L-GAGE®
Light Gauging Sensors

LT3 **page 244**

- Exceptionally accurate advanced time-of-flight sensing technology provides precise measurements over long ranges.
- Retroreflective mode sensor has 50 m range.
- Ranges with diffuse mode sensor are 5 m for white targets and 3 m for gray targets.
- Sensors offer either analog and discrete, or dual-discrete output, with independent window limits.

LT7 **page 248**

- Extremely long-range sensor uses a Class 1 laser beam for accuracy over long distances.
- Retroreflective mode sensor has 250 m range.
- Ranges with diffuse mode sensor are up to 10 m for white, 7 m for gray and 3 m for black targets.
- Models are available with discrete output only or with discrete and analog output.
- RS-422 or SSI compatible serial connections are provided.

LG **page 252**

- One-piece laser gauging system requires no separate controller.
- Ultra narrow beam delivers precise distance, height and thickness measurement and gauging.
- Two sensing ranges are available: 45 to 60 mm and 75 to 125 mm.

Q50 **page 256**

- LED sensor delivers laser-like performance in a compact, low-cost package.
- Models are available to gauge distances either from 100 to 400 mm or 50 to 200 mm, with analog or discrete output.
- Features include high resolution and a fast, selectable response time.

L-GAGE® LT3

Laser Distance-Gauging Sensors

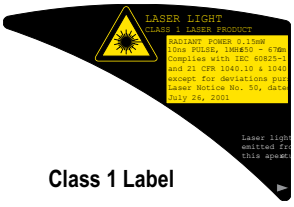
Advanced time-of-flight technology at less cost

The L-GAGE® LT3 sensor uses "time-of-flight" technology for precise, long-distance gauging at the speed of light. The microprocessor-controlled laser distance-gauging sensor features a unique design for exceptional accuracy and range at a much lower cost than competitive laser-gauging devices. Precise performance and low price make the LT3 an ideal solution for a variety of precision inspection applications.

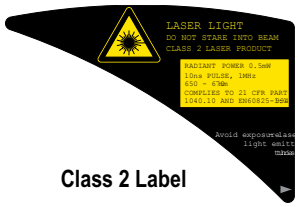
- Available in accurate diffuse-mode models with ranges to 5 m and retroreflective models with a 50 m range
- Emits one million pulses per second
- Reliably detects angled targets

Analog & discrete outputs, or dual-discrete models

The LT3 can include both a discrete (switched) output and an analog output in the same unit, with independently programmable window limits. For added flexibility, the analog output is available in a choice of 4 to 20 mA or 0 to 10V dc. You can also choose models with two independent discrete outputs, selectable PNP (sourcing) or NPN (sinking).



Class 1 Label



Class 2 Label

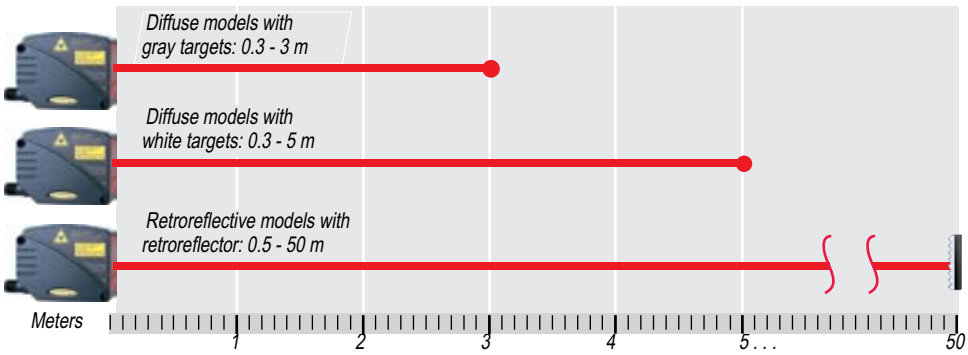
Compact, self-contained design

- The LT3's design conserves production space and decreases setup time.
- The self-contained system measures just 68.5 by 35.3 by 87.0 mm, to fit and function in tighter spaces than competitive systems.

Simple 3-step programming

Programming the LT3 takes just three short steps, which are conveniently printed on the side of the sensor. In addition, push-button TEACH-mode programming sets custom sensing windows. And remote programming offers added security and convenience.

LT3 Sensing Ranges



LASER DIFFUSE
LASER RETRO
BRACKETS PAGE 370
QD CABLES 8-Pin Euro PAGE 416
REFLECTORS PAGE 425

L-GAGE® LT3 Sensors

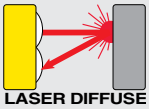
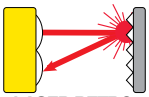
- *Programmable output response for three speeds using simple push-button TEACH*
- *Bright, visible laser spot to simplify alignment*
- *Analog outputs in a choice of 0 to 10V dc or 4 to 20 mA sourcing*
- *Rugged construction to withstand demanding sensing environments; rated IEC IP67, NEMA 6*
- *2 m or 9 m attached cable, or 8-pin Euro-style quick-disconnect*
- *8-pin Euro-style QD cables with shield ordered separately (see page 416)*

MORE INFO ONLINE Detailed Dimensions

QPMA

L-GAGE® LT3, 12-24V dc

MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Laser Class	Sensing Distance	Cable**	Discrete Output	Analog Output	Data Sheet
LT3BD	 LASER DIFFUSE	Class 2	0.3 to 5 m for 90% reflectivity white card (see Performance Curve RRC-1 on page 510 for more information)	2 m	Dual NPN or PNP Selectable	None	68503
LT3BDQ				8-pin Euro QD			
LT3PU				2 m	PNP	0 to 10V dc	65742
LT3PUQ				8-pin Euro QD			
LT3NU				2 m	NPN	0 to 10V dc	
LT3NUQ				8-pin Euro QD			
LT3PI				2 m	PNP	4 to 20 mA	
LT3PIQ				8-pin Euro QD			
LT3NI				2 m	NPN	4 to 20 mA	
LT3NIQ				8-pin Euro QD			
LT3BDLV	 LASER RETRO	Class 1	0.5 to 50 m† (see Performance Curve RRC-2 on page 510 for more information)	2 m	Dual NPN or PNP Selectable	None	68503
LT3BDLVQ				8-pin Euro QD			
LT3PULV				2 m	PNP	0 to 10V dc	68504
LT3PULVQ				8-pin Euro QD			
LT3NULV				2 m	NPN	0 to 10V dc	
LT3NULVQ				8-pin Euro QD			
LT3PILV				2 m	PNP	4 to 20 mA	
LT3PILVQ				8-pin Euro QD			
LT3NILV				2 m	NPN	4 to 20 mA	
LT3NILVQ				8-pin Euro QD			

* Visible Red Laser

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LT3BD W/30**). A model with a QD requires a mating cable (see page 416).

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

L-GAGE® LT3 Specifications

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:** 658 nm visible red IEC and CDRH Class 1 laser, 0.15 mW max. radiant output power	
Sensing Range	**Diffuse:** 90% white card: 0.3 to 5 m 18% gray card: 0.3 to 3 m 6% black card: 0.3 to 2 m	**Retroreflective:** 0.5 to 50 m (using supplied target)
Supply Voltage and Current	12 to 24V dc (10% max. 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	
Output Rating	**Discrete (switched) output:** 100 mA max. **OFF-state leakage current:** less than 5 µA **Output saturation NPN:** less than 200 mV @ 10 mA; less than 600 mV @ 100 mA **Output saturation PNP:** less than 1.2V at 10 mA; less than 1.6V at 100 mA **Analog voltage output:** 2.5 kΩ min. load impedance (voltage sourcing) **Analog current output:** 1 kΩ max. @ 24V; max. load resistance = [Vcc-4.5/0.02 Ω] (current sourcing)	
Output Configuration	**Discrete (switched):** Solid-state switch; NPN (current sinking) or PNP (current sourcing), depending on model. Dual-discrete models feature selectable NPN or PNP, depending on wiring hookup. **Analog output:** 0 to 10V dc or 4 to 20 mA	
Output Protection	Protected against short circuit conditions	
Output Response Time	**Discrete output** **Fast:** 1 millisecond ON/OFF **Medium:** 10 milliseconds ON/OFF **Slow:** 100 milliseconds ON/OFF **Diffuse Analog Voltage output (-3 dB)** **Fast:** 450 Hz (1 millisecond average/1 millisecond update rate) **Medium:** 45 Hz (10 milliseconds average/2 milliseconds update rate) **Slow:** 4.5 Hz (100 milliseconds average/4 milliseconds update rate) **Retroreflective Analog Voltage output (-3 dB)** **Fast:** 114 Hz (6 milliseconds average/ 1 millisecond update rate) **Medium:** 10 Hz (48 milliseconds average/ 1 millisecond update rate) **Slow:** 2.5 Hz (192 milliseconds average/ 1 millisecond update rate)	
Resolution/Repeatability	See charts RRC-1 and RRC-2 on page 510.	
Color Sensitivity (typical)	**Diffuse:** 90% white to 18% gray: less than 10 mm; 90% white to 6% black: less than 20 mm. See chart CSC-1 on page 511.	
Analog Linearity	**Retroreflective:** ± 60 mm from 0.5 to 50 m (0.12% of full scale) (Specified @ 24V dc, 22° C using supplied BRT-TVHG-8X10P retroreflector) **Diffuse:** ± 30 mm from 0.3 to 1.5 m; ± 20 mm from 1.5 to 5 m (Specified @ 24V dc, 22° C using a 90% reflectance white card)	
Discrete Output Hysteresis	**Diffuse** **Fast:** 10 mm **Medium:** 5 mm **Slow:** 3 mm	**Retroreflective** **Fast:** 20 mm **Medium:** 10 mm **Slow:** 6 mm
Temperature Effect	**Diffuse:** less than 2 mm/ ° C	**Retroreflective:** less than 3 mm/° C
Minimum Window Size	**Diffuse:** 20 mm	**Retroreflective:** 40 mm
Remote TEACH Input	18 kΩ min. (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)	
Adjustments	**Response speed:** Push button toggles between fast, medium and slow (see Output Response Time) **Window limits (analog or discrete):** TEACH-mode programming of near and far window limits. Limits may also be taught remotely using TEACH input. **Analog output slope:** The first limit taught is assigned to minimum output current or voltage (4 mA or 0V dc)	

