

L-GAGE® LH Series Sensor

Instruction Manual

Original Instructions
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9 May 2017
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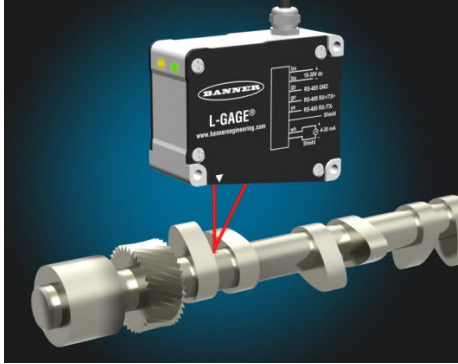
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1 Introduction

Banner's LH Series Laser Displacement Sensor brings a sophisticated and cost-effective solution to precision measurement applications. Featuring a narrow effective beam, excellent resolution, and user configurable outputs, the LH Series sensor solves a variety of measurement applications with an all-in-one design. The LH Series Sensor can serve as a displacement measurement sensor or can perform thickness delta measurements when two sensors are configured to work together. The LH Series Configurator is a software tool for setting up a network of sensors, configuring sensors, and acquiring measurements using serial communication over RS-485. Measurements from multiple sensors can be simultaneously acquired using the LH Network protocol.



This instruction manual provides an overview of the LH Series Laser Displacement Sensor and describes how to install and prepare for configuring the sensor.

Features

- Provides precise displacement measurements or thickness delta measurements (thickness delta measurements requires two sensors)
- Self-contained Class 2 modulated visible laser gauging sensor
- Needs no separate controller
- Narrow effective beam is excellent for precision gauging applications
- Automatic run mode dynamically adjusts laser power and measurement rate based on target conditions or measurement rate can be locked by user
- 4-20 mA analog output that can be easily scaled over a specified measurement window
- Digital output provides the measurement value on the RS-485 bus
- Sensor can be easily configured using LH Series Configurator software

Components

Each LH Series Laser Displacement Sensor Kit includes the following:

- 1 LH Series High-Performance Laser Displacement Sensor
- 1 CD containing Banner LH Series Configurator (p/n 13597) and LH Series Laser Displacement Sensor Configurator Software Manual (p/n 150307)
- This Installation Guide (p/n 152154)



Note: A INTUSB485-LH converter to connect the LH Series Sensor to a PC can be purchased separately.



WARNING: Not To Be Used for Personnel **Protection**

Never use this device as a sensing device for personnel **protection**. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.



LASER LIGHT

DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT

Avoid exposure -
laser light emitted
from this aperture



WARNING: Class 2 Safety Notes

Low-power lasers are by **definition** incapable of causing eye injury within the duration of the blink, or aversion response of 0.25 seconds. They must also emit only visible wavelengths (400-700 nm). Therefore, an ocular hazard can only exist if an individual overcomes their natural aversion to bright light and stares directly into the laser beam. The device requirements for these lasers are to have a [hazard] label and to have an indicator light to indicate laser emission.

The two **operational** safety rules are:

- Do not permit a person to stare at the laser from within the beam
- Do not point the laser at a person's eye at close range



WARNING: Beam Paths:

The beam emitted by a class 2 laser product should be terminated at the end of its useful path. Open laser beam paths should be located above or below eye level where practical.

2 LH Series **Installation** and Setup

2.1 Cable/Connector Wiring

	Pin	Color	Description
	1	White	4-20 mA output source
	2	Brown	Power supply 18–30 V dc
	3	Shield (bundled with white wire inside blue foil wrap)	4-20 mA output return
	4	Yellow	RS-485 RX- / TX-
	5	Grey	Ground of RS-485 bus
	6	Green	RS-485 RX+ / TX+
	7	Blue	Ground
	8	Shield	Shield/drain wire*

* The shield/drain wire is connected internally to the sensor housing and should be connected as follows:

1. If the sensor housing is mounted so that it is in continuity with both the machine frame and earth ground, connect the shield/drain wire (also) to earth ground.
2. If the sensor housing is mounted so that it is insulated from the machine frame, connect the shield/drain wire to -V dc (together with the blue wire).
3. If the sensor is mounted so that it is in continuity with the machine frame, but not with earth ground, do not connect the shield/drain wire (i.e. cut off the shield/drain wire).

2.2 **Installation**

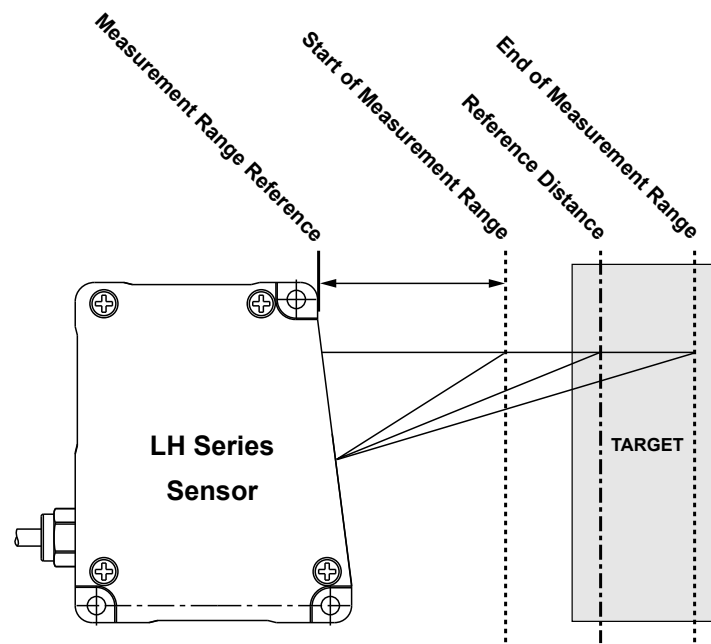
The LH Series Laser Displacement Sensor is an optical instrument capable of micrometer-level resolutions.



