



Features

- Extremely long range: 5 m with white targets, or 3 m with gray targets for diffuse mode sensors, up to 50 m for retroreflective models
- Two discrete (switched) outputs in each sensor, with independent window limits[†]
- Discrete outputs can be used for precision background suppression
- Output select wire is used to choose either NPN or PNP outputs (see hookups)
- Fast, easy-to-use integrated push-button TEACH-mode programming; no potentiometer adjustments
- Remote TEACH function for security and convenience
- Output response is programmable for three speeds
- High-grade retroreflective target included with each retroreflective-mode sensor
- Choose 2 m or 9 m unterminated cable, or 8-pin Euro-style swivel QD connector
- Rugged construction withstands demanding sensing environments; rated IEC IP67, NEMA 6

Models

Models	Sensing Mode	Laser Class	Sensing Distance	Cable*	Supply Voltage	Discrete Output
LT3BD	Diffuse	Class 2	0.3 to 5 m (11.8" to 16.4')	2 m (6.5') 8-wire	12 to 24V dc	NPN or PNP Selectable
LT3BDQ				8-pin Euro-style QD		
LT3BDLV	Retro-reflective	Class 1	0.5 to 50 m** (20" to 164')	2 m (6.5') 8-wire		
LT3BDLVQ				8-pin Euro-style QD		

* 9 m cables are available by adding suffix "**W/30**" to the model number of any cabled sensor (e.g., **LT3BD W/30**). A model with a QD connector requires a mating cable; see page 11.

** Retroreflective range specified using included model BRT-TVHG-8X10P high-grade target.

[†]NOTE: See Banner website for information on analog/discrete models at: bannerengineering.com



WARNING . . .

Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.



CAUTION . . . This sensor contains no user-serviceable components. Do not attempt to repair.

Incorrect component values may produce hazardous laser radiation levels.

L-GAGE[®] LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Theory of Operation

A short electrical pulse drives a semiconductor laser diode to emit a pulse of light. The emitted light is collimated through a lens, which produces a very narrow laser beam. The laser beam bounces off the target, scattering some of its light through the sensor's receiving lens to a photodiode, which creates an electrical pulse. The time interval between the two electrical pulses (transmitting and receiving the beam) is used to calculate the distance to the target, using the speed of light as a constant.

Multiple pulses are evaluated by the sensor's microprocessor, which calculates the appropriate position value. The discrete (switched) output energizes whenever the target is located between the user-programmed discrete window limits. Window limits for both discrete outputs may be the same, or they may be programmed independently.

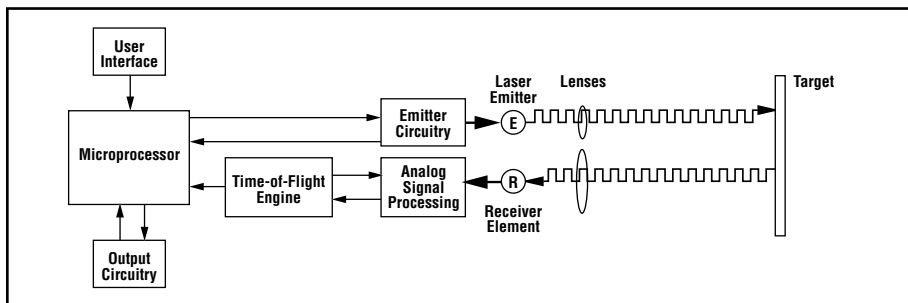


Figure 1. Theory of operation

Programming

Response Speed

Prior to setting window limits, use the sensor's Speed push button to toggle between the three response speed settings. The selected speed will be indicated by one of the three Response Speed indicator LEDs (see Figure 2). See Specifications for further information.

Sensor Setup

Allow 30 minutes after power-up to allow the sensor's internal temperature to stabilize, before operating or attempting to program the sensor. If the sensor will be used in applications where the temperature is several degrees higher or lower than ambient, allow the sensor to stabilize in that condition before programming the window limits. (Range will decrease as the sensor warms up.)

The laser enable feature allows the sensor to be continually powered, and enabled only when being used. This eliminates the need for the extended warm-up period between uses.