More on next page

L-GAGE® LT3 Specifications (cont'd)	
Laser Control	Connect red wire to +5 to 24V dc to enable laser beam; connect to 0 to +1.8V dc (or open connection) to disable; when sensor is powered laser enable time is 100 millisecond delay on enable, when sensor is powered.
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 **Red/Yellow TEACH LEDs:** In programming mode; indicate active output(s)
Construction	**Housing:** ABS/polycarbonate blend **Window:** Acrylic **Quick-disconnect:** ABS/polycarbonate blend
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m shielded 7-conductor (with drain) PVC-jacketed attached cable, or 8-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 416.
Operating Conditions	**Temperature:** 0° to +50° C **Relative humidity:** 90% at 50° C (non-condensing)
Application Notes	• For best accuracy, allow 30-minute warm-up before programming or operating • Retroreflective performance specifications are based on use with supplied BRT-TVHG-8X10P high-grade target. Results may vary with other retroreflective target materials.
Certifications	
Hookup Diagrams	**Discrete/Analog Models:** **NPN:** MI01 (p. 532) **PNP:** MI02 (p. 532) **Dual-Discrete Models:** **NPN:** MI03 (p. 532) **PNP:** MI04 (p. 532)

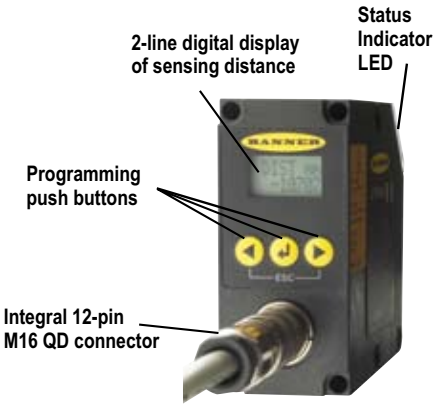
L-GAGE® LT7

Highly Accurate Time-of-Flight Laser Gauging Sensors

- Available in extremely long-range retroreflective models with ranges to 250 m or in diffuse models with ranges to 10 m
- Features TEACH-mode programming, using either integrated push buttons or a serial interface
- Provides ongoing LCD display of sensing distance in millimeters or hundredths of an inch
- Delivers excellent ±10 mm linearity
- Offers choice of RS-422 or SSI-compatible serial connection
- Uses visible Class 2 alignment laser for accurate alignment
- Provides quick warmup to minimize drift

Discrete outputs or analog and discrete models

- Diffuse models provide 2 discrete outputs (PNP) and one 4 to 20 mA output for long-range precision background suppression up to 10 m.
- Retroreflective models offer two discrete outputs (PNP) for extremely long-range sensing.
- All models offer two alarm outputs with ongoing LCD display for easy troubleshooting.



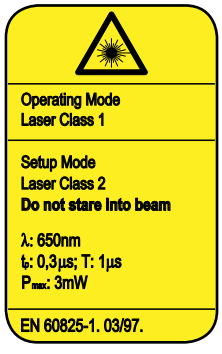
Retroreflective models

- Ideal for long-range automated storage and retrieval applications
- Features ±2 mm resolution

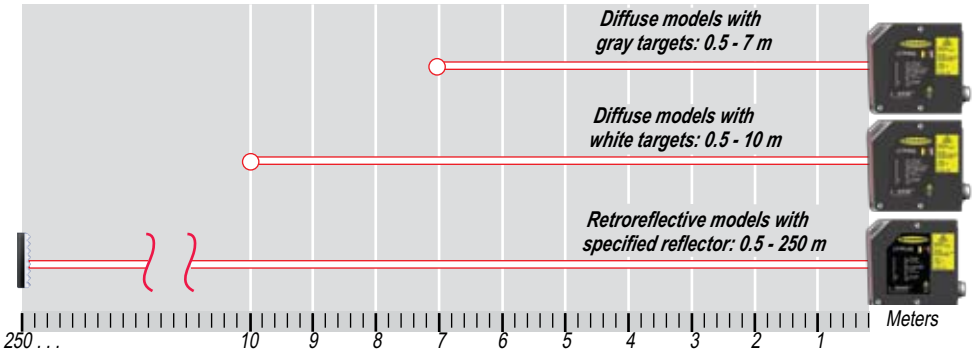
Diffuse models

- Features dark-color performance, ideal for automotive applications
- Offers ±4 mm resolution

LASER RETRO
LASER DIFFUSE
BRACKETS PAGE 372
QD CABLES 12-Pin M16 PAGE 418
REFLECTORS PAGE 425



LT7 Sensing Ranges



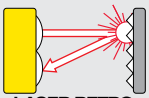
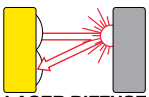
L-GAGE® LT7 Sensors

- *Status Indicator LEDs*
- *2-line digital display*
- *Programming push buttons*
- *Integral 12-pin M16 QD connector*
- *Class 1 sensing laser and Class 2 visible alignment laser*
- *2 PNP Alarm Outputs*
- *RS-422 or SSI-compatible serial connection*

MORE INFO ONLINE Detailed Dimensions

L-GAGE® LT7, 18-30V dc

MORE INFO ONLINE Download PDF

Models	Sensing Mode/LED*	Laser Class	Sensing Distance***	Cable**	Discrete Output	Analog Output	Serial	Data Sheet
LT7PLVQ	 LASER RETRO	Class 1 Sensing Laser (Class 2 Alignment Laser)	0.5 to 250 m	12-pin M16 QD	2 PNP	—	RS-422 or SSI	120244
LT7PIDQ	 LASER DIFFUSE		0.5 to 10 m			4-20 mA		

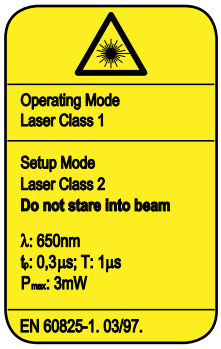
* Infrared Laser
** A model with a QD requires a mating cable (see page 418).
*** Diffuse-mode range specified using a 90% reflectance white card.
Retroreflective-mode range specified using a BRT-250, BRT-540 or BRT-700 retroreflective target (see page 429).

L-GAGE® LT7 Specifications

Sensing Range	**LT7PLVQ:** 0.5 to 250 m (using specified reflector) **LT7PIDQ: 6% Black card:** 0.5 to 3 m **18% Gray card:** 0.5 to 7 m **90% White card:** 0.5 to 10 m
Supply Voltage and Current	18 to 30V dc (10% max. ripple)
Power Consumption	Less than 4.5 W @ 25° C
Measuring Laser	Infrared, 900 nm, Class 1
Laser Control	Measurement laser is ON when sensor is ON. Pilot (visible) laser enabled during Programming mode; alternates with measurement laser.
Spot Size	**Distance** / **Spot Size** **LT7PLVQ:** 10 m / ø 20 mm 50 m / ø 100 mm 100 m / ø 200 mm 250 m / ø 500 mm **LT7PIDQ:** 4 m / 3 x 10 mm 6 m / 4 x 12 mm 10 m / 10 x 20 mm
Pilot Laser (Alignment)	Visible red, 650 nm, Class 2
Discrete & Analog Output Protection	Protected against continuous overload and short circuit
Discrete Outputs	(2) 100 mA, PNP
Discrete Switch Points	Adjustable in 1 mm steps
Discrete Output Hysteresis	Adjustable, 10 mm min.
Alarm Outputs	50 mA, PNP (NO)
Analog Output	**LT7PLVQ:** None **LT7PIDQ:** 4-20 mA
Maximum Cable Length	100 m
Output Response Time	12 milliseconds
Linearity	±10 mm
Resolution/Repeatability	**LT7PLVQ:** ±2 mm **LT7PIDQ:** ±4 mm
Color Sensitivity	**LT7PLVQ:** Not Applicable **LT7PIDQ:** Contact Factory
Temperature Effect	Less than ± 5 mm over the total sensing range
Minimum Analog Window Size	**LT7PLVQ:** Not Applicable **LT7PIDQ:** 300 mm
Adjustments	Push-button-directed password enable/disable, measurement unit select, offset value select, output limits set, output mode select, analog output slope select (diffuse models only) and output limit manual adjust. See data sheet for information.
Serial Interface	RS-422 or SSI compatible
Serial Measurement Speed	**SSI:** 1.4 milliseconds (SSI cycle 80 microseconds) **RS-422:** 2.9 milliseconds @ 57.6 kBaud

More on next page

L-GAGE® LT7 Specifications (cont'd)	
Indicators	**4 LEDs:** **Green:** Power ON/OFF **Red:** Alarm (Error) LED **Orange:** Output 1 and Output 2 conducting LEDs 2-line digital LCD display. See data sheet for more information.
Construction	ABS shock-resistant housing; PMMA window; polycarbonate displays
Weight	Approximately 230 g
Environmental Rating	IEC IP67
Connections	12-pin M16 connector; 100 m max. cable length; use only cables listed on page 418.
Operating Conditions	**Temperature:** -10° to +50° C in continuous operation
Storage Temperature	-30° to +75° C
Vibration/Shock	EN 60947-5-2
Application Notes	• All specifications are based on the specified surface at constant ambient conditions and following a minimum operating time of 15 minutes. • For best accuracy, allow a 15-minute warmup before programming or operating • **Crosstalk avoidance:** Light spots must be separated by at least 200 mm.
Certifications	CE
Hookup Diagrams	MI05 (p. 533)



Class 1 (Infrared Sensing Laser)

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 (Visible Alignment Laser)

Lasers that emit visible radiation in the wavelength range from 400 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.

L-GAGE® LG
Short-range Laser Sensors

Extremely compact, self-contained design

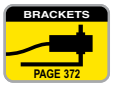
The Banner L-GAGE® LG Series replaces large, two-piece laser gauging sensors with a completely self-contained, compact housing measuring only 55 x 82 x 20 mm.

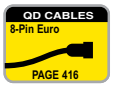
- Features a one-piece design to conserve production space
- Wires easily, decreasing setup time
- Provides a highly accurate solution at a much lower cost
- Does not touch parts it measures, so can be used with moving processes, hot parts and sticky parts

Ultra-precise & flexible, with analog & discrete outputs

Advanced digital signal processing algorithms make the LG Series Class 2 modulated visible laser gauging sensor a powerhouse of performance for a wide range of measurement applications.