Note: Handle the sensor with care when installing and operating. Applications requiring measurement resolution in the micrometer range must take vibration, dust, and thermal expansion effects into consideration. Windows of all sensors must be clean for full functionality. Windows that are soiled by dust, water, oil, etc may cause the sensor to not operate correctly. The windows should be cleaned thoroughly whenever necessary, using a high quality glass cleaner.

2.2.1 Displacement Measurement **Installation**

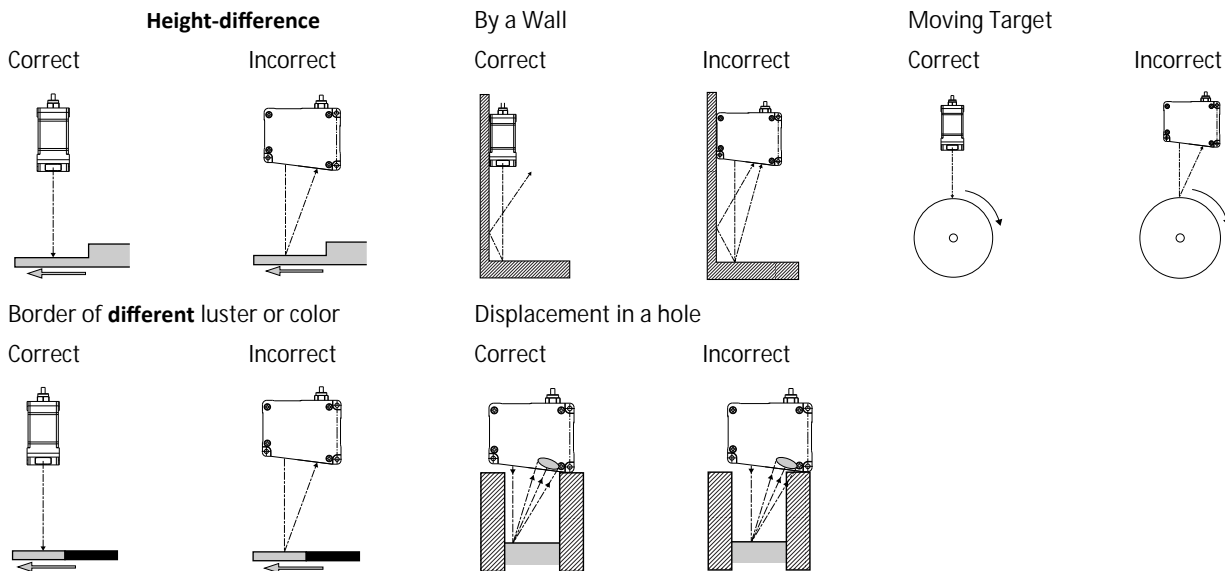
1. Adjust the distance between the sensor head and the target so the target is near the middle of the measurement range.
2. The sensor must be aligned to the target so the laser beam strikes the target surface at a right angle.
3. Secure the sensor with 3 bolts of 4 mm diameter.
4. Attach the M12 cord set and complete wiring of the sensor.



Displacement Measurement **Installation** Tips

Target motion must be perpendicular to emitter/receiver axis.

Some targets (those with a stepped plane facing the sensor, a boundary line, or rounded targets) pose specific problems for sensing distances. For such applications, see below for suggested mounting orientations.



2.2.2 Thickness Delta Measurement **Installation**

For thickness delta measurement using two sensors, the "master/slave separation" is significant instead of the "middle of range" that is significant when measuring displacement. It is frequently necessary to measure materials whose thickness lies in a particular range. In such cases you should increase the distance apart by the nominal thickness of the material that is being measured.

The factory defaults for a thickness delta measurement are as follows:

Model	Default Nominal Thickness	Ideal Master/Slave Separation
LH30	5 mm	65 mm
LH80	20 mm	180 mm

Model	Default Nominal Thickness	Ideal Master/Slave Separation
LH150	50 mm	350 mm

The ideal master/slave separation can be calculated by the following formula:

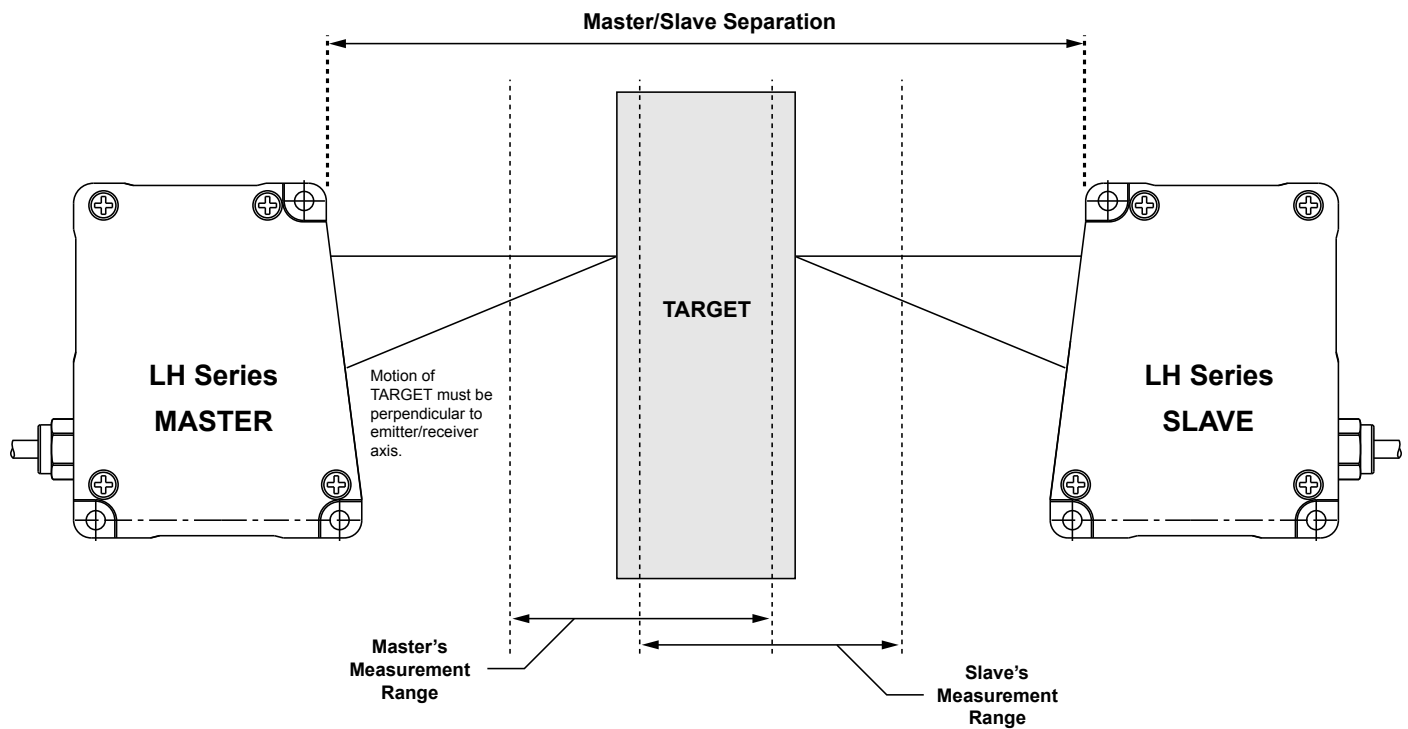
Ideal Separation = 2 * Reference Distance + Nominal Thickness

For example: LH30 with 14mm nominal thickness would be calculated as follows: Ideal Separation = 2 * 30 + 14 = 74 mm
(see [Performance Specifications](#) for Reference Distance)

If the ideal master/slave separation cannot be achieved due to application restrictions, the thickness delta measurement can still be configured to work properly by adjusting the Thickness Delta Offset parameter via the Banner LH Series Configurator software.

Thickness Delta Measurement Installation Steps:

1. Adjust the separation distance between the Master and Slave sensors as required by the application.
2. The Master and Slave sensors must be aligned to the target so the laser beam strikes the target surface at a right angle.
3. Secure both sensors with 3 bolts of 4 mm diameter.
4. Attach the M12 cord set and complete wiring of both sensors.



2.3 Handling and Storage

The LH Series Laser Displacement Sensor is an optical instrument capable of micrometer-level resolutions.



CAUTION: The sensors are delivered in shock-resistant packaging. Always handle/transport the sensors carefully to avoid rough handling. The sensors must be stored in a dry place and should not be subjected to extreme temperature fluctuations.

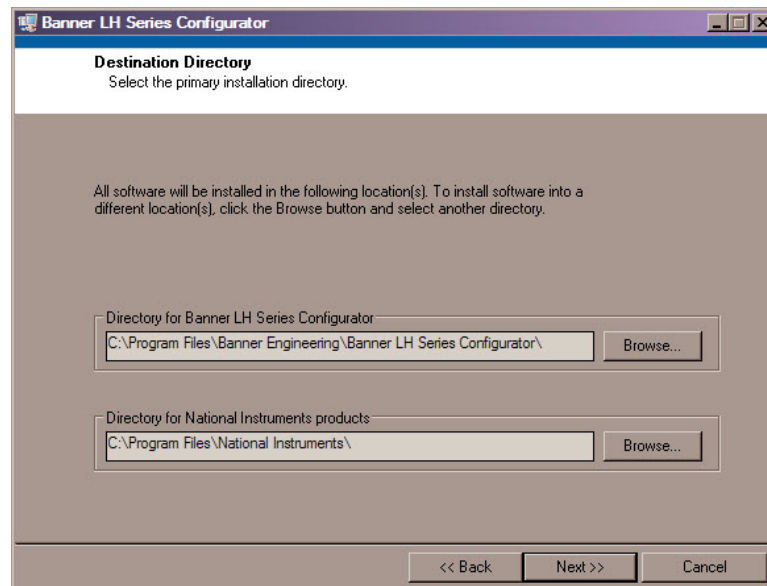
3 LH Series Configurator Software

The LH Series Configurator CD (P/N 13597) includes the LH Series Configurator software and the LH Series Laser Displacement Sensor Configurator Software Manual (P/N 150307).

