L-GAGE® LE250 Laser Gauging Sensors

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Quick Start Guide

Class 2 visible laser displacement sensor with both analog and discrete (switched) outputs

This guide is designed to help you set up and install the L-GAGE® LE Laser Gauging Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at *www.bannerengineering.com*. Search for p/n 179867 to view the manual. Use of this document assumes familiarity with pertinent industry standards and practices.

> ⚠ 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.
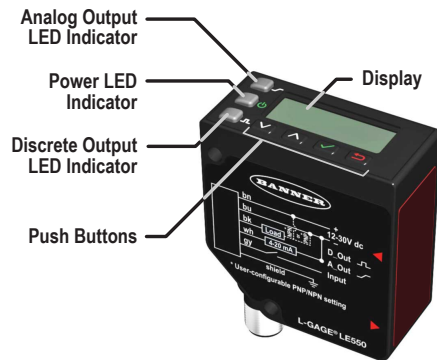
Features and Indicators

Figure 1. LE Sensor Features

Three LED indicators provide ongoing indication of the sensing status.

Analog Output LED Indicator

Solid Amber = Displayed distance is within the taught analog output window
Off = Displayed distance is outside the taught analog output window

Power LED Indicator

Solid Green = Normal operation, power On and laser On
Flashing Green (1 Hz) = Power On and laser Off (laser enable mode)

Discrete Output LED Indicator

Solid Amber = Discrete Output is On
Off = Discrete Output is Off

Laser Description and Safety Information

⚠ For Safe Laser Use - Class 2 Lasers
- Do not stare at the laser.
- Do not point the laser at a person's eye.
- Mount open laser beam paths either above or below eye level, where practical.
- Terminate the beam emitted by the laser product at the end of its useful path.

Reference IEC 60825-1:2001, Section 8.2.

> ⚠ CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

> ⚠ CAUTION: Never stare directly into the sensor lens. Laser light can damage your eyes. Avoid placing any mirror-like object in the beam. Never use a mirror as a retroreflective target.

Class 2 Lasers

Class 2 lasers are 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.

Class 2 Laser Safety Notes

Low-power lasers are, by definition, incapable of causing eye injury within the duration of a blink (aversion response) of 0.25 seconds. They also must emit only visible wavelengths (400 to 700 nm). Therefore, an ocular hazard may exist only if individuals overcome their natural aversion to bright light and stare directly into the laser beam.

LASER LIGHT
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT

Avoid exposure - laser light emitted from this aperture

LASER LIGHT
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
Acc to IEC 60825-1:2007.
Wavelength 635-680nm; 1.0mW max. Output
Complies with 21 CFR 1040.10 and 1040.11
except for deviations pursuant to
Laser Notice No. 50, dated June 24, 2007.

Figure 2. FDA (CDRH) warning label (Class II)

Sensor Installation

NOTE: Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. may create stray light that may degrade the peak performance of the sensor. Blow the window clear using filtered, compressed air, then clean as necessary using 70% isopropyl alcohol and cotton swabs or water and a soft cloth.

Sensor Orientation

Correct sensor-to-object orientation is important to ensure proper sensing. See the following figures for examples of correct and incorrect sensor-to-object orientation as certain placements may pose problems for sensing distances.
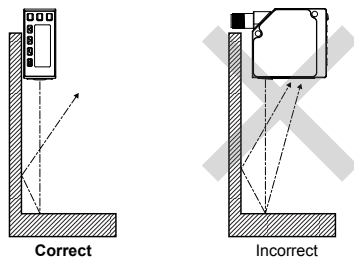

Correct   Incorrect

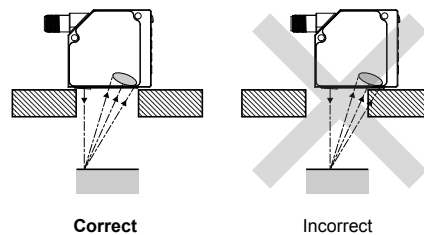*Figure 3. Orientation by a wall*

Correct   Incorrect

Figure 4. Orientation in an opening

Correct   Incorrect
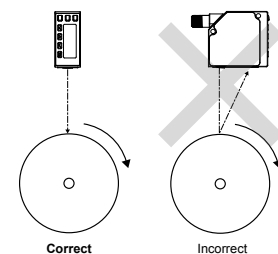
Figure 5. Orientation for a turning object

