

NAIS

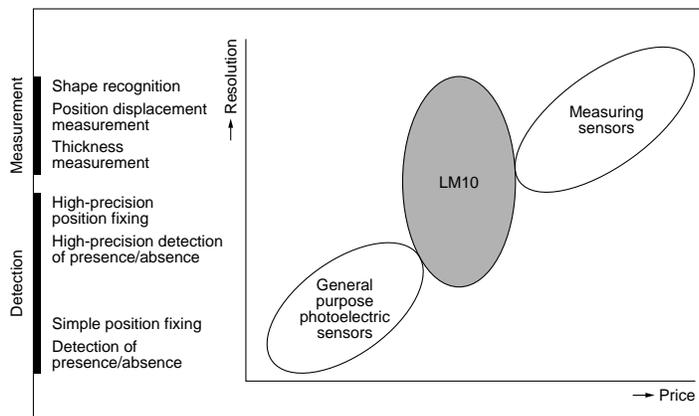
MICRO LASER SENSORS

LM10 Series

DISPLACEMENT LASER SENSOR



The LM10's cost-performance ratio far outstrips the competition.



High-precision measurements with comparative output function

Comparative output function (Intensity/displacement) gives this high-precision device more versatility

In addition to conventional analog output, the LM10 also comes with ON/OFF control outputs; single (high/low outputs) or double (high/low/go outputs) comparators. This gives the LM10 the versatility of both a photoelectric sensor and a high precision laser.

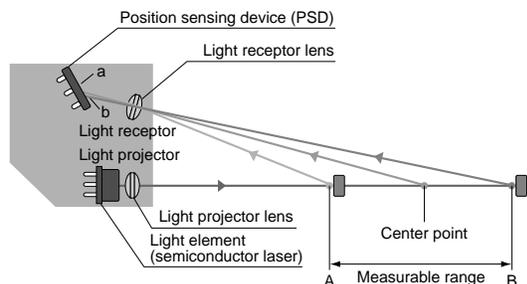
• Setting modes and types of ON/OFF control

Type	Standard mode	Intensity mode
Dual comparator	Displacement control (triple output)	Not Available
Single comparator	Displacement control (double output)	Intensity control (double output)

Displacement control: ON/OFF control on the basis of distance measurement.
 Intensity control: ON/OFF control on the basis of received light level.

• Measurement principle of the LM10 (optical triangulation)

Part of the light rays which come from the target object by means of diffuse reflection are focused to produce a light spot on the position sensing device (PSD). The location of this light spot varies depending on the distance of the target object. By measuring the change in the location of the light spot, the LM10 can measure the displacement of the target object.

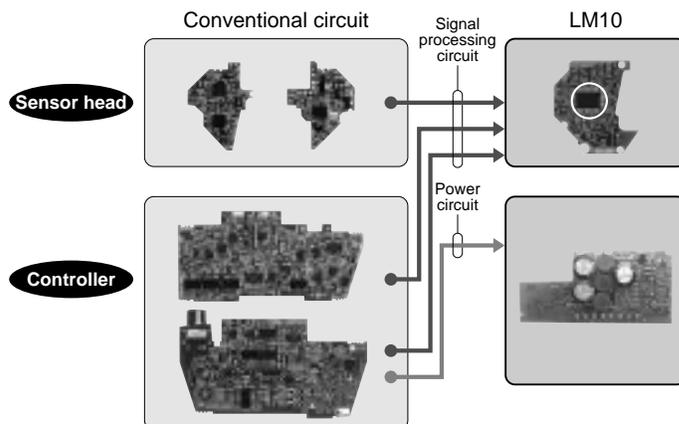


New circuitry lowers costs.

Incorporates our own unique built-in single-channel IC.

The LM10 uses the first single-channel IC (patent pending) ever produced in the industry,* which reduces the dual-channel processing requirement of conventional products to a single channel. Building the arithmetic circuits into the IC has also helped to reduce costs.

* As of November 1996.



Use the LM10 with confidence. It meets FDA standards for class 2 laser safety.

Products available in two series: laser class 2 high and low power.

Development of a high-precision aspheric surface plastic lens has made it possible to maintain both high precision and class 2 safety. The visible light spot makes it easy to see and safe to use.



Interchangeable sensor heads

Sensor head and controller can be managed separately.

Nine types of sensor heads and eight types of controllers can be freely combined in 72 different ways. Unlike those of conventional laser sensors, these heads and controllers are completely interchangeable to meet any type of measuring and processing requirements. There is no need for matched pair management of heads and controllers.

Excellent in the following circumstances...

- When carrying out repairs
- When changing to a different model.

Suppose an accident on the production line damages the sensor head.

Suppose that after purchasing the LM10 it becomes necessary to switch to a different model due to changes in the object you are measuring.

With the MICRO LASER SENSOR LM10...

...all you have to do is replace the sensor head. As long as there is a spare sensor available, the problem can be solved without stopping the production line.

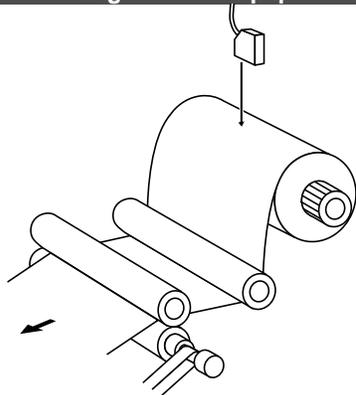
With the MICRO LASER SENSOR LM10...

...all you have to do is buy a new sensor head. The current controller need not be replaced.

