A Higher Level of Performance

Manual

OptioLaser S200

Laser Sensor

For more information, please visit >

www.hawkmeasure.com

Contents

Introduction

Thank you for purchasing the HAWK OptioLaser.

The OptioLaser Series is user configurable, allowing for optimized performance to your specific application. The OptioLaser uses an infrared semiconductor, GaAs laser diode. A light energy wavelength of approximately 905 nanometers, with a beam divergence of 3 milliradians (equal to 3ft at 1000ft), travels to the material being measured. Any solid or liquid in its path will reflect back a certain percentage of emitted light energy. The OptioLaser calculates the distance, based on the time it takes a laser pulse to travel to the material and back.

	Description	Part Number
OptioLaser	OptioLaser S200 series	OL700XXXX
	Serial to USB adapter	OLXXXX
	AC to DC Power Cable	OL7054691

	Description	Part Number
Remote indication	Handheld calibrator / programmer	OLTRT438008
	Wall mount display	OLPD260006H7

	Description	Part Number
Accessories	Tank Adapter	OL7035146
	4” Flange	OL3004960
	Spanner Wrench (necessary for tightening tank adapter)	OL9034501
	Swivel Mount	OL3004959

Safety Precautions

- Avoid staring directly at the laser beam for prolonged periods. The OptioLaser is designed to meet FDA eye safety requirements and classified as eye safe to FDA (CFR21) Class I 7 mm limits, which means that virtually no hazard is associated with directly viewing the laser output under normal conditions. As with any laser device, however, reasonable precautions should be taken in its operation.
- It is recommended that you avoid staring into the transmit aperture while firing the laser. The use of optical instruments with this product may increase eye hazard.
- Never point the instrument directly at the sun.
- The Class 2 Alignment Laser Exit Aperture is located on the upper portion of the Front Plate between the Transmit and Receive Lenses of the Class 1 Measurement Laser.

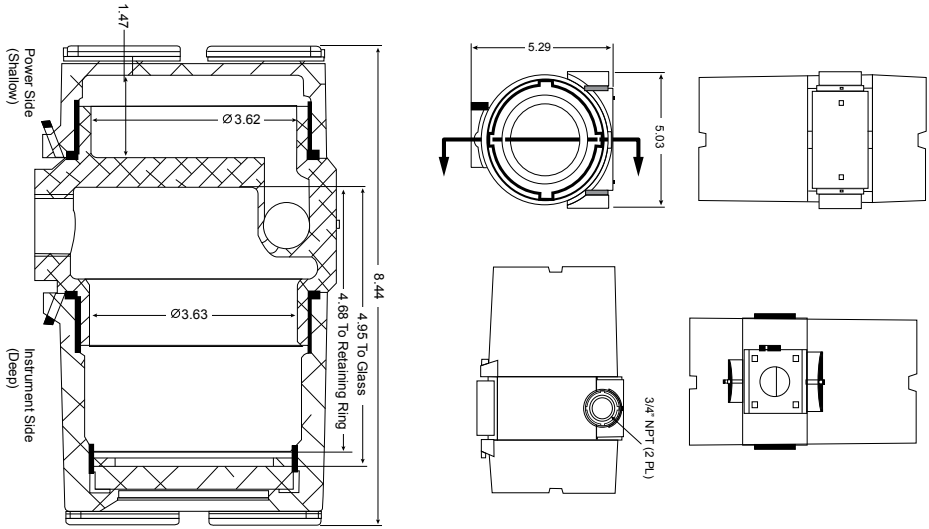
OptioLaser S200 series consists of the laser inside the ruggedized housing, plus

- Serial to USB adapter
- AC to DC power adapter

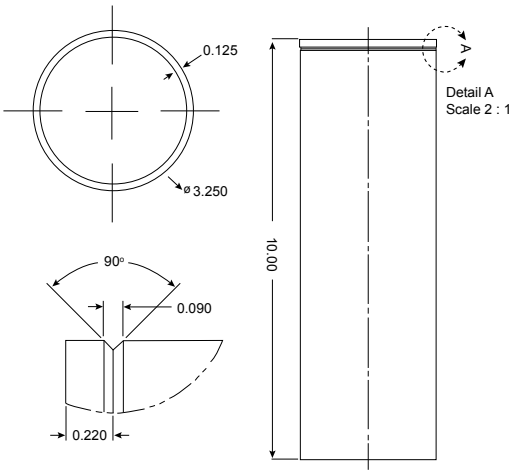
Outputs on each model

Models	I/O				
	Visible Alignment Laser	RS232	4-20	4-20 HART	Trigger
S200		●			●
S210	●	●			●
S230	●	●	●	●	

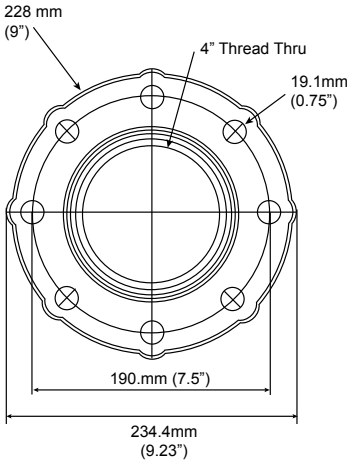
OptioLaser



Dust Tube



Ruggedized 4" Flange Tank Adapter



1

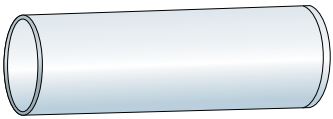
Attach tank adapter to lens side of laser, via set screws

2

Screw the 4 inch flange fully onto the tank adapter (as far down as it will go until the parts are tightly fastened).