Correct   Incorrect
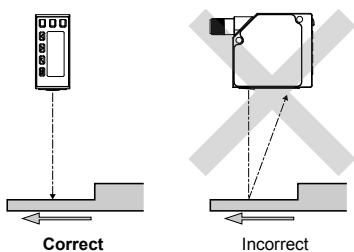
Figure 6. Orientation for a height difference

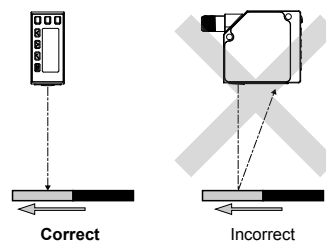**Correct**   Incorrect

Figure 7. Orientation for a color or luster difference

Sensor Mounting

1. If a bracket is needed, mount the sensor onto the bracket.
2. Mount the sensor (or the sensor and the bracket) to the machine or equipment at the desired location. Do not tighten at this time.
3. Check the sensor alignment.
4. Tighten the screws to secure the sensor (or the sensor and the bracket) in the aligned position.
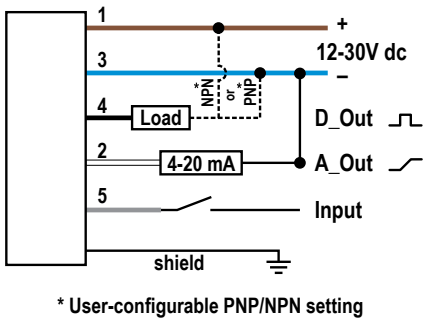
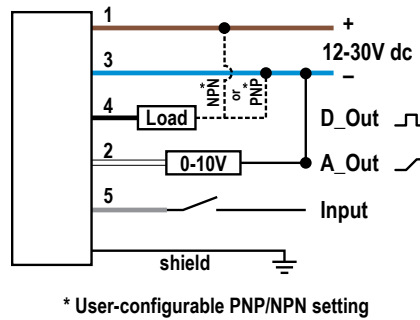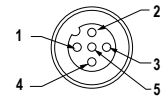## Wiring Diagrams

Figure 8. Analog Current Model

Figure 9. Analog Voltage Model

Key

1 = Brown
2 = White
3 = Blue
4 = Black
5 = Gray

Display

Figure 10. Display in Run Mode

The display is a 2-line, 8-character LCD. The main screen is the Run mode screen, which shows the real-time distance measurement and the analog output measurement.

Buttons

Use the sensor buttons Down, Up, Enter, and Escape to program the sensor and to access sensor information.

Down and Up Buttons

Press Down and Up to:
- Access the Quick Menu from Run mode
- Navigate the menu systems
- Change programming settings

When navigating the menu systems, the menu items loop.

Press Down and Up to change setting values. Press and hold the buttons to cycle through numeric values. After changing a setting value, it slowly flashes until the change is saved using the Enter button.

✅ Enter Button

Press Enter to:
- Access the Sensor Menu from Run mode
- Access the submenus
- Save changes

In the Sensor Menu, a check mark ✓ in the lower right corner of the display indicates that pressing Enter accesses a submenu.

Press Enter to save changes. New values flash rapidly and the sensor returns to the parent menu.

⮌ Escape Button

Press Escape to:
- Leave the current menu and return to the parent menu
- Return to Run mode from the Quick Menu

👉 Important: Pressing Escape discards any unsaved programming changes.

In the Sensor Menu, a return arrow ⮌ in the upper left corner of the display indicates that pressing Escape returns to the parent menu.

Press and hold Escape for 2 seconds to return to Run mode from any menu or remote teach.

Sensor Programming

Program the sensor using the buttons on the sensor or the remote input (limited programming options).