- Features an outstanding maximum resolution of 3 µm for flat white targets
- Uses an ultra-narrow beam for applications requiring precise measurement of distance, height or thickness as well as gauging applications
- Lets you pick the exact range you need with the push of a button
- Houses discrete (switched) and analog outputs in the same unit, each independently programmable

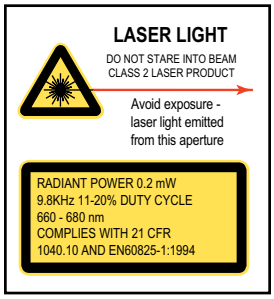




Push-button setup for custom-sized sensing windows

Unlike older, inflexible, fixed-range technology, Banner's TEACH-mode programming lets you set your own custom-sized sensing windows anywhere within the measuring range, using just one push button.

- Available ranges of 45 to 60 mm and 75 to 125 mm
- Can be programmed for analog output, discrete output or both simultaneously with independently controlled sensing window limits



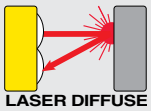
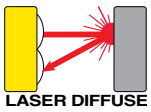
L-GAGE® LG Sensors

- *Choice of NPN or PNP discrete output and either voltage or current analog output*
- *Push-button setup or remote configuration*
- *LED indicators and output programming push buttons*
- *2 m or 9 m attached cable, or 8-pin Euro-style quick-disconnect*
- *8-pin Euro-style QD cables with shield ordered separately (see page 416)*

MORE INFO ONLINE Detailed Dimensions

L-GAGE® LG5, 12-30V dc

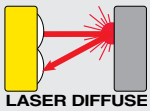
MORE INFO ONLINE Download PDF

Models	Sensing Beam/LED*	Laser Class	Sensing Distance	Beam Size	Cable**	Discrete Output	Analog Output	Data Sheet
LG5A65PU		Class 2	45-60 mm	At 53 mm: 0.4 mm x 0.6 mm Focus 70 mm	2 m	PNP	0-10V dc	59786
LG5A65PUQ					8-pin Euro Pigtail QD			
LG5A65PI					2 m		4-20 mA	
LG5A65PIQ					8-pin Euro Pigtail QD			
LG5A65NU					2 m	NPN	0-10V dc	
LG5A65NUQ					8-pin Euro Pigtail QD			
LG5A65NI					2 m		4-20 mA	
LG5A65NIQ					8-pin Euro Pigtail QD			
LG5B65PU		Class 2	45-60 mm	At 53 mm: 0.1 mm Focus 53 mm	2 m	PNP	0-10V dc	
LG5B65PUQ					8-pin Euro Pigtail QD			
LG5B65PI					2 m		4-20 mA	
LG5B65PIQ					8-pin Euro Pigtail QD			
LG5B65NU					2 m	NPN	0-10V dc	
LG5B65NUQ					8-pin Euro Pigtail QD			
LG5B65NI					2 m		4-20 mA	
LG5B65NIQ					8-pin Euro Pigtail QD			

* Visible Red Laser

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LG5A65PU W/30**). A model with a QD requires a mating cable (see page 416).

L-GAGE® LG10, 12-30V dc

Models	Sensing Beam/LED*	Laser Class	Sensing Distance	Beam Size	Cable**	Discrete Output	Analog Output	Data Sheet
LG10A65PU	 LASER DIFFUSE	Class 2	75-125 mm	At 125 mm: 0.6 mm x 0.8 mm Focus 180 mm	2 m	PNP	0-10V dc	59786
LG10A65PUQ					8-pin Euro Pigtail QD			
LG10A65PI					2 m		4-20 mA	
LG10A65PIQ					8-pin Euro Pigtail QD			
LG10A65NU					2 m	NPN	0-10V dc	
LG10A65NUQ					8-pin Euro Pigtail QD			
LG10A65NI					2 m		4-20 mA	
LG10A65NIQ					8-pin Euro Pigtail QD			

* Visible Red Laser

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LG10A65PU W/30**). A model with a QD requires a mating cable (see page 416).

L-GAGE® LG5 and LG10 Specifications

Sensing Beam	650 nm visible Red IEC and CDRH Class 2 laser; 0.20 mW max. radiant output power
Supply Voltage and Current	12 to 30V dc (10% max. ripple); 50 mA max @ 24V dc (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Delay at Power-up	1.25 second
Output Rating	**Discrete (switched) and Alarm outputs:** 100 mA max. **OFF-state leakage current:** less than 5 µA **Output saturation voltage** **PNP outputs:** less than 1.2V at 10 mA and less than 1.6V at 100 mA **NPN outputs:** less than 200 mV at 10 mA and less than 600 mV at 100 mA **Analog Current output:** 1 kΩ max @ 24V dc, max load resistance = [(Vcc - 4.5)/0.02]Ω (current sourcing) **Analog Voltage output:** 2.5 kΩ min. load impedance (voltage sourcing)
Output Configuration	**Discrete (switched) & alarm outputs:** Solid-state switch; choose NPN (current sinking) or PNP (current sourcing) models **Analog output:** 4 to 20 mA (current sourcing), 0 to 10V dc (voltage sourcing)
Output Protection	Discrete and alarm outputs are protected against continuous overload and short circuit
Output Response Time	**Discrete Outputs (ON/OFF)** **Fast:** 2.0 milliseconds **Medium:** 10 milliseconds **Slow:** 100 milliseconds **Analog Output (-3dB)** **Fast:** 450 Hz (1 millisecond average/1 millisecond update rate) **Medium:** 45 Hz (10 millisecond average/2 millisecond update rate) **Slow:** 4.5 Hz (100 millisecond average/5 millisecond update rate)
Analog Resolution and Repeatability of Discrete Trip Point	**LG5:** **Fast:** Less than 40 µm @ 50 mm **Medium:** Less than 12 µm @ 50 mm **Slow:** Less than 3 µm @ 50 mm See chart RRC-3 on page 510 **LG10:** **Fast:** Less than 150 µm @ 100 mm **Medium:** Less than 50 µm @ 100 mm **Slow:** Less than 10 µm @ 100 mm See chart RRC-4 on page 510
Analog Linearity* *Resolution and linearity specified @ 24V dc, 22° C, using a white ceramic test surface (see Application Notes)	**LG5:** +/- 60 µm over 45 to 60 mm sensing window +/- 10 µm over 49 to 51 mm sensing window **LG10:** +/- 200 µm over 75 to 125 mm sensing window +/- 20 µm over 95 to 100 mm sensing window

More on next page

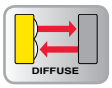
L-GAGE® LG5 and LG10 Specifications (cont'd)	
Minimum Window Size (Analog or Discrete)	**LG5:** 1.5 mm **LG10:** 5 mm
Discrete Output Hysteresis	**LG5:** Less than 0.2 mm **LG10:** Less than 1.0 mm
Color Sensitivity (typical)	**LG5:** Less than 75 µm for white to dark gray ceramic target **LG10:** Less than 100 µm for white to dark gray ceramic target
Temperature Effect	**LG5:** +/- 7 µm/° C **LG10:** +/- 25 µm/° C
Remote TEACH and Laser Control Input Impedance	18 kΩ min. (65 kΩ min. at 5V dc)
Remote TEACH	**To teach:** Connect yellow wire to +5 to 30V dc **To disable:** Connect yellow wire to 0 to +2V dc (or open connection)
Adjustments	**Response speed:** Push button toggles between Slow, Medium, and Fast (see Output Response Time) **Window limits (analog or discrete):** TEACH-mode programming of near and far window limits. Limits may also be taught remotely using TEACH wire. **Analog output slope:** The first limit taught is assigned to the minimum analog output (0V dc or 4 mA).
Laser Control	**To enable laser:** Connect green wire to +5 to 30V dc **To disable laser:** Connect green wire to 0 to +2V dc (or open connection) 250 millisecond delay upon enable/disable
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 when target is within sensing range and the condition of the received light signal. **Tri-color Red/Green/Yellow TEACH LED:** Indicates sensor is ready for programming each limit (indicates Red for analog output, Green for discrete, and Yellow for simultaneous analog and discrete.) **Yellow Fast/Slow LEDs:** Combination of 2 lights ON or OFF indicates 1 of 3 response speeds
Construction	**Housing:** Zinc alloy die-cast, plated and painted finish **Cover plate:** aluminum with painted finish **Lens:** acrylic
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m 7-conductor shielded PVC-jacketed attached cable, or 150 mm 8-pin Euro-style pigtail quick-disconnect. Mating QD cables are purchased separately. See page 416.
Operating Conditions	**Temperature:** -10° to +50° C **Relative humidity:** 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	**Vibration:** 60 Hz, 30 minutes, 3 axes **Shock:** 30G for 11 milliseconds, half sine wave, 3 axes
Application Notes	For comparison, a white ceramic test surface has approximately 91% of the reflectivity of a white Kodak test card with a matte finish. A dark gray ceramic test surface has approximately 11% of the reflectivity of a white Kodak test card with a matte finish. (Allow 15-minute warm-up for maximum linearity.)
Certifications	CE c UL US
Hookup Diagrams	**NPN Models:** MI06 (p. 533) **PNP Models:** MI07 (p. 533)

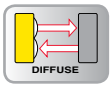
L-GAGE® Q50

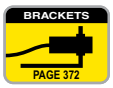
Low-cost LED-based Distance Measurement Sensors

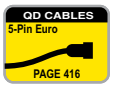
A low-cost alternative to laser measurement sensors

The compact, self-contained L-GAGE® Q50 triangulation sensor combines laser-like performance with LED safety and economy. The Q50 features analog outputs with programmable sensing window limits, and a unique tightly collimated emitter that enables it to operate in tight spaces or on small targets. The Q50 is an appealing laser alternative for many applications, including dry-bulk level measurement, package filling, roll-diameter measurement, loop control and dimensional measurement.