The sensor's red Signal LED indicates the condition of the received signal from the object being measured. When programming window limits, this LED must be ON solid (not flashing) for the sensor to accept the setting. On diffuse-mode models, to ensure that the received signal will not be marginal during operation, move the target object 300 mm beyond the furthest desired set point during setup, and verify that the signal LED is still ON solid.

Window Limits

Window limits may be taught to the sensor in several ways. The following methods (beginning on page 4) describe the programming procedures using the push buttons on the top of the sensor or via remote programming (remote TEACH).

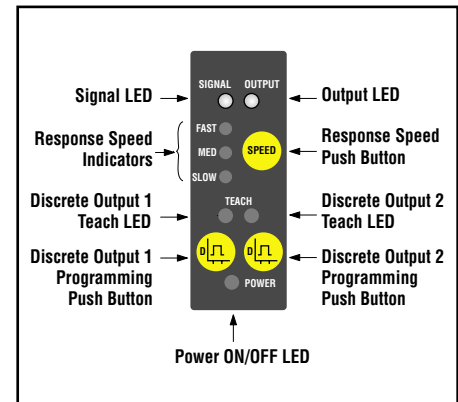


Figure 2. Sensor features

L-GAGE[®] LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Class 2 Safety Notes

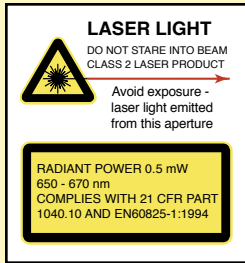
Low-power lasers are by definition incapable of causing eye injury within the duration of the blink, or aversion response, of 0.25 seconds. They must also emit only visible wavelengths (400-700 nm). Therefore, an eye hazard can exist only if an individual overcomes the natural aversion to bright light and stares directly into the laser beam. These lasers are required to have a “hazard” label and to have an indicator light to indicate that laser emission is occurring.

When operating a class 2 laser:

- Do not permit a person to stare directly into the beam
- Do not point the laser at a person’s eye at close range

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.



Push-Button Programming

Both outputs may be taught simultaneously, when complementary operation is required (while one output is conducting, the other is not). When taught separately, each output may be taught different limits (one output may be taught a window, and the other may be programmed for background suppression, for example).

Remote Programming

To program the sensor remotely or to disable the keypad, the Remote Programming function may be used. Disabling the keypad prevents accidental or unauthorized adjustment of any programming settings. Connect the yellow wire of the sensor to +5 to 24V dc, with a remote programming switch connected between them.

NOTE: The impedance of the remote teach input is 55 kΩ.

Programming is accomplished by following a sequence of input pulses (see pages 4 and 5). The duration of each pulse (corresponding to a push button “click”), and the period between multiple pulses, are defined as “T”: 0.04 seconds < T < 0.8 seconds.

Teaching Discrete Limits for Background Suppression

For some applications, ignoring objects beyond a certain distance may be required. To suppress the background, place a target object at the selected distance, and teach the position twice. The sensor’s discrete output will activate when an object is detected between the sensor’s minimum sensing distance and the taught position.

NOTE: The sensor allows for some forgiveness in this procedure. If the two limits are not exactly the same (but less than 20 mm apart), the sensor will put the set point at the “average” of the two limits.

Output 1 and Output 2 may be taught independent limits for background suppression (see Figure 3).

To set both outputs at exactly the same limits, set them simultaneously. This will result in complementary outputs (while one output is conducting, the other is not; see Figure 4). Hysteresis will be controlled by Output 1 and Output 2 will follow.

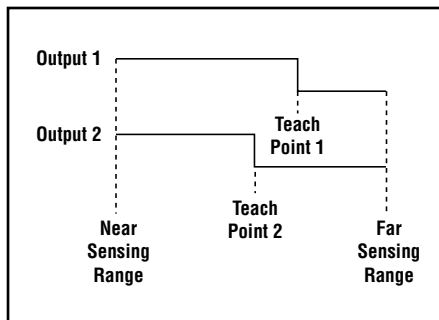


Figure 3. Each output has its own limit for background suppression

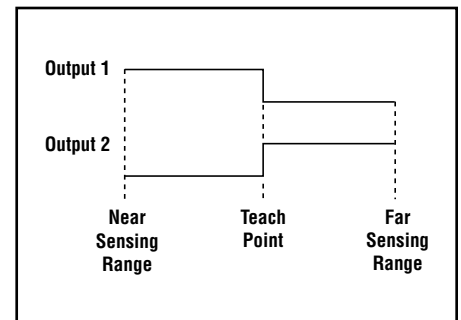


Figure 4. The two outputs share identical limits for background suppression, but are complementary

L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Teaching Independent Limits for Either Output

Either output may be programmed first.