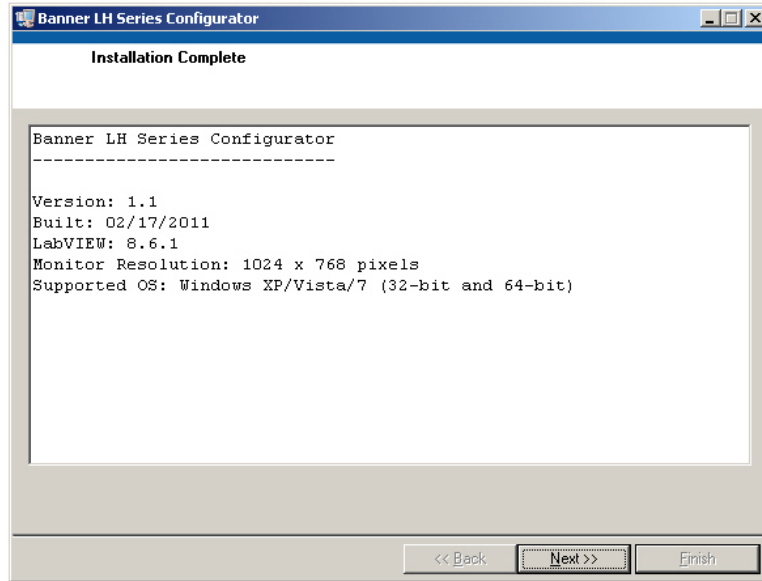
3.1 Software Installation

The LH Series Configurator software is compatible with Windows XP, Windows Vista, and Windows 7 (32-bit and 64-bit). To install the LH Series Configurator software:

1. Start up the computer on which the LH Series Configurator software is to be installed.
2. Close all active programs.
3. Insert the LH Series CD into the CD ROM drive of the personal computer. If you have auto-start enabled, the CD should automatically start. If it doesn't start --
 - a. Double-click on the My Computer icon on the desktop.
 - b. Double-click on the CD Drive in the list that appears.
 - c. Double-click on the setup.exe file.
4. When the Install screen appears, click the Install button.
5. Select the destination directory for the LH Series Configurator software or just click the Next button to accept the defaults.

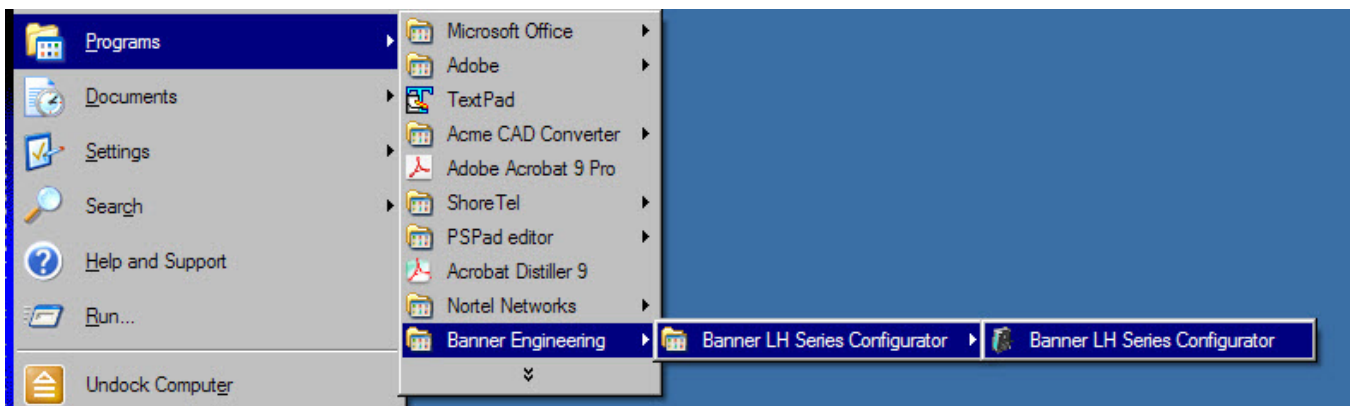


- When the installation completes, click the Finish button.



3.2 Starting Up the LH Series Configurator

To start up the software, double-click the Banner LH Series Configurator icon on the desktop, or launch the Banner LH Series Configurator from the the Start menu.



When the software starts, it displays the Main screen which is described in the section that follows.

