The LTL-M mobile retroreflectometer features

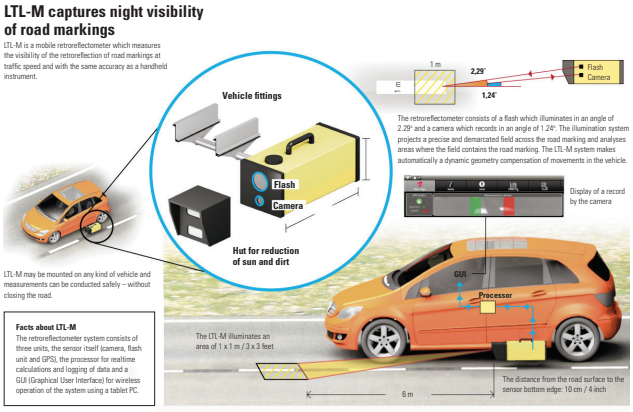
The efficient and accurate way to measure the retroreflection of road markings

LTL-M measures all types of road markings at a simulated distance of 30 m with the highest level of accuracy. LTL-M is used mounted on a vehicle measuring retroreflection at traffic speed, providing full overview of the condition of the road markings. The instrument operates with an accuracy of typically +/- 5 % and a repeatability of typically of +/- 3 %, which is in line with DELTA's hand-held retroreflectometers LTL-2000, LTL-X, and LTL-XL.

LTL-M is a robust, reliable and advanced instrument designed for professionals using modern digital camera and illumination technology. This technology results in high measurement accuracy independent of changes in the geometry of the system caused by vehicle bouncing during driving.

The LTL-M system consists of three parts

- The sensor unit mounted on the outsite of the vehicle contaning camera and flash system
- The real time processor placed inside the vehicle
- The GUI (Graphical User Interface) Tablet PC placed next to the driver



LTL-M illustration from the Danish engineering magazine Ingeniøren

LTL-M mounted on a vehicle

LTL-M measures R_L (nighttime visibility) under dry conditions, daylight contrast as well as records line geometry and missing or non-working road studs (RRPMs).

LTL-M measures white and yellow road markings up to 25 mm/1 inch in profile depth with no adjustments necessary. Calibration and change of light source can be done with a simple operation in the field.

LTL-M comes with GPS and can be delivered with DMI (Distance Measuring Instrument) and an overhead camera. GPS makes it possible to determine exactly where specific measurements have been carried out. A DMI unit ensures correct distance measures if GPS contact cannot be established. An overhead camera supports additional visual inspection of problem areas when data are reviewed.

Measurement data, GPS data and other recorded data will be automatically stored. The system gives the driver the option of marking incidents during operation in the log as well as inform about possible problems and malfunctions.

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Video overlay

The software supplied with the instrument generates an easy-to-read txt.file, a graph and a google earth map for measurement evaluation and presentation. LTL-M lends itself to remote service and easy software upgrades through internet link-up when new advanced road marking analysis is offered.

The LTL-M calibration reference is calibrated at DELTA's DANAK-accredited laboratory and is traceable to standards issued by PTB (Physikalish-Technische Bundesanstalt, Germany) and NIST (National Institute of Standards and Technology, USA). The instrument itself does not need re-calibration unless damaged – except for a recommended calibration of the LTL-M calibration reference every 2 years. The recommended once-daily field calibration of the instrument is simple and fast to carry out.

DELTA offers service of the instrument at its factory and re-calibration of the calibration unit at its DANAK-accredited laboratory.

LTL-M GUI tablet PC

The LTL-M features in brief

- Provides continuous measurements of full width and length of markings at traffic speed
- Digital camera and real-time image processing
- Measures RL under dry conditions
- Measures 1x1 m/3x3 feet pr picture, 25 picture per sec.
- Accuracy in line with hand-held retroreflectometers
- Measures daylight contrast
- Measures plane and profiled markings up to 25 mm/1 inch
- Shows and stores day and time
- Records road studs (RRPMs)
- Records line width
- Provides average values between 1 m/3 feet and indefinite

Straus Zert certification

Test Certificate No. 0913-2011-02 on the suitability of the LTL-M dynamic retroreflectometer for the dynamic measurement of the coefficient of retroreflected luminance RL of road marking.

Overall assessment:
The LTL-M retroreflectometer is suitable for the dynamic measurement regardless of speed, of the coefficient of retroreflected luminance RL of road markings, and delivers the same results as a static retroreflectometer
StrausZert, Germany, December 6, 2011

LTL-M complies with the following standards

EN 1436 (R_L), ASTM E 1710 and EN 1463-1.
US patent no.: US 9,176,057 B2

Contact and further information

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LTL-M
Specifications

System overview
The LTL-M system consists of:
Sensor: 500 x 180 x 200 mm/19.7 x 7.1 x 8.0 in
12.5 kg/28 lbs
Processor: 400 x 170 x 200 mm/ 16.0 x 6.8 x 8.0 in
8 kg/18 lbs
Tablet PC: 256 x 175 x 10 mm/10.0 x 6.9 x 0.4 in
0.6 kg/1.3 lbs
The LTL-M light source is a flash system. The LTL-M measurement system consists of a digital camera and propreotary software.