From Run mode, use the buttons to access the Quick Menu and the Sensor Menu. See *Quick Menu* on page 5, *Sensor Menu (MENU)* on page 6, and the L-GAGE® LE Laser Gauging Sensor Manual (p/n 179867) for more information on the options available from each menu. For TEACH options, follow the TEACH instructions in the Manual.

In addition to programming the sensor, use the remote input to disable the buttons for security, preventing unauthorized or accidental programming changes. See the Manual for more information.
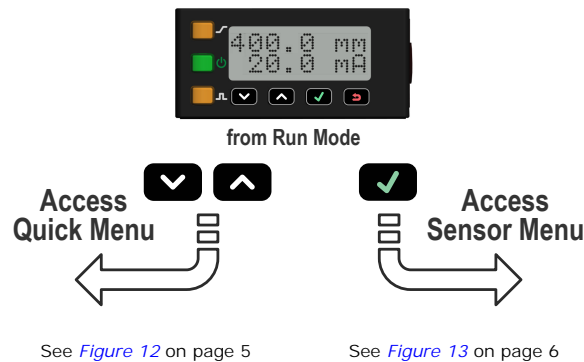

Figure 11. Accessing the Menus

Quick Menu

The sensor includes a Quick Menu with easy access to view and change the analog and discrete output setpoints. Access the Quick Menu by pressing Down ⌄ or Up ⌃ from Run mode. When in the Quick Menu, the current distance measurement displays on the first line and the menu name and the analog value alternate on the second line of the display. Press Enter ✓ to access the setpoints. Press Down ⌄ or Up ⌃ to change the setpoint to the desired value. Press Enter ✓ to save the new value and return to the Quick Menu.
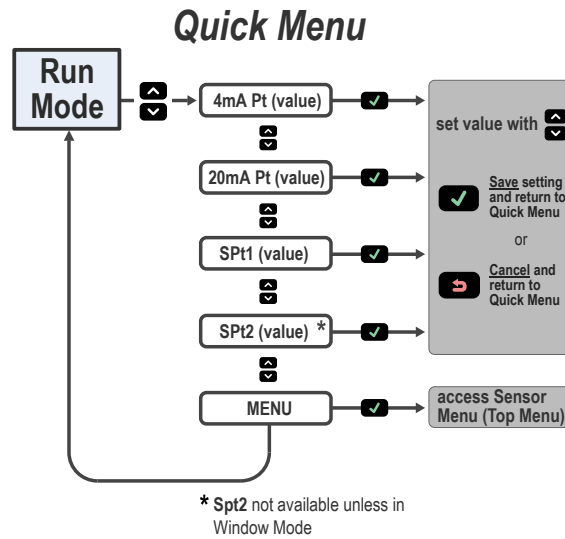
Figure 12. Quick Menu Map (Window Mode)

Sensor Menu (MENU)

Access the Sensor Menu by pressing Enter ✅ from Run mode. The Sensor Menu is also accessible from the Quick Menu: navigate to MENU and press Enter ✅. The Sensor Menu includes several submenus that provide access to view and change sensor settings and to view sensor information.

Figure 13. Sensor Menu Map

Top Menu

Run Mode — Enter ✅ Top Menu → MENU A_OUT

Enter Quick Menu Loop (see Quick Menu diagram)

