Solartron Metrology

LTx Laser Main Manual

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1 SAFETY INFORMATION

The operation of this sensor should only be performed by trained personnel adhering to standards and regulations and who have read the contents of the operating instructions.

1.1 SYMBOLS AND TERMS USED IN THIS MANUAL

	**WARNING** statements identify conditions or practice that could result in personal injury or loss of life or damage to the sensor.		**WARNINGS** Do not operate in an explosive atmosphere. This equipment is not intended for use in a safety critical environment. Avoid unnecessary exposure of laser radiation to the human body. DO NOT look directly into the laser beam. This product is designed for indoor use only avoid splashing with water

1.2 INTENDED USE

This sensor is designed for industrial use only. The senor must be operated within the limits of its specification.

1.3 LASER SAFETY

	Although the output of the laser is low directly looking into the beam must be avoided. Close your eyes or turn away if the laser beam hits the eye. NO repair or service can be performed other than by the manufacturer. Return the sensor to the manufacturer for repair/service.

The LT sensors use a semiconductor laser with a wavelength of 670 nm (Visible red). The laser are Class 2 (II). The laser is operated as pulse mode with maximum optical power ≤ 1 mW.

	Observe Laser protection Regulations

Lasers of Class 2 (II) are not subject to notification and a laser protection officer is not required.

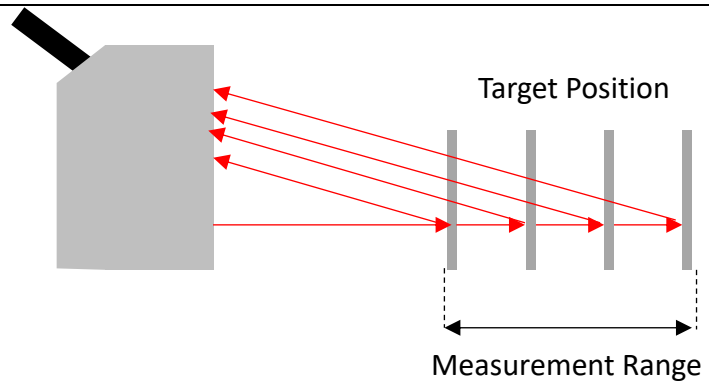
The label below is attached to the cable	The label below is on the body of the sensor
	

During operation the relevant regulations for Safety of Laser products according to IEC 60825-1 must be observed

2 FUNCTIONAL AND TECHNICAL DATA

2.1 DESCRIPTION

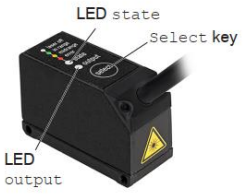
The design of the LT laser sensor is based on optical triangulation. An emitter transmits a visible laser light beam towards a target.



The light beam bounces off the target scattering light some of which reaches the laser sensor detector. The position of the light on the sensor is directly related to the position of the target. The laser sensor processes this data and provides a signal that is passed to the Orbit module.

2.2 LT LASER MODULE

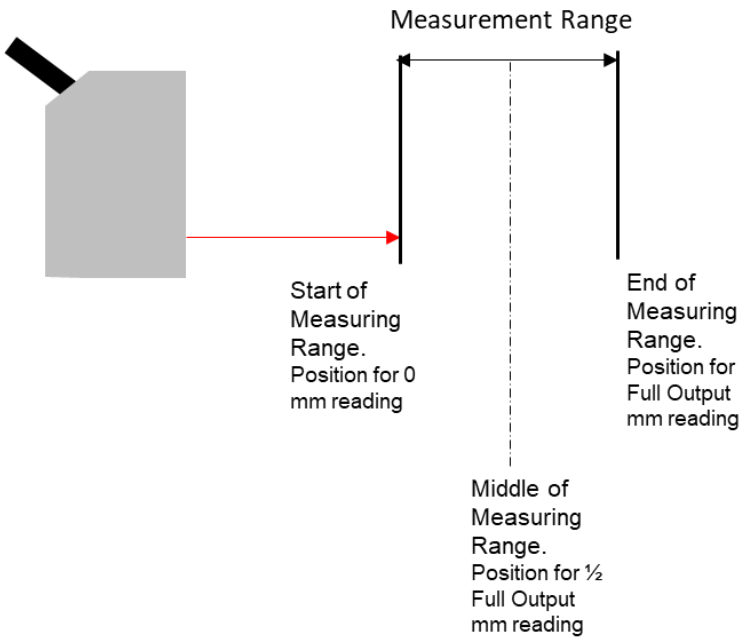
For LT measuring position, please refer to the datasheet. The LT1 & LT2 laser heads have two led indicators and a select key (not used as the laser is controlled by the Orbit Module). When the LT is first powered on, it performs an initialization sequence. Both LEDs flash red, then yellow, then green. After this sequence has completed, the LED indicators have the following meaning:



LED State	Meaning	LED Output	Meaning
Green	Measuring object within sensor range	Green	Operation normal
Yellow	Mid-Range	Yellow	Not used
Red	Error e.g. poor return signal or out of range	Red	Laser head on but not communicating
Off	Laser Off	Off	Laser Off

2.3 LT MEASURING RANGE

Either side of the calibrated stroke (measuring range), there is a defined region under & over range. However, outside this area, the reading is undefined. Therefore, to ensure best performance, the LT sensor should be positioned near to its centre (middle of calibrated stroke).



Best results are obtained after allowing a 20-minute warm up period.

See Data sheet for details of Start of Measuring Range, Middle of Measuring Range and End of Measuring Range for LT1 and LT2

2.4 AUTO TARGET COMPENSATION (ATC)

The Auto Target Compensation (ATC) enables stable compensation independent of colour and brightness of the measuring object. Also, small objects can be detected reliably because of the small measuring spot.

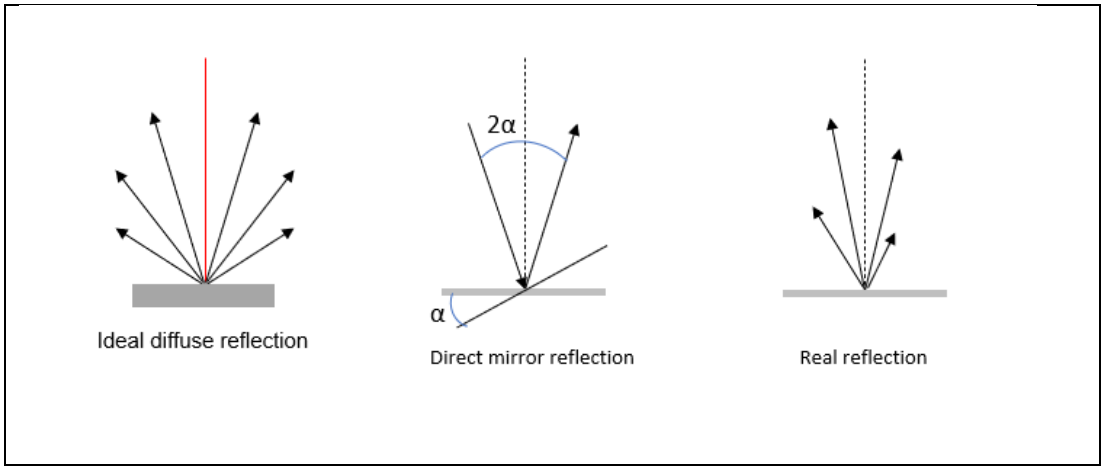
2.5 LASER BEAM CONTROL

The laser beam can be switched off (via Orbit) this allows lasers to measure points close together and prevents beam interference of reflection from one laser to another. In the beam off mode the laser head remains powered enabling readings to be take quickly after turning the beam on.

3 INSTALLATION

3.1 NOTES FOR OPERATION

The basic principle is that the sensor measures the diffuse part of the reflected light.



Minimum reflectance is difficult to define as even a small diffuse reflection can be measured from highly reflecting surfaces. Auto target compensation makes this possible. Results from dark or shiny surfaces can be improved by reducing the LT measuring rate.

3.2 ERROR INFLUENCES

3.2.1 Light from other Sources

The internal optics of the LT sensor s perform well in reducing the effect of light from other sources. However, if the objects being measured are shiny and lower measuring rates are selected interference may occur. In this case it is recommended to use screens to block light from external sources.

3.2.2 Colour Differences

The internal intensity compensation means that colour differences of targets have a minimal effect on the measurement. In some case however colour differences may mean that the laser light penetrates the material to a different depth. This will result in apparent changes of the measurement spot size which can cause measurement errors.

3.2.3 Temperature Effects

It is advisable to allow 20 minutes of warm up before starting measurements for best accuracy. The effect of temperature changes must be considered and a sudden change in temperature will not immediately be detected.