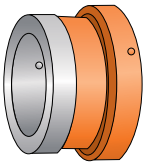
3

Insert the dust tube (slotted side) into the tank adapter and secure gently with set screws.

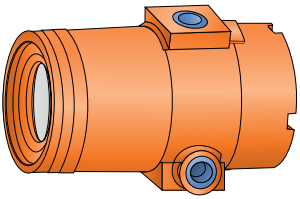


Dust Tube

4" Flange



Tank Adapter



Ruggedized Enclosure

- It is recommended to get familiar with the sensor performance and configuration in a controlled environment.
- After unpacking, power up the unit with the supplied cabling and connect the DB9 pin serial connector to a serial I/O devise such as a PC.
- A DB9 to USB adapter and power and communication cable is included with the unit from Hawk Measurement.
- When using the OptioLaser, communicate using either the supplied interface software, a terminal emulation program such a HyperTerminal or HART, depending upon your options.
- Default = 115200 baud rate, no parity, 8 data bits, 1 stop bit, no flow control.

Measurement Technique

Seeing a Target

The OptioLaser uses infrared laser light to measure distance. This invisible light emits from the transmitter lens, reflects off the target and returns to the receiver lens. The distance is calculated by comparing this transit time.

The ability of a laser sensor to measure depends on the target's reflectance and any interference between the sensor and target such as dust, fog, etc. Reflectance is determined by color, opacity, distance, angle of reflection, as well as the density of any ambient interference between the sensor and the target. For example, a lighter colored target is more reflective than a clear one; heavy dust will reduce the signal strength more than a light mist.

The OptioLaser can measure to most targets within its specified range, even penetrating dust or fog.
A good rule of thumb when measuring with a laser is: If you can see the target, the laser can as well.

Window Application

When measuring through a window, ensure the face plate of the sensor is 3mm or closer to the window, since reflections will increase with a larger gap and could result in measurement error, due to "cross-talk".
Cross-talk occurs when a reflection from a very close reflector, like a window, is combined with the actual target reflection, which could lead to an inaccurate measurement.

Beam Diameter

Beam Diameter at the Target = Free Aperture + (Divergence x Range)

Free Aperture = 23mm
Divergence = 3mrad
Distance to target = 100m

Beam Diameter at the Target = 0.023 + (0.003 x 100) = 0.323m

Therefore, Beam Diameter is 32.3cm at 100m (12.7" at 328ft)

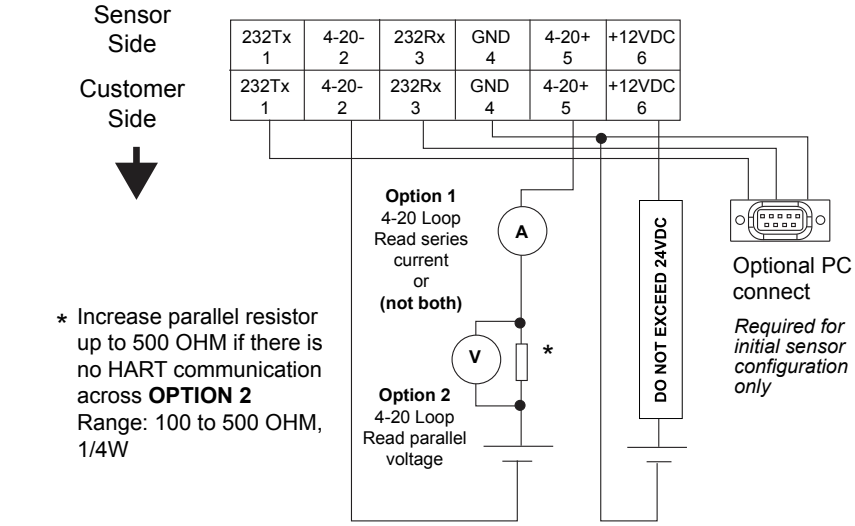
OptioLaser

The OptioLaser has wiring information printed inside the rear cover of the unit.

Ensure your power source is deactivated

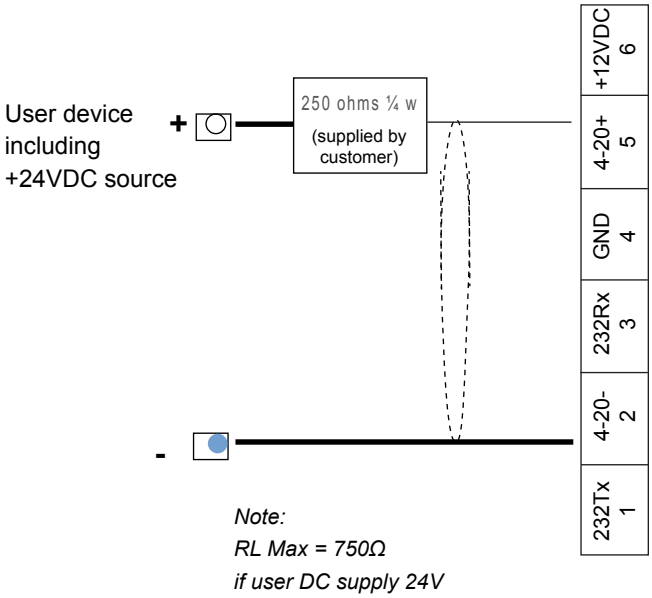
- Unscrew the rear cover to expose the terminal block to access the wiring.
- Pass cables through the cable entry gland before wiring into the terminal block.
- Tighten cable entry gland(s) and cover to ensure sealing is effective.