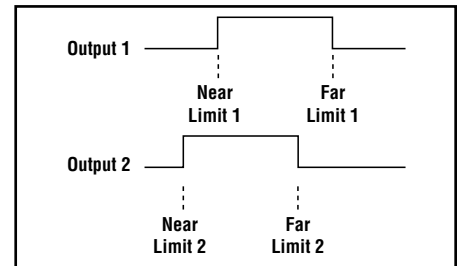


Figure 5. Each output has its own near and far limits

	Push Button 0.04 sec. ≤ “click” ≤ 0.8 sec.		Remote Wire 0.04 sec. ≤ T ≤ 0.8 sec.			
	Procedure	Result	Procedure	Result		
Programming Mode	<ul style="list-style-type: none"> Push and hold push button for desired output > 2 seconds* 	<ul style="list-style-type: none"> Appropriate TEACH LED turns ON Sensor is waiting for first limit 	No action required			
Teach First Limit	<ul style="list-style-type: none"> Position the target for the first limit** “Click” the same push button 	<ul style="list-style-type: none"> TEACH LED flashes Sensor learns first limit and waits for second limit 	<ul style="list-style-type: none"> Position the target for the first limit** <table border="1"> <tr> <td> Output 1 <ul style="list-style-type: none"> Single-pulse the remote line </td> <td> Output 2 <ul style="list-style-type: none"> Double-pulse the remote line </td> </tr> </table>	Output 1 <ul style="list-style-type: none"> Single-pulse the remote line 	Output 2 <ul style="list-style-type: none"> Double-pulse the remote line 	<ul style="list-style-type: none"> Appropriate TEACH LED turns ON, then flashes at 2 Hz Sensor learns first limit and waits for second limit
Output 1 <ul style="list-style-type: none"> Single-pulse the remote line 	Output 2 <ul style="list-style-type: none"> Double-pulse the remote line 					
Teach Second Limit	<ul style="list-style-type: none"> Position the target for the second limit “Click” the same push button 	<ul style="list-style-type: none"> TEACH LED goes OFF Sensor learns second limit and returns automatically to RUN mode 	<ul style="list-style-type: none"> Position the target for the second limit Single-pulse the remote line 	<ul style="list-style-type: none"> Appropriate TEACH LED goes OFF Sensor learns second limit and returns automatically to RUN mode 		
Program Second Output	Repeat for other output, if a second output is desired.					

* Sensor will return to RUN mode if first TEACH condition is not registered within 120 seconds.

** Press and hold the same push button (or hold the remote line high) > 2 seconds (before teaching the second limit) to exit PROGRAM mode without saving any changes. The sensor will revert to the last saved program.

L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Teaching Identical Limits for Both Outputs Simultaneously

To set both outputs at exactly the same limits, they may be set simultaneously. This will result in complementary outputs (while one output is conducting, the other is not). Hysteresis will be controlled by Output 1 and Output 2 will follow.