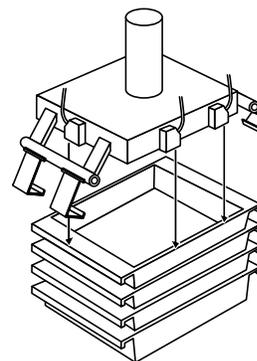
TYPICAL APPLICATIONS

■ Automated assembly

Detection of remaining amount of paper roll

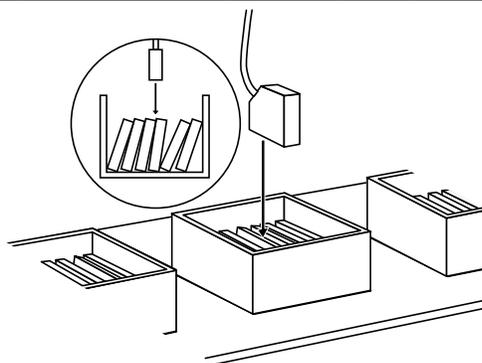


Detection of pallet orientation



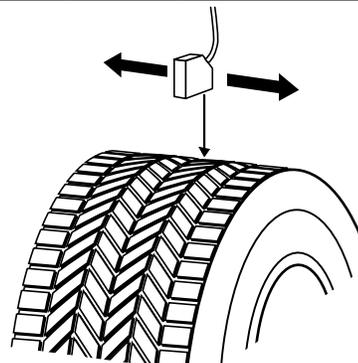
■ Food processing/Packaging

Counting the number of objects in a package



■ Auto industry applications

Inspection of tire groove depth



Product types

• Sensors

Laser class	Type	Measurement range	Resolution (2 σ)	Spot diameter	Part No.
Class 2 low power	LM10-50-1	50 \pm 10 mm 1.969 \pm .394 inch	5 μ m .0002 inch	0.6 \times 1.1 mm .024 \times .043 inch	ANR11501
	LM10-50S-1	50 \pm 10 mm 1.969 \pm .394 inch	5 μ m .0002 inch	0.09 \times 0.05 mm .004 \times .002 inch	ANR11511
	LM10-80-1	80 \pm 20 mm 3.150 \pm .787 inch	20 μ m .0008 inch	0.7 \times 1.2 mm .028 \times .047 inch	ANR11821
	LM10-130-1	130 \pm 50 mm 5.118 \pm 1.969 inch	100 μ m .0039 inch	0.7 \times 1.4 mm .028 \times .055 inch	ANR11151
Class 2 high power	LM10-50-2	50 \pm 10 mm 1.969 \pm .394 inch	1 μ m .00004 inch	0.6 \times 1.1 mm .024 \times .043 inch	ANR12501
	LM10-50S-2	50 \pm 10 mm 1.969 \pm .394 inch	1 μ m .00004 inch	0.09 \times 0.05 mm .004 \times .002 inch	ANR12511
	LM10-80-2	80 \pm 20 mm 3.150 \pm .787 inch	4 μ m .0002 inch	0.7 \times 1.2 mm .028 \times .047 inch	ANR12821
	LM10-130-2	130 \pm 50 mm 5.118 \pm 1.969 inch	20 μ m .0008 inch	0.7 \times 1.4 mm .028 \times .055 inch	ANR12151
	LM10-250-2	250 \pm 150 mm 9.843 \pm 5.906 inch	150 μ m .0059 inch	0.8 \times 1.5 mm .031 \times .059 inch	ANR12261

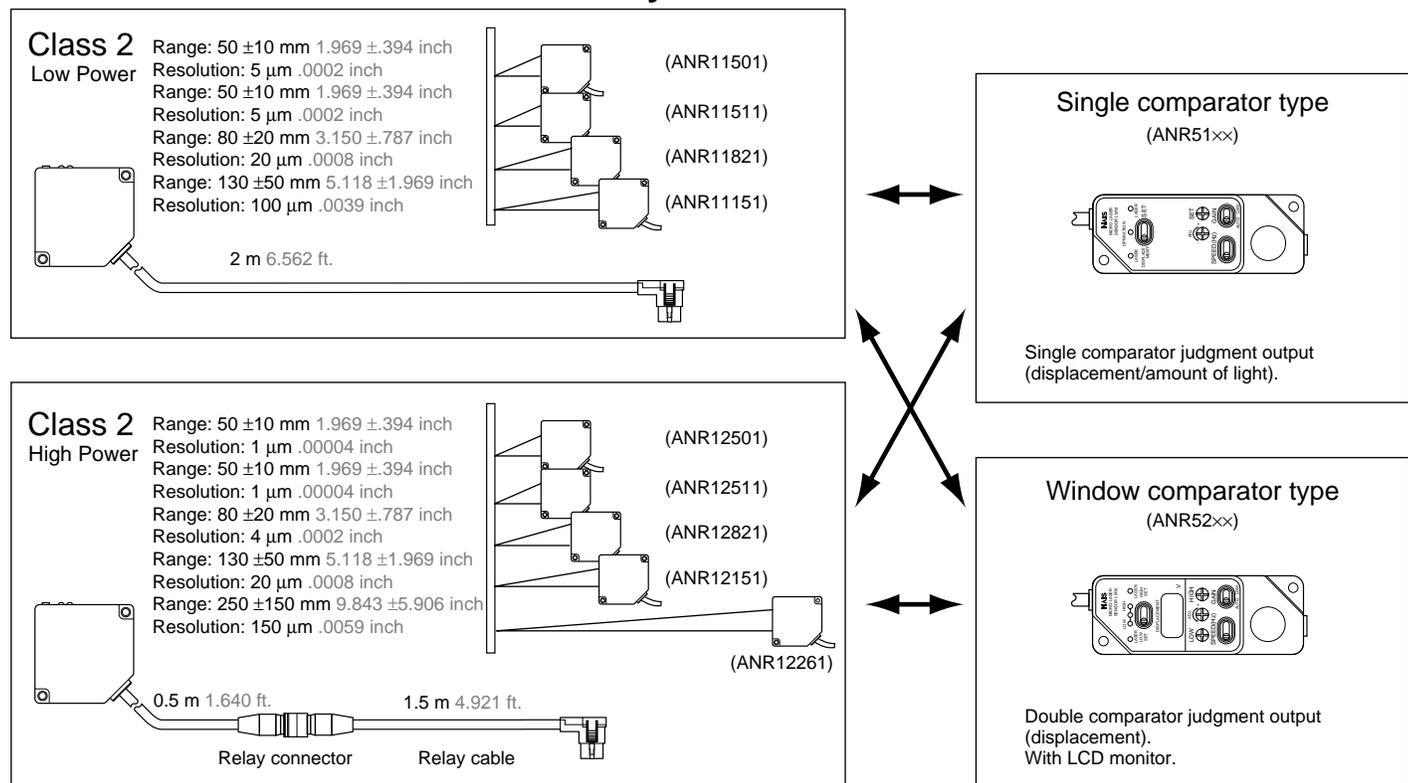
• Controller

Output	Specifications	Part No.
\pm 5 V NPN	Single comparator with intensity setpoint option	ANR5131
	Window (dual) comparator with display	ANR5231
\pm 5 V PNP	Single comparator with intensity setpoint option	ANR5132
	Window (dual) comparator with display	ANR5232
4-20 mA NPN	Single comparator with intensity setpoint option	ANR5141
	Window (dual) comparator with display	ANR5241
4-20 mA PNP	Single comparator with intensity setpoint option	ANR5142
	Window (dual) comparator with display	ANR5242