3.2.4 Vibration

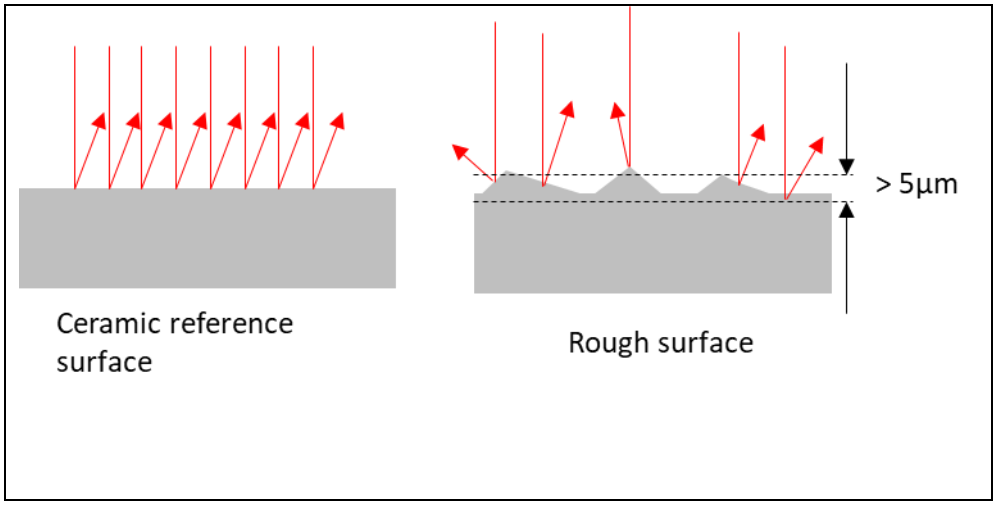
For micron and sub-micron measurements ensure that the LT mounting is stable and that the target is not subject to movement.

3.2.5 Measurement Blurs

When measuring fast moving objects always select a high measurement rate to prevent errors.

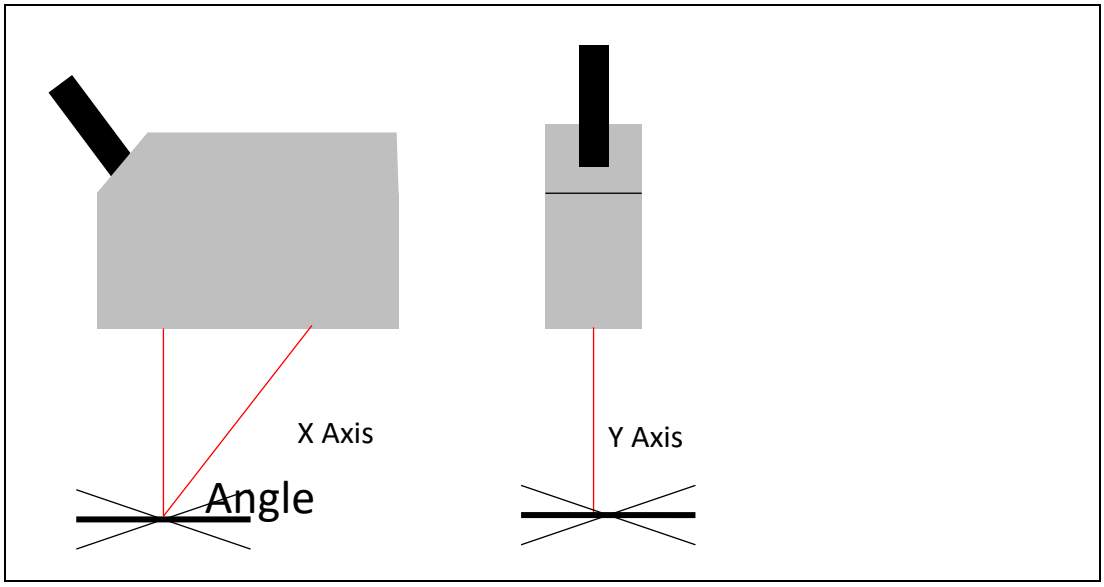
3.2.6 Surface Roughness

Laser sensors use a very small spot to measure the target, this means that they will be impacted by surface finish far more than a contact sensor which averages out most finishes. Suitable selection of averaging may improve the performance.