Sub Menus

MENU A_OUT ✅
- A_OUT Tch2pt ✅
  - Tch2Pt Tch4mA — Tch4mA 100.0 mm
  - Tch2Pt Tch20mA — Tch20mA 400.0 mm
- A_OUT TchMid
  - TchMid WndSize — WndSize 50.0 mm
  - TchMid Tch12mA — Tch12mA 250.0 mm
- A_OUT Adj4mA — Adj4mA 100 mm
- A_OUT Adj20mA — Adj20mA 400 mm
- A_OUT Slope
  - Slope Positive *
  - Slope Negative
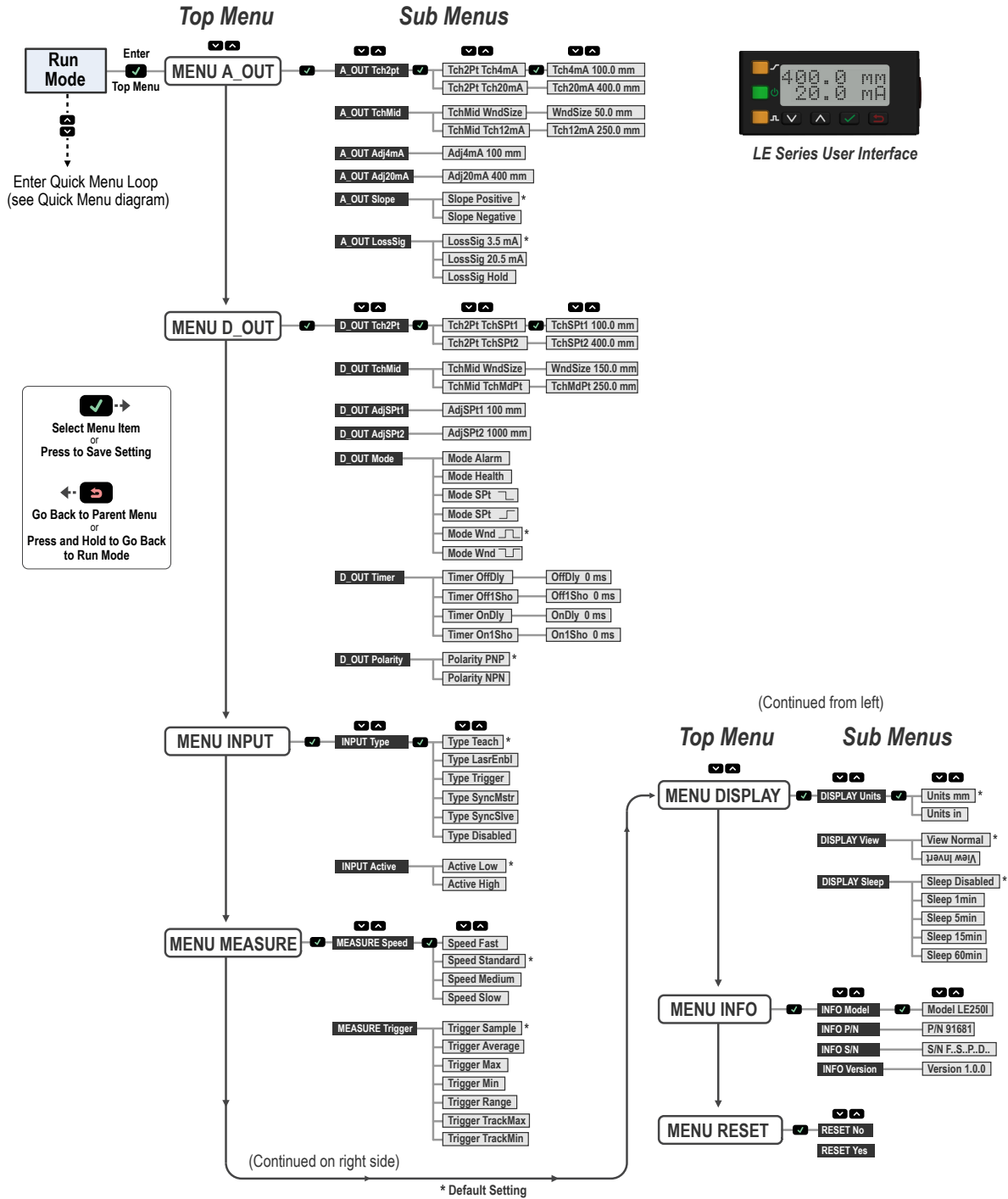- A_OUT LossSig
  - LossSig 3.5 mA *
  - LossSig 20.5 mA
  - LossSig Hold