Note: DO NOT EXCEED 24VDC



Please note: The OptioLaser 4-20mA output is passive, thus it requires 24VDC from a user device such as a PLC input, DCS or indicator in order to function.

Sinking Type Output (2 wire loop powered)

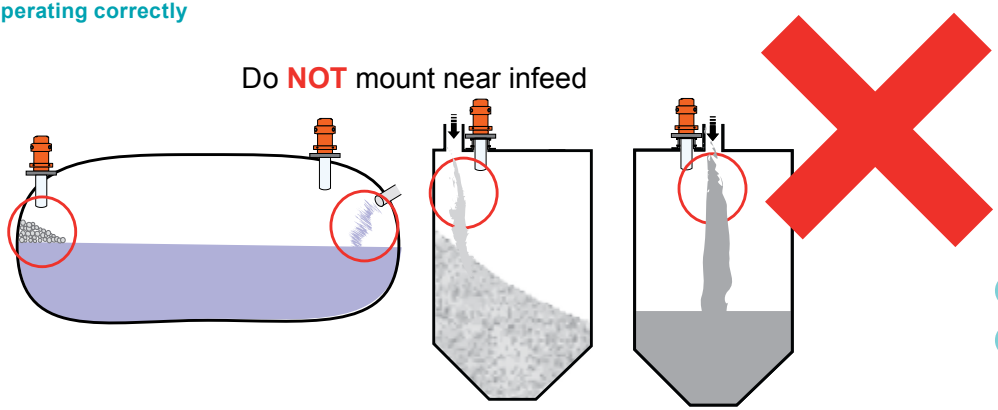


Note:
RL Max = 750Ω
if user DC supply 24V

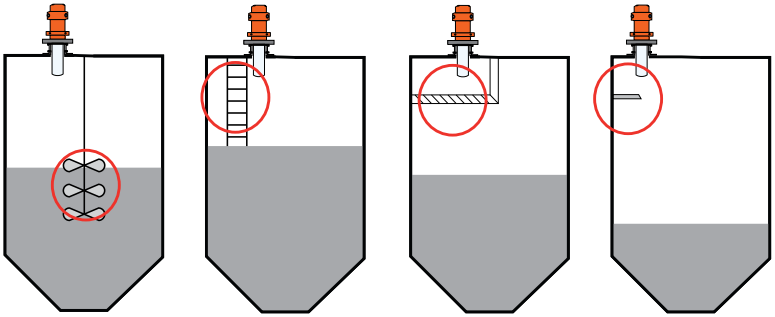
OptioLaser output is sinking current. Voltage to drive current loop must be provided by PLC, indicator, other user device or external DC supply.

These are examples of common INCORRECT mountings which can prevent the device from operating correctly

Do **NOT** mount near infeed



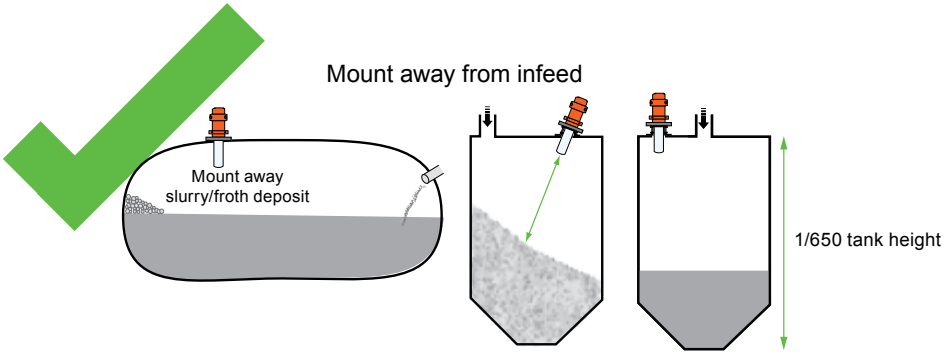
Do **NOT** mount over or adjacent to **any** obstacles



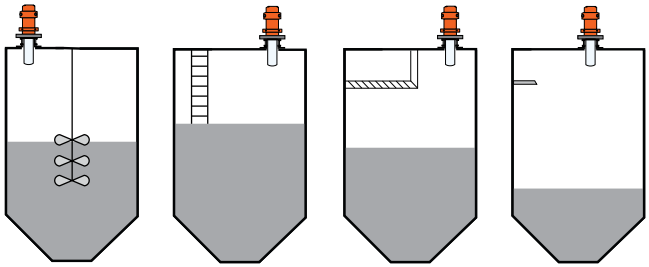
Because of the laser's narrow beam and small beam spread, the recommended installation from tank wall is minimum.