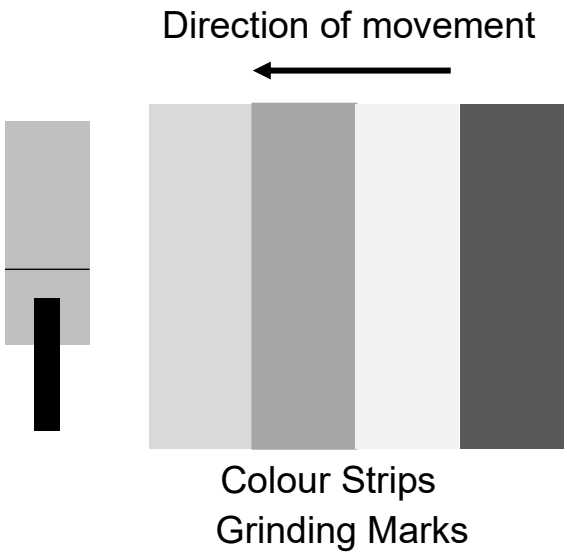
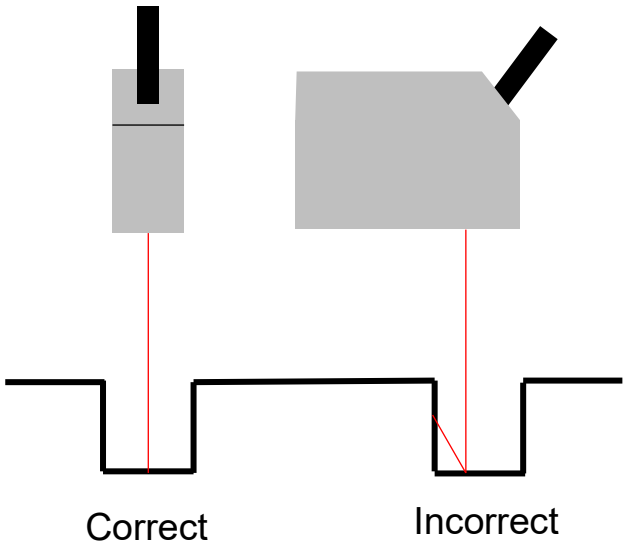


3.2.7 Tilt Angle

Tilt angles of the target for diffuse reflections in both x and y axis of less than 5 degrees do not have significant effects unless the target is highly reflecting.
When taking profile measurements, it is important to consider the tilt angles.



3.2.8 Best Measurement Accuracy

	In case of rolled or polished metals that are moved past the sensor the sensor plane must be arranged in the direction of the grinding marks. The same arrangement is true for coloured strips
	In the case of bore holes, blind holes or edges in the target the sensor must be arranged so that the edges do not block the beam.

3.3 MOUNTING

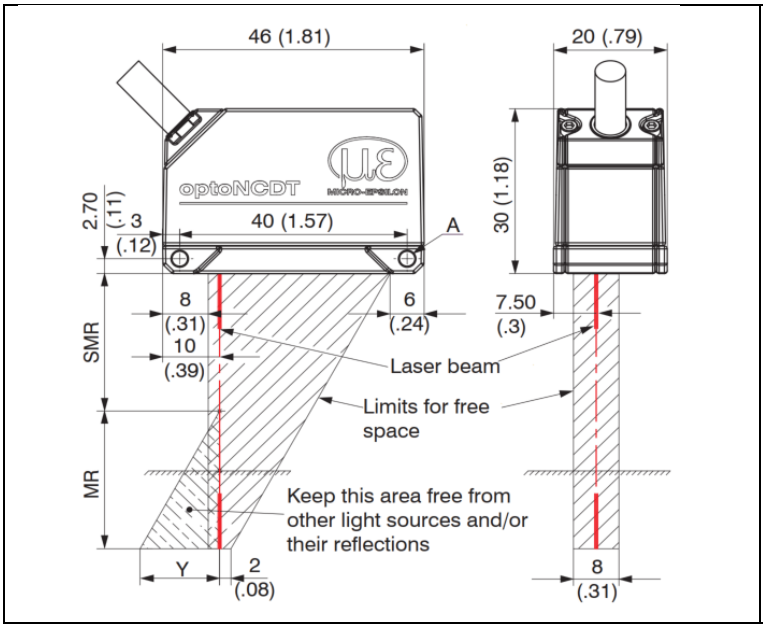
The LTx laser is an optical precision, measurement product with a measurement precision of microns. The laser beam must be directed perpendicularly onto the surface of the target. In case of misalignment, it is possible that the measurement results will not always be accurate.