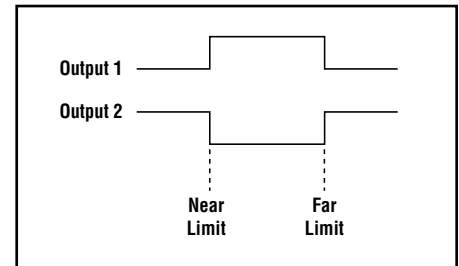


Figure 6. Both outputs have identical limits, but are complementary

	Push Button 0.04 ≤ “click” ≤ 0.8 sec.		Remote Wire 0.04 sec. ≤ T ≤ 0.8 sec.	
	Procedure	Result	Procedure	Result
Programming Mode	<ul style="list-style-type: none"> Push and hold either push button for > 2 seconds* 	<ul style="list-style-type: none"> Corresponding TEACH LED turns ON 	No action required	
	<ul style="list-style-type: none"> Briefly “click” the other button 	<ul style="list-style-type: none"> Corresponding TEACH LED turns ON Sensor is waiting for first limit 		
Teach First Limit	<ul style="list-style-type: none"> Position the target for the first limit** “Click” either push button 	<ul style="list-style-type: none"> Both TEACH LEDs flash at 2 Hz, alternating Red and Green Sensor learns first limit and waits for second limit 	<ul style="list-style-type: none"> Position the target for the first limit** Triple-pulse the remote line 	<ul style="list-style-type: none"> Both TEACH LEDs turn ON Sensor learns first limit and waits for second limit Both TEACH LEDs flash at 2 Hz, alternating Red and Green
Teach Second Limit	<ul style="list-style-type: none"> Position the target for the second limit “Click” either push button 	<ul style="list-style-type: none"> Both TEACH LEDs go OFF Sensor learns second limit and returns automatically to RUN mode 	<ul style="list-style-type: none"> Position the target for the second limit Single-pulse the remote line 	<ul style="list-style-type: none"> Both TEACH LEDs go OFF Sensor learns second limit and returns automatically to RUN mode

* Sensor will return to RUN mode if first TEACH condition is not registered within 120 seconds.

** Press and hold the same push button (or hold the remote line high) > 2 seconds (before teaching the second limit) to exit PROGRAM mode without saving any changes. The sensor will revert to the last saved program.

L-GAGE[®] LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Sensor Setup


Response Speed

Use the Speed push button to toggle between the three response speed settings. The selected speed is indicated by one of three Response Speed indicator LEDs (see Figure 2).

Discrete Output Response Speed	
Slow	100 ms ON and OFF
Medium	10 ms ON and OFF
Fast	1 ms ON and OFF

Push Button Lockout

Enables or disables the keypad to prevent accidental or unauthorized adjustment of the programming settings.

	Procedure		Result
	Push Button	Remote Wire $0.04 \text{ sec.} \leq T \leq 0.8 \text{ sec.}$	
Enable/Disable Push Buttons	<ul style="list-style-type: none"> Not available via push button 	<ul style="list-style-type: none"> Four-pulse the remote line 	<ul style="list-style-type: none"> Push buttons are either enabled or disabled, depending on previous condition

L-GAGE[®] LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Selected Response Speed	Laser Enable Time
Slow	150 ms
Medium	60 ms
Fast	51 ms

Indicators

Power Up/Laser Enable Indicators

When powering up the sensor, the following should occur:

- All LEDs turn ON for 1 second
- Allow 0.6 second delay for Laser Enable at power up. If sensor is already powered up, see table at left for Laser Enable time. Laser Disable time for all speeds is 50 ms.

Signal LED (red) – indicates the strength and condition of the sensor's incoming signal.

Signal LED Status	Indicates
ON	Good signal
OFF	No signal is received, or the target is beyond the range limitations of the sensor (with some tolerance beyond the recommended minimum and maximum sensing distance)
Flashing	Marginal signal strength (can not teach limits)

Output LED (yellow) – lights when a target is sensed within the programmed discrete window limits.

Power ON/OFF LED (green) – indicates the operating status of the sensor.

Power ON/OFF LED Status	Indicates
OFF	Power is OFF
Flashing @ 2Hz	Discrete output is overloaded (RUN mode)
Flashing @ 1Hz	Power ON, Laser is disabled
ON Solid	Sensor is operating normally (power ON, Laser enabled)


