Sensor FAQs

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The Basics

What type of lasers does LTI offer?

Pulsed, 905 nanometers (nm), time-of-flight (TOF) lasers. 905 nm is the wavelength of the infra-red light of the laser (this wavelength lies just outside the visible light spectrum that ranges from 400 nm to 730 nm). TOF signifies the time of flight of the pulse is measured to determine distance.

How do LTI lasers work?

They send out pulses of light at a rapid rate (the speed of light), which reflect off target surfaces, and travel back to the laser. The timing of the return pulse is precisely measured which enables the distance to be calculated.

What data output rates do our lasers operate at?

The ULS ranges from <1 Hz to 2000 Hz; the S Series ranges from <1 Hz to 14 Hz.

What's the distinction between reflective and non-reflective, or cooperative and non-cooperative targets, and what kind of difference does it make?

Reflective, or cooperative, targets reflect the laser pulse much better than a non-reflective, or non-cooperative target. Therefore, you can measure objects that have reflective targets at a longer distance than those with a non-reflective target. A non-reflective, or non-cooperative target is a target that does have any special reflective characteristics. Most natural object are non-reflective. If the target is non-reflective, the laser pulses don't reflect off it as well, so you get a weaker signal back. Therefore, it cannot measure to as long a distance. Even among non-reflective targets, some colors reflect better than others. For example, the color white reflects more than a darker color. Even a target that is gray instead of white has significantly less reflectivity than white. In most cases, however, this is not a critical factor, only in those with longer ranges or where the laser has trouble picking up a reflection at all.

Is the laser beam eye safe?

Yes, all LTI sensors are rated Class 1 for eye safety. But, it is always a good practice not to stare directly into the transmitaperture of any light transmitting device.

Markets & Applications

Is this a proven technology in industrial applications?

Yes, lasers for materials measurement have been an established technology in industrial applications for over a decade. While relatively new compared with ultrasonic and radar, lasers have continued to expand their application base.

LTI has been selling into industrial applications for over 10 years. We are installed in steel mills, bulk material handling, railroads, vehicle guidance and positioning applications, and many more.

Why would a customer consider TOF Lasers over other technologies?

No one sensor technology provides the best solution in all cases. TOF lasers offer a non-contact measurement device that can read off almost any surface, is highly accurate, can read over long ranges, and is generally easy to set up and use.

Laser technology is relatively new to industrial sensors. In the past, laser sensors have been perceived as too expensive or too specialized. But LTI has brought the price point for laser sensors down to competitive levels, and their use has become much more widespread.

Below is a table that summarizes the main advantages of TOF Lasers, as compared with other technologies:

Characteristic	TOF Laser	Phase Shift Laser	Ultra-sonic	Radar	Guided Wave Radar	Weigh & Cable	Load Cells
Non-contact	✓	✓	✓	✓			
Instant Response	✓	✓	✓	✓	✓		✓
Low Cost	✓	✓	✓	✓	✓	✓	
Mat'l Density Dependent	✓	✓					
Unaffected by Mat'l Build-Up	✓	✓	✓				
Penetrates air-borne particulates	✓		✓	✓	✓	✓	
Range > 75 m	✓					✓	✓
Easy to Install	✓	✓				✓	✓
Versatile (suits multiple apps)	✓		✓				

General Sensor Information

What are the main differences between the ULS and the S200 Series Lasers?

The ULS has slightly better accuracy (+/- 2 cm), better ability to look through dusty and hazy environments, better ability to work in adverse conditions, and comes in a more rugged housing (aluminum versus glass-filled polycarbonate).

The S200 Series has up to +/- 4 cm accuracy, is housed in a glass-filled polycarbonate packaging and has a smaller footprint. It has an explosion-proof accessory (Ruggedized Enclosure) which allows it to be rated to meet ATEX and other explosion-proof standards. It is ideal for applications such as level detection or short-range detection of simple targets.

Both the S210 and the S230 come with an alignment laser to facilitate laser alignment.

Customer Requirement	S200	S210	S230	ULS
High data output rate required (>14Hz)				●
Highest accuracy (<4 cm)				●
Greatest range (dependent on accuracy)	●	●	●	
Lighter weight/size	●	●	●	
Lower cost	●	●	●	
4 – 20 mA output required			●	●
4 – 20 mA and HART output required*			●	
Need RS-232 output	●	●	●	●
Need RS-485 output				●
Requires build-in laser alignment		●	●	●

What is Pulse Repetition Frequency and why is it important?

Pulse Repetition Frequency (PRF) is how fast the sensor is sending out laser pulses. This is important because a faster PRF can take more measurements or detect something at higher speeds, or use more pulses to get a better average. PRFs in the ULS can be set from 1 to 4,500 depending on the mode. PRFs in the S200 Series are set at 2,800 pulses per second.

Does the laser need calibrating to the specific distance it is measuring?

No, it is fully calibrated before it leaves the factory and will work to any distance within its specified range.

How is the laser beam diameter calculated?

By their very nature, lasers produce a very narrow beam that can be precisely aimed at a target. This is just one of the features that sets laser sensors apart from other sensor technologies, such as ultrasonic or radar.