Use 1/650 of your tank height as a gauge.

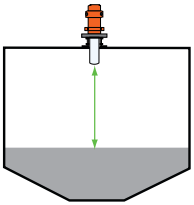
Mount away from infeed



Mount away from all obstacles



Mount perpendicular to product



Laser

- Selecting a suitable position to mount the laser is the single **MOST IMPORTANT** step.
- Please read the installation guide or contact HAWK representative if you have any doubts or questions. Observe minimum range specification of 1.5ft.
- Use common sense when selecting the mounting position. *A clear line of sight is required.*
- Take into account the change in material shape and level. The laser must reflect back to the receiver.
- Keep **away from the inflow** to avoid interference.

Process Conditions

- Ensure the process conditions within the vessel such as temperature, pressure and chemical composition of contents are within the unit's specifications. The unit should not normally come into contact with the measured content.

Moisture Seal

- Cable glands with moisture seals must be used and tightened around the cable. Any unused glands must be sealed.

Moisture Protection

- The lenses of the sensor should be kept clear of excessive contamination for optimal performance.

Cleaning

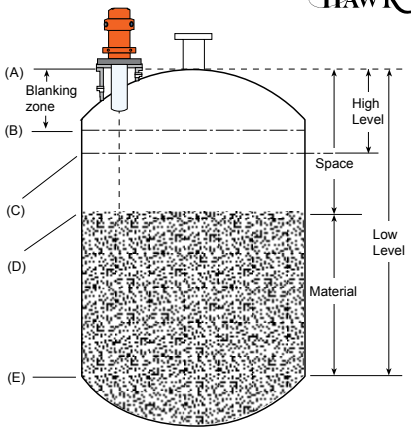
- **Excess Moisture:** Towel off excess moisture and air dry the instrument at room temperature.
- **Exterior Dirt:** Wipe exterior surfaces clean
- **Dirty Lenses:** Use a lint free soft cloth to remove surface dust and loose particles from transmit and receive

After the unit has been installed, mounted and powered you can now enter the settings to get the unit operational in your application conditions.
To start configuration, you will need to have the following information:

- Blanking Zone (at least 1.5 ft (46 cm) or greater)
- End of Blanking Zone
- High Level
- Product Level being measured
- Low Level

(A)	Transducer Face - Top of Flange
(B)	End of Blanking Zone
(C)	High Level or 100% (20mA) position
(D)	Product Level being measured
(E)	Low Level or 0% (4mA) position

High Level = Distance A to C
Low Level = Distance A to E

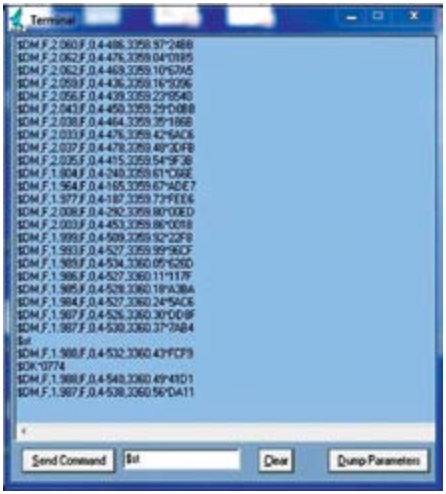


Computer Interface

- **Device:** Model
- **SN:** Device serial number
- **Red "Laser On":** Laser is firing
- **Counter:** Measurement count
- **Enable Visible Laser Pointer:** Alignment laser
- **Disconnect:** Terminates communication stop
- **Start / Stop Measurement:** Laser starts / stops measuring
- **EXIT:** Exits programming
- **Terminal:** Brings up Terminal Mode. User can type in commands and see response as well as scrolling data as the sensor is measuring
- **Configure Sensor:** Accesses setup menus.

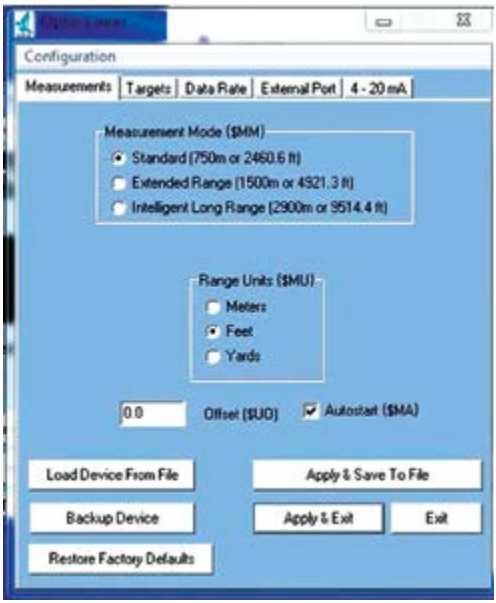
Terminal

- User may enter commands in the lower window. The data scrolls in the main window
- **Dump Parameters:** Scrolls the settings in the sensor for review
- **Send Command:** Sends commands entered in input window to laser
- **Clear:** Clears commands entered in input window.