L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Specifications

Specifications			
Sensing Range	<u>Diffuse Mode</u>		<u>Retroreflective Mode</u>
	90% White card: 0.3 to 5 m	18% Gray card: 0.3 to 3 m	6% Black card: 0.3 to 2 m
			0.5 to 50 m (using supplied target)
Supply Voltage and Current	12 to 24V dc (10% maximum ripple); 108 mA max. @ 24V dc or [2600/V dc] mA		
Supply Protection Circuitry	Protected against reverse polarity and transient voltages		
Delay at Power-up	1 second; outputs do not conduct during this time		
Sensing Beam	Typical beam dia: 6 mm @ 3 m Typical laser lifetime: 75,000 hours Diffuse: 658 nm visible red IEC and CDRH Class 2 laser; 0.5 mW max. radiant output power. Retroreflective Mode: 658 nm visible red IEC and CDRH Class 1 laser; 0.15 mW max. radiant output power.		
Output Protection	Protected against short circuit conditions		
Output Configuration	SPST solid-state switch; selectable NPN (current sinking) or PNP (current sourcing)		
Output Rating	100 mA maximum Off-state leakage current: < 5 µA Output saturation NPN: < 200 mV @ 10 mA and < 600 mV @ 100 mA Output saturation PNP: < 1.2V @ 10 mA and < 1.6V @ 100 mA		
Output Response Time	Fast: 1 ms ON and OFF Medium: 10 ms ON and OFF Slow: 100 ms ON and OFF		
Repeatability	See Figures 7 and 9.		
Color Sensitivity (Diffuse Models)	90% white to 18% gray: <10 mm; 90% white to 6% black: < 20 mm. See Figure 8.		
Discrete Output Hysteresis	<u>Diffuse Mode</u> Fast: 10 mm Medium: 5 mm Slow: 3 mm	<u>Retroreflective Mode</u> Fast: 20 mm Medium: 10 mm Slow: 6 mm	
Temperature Drift	Diffuse Mode: < 2 mm / °C	Retroreflective Mode: < 3 mm/°C	
Minimum Window Size	Diffuse Mode: 20 mm	Retroreflective mode: 40 mm	
Remote Teach Input	18 kΩ minimum (65 kΩ at 5V dc)		
Remote TEACH	To teach: Connect yellow wire to +5 to 24V dc To disable: Connect yellow wire to 0 to +2V dc (or open connection) See Remote Programming on pages 3 - 5.		
Adjustments	Response speed: Push button toggles between 3 response speeds Window limits: TEACH-mode programming of near and far window limits (see programming procedure). Limits may also be taught remotely via TEACH input (see page 4). NPN/PNP Select: See hookups, page 10 Factory defaults: 150 ms response speed Window limits 0.3 m - 5 m using a 90% reflectivity white card Push buttons enabled		
Laser Control	To enable laser beam: Connect red wire to +5 to 24V dc. See page 7 for delay times on enable. To disable: Connect to 0 to +1.8V dc (or open connection)		
Indicators	Green Power ON LED: Indicates when power is ON, overloaded output and laser status Yellow Output LED: Indicates when discrete load output is conducting Red Signal LED: Indicates target is within sensing range and the condition of the received light signal Yellow Speed LED: Indicates the response speed setting Yellow TEACH LEDs: In programming mode, indicate active output(s) NOTE: See page 7 for more information on indicator behavior.		

L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Specifications, cont'd

Construction	Housing: ABS Window: Acrylic Quick-disconnect: ABS/polycarbonate blend
Environmental Rating	IP67, NEMA 6
Connections	2 m (6.5') or 9 m (30') shielded 7-conductor (with drain) PVC-jacketed attached cable or 8-pin Euro-style quick-disconnect
Operating Conditions	Temperature: 0° to +50°C (+32° to +122°F) Maximum Relative Humidity: 90% at 50°C (non-condensing)
Application Notes	<ul style="list-style-type: none"> • Allow 30-minute warm-up before programming or operating (see Sensor Setup, page 2). • Retroreflective performance specifications are based on use with BRT-TVHG-8X10P high-grade target. Results may vary with other retroreflective target materials.
Certifications	

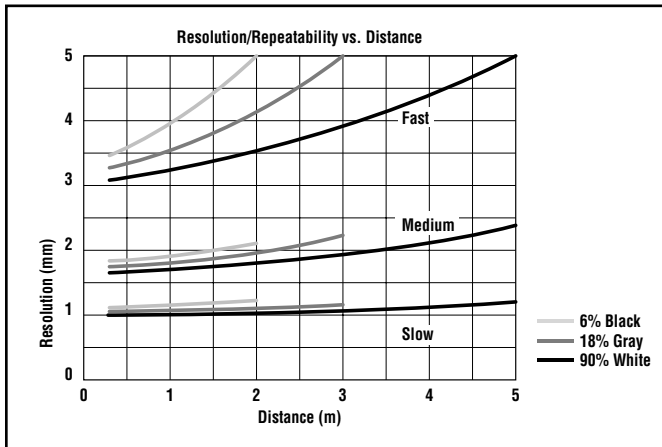


Figure 7. LT3 repeatability (diffuse mode)