Beam diameter over distance can be calculated as follows:

Example:
Distance to target: 100m
Divergence: 3 mrad .023 + (.003 x 100) = 323mm
Free aperture: 23mm

Therefore, the beam diameter at a distance of 100 meters = 32.3cm, or 12.7 inches at a distance of 328 yards

ULS

What sets the ULS apart?

The ULS is a rugged laser sensor that fits into many applications and is easy to set up and operate. It has several different targeting or measurement modes which allow it to be optimized for different industrial applications. It can work in dusty and dirty applications and measure up to +/- 2 cm accuracy. It can also measure to about a mile to a reflective target and 1/3 of a mile to a non-reflective target.

What is the difference between the different target modes in the ULS?

Target Mode	Definition	Recommended Use
Averaging	The ULS will average any number of pulses, up to 4000. The higher the number, the higher the accuracy, but the lower the data output rate.	When a strong target is available, to get the higher accuracy (with a higher # of pulses) or higher data output rate (with a lower # of pulses)
Last Target	The ULS only measures the last target found in the series of pulses it sends out. Its accuracy is about 2 cm less than in Averaging Mode, +/- 4 cm.	To get better results through dust and haze
Binning	The ULS divides the distance to the target into 512 “bins,” and looks for targets in each bin. Max distance is 1660 meters, at which	To better see multiple or weaker targets

	point accuracy is about 3.3 meters.	
Detection	The ULS simply detects if an object is there, it does not give the distance. Maximum detection range is 152 meters.	For a quick detection and trigger, or to detect a presence or profile a car (for example).

What accessories are available for the ULS?

The ULS comes with the following accessories:

- Sighting telescope
- Mounting stand
- Sun shade
- Power/Communications cable

S200 Series

What advantages does the S200 have over the ULS?

The S200 series is lighter in weight, smaller in size, has a smaller footprint, with nearly the same accuracy, some of the same target selection capabilities, and costs significantly less.

What target modes are available with the S200 Series?

For strong targets, use First or Strongest target modes. For targets in dusty or hazy environments, Last Target Mode is generally recommended.

What communication protocols does the S200 series use?

The S200 has RS232 as well as a 0-5 VDC output trigger that makes it versatile depending on what output you need. The S210 has RS-232, SDI-12, and the trigger. The S230 has RS-232, 4-20 mA, and 4-20 mA HART.

Communication Protocol	S200	S210	S230
RS-232 output	●	●	●
0-5 VDC output trigger	●	●	
SDI-12	●	●	
4 – 20 mA output			●
4 – 20 mA and HART output			●

What are the different target modes in the S200 series?

The S200 series has three standard target modes: first, last and strongest.

Target Mode	Definition	Recommended Use
First	The unit only measures the first target it sees	When no obstructions exist between laser sensor and intended target
Strongest	The unit measures to the strongest target it sees	When an obstruction, such as a fence, exists between the intended target and sensor
Last	The unit measures to the last target it sees	To get better results through dust and haze

The S200 series also supports several advanced target modes, which can used under very specific circumstances.

Can lasers read through water?

If the water is very clear and still, the laser will likely read through the water's surface, to some point below the surface level. If the depth of the water is very low (say, six inches), the laser may read to the bottom of the tank or vessel containing the water. In either case, if the intent is to measure the water surface under these conditions, the laser sensor will not provide an accurate, consistent measurement.

Can lasers read the surface of water?

They can if the water has some color or contour to it, such as rapids. Lasers have more of a problem if the water is clear.

Can LTI lasers penetrate foam?

Typically, no. Unless the foam is very low-density and laser light will get through it, the laser can only measure to the top of the foam. However, the customer may be able to use a standpipe, which is separate from the main liquid but still has the same liquid level in it. It may not have the foam, so readings could be made in the standpipe and have accurate measurements. They also may be able to create a small "wash-down" area at the side of the tank which will flatten out the foam.

Will LTI lasers work through dense steam?

The presence of steam is a challenging condition. Like most scenarios, it depends on the density & composition of the steam and the nature of the surface to be measured: composition, clear or opaque; still or turbid, etc. A good general rule of thumb is that if you can see through it, the laser will be able to as well. If not, neither can the laser. There are some exceptions – some material reflects infrared rays more than visible light, so it might look relatively clear but the laser still will not penetrate it.

What considerations are there when measuring through glass?

Borosilicate glass typically works well. Also, there is no degradation using plain glass or even plastic.

When measuring through glass, it is recommended the face plate of the sensor be 3mm or closer to the glass. Light passing through the glass will create reflections and larger gap could result in measurement error.

If there are any questions or uncertainties, it would be best if the customer can get a transmission curve for the glass they are considering and send it to us for review.

What accessories are available for the S200 series?

The S200 sensor family has the following accessories available:

- Ruggedized housing
- Flange
- Dust tube
- Tank adapter
- Swivel mount stand
- Sun shade
- Power/Communications cable

What is a Class 1M laser?

A Class 1M laser is safe for all conditions of use except when passed through magnifying optics such as binoculars and telescopes.