Configure sensor

- The interface will read the configuration from the sensor
- **Measurement Mode:** Selection based on the maximum range.
- **Range Units:** User may select measurement units.
- **Offset:** Adds or subtracts from overall measurement.
- **Autostart:** Enable Autostart for sensor to automatically begin measuring on power up.
- **Load Device from File:** Upload file settings from saved file to sensor.
- **Backup Device:** Save Current Sensor settings to file.
- **Restore Factory Defaults:** Load settings from the factory from non-volatile memory.
- **Apply & Save to File:** Load menu settings to sensor and save file.
- **Apply & Exit:** Save menu settings to sensor and exit.
- **Exit:** Exit programming and return to measure screen



Measurement Mode:	*REFLECTIVE	**NON-REFLECTIVE	ACCURACY
• Standard Range:	2,461 ft / 750 m	2,461 ft /7 50m	(+/- 1.6 in. / 4 cm)
• Extended Range:	4,921 ft / 1500 m	2,953 ft / 900m	(+/- 3.2 in. / 8 cm)
• Intelligent Long Range:	9,514 ft / 2900 m	5,249 ft / 1600m	(+/- 6 in. / 15 cm)

**Reflective, or cooperative, targets = targets that especially reflect the laser pulses (reflective tape or light reflectors).*
***Non-reflective, or non-cooperative targets = targets that have no special reflective ability. Most natural objects are non-reflective, thus laser pulse return is weaker, and therefore you cannot measure as far a distance.*

Targets Tab

• **Target Selection:** Target Discrimination Menu. User selects target based on application.

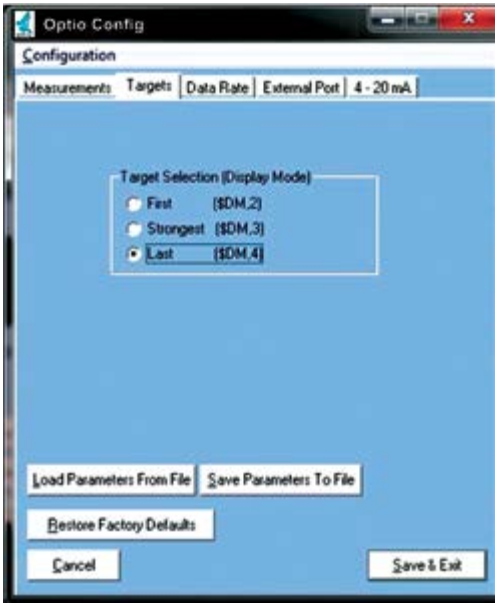
FIRST: The measurement output represents the distance to the first target the units sees that is above the minimum detection level.

IMPORTANT:

Not to be chosen when using the ruggedized housing

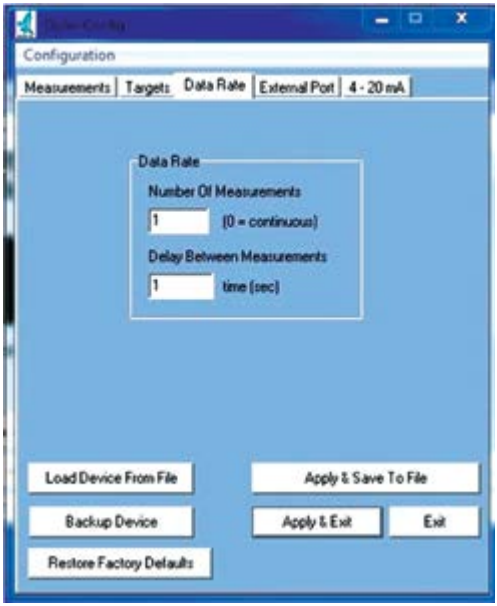
STRONGEST: The measurement output represents the distance to the strongest target the unit sees that is above the minimum detection level.

LAST: Multiple target operating mode. This allows the unit to detect multiple target reflections along the measurement line, allowing weaker distant targets to eventually be detected beyond stronger (closer) targets. Example: measuring a distant building thru close-by bushes.



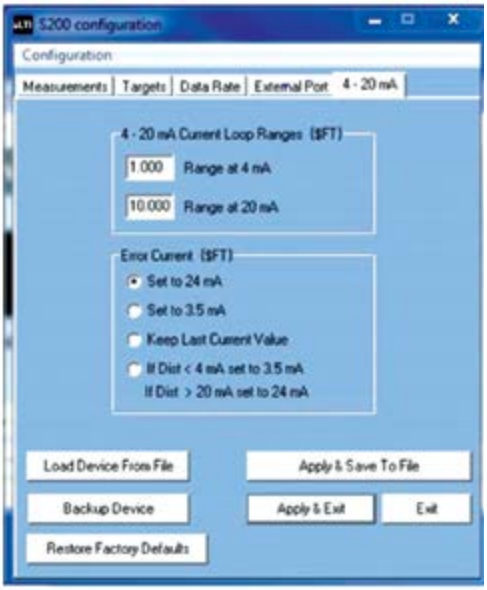
Data Rate Tab

- User selects data update rate. In this example, the update is set to 1Hz or 1 measurement per second.
- User sets both windows to “0” for maximum update rate of 14Hz using these settings.
- Example #1: The user wants an update rate of 5Hz. They would enter 1 for number of measurements and 0.2 (the inverse of 5) for delay between measurements.
- Example #2: The user wants 1 reading every 10 seconds. They would enter 1 for number of Measurements and 10 for delay between measurements.