• Extension cable (for sensor class 2 types only) for connection to the relay cable (1.5 m 4.921 ft. relay cable is supplied with class 2 type sensor heads)

Part name	Specifications	Part No.
Extension cable	2 m 6.562 ft. cable length	ANR81020
	3 m 9.843 ft. cable length	ANR81030
	5 m 16.404 ft. cable length	ANR81050
	8 m 26.247 ft. cable length	ANR81080
	10 m 32.808 ft. cable length	ANR81100
	20 m 65.617 ft. cable length	ANR81200
	30 m 98.425 ft. cable length	ANR81300

Sensor head and controller assembly



Specifications

1) Sensor head

• Low Power

Part Number	ANR11501	ANR11511	ANR11821	ANR11151
Center Point Distance	50 mm 1.969 inch	50 mm 1.969 inch	80 mm 3.150 inch	130 mm 5.118 inch
Measurable Range	±10 mm ±.394 inch	±10 mm ±.394 inch	±20 mm ±.787 inch	±50 mm ±1.969 inch
Light Source	Visible laser diode (685 nm)			
Pulse Width/Max. Output/Laser Class	15 µs (Duty 50 %)/0.4 mW (Peak value)/Class 1 (IEC825)			
Beam Spot Diameter	0.6 × 1.1 mm .024 × .043 inch	0.09 × 0.05 mm .004 × .002 inch	0.7 × 1.2 mm .028 × .047 inch	0.7 × 1.4 mm .028 × .055 inch
Resolution (2σ)	10 Hz 100 Hz 1 kHz 5 µm .0002 inch 3mV 16 µm .0006 inch 8mV 50 µm .0020 inch 25mV	5 µm .0002 inch 3mV 16 µm .0006 inch 8mV 50 µm .0020 inch 25mV	20 µm .0008 inch 5mV 65 µm .0026 inch 16mV 200 µm .0079 inch 50mV	100 µm .0039 inch 10mV 330 µm .0130 inch 33mV 1 mm .039 inch 100mV
Linearity Error (%FS)*	±0.2 % of F.S.			
Protective Construction (except for connector)	IP67			
Ambient Light Level (fluorescent lamp)	Max. 2,500 lx			
Weight (with cable)	300 g 10.58 oz			

*White ceramics is the target of this value

• High Power

Part Number	ANR12501	ANR12511	ANR12821	ANR12151	ANR12261
Center Point Distance	50 mm 1.969 inch	50 mm 1.969 inch	80 mm 3.150 inch	130 mm 5.118 inch	250 mm 9.843 inch
Measurable Range	±10 mm ±.394 inch	±10 mm ±.394 inch	±20 mm ±.787 inch	±50 mm ±1.969 inch	±150 mm ±5.906 inch
Light Source	Visible laser diode (685 nm)				
Pulse Width/Max. Output/Laser Class	15 µs (Duty 50 %)/1.6 mW (Peak value)/Class 2				
Beam Spot Diameter	0.6 × 1.1 mm .024 × .043 inch	0.09 × 0.05 mm .004 × .002 inch	0.7 × 1.2 mm .028 × .047 inch	0.7 × 1.4 mm .028 × .055 inch	0.8 × 1.5 mm .031 × .059 inch
Resolution (2σ)	10 Hz 100 Hz 1 kHz 1 µm .00004 inch 1mV 3.5 µm .0001 inch 2mV 10 µm .0004 inch 5mV	1 µm .00004 inch 1mV 3.5 µm .0001 inch 2mV 10 µm .0004 inch 5mV	4 µm .0002 inch 1mV 13 µm .0005 inch 3mV 40 µm .0016 inch 10mV	20 µm .0008 inch 2mV 65 µm .0026 inch 7mV 200 µm .0079 inch 20mV	150 µm .0059 inch 5mV 500 µm .0197 inch 17mV 1.5 mm .059 inch 50mV
Linearity Error (%FS)*	±0.2 % of F.S.				±0.4 % of F.S.
Protective Construction (except for connector)	IP67				
Ambient Light Level (fluorescent lamp)	Max. 3,000 lx				Max. 2,500 lx
Weight	Sensor (with cable): 240 g 8.47 oz, Relay Cable: 130 g 4.59 oz				

*White ceramics is the target of this value

2) Controller

Part Number	ANR5131/ANR5132	ANR5141/ANR5142	ANR5231/ANR5232	ANR5241/ANR5242
Analog Output	±5 V/F.S. (Max. 2 mA)	4 to 20 mA/F.S. (Max. 250 Ω)	±5 V/F.S. (Max. 2 mA)	4 to 20 mA/F.S. (Max. 250 Ω)
Output Impedance	50 Ω	—	50 Ω	—
Temperature Drift (sensor and controller range set)	Max. ±(0.03 % of F.S.)/°C	Max. ±(0.04 % of F.S.)/°C	Max. ±(0.03 % of F.S.)/°C	Max. ±(0.04 % of F.S.)/°C
Zero-Point Adjustment	±10 % of F.S.			
Response Frequency (−3 dB)	1 kHz/100 Hz/10 Hz			
Response Time (10 – 90 %)	0.4 ms/4 ms/40 ms			
Comparison Output	NPN/PNP open collector 2 points (100 mA, Max. 30 V DC, residual output voltage Max. 1.5 V) FAR/LIGHT ON, NEAR/DARK ON		NPN/PNP open collector 3 points (100 mA, Max. 30 V DC, residual output voltage Max. 1.5 V) HIGH, IN-RANGE, LOW	
Hysteresis	Max. 0.15 % of F.S.			
Alarm Output	NPN/PNP open collector 1 point (100 mA, 30 V DC, residual output voltage Max. 1.5 V)			
Intensity Output	±5 V			
Timing Input	No voltage input (when connected to 0v, no comparison judgement output allowed)			
Indication	Sensor: LED (RANGE)		Sensor: LED (RANGE) Controller: LCD 3 digits display (indication renewal cycle)	
Gain Selection	AUTO, LOW (switchable)			
Cross Talk Prevention**	Yes (between 2 sets)			
Operating Voltage Range	12 to 24 V DC (−15 %, +10 %) Ripple 0.5 V (P-P)			
Rated Current Consumption (sensor and controller set)	Max. 250 mA at 12 V DC			
Weight (with cable)	180 g 6.35 oz			