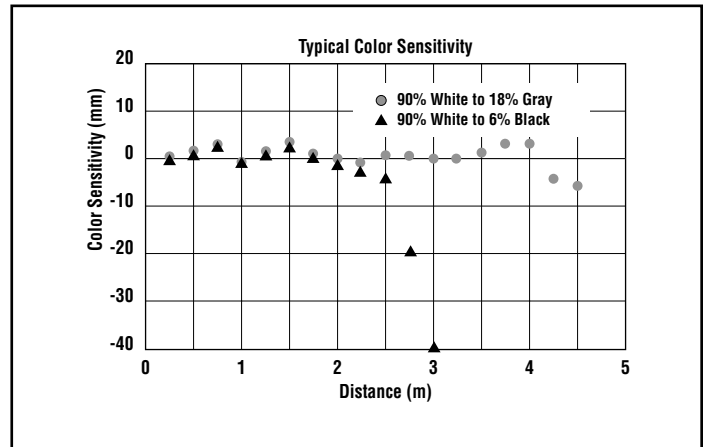


Figure 8. LT3 color sensitivity (typical; diffuse mode)

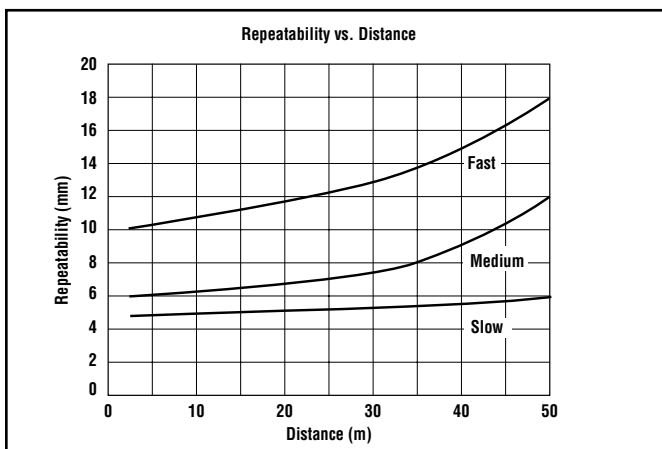


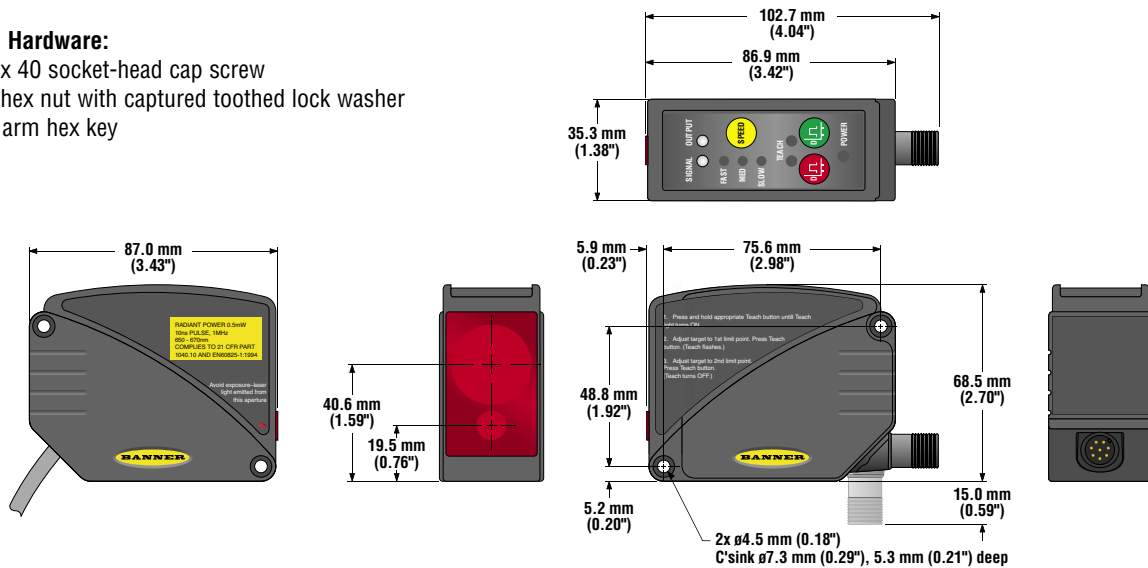
Figure 9. LT3 repeatability (retroreflective mode)