⚠	Handle the unit carefully when installing. Do not point the laser at other persons and do not look into the laser beam. Ensure the installation is carried out be a suitably qualified person. Mount the sensor using the existing holes onto a flat surface. DO NOT use clamps.

Mount the sensor by means of 2 screws type M3 or by means of through bores for M2 using screws from the accessories.

Bolt connection					
Through length	Screw depth	Amount	Screw	Washer	Torque
20 mm	min 5 mm	2	M2x25 ISO 7089-A2	A2.2 ISO 7089-A2	0.5 Nm (µ=0.2)
	min 4.8 mm, max 20 mm	2	M3 ISO 4762-A2		1 Nm (µ=0.12)

Remain compliant with the information below



		LT1	LT2
SMR	mm	25	20
MR	mm	20	10
Y	mm	21	10

4 OPERATION

The LTx laser is controlled via the Orbit Interface. This can control taking measurements and setting up the laser sample rates. A beam on/off function is also provided. See the Orbit Software manual (502989) for details.

4.1 IMPROVING READING QUALITY

The LTx lasers offer various features to improve the quality of reading (e.g. averaging).

4.1.1 LT1

4.1.1.1 Signal Quality

This laser module offers a Signal Quality setting that allows set-point averaging modes to be utilised:

- No Averaging
- Balanced
    - Moving average, 64 values
- Dynamic
    - Median average, 9 values

4.1.2 LT2

4.1.2.1 Averaging

This laser module offers an averaging setting that allows various averaging modes to be utilised:

- None
    - No averaging performed.
- Moving
    - The selected number N of successive measurement values (window width) is used to generate the arithmetic average.
    - Where N => the averaging number or *Depth* (only powers of 2 (2 / 4 / 8 ... 128.) are allowed.
- Recursive
    - Each new measurement value is added, as a weighted value, to the sum of the previous measurement values. This allows a high degree of smoothing of the measurement values. However, it requires extremely long transient recovery times for steps in measurement values. The recursive average shows low pass behaviour.
    - Range of values for number of average N (or *Depth*) is 1 ... 32768
- Median
    - The median is generated from a pre-selected number of measurement values, N or *Depth* (3, 5, 7 or 9). The average value is then given as the median (middle value) of the last N measurement values.

4.1.2.2 Target Mode

In order for the LT2 laser module to better cope with the target being measured, there are various options available:

- Standard
    - Standard target mode - Suitable for materials made of ceramics, metal or filled plastics

- Multi Surface,
    - Multi / Changing surfaces - Suitable e.g. for Printed circuit boards (PCB) or hybrid materials
- Light Penetration
    - Suitable for plastics (POM, Teflon), materials with large penetration depth of the laser

4.2 READINGS

The available readings from the lasers are detailed in the table, next.

Laser Type	Distance	Exposure Time	Intensity	Video
LT1	✓	×	×	×
LT2	✓	✓	✓	✓

4.2.1 Distance

This is the laser reading distance in millimetres. Read only.

4.2.2 Exposure Time

This is also known as the shutter time of the laser. The laser automatically compensates for different surfaces by altering the exposure time to allow the optimum amount of light. E.g. if a darker surface (black) is measured, the exposure time would be longer to account for smaller reflections) – refer to Auto Target COMPENSATION (ATC). The value can be used to see if the laser is having difficulty adjusting to the surface being measured. Note that the exposure time is dependent on the measuring rate and can only be increased by reducing the sensor's measuring rate (see Notes for Operation).
Expressed in micro-seconds. Read only.

4.2.3 Intensity

This is the intensity of the measured signal – in percent. This is linked with the Exposure Time.
Expressed in percent. Read only.