**The value of the linearity characteristics, resolution and response time might get worse.

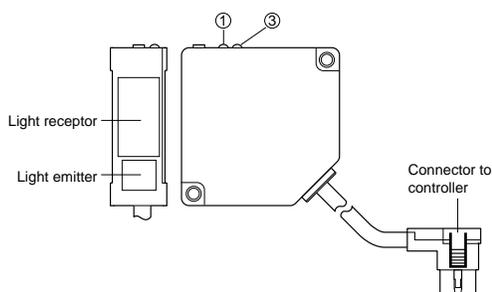
3) Common

Insulated Resistance (initial)	Between external DC input and Sensor metal parts (except for connector metal parts) 20 MΩ or more (at 500 V DC)
Breakdown Voltage (initial)	Between external DC input and Sensor metal parts (except for connector metal parts) 50 V AC 1 min
Vibration Resistance (screw installation)	10 to 55 Hz (1 cycle/min) Double amplitude of 1.5 mm .059 inch (Sensor) 2 hours on 3 axes Double amplitude of 0.75 mm .030 inch (Controller)
Shock Resistance (screw installation)	Shock of 98 m/s ² or more, 3 times on 3 axes
Operating Ambient Temperature	0 to 50° C +32 to +122° F
Storage Ambient Temperature	−20 to 70° C −4 to +158° F
Operating Ambient Humidity	35 % to 85 % RH (without dew condensation)

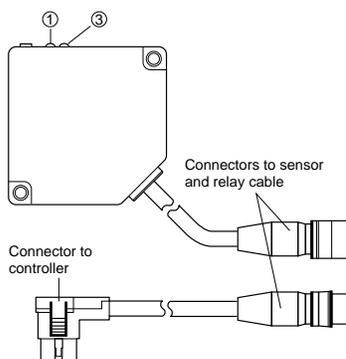
• If there is no description for measurement conditions, the test is performed under operating voltage 24 V DC, ambient temperature 20° C 68° F, Gain AUTO, response 10 Hz, Cross-talk prevention OFF and white ceramics as a target at a center point distance.

Part names and functions

• Class 1 type sensor

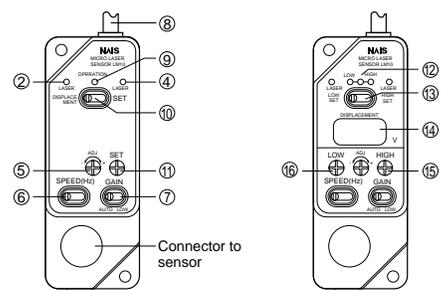


• Class 2 type sensor and relay cable



• Controller

Single-comparator type Window-comparator type



Common for both types

- ①, ② **Laser emission indicator LED**
This LED lights during laser emission or just before and after its emission. To indicate an alarm condition, the LED on the sensor head flashes.
- ③ **Range indicator LED**
Flashes when the target is within the measurable range. Stays lit when the target is near the center point distance.
- ④ **Alarm indicator LED**
Lights when measurement is not possible (not enough light [DARK] or too much light [BRIGHT])
- ⑤ **Zero-point adjustment potentiometer**

Adjusts the zero point position to within a $\pm 10\%$ F.S. Use to make minute adjustments after installing the sensor.

- ⑥ **SPEED selection switch**
The response speed can be set to one of three settings to allow adjustment for the target speed. When high response speed is unnecessary, set to the 10 Hz mode.
- ⑦ **GAIN selector switch**

Under normal conditions, set to AUTO. During edge detection and other applications where you want to cut out the low light level areas, set to LOW.

- ⑧ **I/O cable**

Single comparator type

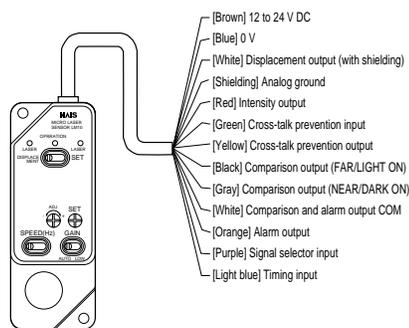
- ⑨ **Operation indicator LED**
lights when the NEAR/DARK ON output is on.
- ⑩ **OUTPUT selector switch**
Switches between the displacement data/intensity data output and the comparison value setting output.
- ⑪ **Comparison value setting potentiometer**
Sets the comparison value. By setting the OUTPUT selector switch to the right, the set value can be monitored at the analog displacement output.

Window comparator type

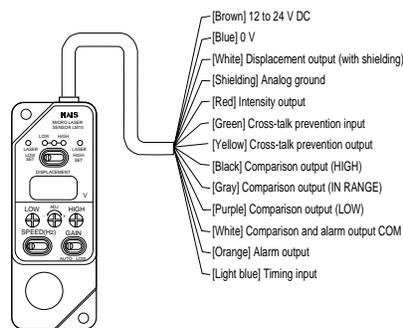
- ⑫ **Operation indicator LED**
The LED lights that corresponds to the comparison output currently activated
- ⑬ **Display/output selector switch**
Switches between the displacement data output and the comparison value setting output.
- ⑭ **Display**
3-digit display of the displacement data, the upper or the lower limit values.
- ⑮ **HIGH limit setting potentiometer**
- ⑯ **LOW limit setting potentiometer**
Sets the comparison value's upper limit (HIGH) and lower limit (LOW). Set it so that the HIGH value is greater than the LOW value. By setting the display and analog displacement output switch to either LOW or HIGH, you can monitor the set value on the display and the analog displacement output. When not setting the comparison output, return the switch to the center position.