Patented scalable analog output

- Automatically scales the analog output over the width of the programmed sensing window
- Streamlines setup and maximizes resolution in electrically noisy environments
- Offers 4 to 20 mA (current sourcing) or 0 to 10V (voltage sourcing) output configurations
- Available with discrete output

Reliable sensing for varied targets

- 50 to 300 mm range visible red beam models
- 50 to 400 mm range infrared beam models
- Sensor linearity less than 1 percent of full scale

Programmable features

- Offers TEACH programming and remote programming
- Requires no potentiometer adjustments
- Offers choice of positive or negative analog output slope
- Allows choice of output response speed from 4 to 64 milliseconds
- Provides remote location programming for maximum security and convenience

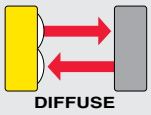
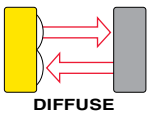
L-GAGE® Q50 Sensors

- *Simple push-button TEACH programming*
- *Range indicator LED*
- *High resolution of less than 1 mm*
- *Fast response, to 4 milliseconds*
- *2 m or 9 m attached cable, or swivel 5-pin Euro-style quick-disconnect*
- *5-pin Euro-style QD cables with shield, ordered separately (see page 416)*

MORE INFO ONLINE Detailed Dimensions

L-GAGE® Q50 Discrete Output, 12-30V dc

MORE INFO ONLINE Download PDF

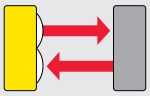
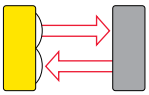
Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet
Q50AVN	 DIFFUSE	50-150 mm	2 m	NPN	48 ms	67417
Q50AVNQ			5-pin Euro QD			
Q50AVNY			2 m		4 ms	
Q50AVNYQ			5-pin Euro QD			
Q50AVP			2 m	PNP	48 ms	
Q50AVPQ			5-pin Euro QD			
Q50AVPY			2 m		4 ms	
Q50AVPYQ			5-pin Euro QD			
Q50AN	 DIFFUSE	50-200 mm	2 m	NPN	48 ms	67417
Q50ANQ			5-pin Euro QD			
Q50ANY			2 m		4 ms	
Q50ANYQ			5-pin Euro QD			
Q50AP			2 m	PNP	48 ms	
Q50APQ			5-pin Euro QD			
Q50APY			2 m		4 ms	
Q50APYQ			5-pin Euro QD			

* ⇨ Infrared LED ➡ Visible Red LED

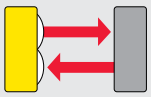
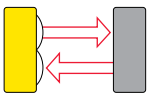
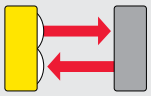
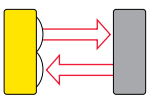
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q50AVN W/30).** A model with a QD requires a mating cable (see page 416).

More on next page

L-GAGE® Q50 Discrete Output, 12-30V dc (cont'd)

Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet
Q50BVN	 DIFFUSE	100-300 mm	2 m	NPN	48 ms	65741
Q50BVNQ			5-pin Euro QD			
Q50BVNY			2 m		4 ms	
Q50BVNYQ			5-pin Euro QD			
Q50BVP			2 m	PNP	48 ms	
Q50BVPQ			5-pin Euro QD			
Q50BVPY			2 m		4 ms	
Q50BVPYQ			5-pin Euro QD			
Q50BN	 DIFFUSE	100-400 mm	2 m	NPN	48 ms	65741
Q50BNQ			5-pin Euro QD			
Q50BNY			2 m		4 ms	
Q50BNYQ			5-pin Euro QD			
Q50BP			2 m	PNP	48 ms	
Q50BPQ			5-pin Euro QD			
Q50BPY			2 m		4 ms	
Q50BPYQ			5-pin Euro QD			

L-GAGE® Q50 Analog Output, 15-30V dc

Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet
Q50AVI	 DIFFUSE	50-150 mm	2 m	4 to 20 mA	4 ms or 64 ms selectable	67416
Q50AVIQ			5-pin Euro QD			
Q50AVU			2 m	0 to 10V		
Q50AVUQ			5-pin Euro QD			
Q50AI	 DIFFUSE	50-200 mm	2 m	4 to 20 mA		67416
Q50AIQ			5-pin Euro QD			
Q50AU			2 m	0 to 10V		
Q50AUQ			5-pin Euro QD			
Q50BVI	 DIFFUSE	100-300 mm	2 m	4 to 20 mA		64323
Q50BVIQ			5-pin Euro QD			
Q50BVU			2 m	0 to 10V		
Q50BVUQ			5-pin Euro QD			
Q50BI	 DIFFUSE	100-400 mm	2 m	4 to 20 mA		64323
Q50BIQ			5-pin Euro QD			
Q50BU			2 m	0 to 10V		
Q50BUQ			5-pin Euro QD			

* ⇨ Infrared LED → Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q50BVN W/30**). A model with a QD requires a mating cable (see page 416).

L-GAGE® Q50 Discrete Output Specifications

Sensing Beam	**Wavelength: Q50..V:** 685 nm (typical) **Q50..:** 880 nm (typical) **Beam Size: Q50..V:** 20 mm dia. (max.) **Q50..:** 20 mm dia. (max.)
Sensing Range	**Q50AV:** 50 to 150 mm **Q50A:** 50 to 200 mm **Q50BV:** 100 to 300 mm **Q50B:** 100 to 400 mm
Supply Voltage and Current	12 to 30V dc (10% max. ripple); 70 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Output Configuration	Solid-state Complementary; Choose NPN (current sinking) or PNP (current sourcing) models.
Delay at Power-up	2 seconds
Output Rating	Complementary Discrete Output 150 mA max., per output **OFF-state leakage current:** Less than 10 µA **ON-state saturation voltage:** Less than 1V @ 10 mA and less than 1.5V @ 100 mA
Output Protection	Protected against false pulse on power-up and continuous overload or short circuit of outputs.
Output Response Time	2-second delay on power-up: **Fast:** 4 milliseconds ON/OFF **Slow:** 48 milliseconds ON/OFF
Output Hysteresis	See charts HC-5 and HC-6 on page 512.
Sensing Repeatability	**Slow Response (Q50..):** 0.5% of sensing distance **Fast Response (Q50..Y):** 1.0% of sensing distance
Color Sensitivity (typical)	See charts CSC-2 and CSC-3 on page 511.
Temperature Effect	**Q50B.. models:** From 0° to 50° C: 0.25 mm/° C From -10° to 55° C: 0.35 mm/° C **Q50A.. models:** From 0° to 50° C: 0.08 mm/° C From -10° to 55° C: 0.11 mm/° C
Remote TEACH Input Impedance	15 kΩ
Remote TEACH Input	**To TEACH:** Connect gray wire to +5 to 30V dc **To Disable:** Connect gray wire to 0 to +2V dc (or open connection)
Adjustments	**Sensing Window Limits:** TEACH-mode programming of near and far window limits may be set using the TEACH push button or remotely using the gray TEACH wire.
Indicators	**Range LED Indicator (Green/Red)** **Green** — Target is within sensing range **Red** — Target is outside sensing range **Flashing Green** — Outputs are overloaded **OFF** — Sensor Power OFF **Teach/Output LED Indicator (Yellow/Red)** **Yellow** (window limits) — Target is within taught window limits **Yellow** (fixed field) — Target is closer than cutoff limit **OFF** — Target is outside taught window limits **Red** — Sensor is in TEACH mode
Ambient Light Immunity	< 10,000 LUX
Construction	**Housing:** Molded ABS/Polycarbonate **Window Lens:** Lens: Acrylic **Hardware:** M3 hardware is included
Environmental Rating	IEC IP67; NEMA 6P
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect. See page 416.
Operating Conditions	**Temperature:** -10° to +55° C **Relative humidity:** 90% at +50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60 Hz max. double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Allow 15-minute warm-up for maximum performance
Certifications	CE
Hookup Diagrams	MI08 (p. 533)

L-GAGE® Q50 Analog Output Specifications

Sensing Beam	**Wavelength: Q50..V:** 685 nm (typical) **Q50..:** 880 nm (typical) **Beam Size: Q50..V:** 20 mm dia. (max.) **Q50..:** 20 mm dia. (max.)
Sensing Range	**Q50AV:** 50 to 150 mm **Q50A:** 50 to 200 mm **Q50BV:** 100 to 300 mm **Q50B:** 100 to 400 mm
Supply Voltage and Current	15 to 30V dc (10% max. ripple); 70 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Output Configuration	**4-20 mA current sourcing models:** 1 kΩ max. load @ 24V dc. Max. load = [(Vcc -4.5)/0.02]Ω **0-10V voltage sourcing models:** 15 mA max.
Delay at Power-up	2 seconds
Output Protection	Protected against short circuit conditions
Output Response Time	**Analog Output** — **Average Interval** — **Update Rate** — **-3 dB Frequency Response** **Fast:** 4 milliseconds 1 millisecond 112 Hz **Slow:** 64 milliseconds 4 milliseconds 7 Hz
Resolution	See RRC-5 and RRC-6 on page 510 for typical value. **Q50B models:** **Target Distance:** 200 mm **Slow Response:** 1 mm (max) **Fast Response:** 4 mm (max) **Q50A models:** **Target Distance:** 100 mm **Slow Response:** 0.5 mm (max) **Fast Response:** 2 mm (max)
Linearity	**Q50B.. models:** ±3 mm **Q50A.. models:** ±1.5 mm
Color Sensitivity (typical)	See charts CSC-4 and CSC-5 on page 511.
Temperature Effect	**Q50B.. models:** From 0° to 50° C: 0.25 mm/° C From -10° to 55° C: 0.35 mm/° C **Q50A.. models:** From 0° to 50° C: 0.08 mm/° C From -10° to 55° C: 0.11 mm/° C
Remote and Speed Input Impedance	15 kΩ
Remote TEACH Input	**To Teach:** Connect gray wire to +5 to 30V dc **To Disable:** Connect gray wire to 0 to +2V dc (or open connection)
Adjustments	**Fast Speed:** Connect black wire to +5 to 30V dc **Slow Speed:** Connect black wire to 0 to +2V dc (or open connection)
Indicators	**Range LED Indicator (Green/Red)** **Green** — Target is within sensing range **Red** — Target is outside sensing range **OFF** — Sensor Power OFF **Teach/Output LED Indicator (Yellow/Red)** **Yellow** — Target is within taught window limits **OFF** — Target is outside taught window limits **Red** — Sensor is in TEACH mode
Ambient Light Immunity	< 10,000 LUX
Construction	**Housing:** Molded ABS/Polycarbonate **Hardware:** M3 hardware is included. **Window Lens:** Acrylic
Environmental Rating	IEC IP67; NEMA 6P
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect. See page 416.
Operating Conditions	**Temperature:** -10° to +55° C **Relative humidity:** 90% at +50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max. double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Allow 15-minute warm-up for maximum performance
Certifications	CE
Hookup Diagrams	MI09 (p. 534)

U-GAGE®
Ultrasonic Sensors

QT50U **page 262**

- Long-range ac or dc sensor covers 8 m, with minimal dead zone.
- Advanced programming capability includes a unique temperature compensation feature.
- Retrosonic mode has reduced dead zone.
- Each output has two independent near and far limits.
- Optional Teflon® coating resists harsh chemicals.