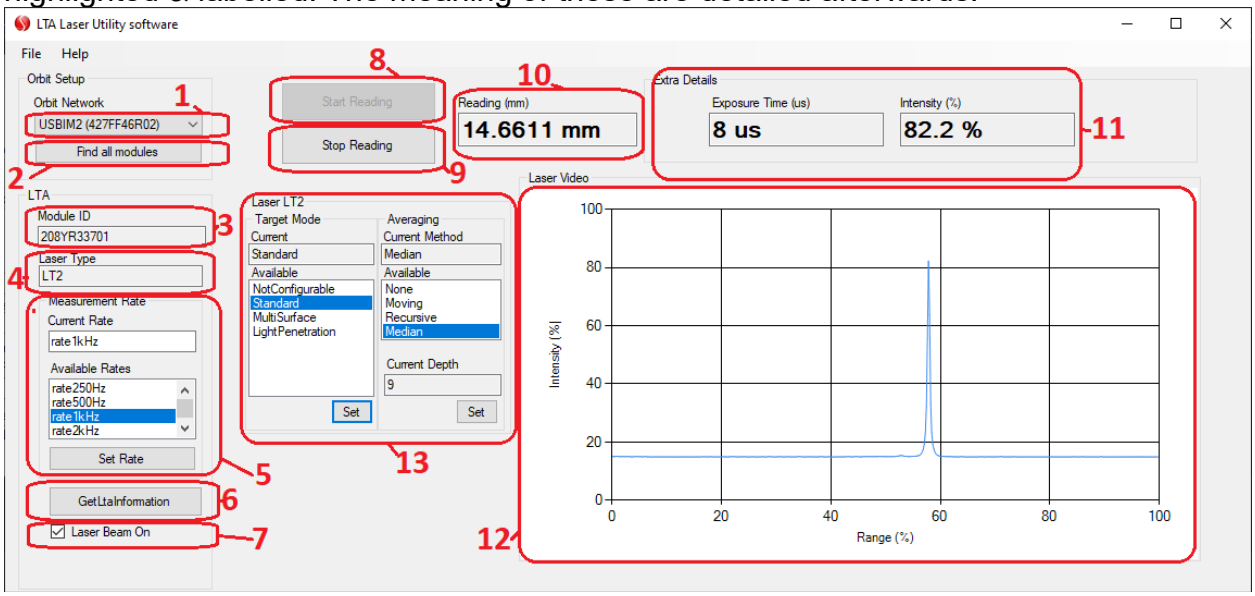
4.2.4 Video

This is a reading mode that allows the raw video signal (LT2 only) from the sensor's detector to be read. Internally, the laser uses this signal to calculate the reading. The main purpose of reading the video signal is to see the quality of the peak and if any additional peaks are visible which may indicate external light influence. A single, distinct peak (such as the video signal shown in the Laser Utility Software) is typical of that seen for a good (valid) reading.

4.3 LASER UTILITY SOFTWARE

This software is provided on the Orbit Support Pack software to allow laser readings and settings to be altered.
This software also allows for the laser *video* signal (LT2 only) to be viewed. This is useful for diagnostic purposes and can highlight installation errors.
For example, it can be used to highlight / indicate that multiple peaks are occurring (from unwanted reflections) that could lead to erroneous readings be taken (see Error Influences).

Note that the *video* signal is the raw output emitted from the sensor's detector. This is only obtainable from LT2 sensors.
The screenshot, next highlights a typical view for a LT2 laser. Individual controls are highlighted & labelled. The meaning of these are detailed afterwards:



1) Orbit network used to communicate with laser module
2) Click this button to find / detect any modules on the selected Orbit network.
3) The currently selected module's Orbit identity.
4) The currently selected module's type (e.g. LT1 or LT2)
5) The currently selected module's measurement / sample rate. Note that this setting is stored in the sensor's non-volatile memory. See datasheet for a list of available rates.
6) This returns the sensor's manufacturer details
7) This checkbox is used to turn the laser beam off and on
8) Starts reading the laser. This updates readings and starts displaying video information (if available)
9) Stops reading
10) Displays the laser's current Distance reading.
11) Displays the laser's current Exposure Time (shutter) and Intensity (LT2 only).
12) Displays the raw Video signal (LT2 only) from the sensor's detector. This is graphed, live. A single, distinct peak (such as the video signal shown in the screenshot) is typical of that seen for a good (valid) reading.
13) Displays the specific controls for the connected laser.
    a. LT1
        i. Signal Quality – Basic settings for averaging readings.
    b. LT2

i. Target Mode option – to improve the quality of the reading when measuring different types of surfaces.
ii. Averaging options – to improve the quality of the reading by utilising different algorithms.

5 REVISION HISTORY

REVISION	DATE	COMMENTS
1	03/05/22	Initial Issue
2	28/11/22	Laser Utility Software added. Revision history added.
3	23/03/23	Laser Utility Software updated. Added Improving Reading Quality & Readings sections.