Connections and functions

Single comparator type

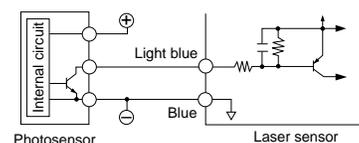


Window (dual) comparator type



to establish the timing, use a transistor with a residual output voltage of 1.5 V or less during output.

Timing input connection example



3. Cross-talk prevention I/O [green (input), yellow (output)]

When using two sensors, you can set the cross-talk prevention mode by connecting the input wire of each to the output wire of the other. Be aware that this mode may adversely affect the linear characteristics, resolution, and response.

1. Power supply

[brown (+), blue (-)]
Input 12 to 24 V DC.

2. Timing input [light blue]

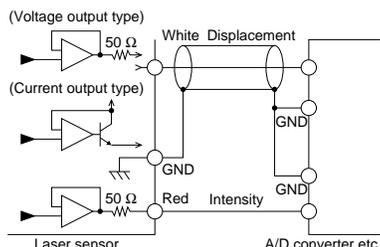
While shorted to 0 V (blue), the comparison output is disabled. When using a transistor

4. Analog displacement output [white, shielding (GND)]

An analog voltage is output that corresponds to the displacement of the target within the measurement range. When the output switch is at the SET position, each comparison value setting is output.

5. Intensity output [red, shielding (GND)]

Analog voltage (-5 V to +5 V) is output corresponding to the amount of light reflected from the target. If the amount of light increases, the voltage value becomes larger and if it decreases, the voltage value becomes smaller.



7. Comparison output

- Single comparator type [black, white (COM)]

Signal selector input [purple]	Comparing operations
When not connected	When displacement data is greater than set value (far side): FAR/LIGHT ON output is on. When displacement data is less than set value (near side): NEAR/DARK ON output is on.
When connected to 0 V [blue]	When intensity data is greater than set value (near side): FAR/LIGHT ON output is on. When intensity data is less than set value (far side): NEAR/DARK ON output is on.

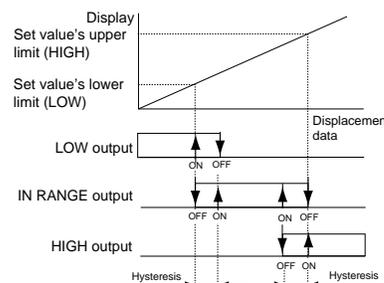
Note: With the single comparator type, connecting the purple wire and blue wire changes from the analog displacement output to the light amount monitoring value output.

- Window comparator type [black, gray, purple, white (COM)]
- Judgment result of displacement data is output.

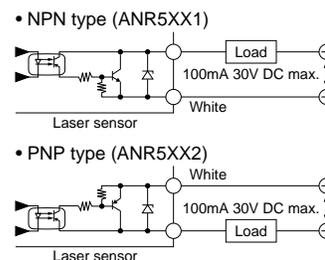
LOW [purple]	Outputs when below the set value's lower limit.
IN RANGE [gray]	Outputs when between the set value's lower and upper limits.
HIGH [black]	Outputs when above the set value's upper limit.

Description of comparison output operations

Window comparator type



Alarm and comparison output connection example



6. Alarm output

[orange, white (COM)]

Outputs during insufficient light (DARK) or too much light (BRIGHT).

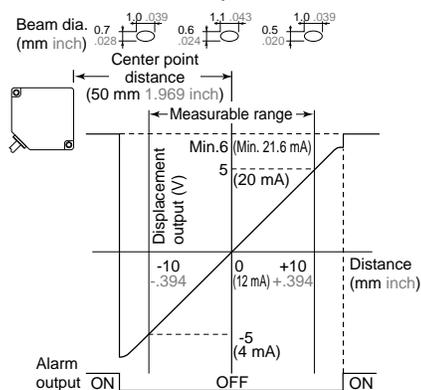
Data

1. Distance - output range

An analog voltage is output that corresponds to the displacement of the target within the measurable range.

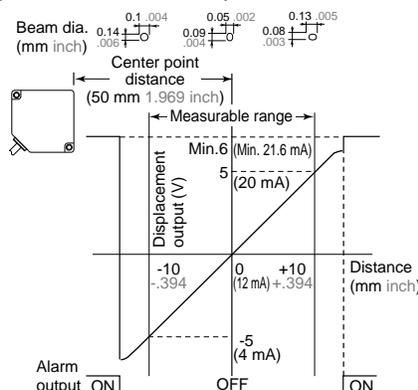
LM10-50

(ANR11501, ANR12501)



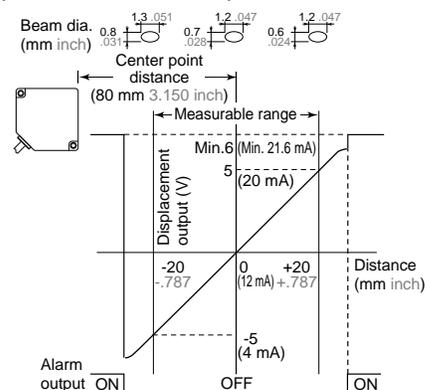
LM10-50S

(ANR11511, ANR12511)



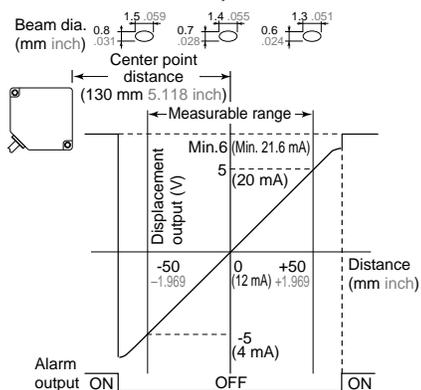
LM10-80

(ANR11821, ANR12821)