S18U **page 266**

- Compact 18 mm straight or right-angle housing
- Highly accurate detection from 30 to 300 mm
- Wide range of mounting options

QS18U **page 269**

- Compact 18 mm universal housing
- Compensation for air temperature fluctuations
- Optional encapsulation for resistance to harsh chemicals (IP68)

T30U **page 272**

- Right-angle T-style housing with 30 mm threaded lens
- Analog and discrete outputs in the same sensor
- Programmable sensing windows with 150 mm to 1 m range or 300 mm to 2 m range
- Optional Teflon® coating for resistance to harsh chemicals

Teflon® is a registered trademark of Dupont™.

Coming Soon!

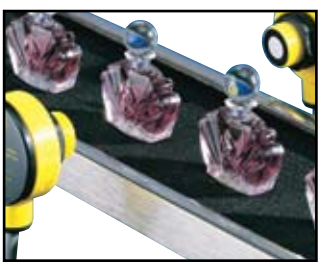
T30U models with temperature compensation, longer sensing ranges, shorter dead zones and improved linearity.

Q45U **page 276**

- Operating window limits from 100 mm to 3 m
- Discrete output models for ON/OFF presence detection or HIGH/LOW level control
- Programmable response time

Q45UR **page 280**

- Ultra-accurate remote gauging
- Compact housing with choice of three remote sensing heads
- Compensation for temperature variations at remote head



T18U **page 284**

- Dual range, opposed ultrasonic sensors
- Two combinations of range and response time in the same unit
- Ideal for sensing under bright lighting and for clear materials
- T-style sensor with 18 mm threaded lens

U-GAGE® QT50U
Long-range Ultrasonic Sensor

Enhanced long-range sensing

- Senses extended range of up to 8 m
- Features ultrasonic dead-zone of only 2.5% of the total range—75% less than comparable products
- Available in analog or discrete dc models and in ac/dc universal voltage models with electromechanical relay output
- Offers retrosonic sensing mode

Designed for challenging applications

- Features a completely sealed, shock-resistant housing that is ideal for monitoring levels of liquids as well as solids
- Uses a narrow sensing beam to detect targets at long range within confined areas—such as a storage tank—without interference from the tank walls
- Available in a chemically resistant model with a Teflon® coating to protect the transducer
- Provides continuous monitoring (analog model)
- Offers dual-discrete option for setting independent near and far limits for both outputs, for applications requiring high and low-limit sensing

Chemically resistant models

BRACKETS
PAGE 372
QD CABLES
5-Pin Euro + 5-Pin Micro + 5-Pin Mini
PAGE 415, 419 & 421

Engineered for flexibility

- Offers a multitude of configurations in the same analog or discrete unit, using an advanced microprocessor and 8 DIP switches (dc models only)
- Compensates for temperature, for greatest sensing accuracy
- Reduces dead zone and detects objects of any size, shape and orientation (retrosonic mode)

Push-button programming

- Simplifies setup with push-button and remote TEACH-mode programming
- Shows status during setup and operation, using highly visible LEDs indicators

* Discrete dc model shown.

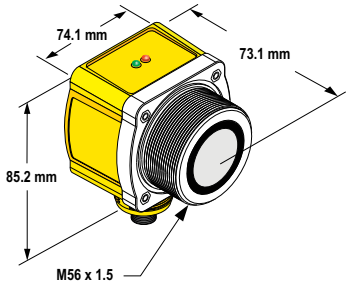
Teflon® is a registered trademark of Dupont™.

U-GAGE® QT50U Sensors

- *Push-button TEACH programming for easy setup*
- *Rugged encapsulated design for harsh environments*
- *Cabled or quick-disconnect models*
- *Bright LED status indicators for setup and operation*
- *QD cables with shield, ordered separately (see pages 415, 419 and 421)*

DC and Universal Voltage Models

MORE INFO ONLINE Detailed Dimensions



Teflon®-protected Models (Suffix -CRFV)

U-GAGE® QT50U, 10-30V dc

MORE INFO ONLINE Download PDF

Models*	Range	Cable**	Output	Data Sheet
QT50ULB	200 mm - 8 m	2 m	Selectable: 0 to 10V dc or 4 to 20 mA	70137
QT50ULBQ		5-pin Mini QD		
QT50ULBQ6		5-pin Euro QD		
QT50UDB	200 mm - 8 m	2 m	Selectable Dual NPN or PNP	110112
QT50UDBQ		5-pin Mini QD		
QT50UDBQ6		5-pin Euro QD		

U-GAGE® QT50U Universal Voltage, 85-264V ac/24-250V dc

MORE INFO ONLINE Download PDF

Models*	Range	Cable*	Output Operation Mode	Output	Data Sheet
QT50UVR3W	200 mm - 8 m	2 m	Window-limit (complementary outputs)	SPDT e/m relay	117764
QT50UVR3WQ1		5-pin Micro QD			
QT50UVR3WQ		5-pin Mini QD			
QT50UVR3F	200 mm - 8 m	2 m	Pump/level control (pump-in and pump-out logic)	SPDT e/m relay	117764
QT50UVR3FQ1		5-pin Micro QD			
QT50UVR3FQ		5-pin Mini QD			

* For sensors with Teflon®-protected face and transducer, add suffix **-CRFV** to the model number (example, **QT50ULB-CRFV**). See data sheet part number 122155 for additional info.

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QT50ULB W/30**). A model with a QD requires a mating cable (see pages 415, 419 and 421).

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U-GAGE® QT50U DC Specifications

Effective Beam	See charts EBPC-1, EBPC-2 and EBPC-3 on page 513.
Supply Voltage and Current	**Analog models:** 10 - 30V dc (10% max. ripple); 100 mA max @ 10V, 40 mA max. @ 30V (exclusive of load) **Dual-discrete models:** 10 to 30V dc (10% max. ripple); 100 mA max. @ 10V, 40 mA @ 30V (exclusive of load)
Ultrasonic Frequency	75 kHz burst, rep. rate 96 milliseconds
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Output Protection	Protected against short circuit conditions
Delay at Power-up	1.5 seconds
Output Configuration	**Analog models: Voltage sourcing:** 0 to 10V dc **Current sourcing:** 4 to 20 mA **Dual-discrete models:** Dual PNP or NPN, selectable using DIP switch
Output Ratings	**Analog Voltage Output:** 0 to 10V dc **Minimum load resistance** = 500 Ω **Minimum required supply voltage for full 0-10V output span** = $(\frac{1000}{RLOAD} + 13)$V dc **Analog Current Output:** 4 to 20 mA **Maximum load resistance** = 1 kΩ or $(\frac{V\ supply - 5}{0.02})$ Ω, whichever is lower **Minimum required supply voltage for full 4-20 mA output span** = 10V dc or [(RLoad x 0.02)+5]V dc, whichever is greater. 4-20 mA output calibrated at 25° C with 250 Ω load. **Discrete Output:** 150 mA max. **OFF-State leakage current:** less than 5 µA **Output saturation: NPN:** less than 200 mV @ 10 mA; less than 650 mV @ 150 mA **PNP:** less than 1.2V @ 10 mA; less than 1.65V @ 150 mA
Temperature Effect	**Uncompensated:** 0.2% of distance/° C **Compensated:** 0.02% of distance/° C
Linearity (Analog Models)	+/- 0.2% of span from 200 to 8000 mm; +/- 0.1% of span from 500 to 8000 mm (1 mm minimum)
Resolution/Repeatability	1.0 mm
Hysteresis	5 mm
Output Response Time	**Analog models:** 100 to 2300 milliseconds **Dual-discrete models:** 100 to 1600 milliseconds
Minimum Window Size	20 mm
Adjustments	**Sensing window limits:** TEACH-Mode programming of near and far window limits may be set using the push buttons or remotely using TEACH input.
Indicators	**Green Power ON LED:** Indicates power is ON **Red Signal LED:** Indicates target is within sensing range, and the condition of the received signal. **Teach/Output indicator (bicolor Yellow/Red):** **Yellow**–Target is within taught limits **Yellow OFF (Discrete)**–Target is outside taught window limits **Red**–Sensor is in TEACH mode **Yellow Flashing (Analog)**–Target is outside taught window limits
Remote TEACH	See data sheet p/n 70137 (Analog) and p/n 110112 (Discrete)
Construction	**Transducer:** Ceramic/Epoxy composite **Housing:** ABS/Polycarbonate **Membrane Switch:** Polyester **Lightpipes:** Acrylic
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Euro-style quick-disconnect or 5-pin Mini-style quick-disconnect. QD cables are ordered separately. See pages 415 and 421.
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Temperature Warmup Drift	Less than 0.8% of sensing distance upon power-up with Temperature Compensation enabled
Application Notes	• Objects passing inside the specified near limit (200 mm) may produce a false response • For best accuracy, allow 30 minute warm-up before programming or operating

More on next page

U-GAGE® QT50U DC Specifications (cont'd)	
Certifications	CE
Hookup Diagrams	**Analog Models:** MI11 (p. 534) **Discrete Models:** MI10 (p. 534)

