.

*Fixed Distance/Zero Velocity Check Diagram*