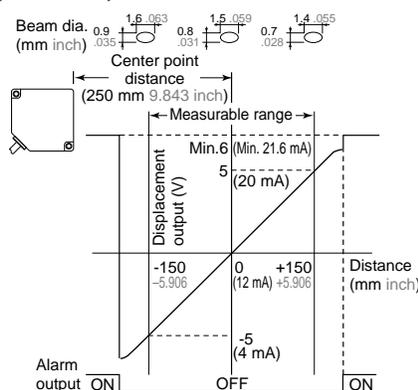
LM10-130

(ANR11151, ANR12151)



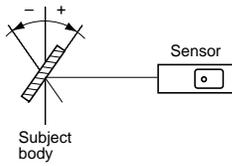
LM10-250

(ANR12261)

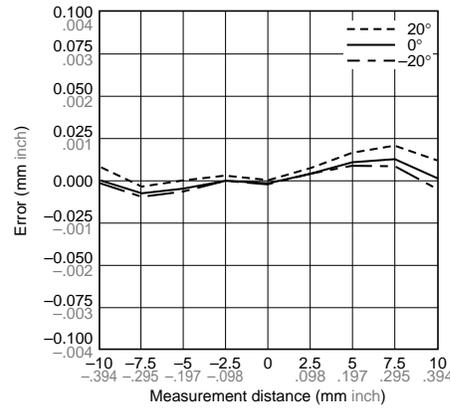


2. Distance characteristics (class 2 type sensor head)

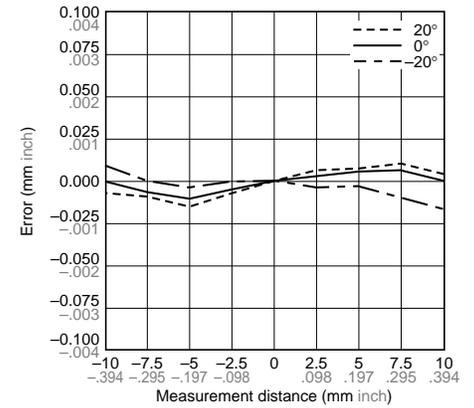
- White ceramic ($0^\circ, \pm 20^\circ$) vertical orientation



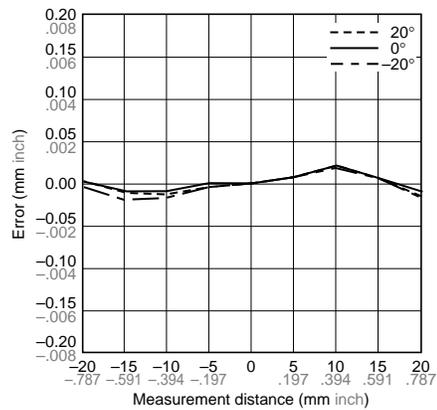
ANR1250



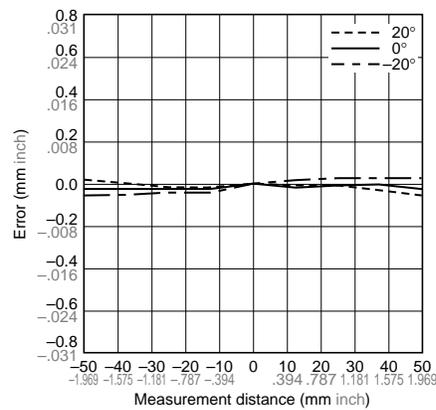
ANR1251



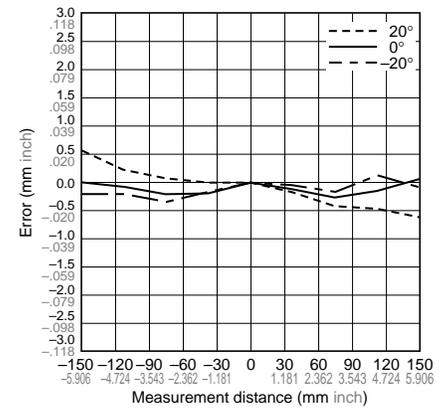
ANR1282



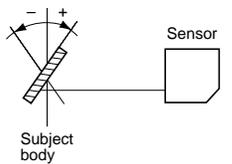
ANR1215



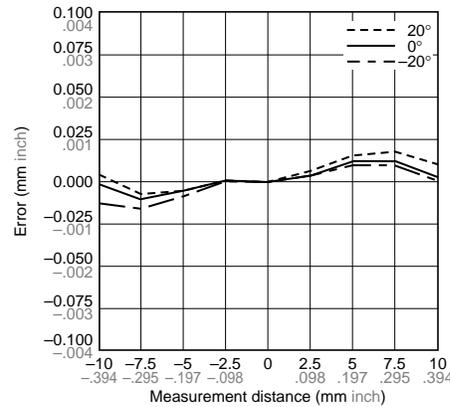
ANR1226



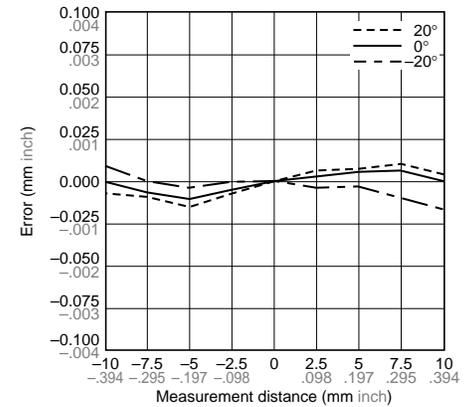
- White ceramic ($0^\circ, \pm 20^\circ$) horizontal orientation