MENU D_OUT ✅
- D_OUT Tch2Pt ✅
  - Tch2Pt TchSPt1 ✅ — TchSPt1 100.0 mm
  - Tch2Pt TchSPt2 — TchSPt2 400.0 mm
- D_OUT TchMid
  - TchMid WndSize — WndSize 150.0 mm
  - TchMid TchMdPt — TchMdPt 250.0 mm
- D_OUT AdjSPt1 — AdjSPt1 100 mm
- D_OUT AdjSPt2 — AdjSPt2 1000 mm
- D_OUT Mode
  - Mode Alarm
  - Mode Health
  - Mode SPt ⌐
  - Mode SPt _⌐
  - Mode Wnd _⌐_ *
  - Mode Wnd ⌐‾
- D_OUT Timer
  - Timer OffDly — OffDly 0 ms
  - Timer Off1Sho — Off1Sho 0 ms
  - Timer OnDly — OnDly 0 ms
  - Timer On1Sho — On1Sho 0 ms
- D_OUT Polarity
  - Polarity PNP *
  - Polarity NPN

✅ ⟶ Select Menu Item or Press to Save Setting

⟵ 🔙 Go Back to Parent Menu or Press and Hold to Go Back to Run Mode

MENU INPUT ✅
- INPUT Type ✅
  - Type Teach *
  - Type LasrEnbl
  - Type Trigger
  - Type SyncMstr
  - Type SyncSlve
  - Type Disabled
- INPUT Active
  - Active Low *
  - Active High

MENU MEASURE ✅
- MEASURE Speed ✅
  - Speed Fast
  - Speed Standard *
  - Speed Medium
  - Speed Slow
- MEASURE Trigger
  - Trigger Sample *
  - Trigger Average
  - Trigger Max
  - Trigger Min
  - Trigger Range
  - Trigger TrackMax
  - Trigger TrackMin

(Continued on right side)

(Continued from left)

Top Menu   **Sub Menus**

MENU DISPLAY ✅
- DISPLAY Units ✅
  - Units mm *
  - Units in
- DISPLAY View
  - View Normal *
  - View Invert
- DISPLAY Sleep
  - Sleep Disabled *
  - Sleep 1min
  - Sleep 5min
  - Sleep 15min
  - Sleep 60min

MENU INFO ✅
- INFO Model ✅ — Model LE250I
- INFO P/N — P/N 91681
- INFO S/N — S/N F..S..P.D..
- INFO Version — Version 1.0.0

MENU RESET ✅
- RESET No
- RESET Yes

* Default Setting

LE Series User Interface

400.0 mm
20.0 mA

Specifications

Sensing Beam
Visible red Class 2 laser, 650 nm

Supply Voltage (Vcc)
12 to 30 V dc

Power and Current Consumption, exclusive of load
Normal Run Mode: 1.7 W, Current consumption < 70 mA at 24 V dc

Sensing Range
100.0 mm (3.94") to 400.0 mm (15.75")

Output Configuration
Analog output: 4 to 20 mA or 0 to 10 V, depending on model
Discrete output rating: Discrete NPN/PNP is user-configurable

Output Ratings
Discrete Output: 100 mA maximum (protected against continuous overload and short circuit)
OFF-state leakage current—PNP: < 10 µA at 30 V
OFF-state leakage current—NPN: < 200 µA at 30 V
Output saturation voltage—PNP outputs: < 3 V at 100 mA
Output saturation voltage—NPN outputs: < 1.6 V at 100 mA
Analog current output (LE...I Models):1 kΩ max. @ 24 V; max. load resistance = [Vcc-4.5/0.02 Ω]
Analog voltage output (LE...U Models): 2.5 kΩ min. load resistance

Remote Input
Allowable Input Voltage Range: 0 to Vcc
Active Low (internal weak pullup—sinking current):
· High State > 4.3 V at 740 µA max.
· Low State < 1.3 V at 800 µA max.
Active High (internal weak pulldown—sourcing current):
· High State > 4.3 V at 1.7 mA max.
· Low State < 1.3 V at 1.6 mA max.