4-20mA Tab

- 4-20 menu allows the user to set ranges at 4 and 20 scale.
- Error current is set here as well.
- A difference of at least 6.6 ft (2m) must be between the range of 4mA and 20mA
- After settings are made, it is necessary to Apply & Exit



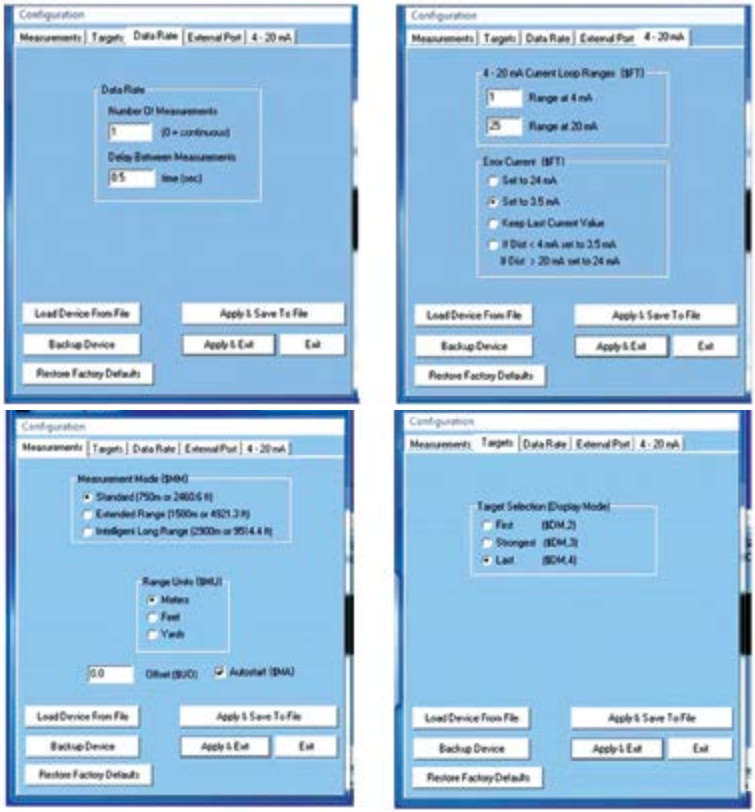
These examples are not absolute - sensor setup configuration varies depending on ambient conditions, target integrity, distance, constraints, and user requirements.

Tank and Silo Measurement

Consideration: Measure the liquid in a tank, thru ambient conditions such as mist and steam.

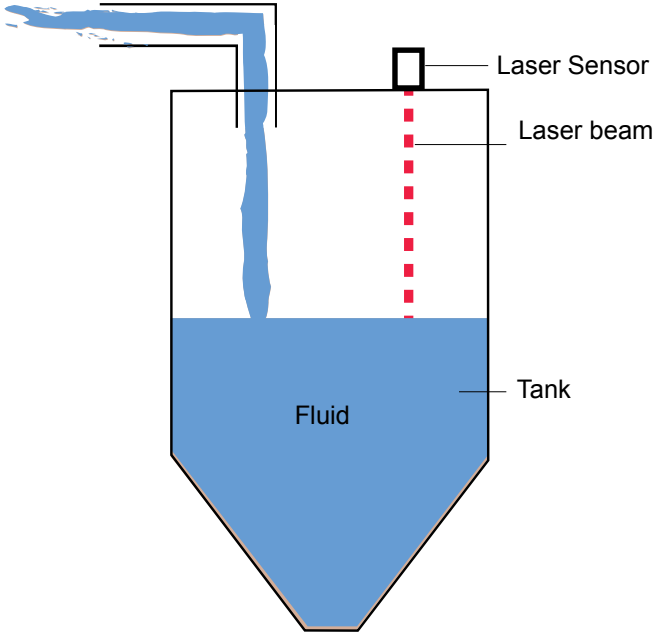
Summary:

- In this example, the maximum distance to the bottom of the tank is 82 ft (25 m) so the Standard Measurement Mode will yield the best accuracy.
- The sensor must be able to penetrate mist and steam inside of the tank. Choose Last Target for this.
- We want a measurement speed of 2Hz.
- We also want the unit to begin measuring upon power up - enable Autostart.
- If the measured distance exceeds our maximum or minimum, 3.5mA will be output.



Liquid Measurement Consideration

To measure the depth in the tank to the surface of a liquid.



In the example above, the maximum distance to the bottom of the tank is 82 ft (25 m) so the standard Measurement Mode will yield the best accuracy.

- The sensor must be able to penetrate steam or mist inside the tank. Choose Last Target for this.
- Set a measurement speed of 2Hz.
- Set the unit to begin measuring upon power up – enable Autostart.
- If the measured distance exceeds the maximum or minimum, 3.5mA will be output.
- Each liquid will react differently and the user will need to adjust the settings for optimum performance.