U-GAGE® QT50U Universal Voltage Specifications	
Effective Beam	See charts EBPC-1, EBPC-2 and EBPC-3 on page 513.
Supply Voltage	85 to 264V ac, 50/60 Hz / 24 to 250V dc (1.5 watts max., exclusive of load)
Ultrasonic Frequency	75 kHz burst, rep. rate 96 milliseconds.
Supply Protection Circuitry	Protected against transient over voltages. DC hookup is without regard to polarity.
Output Protection	Protected against short circuit conditions
Delay at Power-up	1.5 seconds
Output Configuration	SPDT (Single-Pole, Double-Throw) electromechanical relay output. One normally open (NO) and one normally closed (NC).
Output Ratings	**Max. switching power (resistive load):** 2000 VA, 240 W (1000 VA, 120 W for sensors with Micro QD) **Max. switching voltage (resistive load):** 250V ac, 125V dc **Max. switching current (resistive load):** 8A @ 250V ac, 8A @ 30V dc derated to 200 mA @ 125V dc (4A max. for sensors with Micro QD) **Min. voltage and current:** 5V dc, 10 mA **Mechanical life of relay:** 50,000,000 operations **Electrical life of relay at full resistive load:** 100,000 operations NOTE: Transient suppression is recommended when switching inductive loads.
Temperature Effect	**Uncompensated:** 0.2% of distance/° C **Compensated:** 0.02% of distance/° C
Repeatability	1.0 mm
Hysteresis	**Window-limit sensor models:** 5 mm **Fill-level control sensor models:** 0 mm
Output Response Time	Selectable 1600, 400 or 100 milliseconds
Minimum Window Size	20 mm
Adjustments	**Sensing limits:** TEACH-Mode programming of near and far limits may be set using the TEACH push button. **Sensor configuration:** Output response time and temperature compensation mode may be set using the Speed push button. **Factory default settings:** 400 milliseconds output response time; temperature compensation enabled
Indicators	**Green Power ON LED:** Indicates power is ON **Red Signal LED**: Indicates target is within sensing range, and the condition of the received signal. **Output indicator (bicolor Yellow/Red):** Indicates output status or TEACH mode **Response indicator (bicolor Yellow/Red):** Indicates output response time selection
Construction	**Transducer:** Ceramic/Epoxy composite **Housing:** ABS **Membrane Switch:** Polyester
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Micro-style quick-disconnect or 5-pin Mini-style quick-disconnect. QD cables are ordered separately. See pages 419 and 421.
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Temperature Warmup Drift	Less than 1.0% of sensing distance upon power-up with Temperature Compensation enabled
Application Notes	Objects passing inside the specified minimum sensing distance (200 mm) may produce a false response.
Certifications	Contact factory for more information.
Hookup Diagrams	UN05 (p. 529)

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U-GAGE® S18U
Compact Ultrasonic Sensor

On-board diagnostics

The highly accurate U-GAGE® S18U is the industry's first compact ultrasonic sensor with push-button TEACH programming and diagnostic LEDs integrated right into the housing. The S18U small size doesn't limit its accuracy. It is unaffected by target color and has all the features of much larger sensors:

- Integrated diagnostic LEDs and push-button programming
- Minimal dead zone
- Retrosonic sensing mode
- Temperature compensation circuitry
- Programmable background suppression
- Analog and discrete versions

BRACKETS
PAGE 373

QD CABLES
5-Pin Euro
PAGE 415

Two housing styles

- Available in straight or right-angle versions with a wide variety of mounting hardware for enhanced sensing versatility
- Ideal for material handling and packaged goods applications, such as bottling or liquid level detection and control for small containers
- Senses from 30 to 300 mm

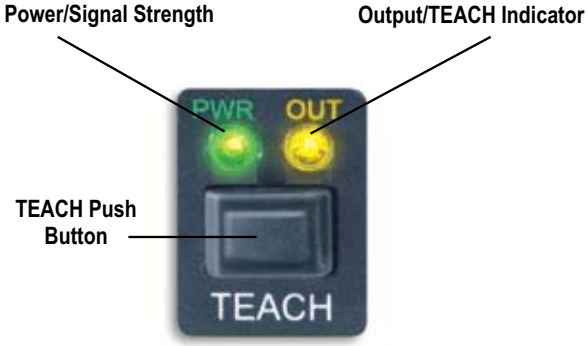
Straight

Right Angle

Accessory wave guides are available for narrowing sensing beam. (see page 445)

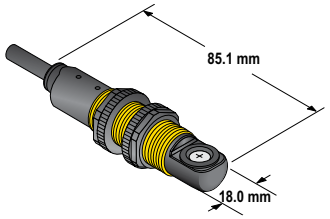
Integrated push-button programming

Program the unit with its integrated TEACH-mode push button or remote TEACH wire. Bright LEDs indicate status during setup and offer visual diagnostics during operation. Configure a set sensing window, background suppressed sensing or retrosonic mode for detecting any object regardless of shape, angle or size.

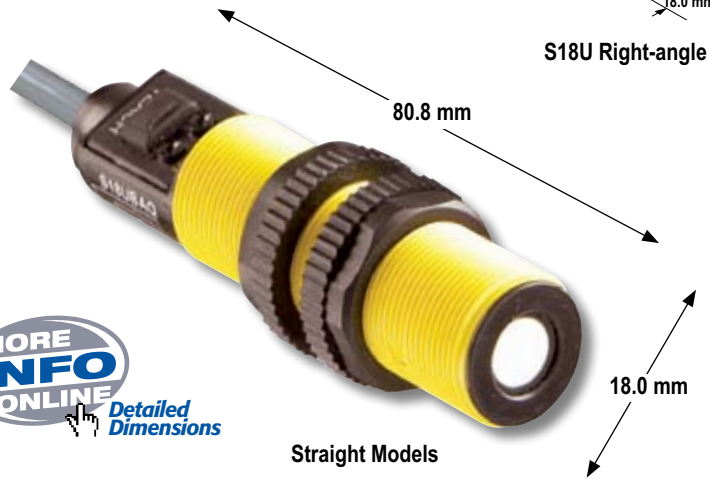


U-GAGE® S18U Sensors

- *Push-button TEACH programming for easy setup*
- *18 mm threaded barrel housing*
- *Straight or right-angle housing*
- *Rugged encapsulated design for harsh environments*
- *Bright diagnostic LEDs on sensor housing*
- *5-pin Euro-style QD cables with shield, ordered separately (see page 415)*
- *Optional wave guides for narrowing sensing beam (see page 444)*



S18U Right-angle Models



MORE INFO ONLINE Detailed Dimensions

Straight Models

U-GAGE® S18U, 10-30V dc

MORE INFO ONLINE Download PDF

Models	Range	Cable*	Output	Housing Configuration	Data Sheet
S18UUA	30 - 300 mm	2 m	0 to 10V dc	Straight	110738
S18UUAQ		5-pin Euro QD			
S18UIA		2 m	4 to 20 mA		
S18UIAQ		5-pin Euro QD			
S18UUAR	30 - 300 mm	2 m	0 to 10V dc	Right-Angle	110738
S18UUARQ		5-pin Euro QD			
S18UIAR		2 m	4 to 20 mA		
S18UIARQ		5-pin Euro QD			
S18UBA	30 - 300 mm	2 m	Bipolar NPN/PNP	Straight	108964
S18UBAQ		5-pin Euro QD			
S18UBAR		2 m		Right-Angle	
S18UBARQ		5-pin Euro QD			

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **S18UUA W/30**). A model with a QD requires a mating cable (see page 415).

U-GAGE® S18U Specifications	
Effective Beam	See charts EBPC-4 and EBPC-5 on page 513.
Supply Voltage and Current	10 to 30V dc (10% max. ripple); 65 mA max. (exclusive of load), 40 mA typical @ 25V input
Ultrasonic Frequency	300 kHz, rep. rate 2.5 milliseconds
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Protection	Protected against short circuit conditions

More on next page

U-GAGE® S18U Specifications (cont'd)

Output Ratings	**Analog:** **Analog Voltage Output:** 2.5 kΩ min. load resistance Minimum supply for a full 10V output is 12V dc (for supply voltages between 10 and 12, V out max is at least V supply -2) **Analog Current Output:** 1 kΩ max @ 24V input Max load resistance = (Vcc-4)/0.02 Ω **Discrete:** 100 mA max. **OFF-state leakage current:** less than 5 µA **NPN saturation:** less than 200 mV @ 10 mA and less than 600 mV @ 100 mA **PNP saturation:** less than 1.2V @ 10 mA and less than 1.6V @ 100 mA
Output Configuration	**Analog:** 0 to 10V dc or 4 to 20 mA, depending on model **Discrete: Bipolar:** One NPN (current sinking) and one PNP (current sourcing) output in each model. Solid-state switch conducts when target is sensed within sensing window.
Output Response Time	**Analog: 30 milliseconds:** Black wire at 0-2V dc (or open) **Discrete:** 5 milliseconds **2.5 milliseconds**: Black wire at 5-30V dc
Delay at Power-up	300 milliseconds
Linearity* (Analog output models)	**2.5 milliseconds response:** ± 1 mm **30 milliseconds response:** ± 0.5 mm
Resolution* (Analog output models)	**2.5 milliseconds response:** 1 mm **30 milliseconds response:** 0.5 mm
Repeatability	0.5 mm
Temperature Effect	0.02% of distance/ ° C
Temperature Warmup Drift	Less than 1.7% of sensing distance upon power-up
Minimum Window Size	5 mm
Switching Hysteresis (Discrete output models)	0.7 mm
Adjustments	**Sensing window limits:** TEACH-Mode programming of near and far window limits may be set using the push-button or remotely using TEACH input.
Indicators	**Power/Signal Strength (Red/Green)** **Green**—Target is within sensing range **Red**—Target is outside sensing range **OFF**—Sensing power is OFF **TEACH/Output Indicator (Yellow/Red)** **Yellow** —Target is within taught limits **OFF**—Target is outside taught window limits **Red**—Sensor is in TEACH mode
Remote TEACH Input	**Impedance:** 12 kΩ
Construction	**Threaded Barrel:** Thermoplastic polyester **Push-Button Housing:** ABS/PC **Push Button:** Santoprene **Lightpipes:** Acrylic
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 415.
Operating Conditions	**Temperature:** -20° to +60° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Application Notes	Objects passing inside the specified near limit may produce a false response.
Certifications	CE c UL us
Hookup Diagrams	**Analog Models:** MI13 (p. 535) **Discrete Models:** MI12 (p. 534)

*Linearity and resolution are specified using a 50 x 50 mm aluminum plate at 22° C under fixed sensing conditions.