Optical specifications
Field of measurement: 1000 x 1000 mm / 39.4 x 39.4 in
Illumination angle R_L: According to EN 1436 and ASTM E 1710
Observation angle R_L: According to EN 1436 and ASTM E 1710
LTL-M works based on reversed geometry, this is according to ASTM E 1767.
Illumination angular spread:
- Horisontal: 0.33°
- Vertical: 0.17°

Observation angular spread: ±0.17°
Equivalent observation distance: 30 m
R_L range (mcd·m^{-2}·lx^{-1}): 0 - 2000
RRPMs/Road studs: 2 % level for new (white), 0.14 CIL value

Regulatory compliance
EU
The LTL-M system without GPS unit complies with the following directives of the European Parliament and of the Council:
- Directive 2004/104/EC of 14 October 2004 relating to the radio interference (electromagnetic compatibility) of vehicles and amending Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers.
- Directive 2011/65/EU of 8 June 2011 on restriction of the use of certain hazardous substances (RoHS).
- Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE).

The LTL-M system without GPS unit complies with Regulation No. 10 of the Economic Commission for Europe of the United Nations (UN/ECE) - Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility:
- UN ECE R10 revision 3

The equipment is tested to the following standards:
Automotive Directive:
- CISPR 25:2008
- ISO 7637-2:2004+A1
- ISO 11452-2:2004
- ISO 11452-4:2011
- ISO 10605:2008

The LTL-M GPS unit complies with the following directives of the European Parliament and of the Council:
- Directive 1999/5/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment.
- Directive 2011/65/EU of 8 June 2011 on restriction of the use of certain hazardous substances (RoHS).
- Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment (WEEE).

The equipment is tested to the following standards:
R&TTE article 3.1a (health & safety):
- EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011

R&TTE article 3.1b (electromagnetic compatibility):
- EN 301489-1 V1.8.1:2008
- EN 301489-3 V1.4.1:2002

R&TTE article 3.2 (radio parameters):
- EN 300440-2 V1.4.1:2010

USA
The LTL-M system including GPS unit complies with the following rule part of the Federal Communications Committee:
- FCC CFR 47 Part 15, Subpart B, specific rule parts §15.5 & §15.29.

The incorporated GPS module is not an intentional transmitter in FCC definitions, and the LTL-M system is exempted from other rule parts that the specifically mentioned pursuant to §15.103.
As automotive equipment, the LTL-M system is exempted from safety testing under authority of OSHA.

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Electrical characteristics
Power supply: 12 V vehicle power/15 A

Environmental specification
Temperature:
- Operating: 0°C to +45°C / 32°F to 113°F
- Storage: -15°C to +55°C / 5°F to 131°F
- Humidity: 85%, non condensing

Data
Typical repeatibility: +/- 3%
Typical reproducibility: +/- 5%

Standards
EN 1436 and ASTM E-1710 for pavement markings
EN 1463-1: 1997 for RRPMs

Features
- Continuous measurement of night time visibility (R_L) of road markings at driving speed
- Automatic compensation for vehicle movements (Patented)
- Measures daylight contrast and line geometry
- Measures presence of road studs (RRPMs)
- Measures all types of plain and profiled markings
- Measures white and yellow markings
- Measures dry markings
- Measures profiles up to 25 mm / 1 in
- Stop and mark function during operation
- Measured data are automatically stored
- Multilingual menu
- Can be operated by one person
- Software for reporting and transfer of data to MS-Excel
- Data presentation on Google Earth
- Future software upgrades can easily be integrated

Standard delivery
- LTL-M retroreflectometer system (sensor, processor, user interface tablet PC)
- GPS
- Transportation boxes on wheels
- Software for data presentation
- Calibration standard with DANAK certificate and alignment board
- Vehicle fixture (2 sets)
- User manual and quick guide
- Spare window glasses and gaskets
- Tablet PC windscreen holder
- Remote service dongle (D-Link)

Options
- Overhead video camera
- DMI (Distance Measurement Instrument)

Approval
StrausZert, Test no.: 0913-2011-02
US patent no.: US 9,176,057 B2

Warranty
2 years

R&TTE Declaration of Conformity (DoC) and US Attestation of Conformity (AoC) can by supplied by DELTA upon request or viewed on: roadsensors.madebydelta.com/technical-background/certification

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