Your HART compatible model allows the user communication with a HART compatible device as a Generic Device. Shown are typical screen shots using a 475 hand-held controller.

Read / Write	
PV LRV	Primary Value Lower Range Value
PV URV	Primary Value Upper Range Value
Descriptor	Descriptor Field
Final Assembly Number	Descriptor Field
TAG, Long TAG, Message	Descriptor Fields
Read Only or No Write Ability	
Burst	Maximized the data rate
4-20 Current	Reading
Range	Reading
Percent of Range	Reading
Units	Feet, Meters, Yards

Sensor FAQs

What type of laser does Hawk Measurement offer?

Pulsed, 905 nanometers (nm), Time-Of-Flight (TOF) lasers. 905 nm is the wavelength of the infrared light of the laser (this wavelength lies just outside the visible light spectrum that ranges from 400 nm to 730 nm).

How does the Hawk Measurement laser work?

The transmitter lens sends out pulses of light, which are reflected by a target's surface, and return to the laser's receiver lens. The transit time of the pulse is precisely measured, enabling the distance to be calculated.

What data output rates do our lasers operate at?

The OptioLaser ranges from <1 Hz to 14Hz

What's the difference between reflective and non-reflective targets?

Reflective targets - targets that are especially reflective to laser pulses (reflective tape or light reflectors), allowing longer distances to be measured.

Non-reflective targets – targets that have no special reflective ability. Most natural objects are non-reflective, returning a weaker signal, thus limiting the possible measuring range. Among non-reflective targets, some colors reflect light better than others. For example, lighter colored targets reflect more light energy than darker colored targets.

Is the laser beam eye safe?

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

General Sensor Information

What is Pulse Repetition and why is it important?

Pulse Repetition Frequency (PRF): How fast the sensor is sending out laser pulses. A faster PRF can take more measurements or detect targets at higher speeds and/or use more pulses to get a better average. PRFs in the Optio is set at 2,800 PRF.

Is the 4-20 mA output of OptioLaser actively or passively powered?

For the OptioLaser sensor, the 4-20 mA loop is passively powered (sinking), meaning power must be supplied by an outside source.

Does the laser need to be calibrated to a specific range?

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?

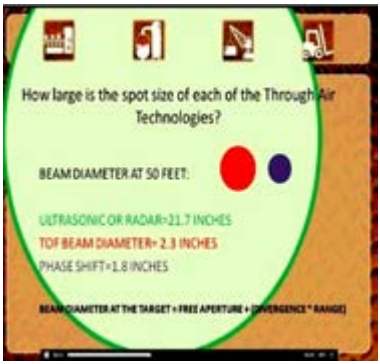
Lasers produce a very narrow beam that can be precisely aimed at a target. This is just one of the features that sets laser sensors apart from other technologies.

Beam diameter over distance can be calculated as follows:

Example:

- Free aperture: 23mm
- Divergence: 3 mrad
- Distance to target: 100m
- Calculation = 0.023 + (.003 x 100) = 0.323m

Therefore, the beam diameter is 32.3 cm (12.7”) at a distance of 100 m (328 ft).



Model	Sensor	Tank Height (ft)	Beamwidth @ Tank Height (ft)	Needed Distance From Wall (ft)
OptioLaser	S200	100	0.375	0.1875
	S200	500	1.575	0.7875
	S200	1000	3.075	1.5375
	S200	2500	7.575	3.7875
	S200	5249	15.822	7.911
	S200	9514	28.617	14.3085

What are the benefits of our devices in specific markets?

Market	Benefits
Plant Management	• Ruggedness • Ability to liquids and solids in harsh environments • Ability to set target mode to optimize measurements (averaging or last mode)
Collision Avoidance	• Ability to measure instantly and precisely, and provide a quick response • Ability to measure through narrow opening, grates or along a wall
Security & Surveillance	• Ability to detect movement at long distances • Ability to detect an object and drive a trigger

Is this a proven technology in industrial applications?

Yes, lasers for material 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.

Do you need high data output rates in industrial applications?

Usually, there is no need for high output rates because processes are relatively slow; typically 10Hz or less.

What are the different target modes in the OptioLaser S200 Series?

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

Target Mode	Definition	Recommended Use
First*	The unit only measures to the first target it sees	*First mode not utilized for the S200 with ruggedized housing
Strongest	The unit measures to the strongest target it sees	When an obstruction, such as a grate, exists between the intended target and sensor
Last	The unit measures to the last target it sees	To get better results through steam and mist.

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

Can lasers read through water?

If the water is very clear and still, the laser will likely read through the surface to some point below the surface level. If the depth of the water is shallow, the laser may read to the bottom of the tank or vessel. In either case, the laser sensor will not provide an accurate, consistent measurement.

Can lasers read the surface of water?

Yes, if the water has some color to it.

Can lasers penetrate foam?

Unless the foam has a very low-density, the laser can only measure the top of the foam. However, if the customer can use a standpipe, foam dispersion system or other means to dissipate the foam, then the laser will be able to provide an accurate measurement of the liquid level.

Will lasers measure through dense steam?

Like foam, it depends on the density and composition of the steam, as well as the nature of the surface to be measured: composition, clear or opaque, still or turbid General rule of thumb: if you can see through it, the laser will be able to as well. There are some exceptions – some materials reflect infrared rays more than visible light, so it might look relatively clear but the laser will still not go through it.