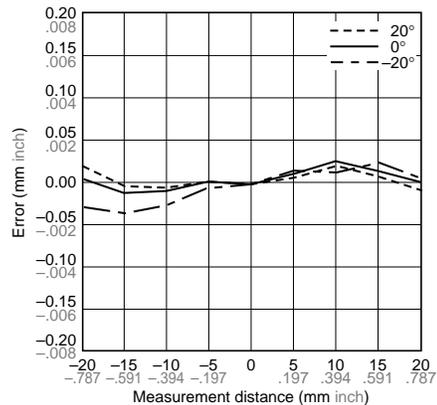
ANR1250



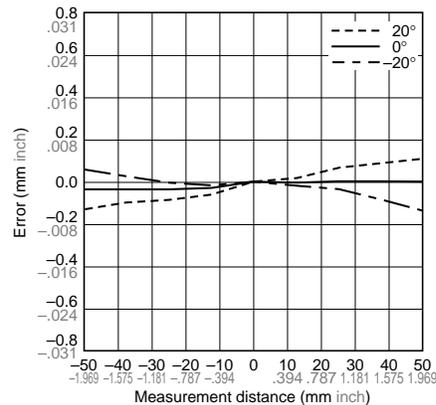
ANR1251



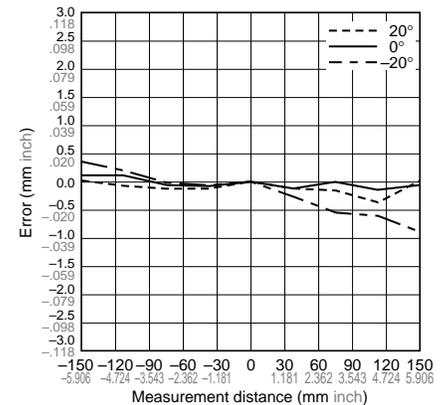
ANR1282



ANR1215



ANR1226

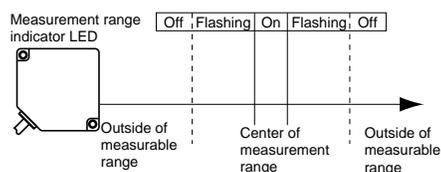


Precautions during installation



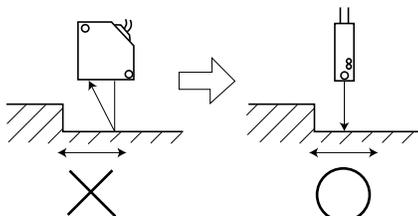
1. Procedure for setting the sensor

1) While watching the range indicator LED, set the sensor so that the distance to the subject body is within the measurable range.

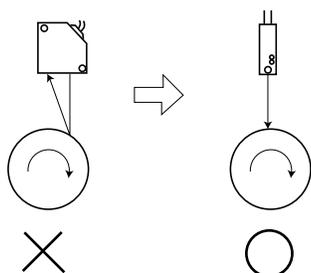


2) Be careful of the sensor's orientation during installation. When the subject body moves as shown below, errors will develop depending on the orientation of the sensor. In order to minimize these errors, be sure to install the sensor in the correct orientation.

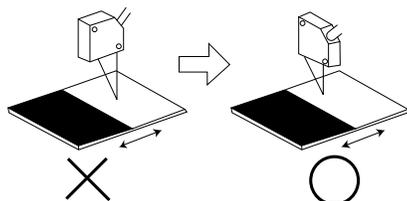
• Step detection



• Concentricity measurement



• Extremely different adjacent colors or materials



2. Installing the sensor

1) Using the two installation holes, firmly install the sensor so that the sensor's front surface is parallel to the target. Do not tighten the installation screws to a torque over 2 N·m.

2) Glass is used at the sensor's light emission and light reception surfaces and, therefore, never subject it to impacts of any kind. Also, be very careful not to allow oils, fingerprints, or other substances that may refract the light, to get on the glass during installation.

3) If light reflected off the target is then reflected off nearby objects or walls and then received by the sensor, the sensor reading will be adversely affected. To prevent this, either further separate the sensor or apply a black delustering paint to prevent the unwanted reflection of light.

3. Installing the controller

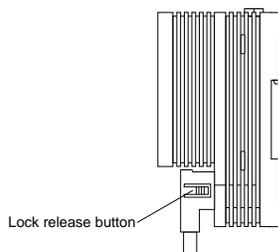
1) When installing more than one controller in a row, maintain at least 10 mm between each unit. Also, when installing the controller inside control panels or other areas where the air is not properly ventilated, the controller will cause the ambient temperature to rise. In these cases, ensure the proper cooling facilities.

4. Wiring

1) Perform all wiring by faithfully following the input and output circuit explanations and documents that came with the instrument.

2) When installing or removing a connector, always first turn off the controller and then begin operations.

3) All connectors are of the lock-on type. When connecting a connector, be sure to securely insert it until it locks into place. When removing a connector, first press in the lock release button on the connector side and then remove the connector.



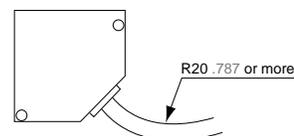
4) After removing a connector, do not touch the terminals located inside.

5) The connector's metal portion is internally connected to the analog output GND. In order to prevent affects from noise or damage to the internal circuits, be sure to insulate the metal portion with electrical tape or other means.

5. Cable

1) When the sensor and controller are fixed and cables connected, do not subject the cables to a pull of more than 3 kg. Have no bends in the cables with a radius of less than 20 mm. Also, do not bend a sensor's cable near where the cable is attached to the sensor.

2) When the sensor is to be moved while in use, do not have it so that the sensor's cable becomes bent. If the location is such that it cannot be helped, we recommend purchasing the appropriate length extension cable so that bending is unnecessary.



Precautions during operation

1. Operating environment

- 1) Use in an ambient temperature between 0 °C 32 °F and 50 °C 122 °F. Store in a location where the temperature stays between -20 °C -4 °F and 70 °C 158 °F.
- 2) Use in an ambient humidity between 35 % and 85 % RH. Avoid use in locations with drastic humidity changes which cause condensation.
- 3) Use in a location where the illuminance from incandescent lamps received at the light receptors surface is below 2,500 lx (ANR11 series and ANR1226), or below 3,000 lx (ANR1250, ANR1251, ANR1282, and ANR1215). Also, locate the unit so that sunlight, light of the same wavelength, or other disturbing light, does not directly hit the light receptor. When exceptional accuracy is required, install a shielding plate or other type of shading mechanism.
- 4) The power supply voltage should be between 85 % and 110 % of the rated voltage.
- 5) Since the internal circuits may become damaged if an external surge voltage exceeds 500 V [$\pm(1.2 \times 50) \mu\text{s}$ unipolar full-wave voltage], always use a surge absorber or surge absorbing element.