L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Dimensions

Mounting Hardware:

- M4 x 0.7 x 40 socket-head cap screw
- M4 x 0.7 hex nut with captured toothed lock washer
- M3 short arm hex key

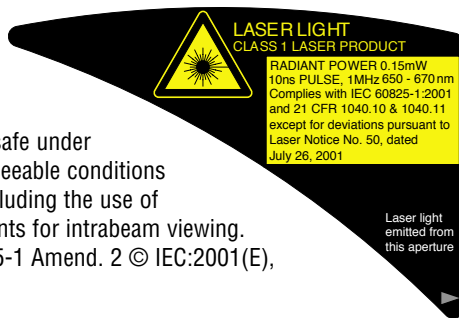


Description of Laser Classes

Class 1 Label (Retroreflective-Mode Models)

Class 1

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.



Class 2 Label (Diffuse-Mode Models)

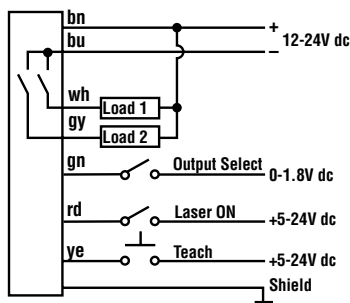
Class 2

Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

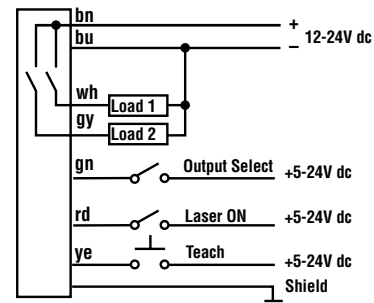


Hookups

NPN Hookup



PNP Hookup



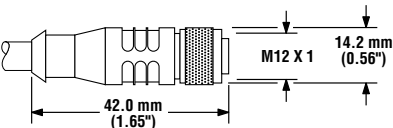
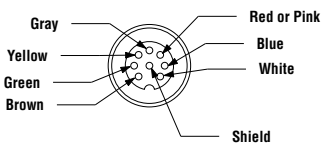
NOTE: Hookups for QD models are functionally identical.

L-GAGE® LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Accessories

Euro-Style Quick-Disconnect Cables

Cable: PVC jacket, polyurethane connector body, chrome-plated brass coupling nut
Conductors: 24 AWG high-flex stranded, PVC insulation, gold-plated contacts
Temperature: -40° to +105°C (-40° to +221°F)
Voltage Rating: 30V ac/36V dc

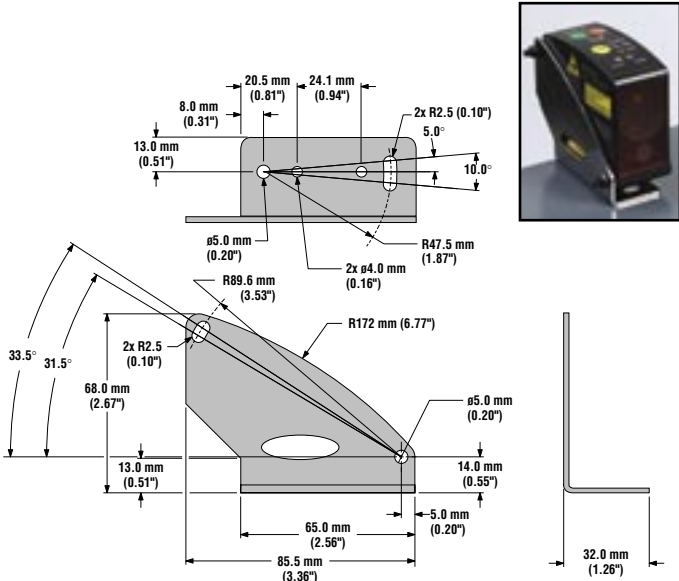
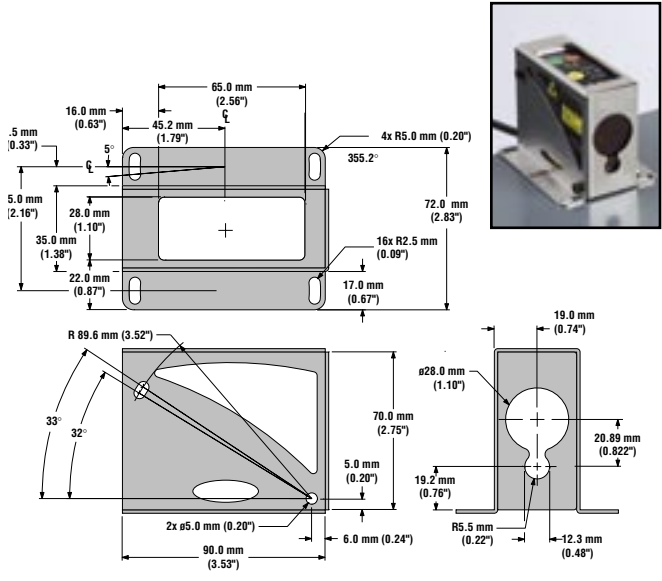
Style	Model	Length	Connector	Pin-Out (Female View)
8-Pin Euro Straight	MQDC-806 MQDC-815 MQDC-830	2 m (6.5') 5 m (15') 9 m (30')		