3.3 LH Series Configurator Main Screen



Menu Bar

Main Menu	Menu Option	Description
File	<i>Return to Main Screen</i>	Returns the user to the Main Screen.
	<i>Load Last LH Network Setup</i>	The LH Series Configurator software is automatically saving the network setup in the background while the user is setting up the LH Network. This menu option provides a way for a user to quickly load the saved network setup after an interruption. Note that, if something has changed on the network since the last time the LH Series Configurator software was used, you will need to re-scan the network.
	<i>Open LH Network Setup File</i>	Provides a way to load a previously saved LH Network Setup File. Note that, if something has changed on the network since the last time the LH Series Configurator software was used, you will need to re-scan the network.
	<i>Save LH Network Setup File</i>	Saves an LH Network Setup File.
	<i>Exit</i>	Used to exit the LH Series Configurator software.
Tools	<i>LH Assistant</i>	An alternative way to access the LH Assistant setup wizards and utility tools.
	<i>Show Comm Traffic</i>	Used for monitoring communications traffic.
Help	<i>Show Help</i>	Launches the Main Help contents.
	<i>About Banner LH Series Configurator</i>	Displays software version information.

L2. Assistant

The LH Assistant button launches the LH Assistant, which includes wizards to guide the user step-by-step through setting up a single displacement sensor, a master/slave pair of sensors for a thickness delta measurement, or a network of sensors. The LH Assistant also includes two utilities, one for resetting a sensor back to factory defaults and the other for manually assigning a sensor to an existing network.

L3. Configurator

The LH Configurator button connects to the LH Network and launches the LH Network and Measurements screen. Typically, a user will launch the LH Network and Measurements screen after a network is configured for the purpose of acquiring measurement data from the network, refining sensor configurations, and diagnosing problems.

COM Port

The COM Port selector displays the current COM Port that the PC is using to communicate with the LH Network. There is an option to Refresh (that is, scan) for all available COM Ports on the PC.



Tip: If using an INTUSB485-LH converter:

1. Refresh the COM Port list with the converter disconnected.
2. Connect the converter to an available USB port.
3. Refresh the COM Port list again. The converter will be the new COM Port in the list.

4 Specifications

4.1 General Specifications

Supply Voltage and Current
18 to 30 V dc (10% maximum ripple); 250 mA maximum at 24 V dc (exclusive of load)

Supply Protection Circuitry
Protected against reverse polarity and transient over voltages

Delay at Power-up
1.25 seconds

Sensing Beam
670 nm (1 mW) visible red IEC and CDRH Class 2 laser

Measuring Frequency
Dynamically adjusted from 300 to 4000 Hz depending on target conditions, or locked via LH Series Configurator software.

Output Configuration and Rating
Current output: 4–20mA (current sourcing), maximum load 250 Ω

Output Response Time
User adjustable output filtering via LH Series Configurator software
1.25 ms Analog Output Hold upon loss of target

Vibration and Mechanical Shock

Vibration: IEC60947-5-2, 10-55 Hz, 0.5 mm P-P, 3 axis
Shock: IEC60947-5-2, 30G, 11 milliseconds, half sine wave, 3 axis
Maximum **mounting bolt tightening** torque: 1 Nm

Factory Default Settings

Measurement Mode: Displacement
Sensor Address: Unset (Address 0)
Baud Rate: 115200
Analog Output: 4-20 mA, positive slope, full scale range

Construction

Aluminum housing and cover plate; glass lens;
PVC and nickel-plated brass cable

Environmental Rating
IP67

Connections

150 mm (6 in) cable with an 8-pin M12/Euro-style pigtail quick-disconnect; mating QD cables are purchased separately

Serial Communication Interface
RS-485, optically isolated, up to 230 KBaud

Serial Communication Protocol
LH Network

Application Notes
Allow 30-minute warm-up

Adjustments
None on sensor; Configuration through LH Series Configurator software

Ambient Light
≤ 3000 Lux

Temperature Effect
0.01% of full scale range/°C

Operating Conditions
–10 °C to +45 °C (+14 °F to +113 °F)
–10 °C to +80 °C (+14 °F to +176 °F) (storage temperature)
85% maximum relative humidity at +45° C, non-condensing

Certifications

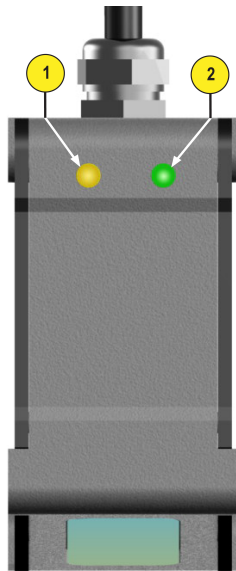


4.2 Performance Specifications

Specification	Model		
	LH30IX485QP	LH80IX485QP	LH150IX485QP
Measurement Range (mm)	25 to 35	60 to 100	100 to 200
Measurement Span (mm)	10	40	100
Start of Measurement Range (mm)	25	60	100
Reference Distance (mm)	30	80	150
End of Measurement Range (mm)	35	100	200
Maximum Thickness Delta Measurement (mm) ¹	10	40	100
Default Ideal Separation for Thickness Delta Measurement (mm)	65	180	350
Spot Diameter at Reference Distance (micron)	50	125	225
Linearity ² (0.1% of full scale range) (micron)	10	40	100
Resolution ^{2, 3} (micron)	1	4	10

1. Thickness Delta is the change in thickness (i.e. 100-110mm is 10mm of thickness delta)
2. Measured at 20°C, using a standard white ceramic target
3. Resolution measured with the Output Filter value set to 64

4.3 Indicators



1. Amber Signal LED
2. Green Power LED

4.3.1 Green Power LED

The Green Power LED indicates the operating status of the sensor.