Supply Protection Circuitry
Protected against reverse polarity and transient over-voltages
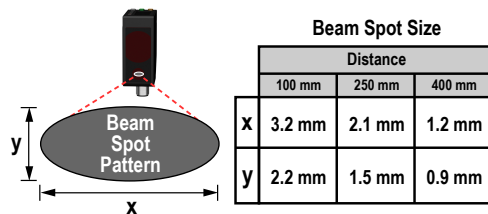
Analog Resolution
100 mm to 250 mm: Less than 0.02 mm
250 mm to 400 mm: Less than 0.2 mm

Measurement/Output Rate
< 1 ms

Typical Beam Spot Size

Beam Spot Size

	Distance		
	100 mm	250 mm	400 mm
x	3.2 mm	2.1 mm	1.2 mm
y	2.2 mm	1.5 mm	0.9 mm

Beam spot size is calculated as 1.6 times the D4σ measured value

Response Time
Fast: 2 ms [1]
Standard: 5 ms
Medium: 15 ms
Slow: 50 ms

Delay at Power Up
2 s

Ambient Light Immunity
> 10,000 lux

Minimum Window Size, Analog and Discrete
1.0 mm (0.039")

Boresighting
4 mm radius at 400 mm

Maximum Torque
2 N·m (17.7 in-lbs)

Repeatability
See *Performance Curves*

Temperature Effect
See *Performance Curves*

Accuracy
See *Performance Curves*

Indicators
Power LED Indicator
Solid Green = Normal operation, power On and laser On
Flashing Green (1 Hz) = Power On and laser Off (laser enable mode)
Analog Output LED Indicator
Solid Amber = Displayed distance is within the taught analog output window
Off = Displayed distance is outside the taught analog output window
Discrete Output LED Indicator
Solid Amber = Discrete Output is On
Off = Discrete Output is Off

Construction
Housing: die-cast zinc
Window: acrylic

Vibration/Mechanical Shock
All models meet Mil. Std. 202 G requirements method 201A. Also meets IEC 60947-5-2.

Environmental Rating
IP67, NEMA 6

Operating Conditions
Temperature: −20 °C to +55 °C (−4 °F to +131°F)
Humidity: 90% at +55 °C maximum relative humidity (non-condensing)

Storage Temperature
−30 °C to +65 °C (−22 °F to +149 °F)

Application Note
For optimum performance, allow 10 minutes for the sensor to warm up

Certifications

CE   c(UL)us LISTED
Ind. Cont. Eq.
3TJJ

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[1] Response time for lateral entry of object into measurement range < 5 ms
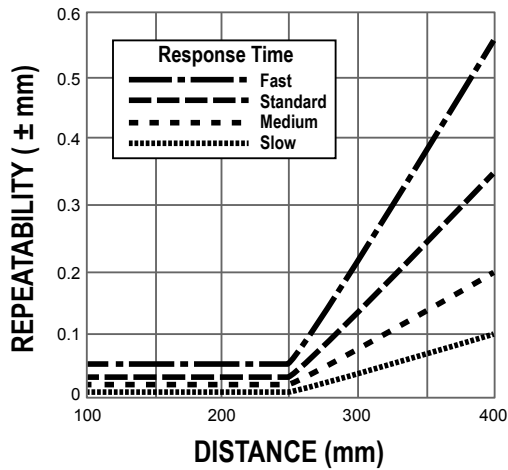
Performance Curves

Figure 14. Repeatability (90% to 6% reflectance)
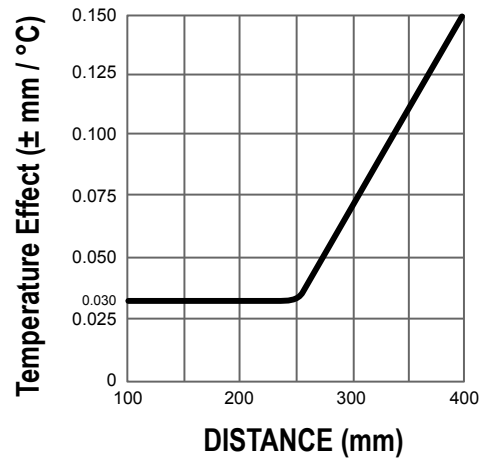

Figure 15. Temperature Effect

Figure 16. Accuracy (90% to 6% reflectance)

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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