What considerations are there when measuring through glass?

Borosilicate glass typically works well. Also, there is no degradation using plane glass or even plastic. When measuring through glass, it is recommended the face plate of the sensor be 3mm or closer to the glass. Larger gaps could result in measurement error.

Typically, a transmission of over 90% is desirable. Uncoated glass has a 8% reflection loss per each plate. It is better if each side is coated with an anti-reflection coating, which can reduce the reflection loss to close to 0%". If there are any questions or uncertainties, the customer should get transmission curve for the glass they are considering.

What accessories are available for the OptioLaser S200 series?

The following accessories are available:

- Flange
- Dust tube
- Tank adapter
- Swivel mount stand
- Power/Communications cable
- Swivel mount stand

Certifications

Does the OptioLaser have IEC 60825-1 certification?

Lasers are self-certified, allowable in the United States. The power levels of our lasers are within Class 1 eye safety limits.

At the highest PRF (4KHz) and highest power level (400 nJ per pulse), we meet Class 1M limits, safe unless looked at through a magnifying lens. At lower PRF settings, our lasers can be Class 1 depending on the power setting. However, the alignment laser is always a Class 2M device.

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.

What is the significance of 50mm is and 7mm apertures?

The classification looks at what the eye would see when looking through an optical aid (binoculars, magnifying glass, telescope, estimated 50mm aperture) and the naked eye (7mm aperture, no optical aid).

Operating Temperature

The OptioLaser is rated for temperatures of -20°F to 140°F (-28°C to 60°C). Do not operate the instrument in temperatures outside of that range.

Moisture Protection

The lenses of the sensor should be kept clear of excessive contamination for optimal performance.

Cleaning

Excess Moisture: Towel off excess moisture and air dry the instrument at room temperature.

Exterior Dirt: Wipe exterior surfaces clean.

Dirty Lenses: Use a soft lint-free cloth to remove surface dust and loose particles from transmit and receive lenses. To clean a lens, moisten it with lens cleaning solution and wipe it clean with a lens cloth or lens tissue.

Specifications

Performance	**Minimum Range**	1.5 feet (46 cm)
	Maximum Range to Reflective targets	
	Low Accuracy	9514 ft (2900 m) Accuracy: +/- 6” (15 cm)
	Medium Accuracy	4921 ft (1500 m) +/- 3.2” (8 cm)
	High Accuracy	2461 ft (750 m) +/- 1.6” (4 cm)
	Maximum Range to Non-Reflective targets	
	Low Accuracy	5249 ft (1600 m) Accuracy: +/- 6” (15 cm)
	Medium Accuracy	2953 (900 m) +/- 3.2” (8 cm)
	High Accuracy	2461 ft (750 m) +/- 1.6” (4 cm)
	Data Output Rate	Option 1: <1 up to 14 Hz depending on target
		Option 2: Fixed 200 Hz mode
	Target Modes	First, Strongest, Last, First Second Third
		Last Second to Last, First Strongest Last
		First Second Third Strongest Last
Optical & Electrical	**Wavelength**	905 nm (infrared)
	Beam Divergence	3 mrad equal to 1 ft (30 cm) beam diameter at 328 ft (100m)
	I/O	S200:RS232, Trigger; S210:RS232,Trigger, Alignment S230:4-20, HART, Alignment
	Input Power	12-24VDC (12VDC recommended)
	Current Draw	Measuring = 150 mA, Standby = 40mA
Physical	**Dimensions**	5” dia. x 10” length 12.7 cm dia. x 25.4 cm length
	Weight	8 lbs. (3.62 kg)
	Housing and Frame Material	Cast aluminum, epoxy coated
Environmental	**Eye Safety**	Class 1, 7mm (FDA CFR21)
		Class 1m (IEC 60825-1:2001)
	Shock Vibration	MIL-STD-810
	Moisture	IP54
	Operating Temperature	-20 °F to 140 °F (-28°C to 50°C)

HAWK, Since 1988

Hawk Measurement Systems Pty Ltd (HAWK) was established in 1988. It's founding members saw the universal requirement of various industries requiring improved process control and efficiency in their operations.

We Can Help

HAWK understands the difficulties customers face when seeking accurate level measurement. Every application is different, involving a multitude of environmental factors. This is where HAWK excels. Our aim is to ensure that customers feel comfortable with our technology, and are provided with long term and reliable solutions. We believe that a combination of application and product expertise, as well as forward thinking and proactive support policies are the foundation of successful customer-supplier relationships.

Progressive Technical Support

HAWK believes that the future of the Level Measurement Industry revolves around the quality of pre and post sales - support. Our aim is for all sales & support staff to be product experts, and more importantly application experts making our customers applications as efficient and consistent as possible.

Knowledge Sharing

HAWK believes that knowledge sharing is key to creating long term relationships. Empowering our customers and our worldwide distribution network, whilst being available at all times to lend a helping hand, is the perfect recipe for long-term solutions and relationships. HAWK openly extends an invitation to share our 25 years of level measurement experience, and ensure that your day-to-day processes are efficient, understood, and always working.

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