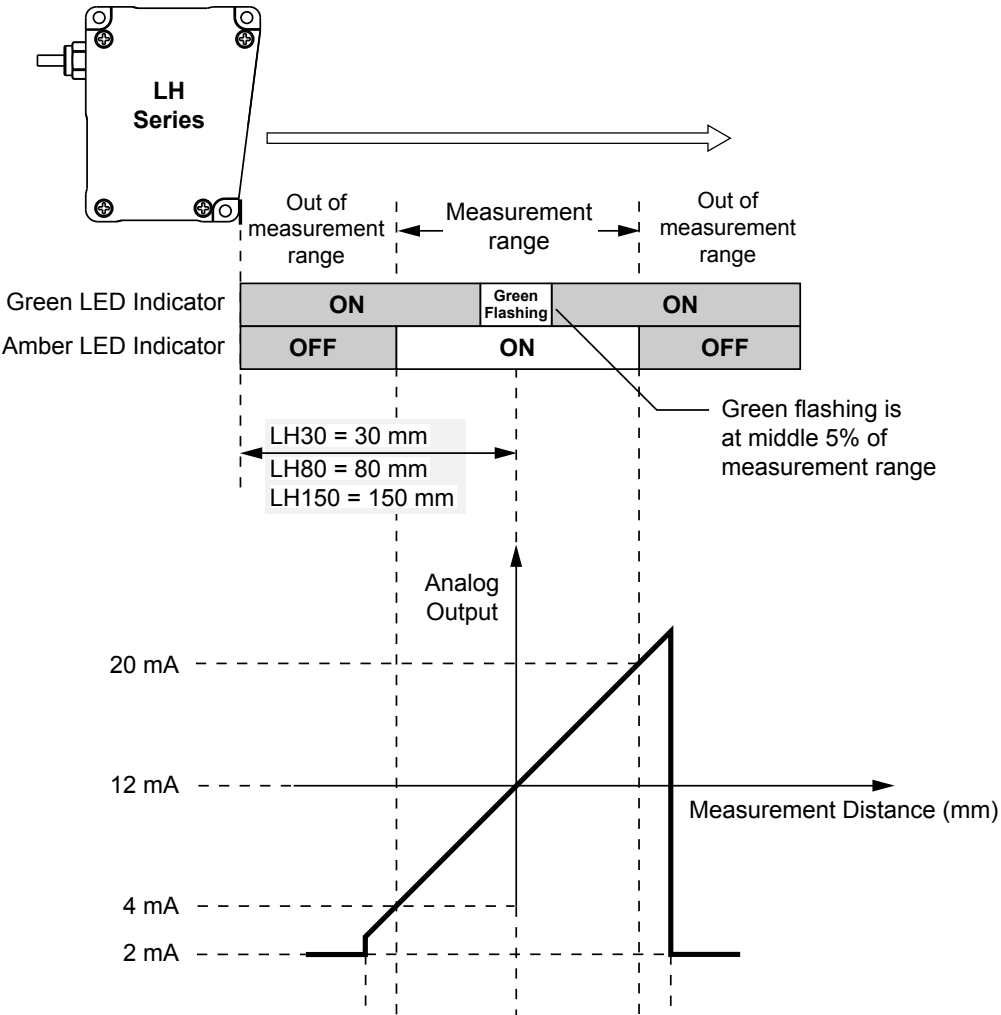
Power LED Status	Indicates
OFF	Power is OFF
Flashing	Target detected in middle 5% of measurement range
ON Solid	Sensor is operating normally (power is ON, Laser enabled)

4.3.2 Amber Signal LED

The Amber Signal LED indicates that a valid target is detected within the measurement range.