QS18U
Ultrasonic WORLD-BEAM® Sensor

- Senses clear or transparent material and color variations
- Senses within a 50 to 500 mm window with a 15 millisecond response time
- Delivers high accuracy in wet or dirty environments
- Available in encapsulated IP68 models rated for a range of harsh conditions
- Features push-button TEACH for easy programming at the sensor or remotely

Features

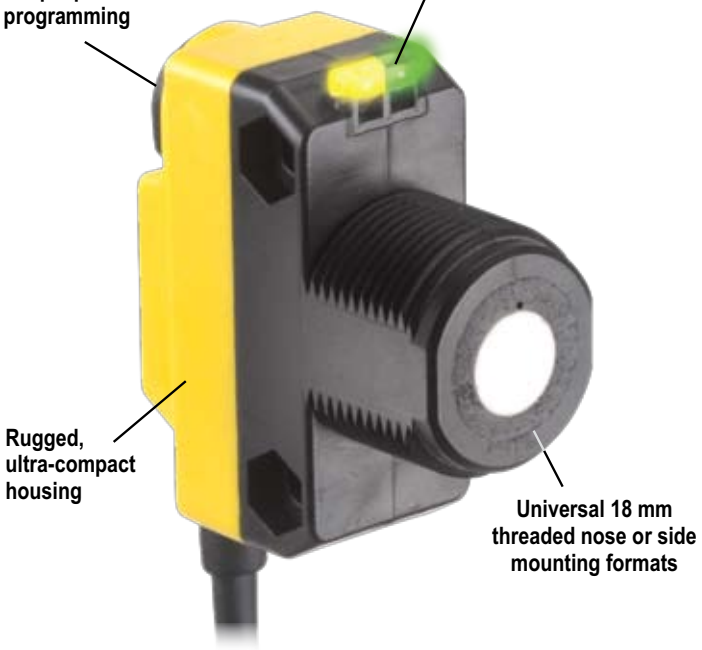
- TEACH setup using on-board push-button or remote wire
- 2 m or 9 m integral cable, 4-pin Euro- or Pico-style integral quick-disconnect, or 150 mm threaded pigtail QD cable options
- Wide operating range of -20° to 60° C
- Retrosonic sensing mode

Applications

- Sense clear web materials in confined areas
- Detect clear or shiny bottles in a filling line
- Detect highly reflective surfaces
- Verify liquid or dry bulk levels from inside cramped locations

Choice of pre-wired cable, Pico- or Euro-style integral QD connector, or pigtail QD (not shown)

Accessory wave guides are available for narrowing sensing beam. (see page 444.)



BRACKETS
PAGE 373
QD CABLES
4-Pin Euro + 4-Pin Pico
PAGE 411 & 412

WORLD-BEAM® QS18U Sensors

- *Bicolor LED indicator for power and signal strength*
- *Bicolor LED indicator for TEACH/output*
- *Choice of cables and connectors*
- *Rugged, ultra-compact housing*
- *4-pin Pico- or Euro-style QD cables with shield ordered separately (see pages 411 and 412)*
- *Optional wave guides for narrowing sensing beam (see page 444)*

MORE INFO ONLINE Detailed Dimensions

WORLD-BEAM® QS18U, 12-30V dc

MORE INFO ONLINE Download PDF

Model	Range	Cable*	TEACH Options	Output	Data Sheet
QS18UNA	50 - 500 mm	2 m	Integral push button and remote TEACH (IP67; NEMA 6P)	**NPN**	119287
QS18UNAQ8		4-pin Euro QD			
QS18UPA		2 m		**PNP**	
QS18UPAQ8		4-pin Euro QD			
QS18UNAE†	50 - 500 mm	2 m	Remote TEACH (epoxy-encapsulated, IP68; NEMA 6P)	**NPN**	119287
QS18UNAEQ8†		4-pin Euro QD			
QS18UPAE†		2 m		**PNP**	
QS18UPAEQ8†		4-pin Euro QD			

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QS18UNA W/30**). A model with a QD requires a mating cable (see pages 411 and 412).
QD models:
- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18UNAQ8**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18UNAQ7**).
- For 4-pin 150 mm Euro-style pigtail, add suffix **Q5** (example, **QS18UNAQ5**).
- For 4-pin 150 mm Pico-style pigtail, add suffix **Q** (example, **QS18UNAFQ**).

† Models are epoxy-encapsulated, IP68; NEMA 6P with remote TEACH programming

WORLD-BEAM® QS18U Specifications		
Sensing Range	50 to 500 mm	
Sensing Beam	See charts EBPC-6 and EBPC-7 on pages 513-514.	
Supply Voltage	12 to 30V dc (10% max. ripple); 25 mA max. (exclusive of load)	
Ultrasonic Frequency	300 kHz, rep. rate 7.5 milliseconds	
Supply Protection Circuitry	Protected against reverse polarity and transient voltages	
Output Protection	Protected against short circuit conditions	
Delay at Power-Up	300 milliseconds	
Output Configurations	Solid-state switch conducts when target is sensed within sensing window; One NPN (current sinking) or one PNP (current sourcing), depending on model.	
Temperature Effect	**Non-encapsulated models**: ± 0.05% per ° C from -20° to +50° C, ± 0.1% per ° C from +50° to +60° C **Encapsulated models:** ± 0.05% per ° C from 0° to +60° C, ± 0.1% per ° C from -20° to 0° C	
Repeatability	0.7 mm	
Hysteresis	1.4 mm	
Output Ratings	100 mA max. **OFF-state leakage current:** less than 10 µA (sourcing); less than 200 µA (sinking) **NPN ON-state saturation voltage:** less than 1.6V @ 100 mA **PNP ON-state saturation voltage:** less than 2.0V @ 100 mA	
Output Response Time	15 milliseconds	
Minimum Window Size	5 mm	
Adjustments	**Sensing window limits:** TEACH-Mode programming of near and far window limits may be set using the push button or remotely using TEACH input.	
Indicators	**Range Indicator (Red/Green)** **Green**—Target is within sensing range **Red**—Target is outside sensing range **OFF**—Sensing power is OFF	**Teach/Output Indicator (Yellow/Red)** **Yellow**—Target is within taught limits **OFF**—Target is outside taught window limits **Red**—Sensor is in TEACH mode
Construction	**Housing**: ABS **Push Button:** TPE	**Push-Button Housing:** ABS **Lightpipes:** Polycarbonate
Environmental Rating	Leakproof design, rated IEC IP67 or IP68; NEMA 6P, depending on model	
Connections	2 m or 9 m 4-conductor PVC jacketed attached cable, or 4-pin Euro-style integral QD (**Q8**), or 4-pin Pico-style integral QD (**Q7**), or 4-pin Euro-style 150 mm pigtail QD (**Q5**), or 4-pin Pico-style 150 mm pigtail QD (**Q**), depending on model. See pages 411 and 412.	
Operating Conditions	**Temperature:** -20° to +60° C	**Relative humidity**: 100% (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave.	
Temperature Warmup Drift	See data sheet p/n 119287 for more information.	
Application Notes	Objects passing inside the specified near limit may produce a false response.	
Certifications	CE	
Hookup Diagrams	MI14 (p. 535)	

U-GAGE® T30U
Compact Sensors in Universal Housing

Incredible versatility
The U-GAGE® T30U sets new standards for ultrasonic sensor versatility by including discrete (switched) and analog outputs in the same compact sensor. Dual-discrete models also are available.

Two model types
- Combined analog and discrete output models:
  - Offers choice of either NPN or PNP discrete output and either 0-10V dc or 4-20 mA sourcing analog output—in the same compact sensor
  - Features outputs that are independently configurable

- Dual-discrete output:
  - Features two NPN or two PNP discrete outputs
  - Offers independently programmable outputs
  - Available in models for direct liquid level control (pump in/pump out)

BRACKETS
PAGE 373
QD CABLES
5-Pin Euro
PAGE 415

Coming in 2008—New T30UX Models
COMING SOON!
- Longer sensing ranges: 1, 2 and 3 m with shorter dead zones
- Built-in temperature compensation
- Improved linearity of analog output

Patented, ultra-short T-shaped package
The T30U is the shortest 30 mm diameter ultrasonic sensor available and is less than half the length of comparable competitive sensors.
- Four LED indicators keep you constantly informed of programming and operating status.
- Strength of flashing red LED indicates the strength of the received signal.
- Two yellow LEDs indicate the target is within the operating window limits.
- Digital filtering provides immunity from random electrical and acoustic noise, as well as protection from transient voltage and reverse polarity.
- Optional Teflon® coating protects the transducer from harsh chemicals.

Push-button TEACH-mode programming
- Features simple 3-step push-button setup for accurate, custom sensing windows within a 150 mm to 1 m range or a 300 mm to 2 m range
- Can be programmed from a remote location using an external switch, computer or controller for added security and convenience

Chemically resistant models

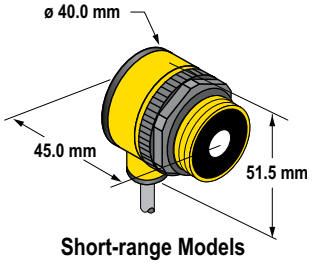
Teflon® is a registered trademark of Dupont™.

U-GAGE® T30U Sensors

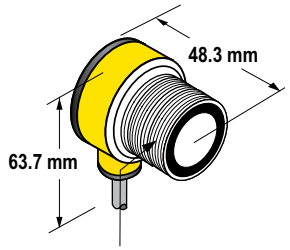
- *T-style right-angle sensor package with 30 mm threaded mount*
- *2 m or 9 m attached cable, or quick-disconnect fitting*
- *Easy-to-use push-button programming*
- *LED indicators for Power, Signal and both outputs*
- *5-pin Euro-style QD cables with shield ordered separately (see page 415)*

MORE INFO ONLINE Detailed Dimensions

Long-range Models



Short-range Models



M36 x 1.5
Teflon-protected Models
Suffix -CRFV

U-GAGE® T30U, 12-24V dc

MORE INFO ONLINE Download PDF

Models*	Range	Frequency	Cable**	Discrete Output(s)	Analog Output	Response Time	Data Sheet
T30UINA	150 mm - 1 m	228 kHz	2 m	NPN	4 to 20 mA	48 ms	57438
T30UINAQ			5-pin Euro QD				
T30UIPA			2 m	PNP			
T30UIPAQ			5-pin Euro QD				
T30UINB	300 mm - 2 m†	128 kHz	2 m	NPN	4 to 20 mA	96 ms	57438
T30UINBQ			5-pin Euro QD				
T30UIPB			2 m	PNP			
T30UIPBQ			5-pin Euro QD				
T30UDNA	150 mm - 1 m	228 kHz	2 m	Dual NPN	None	48 ms	59200
T30UDNAQ			5-pin Euro QD				
T30UDPA			2 m	Dual PNP			
T30UDPAQ			5-pin Euro QD				
T30UDNB	300 mm - 2 m†	128 kHz	2 m	Dual NPN	None	96 ms	59200
T30UDNBQ			5-pin Euro QD				
T30UDPB			2 m	Dual PNP			
T30UDPBQ			5-pin Euro QD				
T30UHNA	150 mm - 1 m	228 kHz	2 m	Pump/Level Control Dual NPN	None	48 ms	63974
T30UHNAQ			5-pin Euro QD				
T30UHNB	300 mm - 2 m†	128 kHz	2 m			96 ms	
T30UHNBQ			5-pin Euro QD				
T30UHPA	150 mm - 1 m	228 kHz	2 m	Pump/Level Control Dual PNP	None	48 ms	63974
T30UHPAQ			5-pin Euro QD				
T30UHPB	300 mm - 2 m†	128 kHz	2 m			96 ms	
T30UHPBQ			5-pin Euro QD				

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix **-CRFV** to the model number (example, **T30UINB-CRFV**).
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UINA W/30**). A model with a QD requires a mating cable (see page 415).
† Teflon®-encapsulated models have a range of 300 - 1.5 m.