Retroreflective Tape

Model	Size
BRT-TVHG-8X10P	203 x 254 mm (8" x 10")

NOTE: Retroreflective material has a pressure-sensitive adhesive. For maximum adhesion, surfaces must be clean and dry before applying. For best results, use full-size; target may be trimmed as necessary.

Accessory Mounting Brackets

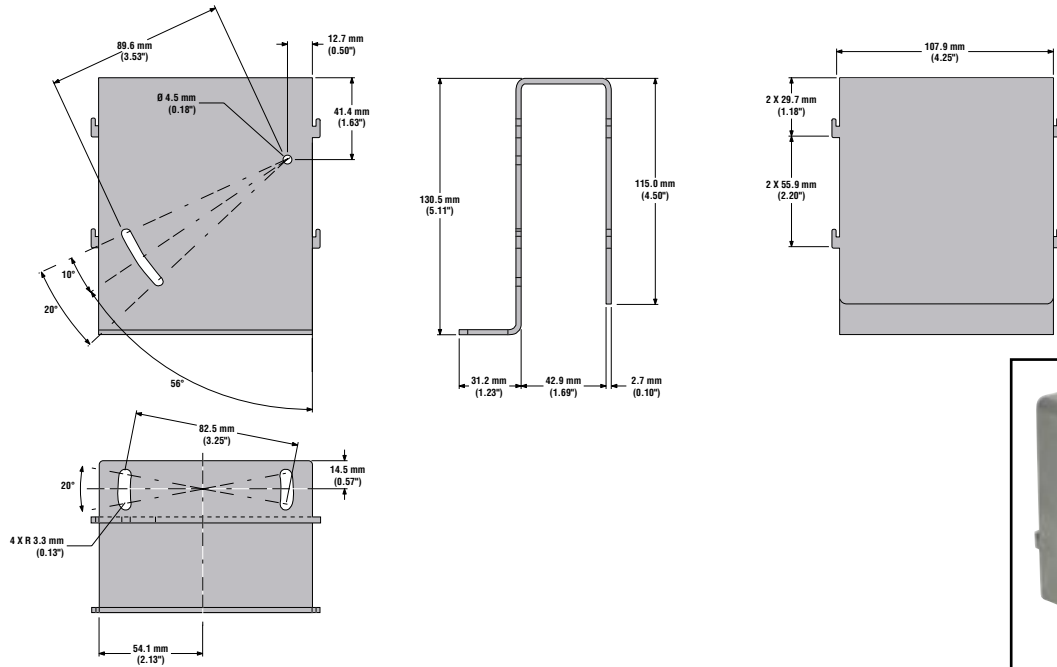
SMBLT31	<ul style="list-style-type: none"> • Right-angle bracket • 300 series stainless steel 	SMBLT32	<ul style="list-style-type: none"> • Full bracket • 304 series stainless steel • Mounting hardware included
			

L-GAGE[®] LT3 Long-Range Time-of-Flight Sensor – Two Discrete Outputs

Accessory Mounting Brackets, continued

SMBLT3IP

- Replaceable windows for welding environments
- Stainless steel construction
- Includes 2 weld-resistant windows



WARRANTY: Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.