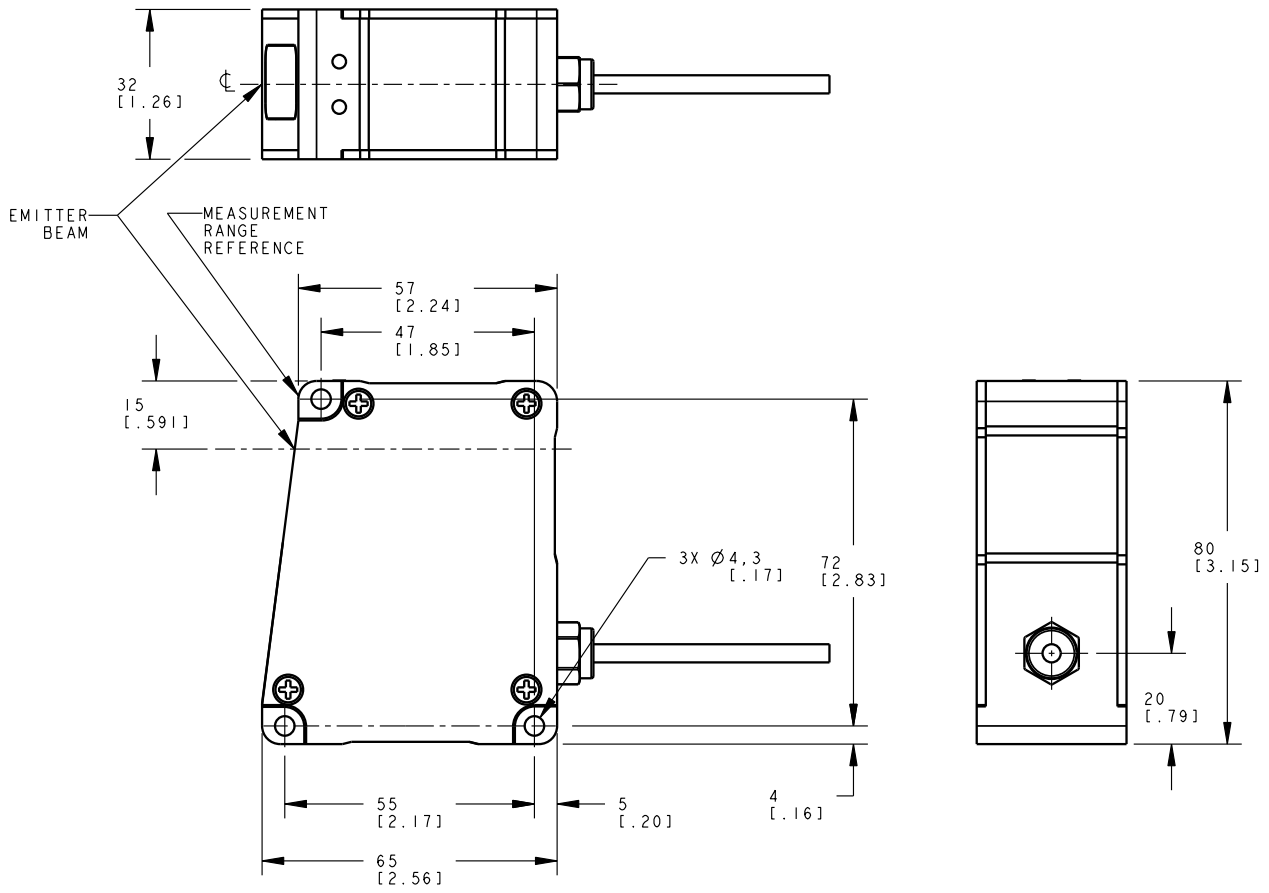
Signal LED Status	Indicates
OFF	No signal is received, or the target is outside the measurement range of the sensor
ON Solid	A valid target is within the measurement range of the sensor

4.3.3 LED Indicators and Outputs



	Start	Reference	End
LH30	25 mm	30 mm	35 mm
LH80	60 mm	80 mm	100 mm
LH150	100 mm	150 mm	200 mm
LH30 Spot Size Ø (micron)	110	50	110
LH80 Spot Size Ø (micron)	200	125	200
LH150 Spot Size Ø (micron)	350	225	350
RS-485 Digital Output	62768	32768	2768

4.4 Dimensions



5 Accessories

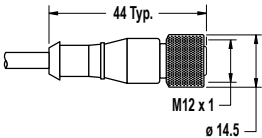
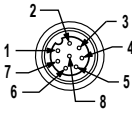
5.1 Brackets

<p>SMBLH1</p> <ul style="list-style-type: none"> • Main mounting bracket for LH Series sensor • T-slot or "bolt-on" bracket for mounting one sensor • Anodized Aluminum  <p>Hole size: A = M4</p>	<p>SMBLH30</p> <ul style="list-style-type: none"> • LH series adjustable bracket • Brackets for thickness and displacement measurement • Anodized Aluminum • For LH30 sensors  <p>Hole size: A = M4 Height: H = 208.0</p>
<p>SMBLH80</p> <ul style="list-style-type: none"> • LH series adjustable bracket • Brackets for thickness and displacement measurement • Anodized Aluminum • For LH80 sensors  <p>Hole size: A = M4 Height: H = 358.0</p>	<p>SMBLH150</p> <ul style="list-style-type: none"> • LH series adjustable bracket • Brackets for thickness and displacement measurement • Anodized Aluminum • For LH150 sensors  <p>Hole size: A = M4 Height: H = 608.0</p>

5.2 INTUSB485-LH Adapter

Model	Adapter	Length
INTUSB485-LH	RS-485 to USB	.75 meter

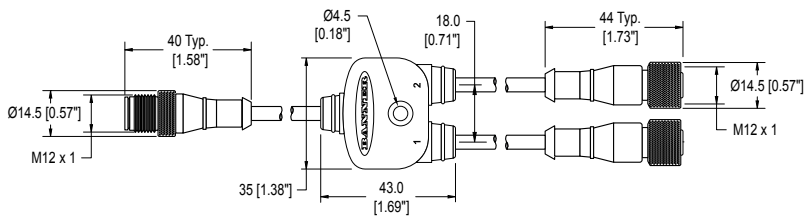
5.3 Cordsets

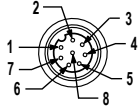
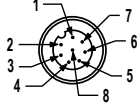
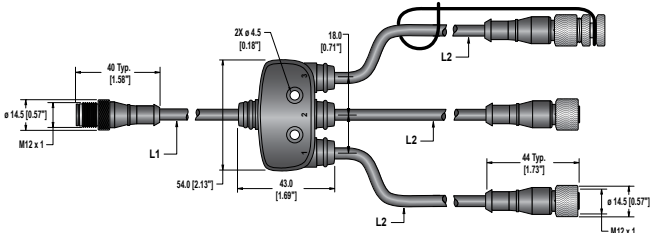
8-Pin Threaded M12/Euro-Style Cordsets with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQLH-806-F	1.83 m (6 ft)	Straight	 <p>44 Typ. M12 x 1 ø 14.5</p>	
MQLH-815-F	4.58 m (15 ft)			