- 6) Keep the sensor light emitter and light receptor surface clean and free of moisture, oil, finger prints, and other light refracting substances, and free of dust, dirt, and other light blocking substances. When cleaning the glass surfaces, wipe with a soft cloth or lens cleaning paper.
- 7) Although the sensor is of waterproof construction, it does not mean that measurements can be taken underwater or in the rain. Moreover, the connectors are not watertight.
- 8) Do not use the unit in locations with flammable or corrosive gases, locations with excessive dust, locations splashed by water, or locations subjected to vibrations or excessive shocks.
- 9) Since the controller contains molded resins, do not use in environments that contain, or where contact with, benzene, thinners, alcohols and other organic solvents; and ammonia, caustic sodas, and other alkaline substances is possible.

2. Noise precautions

- 1) Install the unit as far away as possible from high voltage wires, power wires, or devices that generate large switching surges.
- 2) Separate the sensor cable wiring, high voltage circuit, and power circuit.
- 3) If there is much noise on the power supply, it will affect the analog output. In such cases, use a noise filter or noise-cut transformer.

3. Insulation resistance and withstand voltage

- 1) Do not perform insulation resistance or withstand voltage tests between the connector's metal portions and input/outputs.

4. Power supply

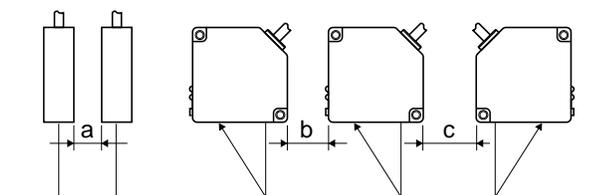
- 1) Select a power supply with a ripple voltage below 0.5 V (P-P) and a current capacity above 0.3 A.
- 2) In order to avoid high-frequency noises when using an off-the-market switching regulator, be sure to ground the frame ground (FG) terminal.
- 3) When using a power supply that uses a transformer, be sure to use an insulated transformer. When using an auto-transformer (single-wound transformer), it is possible to damage this unit or the power supply.

5. Warm-up time

- 1) Allow at least 30 minutes, after turning on the unit, for the unit to properly warm up.

Area of interference

When using more than one sensor together, be careful of the area of interference.



Sensor model	a	b	c
ANR1150	40 1.575	10 .394	70 2.756
ANR1151			110 4.331
ANR1182	50 1.969		150 5.906
ANR1115	80 3.150	20 .787	90 3.543
ANR1250	50 1.969		130 5.118
ANR1251			190 7.480
ANR1282	80 3.150		400 15.748
ANR1215	120 4.724		
ANR1226	210 8.268		

Units (mm inch)

CE marking

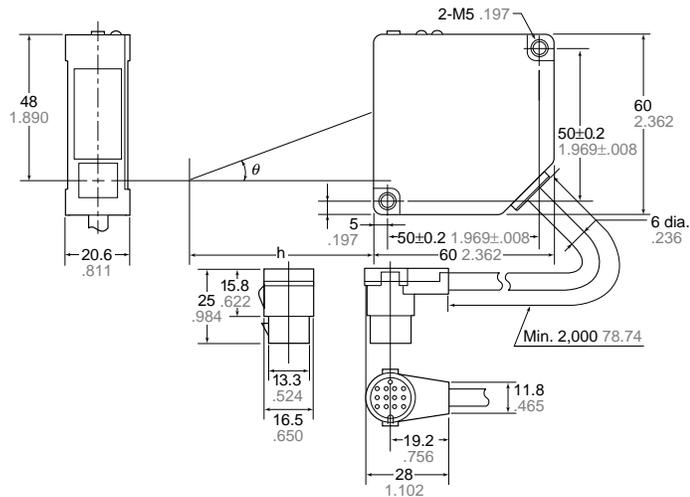
Conforms to the EMC and low voltage directives listed below.

- EMC directive (89/336/EEC)
 - EN50081-2: 1993
 - EN50082-2: 1995
- Low voltage directive (73/23/EEC)
 - EN60825-1: 1994

CE marking obtained by the standard product specifications.

Dimensions (units: mm inch)

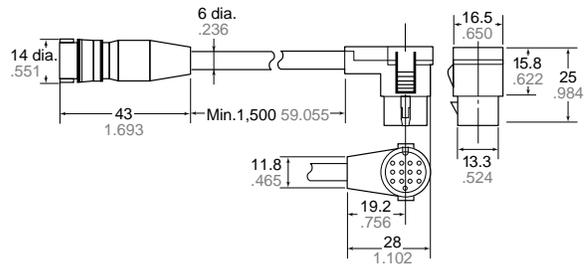
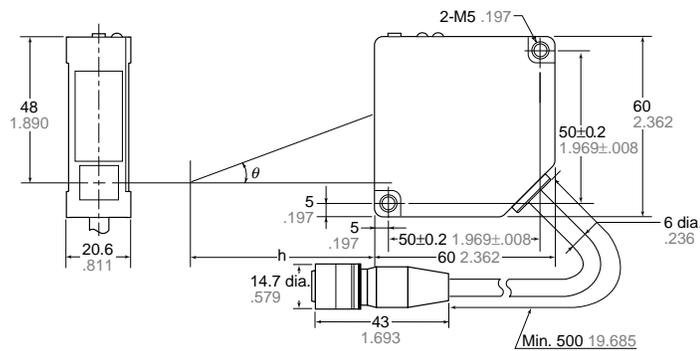
• Sensor (ANR11 series)



	h	θ
ANR1 × 5	50 mm 1.969 inch	20°
ANR1 × 82	80 mm 3.150 inch	16°
ANR1 × 15	130 mm 5.118 inch	11°
ANR1226	250 mm 9.843 inch	8°

• Sensor (ANR12 series)

Relay cable (ANR12 series)



• Controller (common)