8-Pin Threaded M12/Euro-Style Cordsets with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQLH-830-F	9.14 m (30 ft)			1 = White 2 = Brown 3 = Shield 4 = Yellow 5 = Gray 6 = Green 7 = Blue 8 = Shield

8-Pin Threaded M12/Euro-Style Cordsets with Shield—Double Ended				
Model	Length	Style	Dimensions	Pinout
MQLH-806-MF	1.83 m (6 ft)	Male Straight/ Female Straight		Female
MQLH-815-MF	4.57 m (15 ft)			
MQLH-830-MF	9.14 m (30 ft)			Male
MQLH-801-MM	0.30 m (1 ft)	Male Straight/ Male Straight		1 = White 2 = Brown 3 = Shield 4 = Yellow 5 = Gray 6 = Green 7 = Blue 8 = Shield

8-Pin Threaded M12/Euro-Style Splitter Cordsets with Shield—Flat Junction			
Model	Branches (Female)	Trunk (Male)	Pinout
CSB-M1280M1280-LH	No branches	No trunk	Male
CSB-M1281M1282-LH	0.60 m	0.30 m	
			Female
			1 = White 2 = Brown 3 = Shield 4 = Yellow 5 = Gray 6 = Green 7 = Blue 8 = Shield



8-Pin Threaded M12/Euro-Style Splitter Cordsets with Shield—Flat Junction			
Model	Branches (Female)	Trunk (Male)	Pinout
CSB3-M1281M1282-LH	0.60 m	0.30 m	<p>Female</p>  <p>Male</p>  <p> 1 = White 2 = Brown 3 = Shield 4 = Yellow 5 = Gray 6 = Green 7 = Blue 8 = Shield </p>
			

6 Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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www.bannerengineering.com.

6.1 Contact Us

Corporate Headquarters

Address:
Banner Engineering Corporate
9714 Tenth Avenue North
Minneapolis, Minnesota 55441, USA

Phone: +1 763 544 3164
Website: www.bannerengineering.com

Europe

Address:
Banner Engineering EMEA
Park Lane Culliganlaan 2F
Diegem B-1831, Belgium

Phone: +32 (0)2 456 0780
Website: www.bannerengineering.com/eu
Email: mail@bannerengineering.com

Turkey

Address:
Banner Engineering Turkey
Barbaros Mah. Uphill Court Towers A Blok D:49
34746 Batı Ataşehir İstanbul Türkiye

Phone: +90 216 688 8282
Website: www.bannerengineering.com.tr
Email: turkey@bannerengineering.com.tr

India

Address:
Banner Engineering India Pune Head Quarters
Office No. 1001, 10th Floor Sai Capital, Opp. ICC Senapati Bapat Road
Pune 411016, India

Phone: +91 (0) 206 640 5624
Website: www.bannerengineering.co.in
Email: salesindia@bannerengineering.com

Mexico

Address:
Banner Engineering de Mexico Monterrey Head Office
Edificio VAO Av. David Alfaro Siqueiros No.103 Col. Valle Oriente C.P.66269
San Pedro Garza Garcia, Nuevo Leon, Mexico

Phone: +52 81 8363 2714 or 01 800 BANNERE (toll free)
Website: www.bannerengineering.com.mx
Email: mexico@bannerengineering.com

Brazil

Address:
Banner do Brasil
Rua Barão de Teffé nº 1000, sala 54
Campos Eliseos, Jundiaí - SP, CEP.: 13208-761, Brasil

Phone: +1 763 544 3164
Website: www.bannerengineering.com.br
Email: brasil@bannerengineering.com

China

Address:
Banner Engineering Shanghai Rep Office
Xinlian Scientific Research Building Level 12, Building 2
1535 Hongmei Road, Shanghai 200233, China

Phone: +86 212 422 6888
Website: www.bannerengineering.com.cn
Email: sensors@bannerengineering.com.cn

Japan

Address:
Banner Engineering Japan
Cent-Urban Building 305 3-23-15 Nishi-Nakajima Yodogawa-Ku
Osaka 532-0011, Japan

Phone: +81 (0)6 6309 0411
Website: www.bannerengineering.co.jp
Email: mail@bannerengineering.co.jp

Taiwan

Address:
Banner Engineering Taiwan
8F-2, No. 308 Section 1, Neihu Road
Taipei 114, Taiwan

Phone: +886 (0)2 8751 9966
Website: www.bannerengineering.com.tw
Email: info@bannerengineering.com.tw