Teflon® is a registered trademark of Dupont™

U-GAGE® T30U, 15-24V dc

Models*	Range	Frequency	Cable**	Discrete Output(s)	Analog Output	Response Time	Data Sheet
T30UUNA	150 mm - 1 m	228 kHz	2 m	NPN	0 to 10V dc	48 ms	57438
T30UUNAQ			5-pin Euro QD				
T30UUPA			2 m	PNP			
T30UUPAQ			5-pin Euro QD				
T30UUNB	300 mm - 2 m†	128 kHz	2 m	NPN	0 to 10V dc	96 ms	
T30UUNBQ			5-pin Euro QD				
T30UUPB			2 m	PNP			
T30UUPBQ			5-pin Euro QD				

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix **-CRFV** to the model number (example, **T30UUNB-CRFV**).
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UUNA W/30**). A model with a QD requires a mating cable (see page 415).
† Teflon®-encapsulated models have a range of 300 - 1.5 m.

U-GAGE® T30U Specifications

Sensing Range	**"A" suffix models:** 150 mm min. near limit; 1 m max. far limit **"B" suffix models:** 300 mm min. near limit; 2 m max. far limit **"-CRFV" models:** 300 mm min. near limit; 1.5 m max. far limit
Effective Beam	See charts EBPC-8, EBPC-9, EBPC-10, EBPC-11 and EBPC-12 on page 514.
Supply Voltage	**Current sourcing analog output models:** 12 to 24V dc (10% max. ripple); 90 mA (exclusive of load) **Voltage sourcing analog output models:** 15 to 24V dc (10% max. ripple); 90 mA (exclusive of load) **Dual-discrete output models:** 12 to 24V dc (10% max. ripple); 90 mA (exclusive of load)
Ultrasonic Frequency	**Short Range:** 228 kHz **Long Range:** 128 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.
Output Protection	Protected against continuous overload and short-circuit; transient over-voltage; no false pulse on power-up.
Output Configuration	**Discrete (switched) output:** Solid-state switch conducts when target is sensed within sensing window; choose NPN (current sinking) or PNP (current sourcing) models. **Analog output:** Choose 0 to 10V dc sourcing or 4 to 20 mA sourcing output models; output slope may be selected using TEACH sequence.
Output Ratings	**Discrete (switched) output:** 100 mA max., total–both outputs **OFF-state leakage current:** less than 10 µA **ON-state saturation voltage:** less than 1V at 10 mA and less than 1.5V at 100 mA **Analog Output:** **Voltage sourcing:** 0 to 10V dc (at 1 kΩ min. resistance) **Current sourcing:** 4 to 20 mA, 1 Ω to Rmax. $Rmax = \frac{V^{supply} - 7V}{20\ mA}$
Output Response Time	**Discrete output:** **"A" suffix models:** 48 milliseconds **"B" suffix models:** 96 milliseconds **Analog output:** **"A" suffix models:** 48 milliseconds average, 16-millisecond update **"B" suffix models:** 96 milliseconds average, 32-millisecond update

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More on next page

U-GAGE® T30U Specifications (cont'd)

Sensing Performance (Specified using a 100 x 100 mm aluminum target at 25˚ C under fixed sensing conditions.)	**Analog sensing resolution or discrete output repeatability:** ±0.25% of measured distance **"A" suffix models:** .5 mm min **"B" suffix models:** 1 mm min **Analog linearity:** ±0.5% of full-scale span **Min. window size:** 10 mm **Hysteresis of discrete output:** 2.5 mm **Temperature effect:** 0.2% of sensing distance per ° C
Adjustments	**Sensing window limits (analog or discrete):** TEACH-mode programming of near and far window limits may be set using membrane push buttons on sensor or remotely using TEACH input. Window limits may be programmed separately, or together. **Analog output slope:** the first limit taught is assigned to the minimum output value (4 mA or 0V).
Indicators	**Four status LEDs: In RUN mode:** **Green ON Steady:** Power ON, RUN mode **Green Flashing:** Discrete output is overloaded **Red Flashing:** Relative received signal strength **Yellow analog ON Steady:** Target is inside window limits **Yellow discrete ON Steady:** Output conducting **In Program mode:** **Green OFF:** PROGRAM mode **Red Flashing:** Relative received signal strength **Yellow ON Steady:** Ready for first window limit **Yellow Flashing:** Ready for second limit **Yellow OFF:** Not teaching this output
Construction	Molded reinforced thermoplastic polyester housing.
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 415.
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Objects passing inside the specified near limit will produce a false response. NOTE: For more information about out-of-range and signal loss response of the analog output, see product literature.
Certifications	CE
Hookup Diagrams	**Analog/Discrete Models:** MI16 (p. 535) **Dual-Discrete Models:** MI15 (p. 535)

U-GAGE® Q45U
Flexible Ultrasonic Sensors

The U-GAGE® Q45U series offers a choice of analog or bipolar discrete models, designed for either long-range or short-range sensing.

- Push-button TEACH programming makes it easy to set the near/far limits of the sensing window.
- Available ranges are 100 to 1400 mm for the short-range models and 0.25 to 3.0 m for the long-range models.
- Bipolar discrete models have switches for ON/OFF presence detection and HIGH/LOW level control.
  - In ON/OFF mode, detects either when the target is within the set range or when it is outside the range.
  - In HIGH/LOW mode, detects when the target is outside the configured range, for fill level control, web tensioning control and similar applications.
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.
- For remote programming, analog models can be wired directly to an external switch, controller or computer to set window limits—ideal for inaccessible applications such as roll diameter detection for overhead cranes.

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QD CABLES
5-Pin Euro + 5-Pin Mini
PAGE 415 & 421

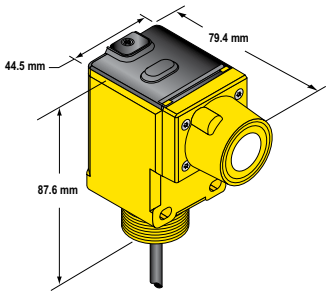
Program storage cards
After you set up window limits, you can store the limits on circuit cards with non-volatile memory for fast setup. Just store the settings from any Q45U sensor on the card, and then transfer the settings to any Q45U sensor with the same available sensing range.

U-GAGE® Q45U Sensors

- *5-segment target position indicator*
- *2 m or 9 m attached cable, or Mini- or Euro-style quick-disconnect*
- *Three status LEDs*
- *Simple push button for programming limits of sensing window*
- *5-pin Mini- or Euro-style QD cables with shield ordered separately (see pages 415 and 421)*

Short-range Models

MORE INFO ONLINE Detailed Dimensions



Long-range Models

U-GAGE® Q45U Discrete Output, 12-24V dc

MORE INFO ONLINE Download PDF

Models	Range	Temperature Compensation	Cable*	Output Type	Response Time	Data Sheet
Q45UBB63DA	100 mm - 1.4 m	No	2 m	Bipolar NPN/PNP	Programmable for 20, 40, 160, or 640 ms	44177
Q45UBB63DAQ			5-pin Mini QD			
Q45UBB63DAQ6			5-pin Euro QD			
Q45UBB63DAC		Yes	2 m			
Q45UBB63DACQ			5-pin Mini QD			
Q45UBB63DACQ6			5-pin Euro QD			
Q45UBB63BC	250 mm - 3 m†	Yes	2 m	Bipolar NPN/PNP	Programmable for 40, 80, 320, or 1280 ms	48454
Q45UBB63BCQ			5-pin Mini QD			
Q45UBB63BCQ6			5-pin Euro QD			

U-GAGE® Q45U Analog Output, 15-24V dc

MORE INFO ONLINE Download PDF

Models	Range	Temperature Compensation	Cable*	Output Type	Response Time	Data Sheet
Q45ULIU64ACR	100 mm - 1.4 m	Yes	2 m	Selectable 0 to 10V dc or 4 to 20 mA	Adjustable from 40 to 1280 ms	47818
Q45ULIU64ACRQ			5-pin Mini QD			
Q45ULIU64ACRQ6			5-pin Euro QD			
Q45ULIU64BCR	250 mm - 3 m†	Yes	2 m		Adjustable from 80 to 2560 ms	48456
Q45ULIU64BCRQ			5-pin Mini QD			
Q45ULIU64BCRQ6			5-pin Euro QD			

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UBB63DA W/30**). A model with a QD requires a mating cable (see pages 415 and 421).

† The far limit may be extended as far as 3.9 m for good acoustical targets–hard surfaces with area greater than 100 cm².

U-GAGE® Q45U Specifications

Sensing Range	**Near limit:** 100 mm min. **Long Range:** Near limit: 250 mm min. **Far limit:** 1.4 m max. **Long Range:** Far limit: 3.0 m max. NOTE: The far limit may be extended on long range units, as far as 3.9 m for good acoustical targets (hard surfaces with area greater than 100 cm^2)
Supply Voltage and Current	**Discrete:** 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) **Analog:** 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)
Ultrasonic Frequency	**Long Range:** 128 kHz **Short Range:** 230 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs.
Output Configuration	**Discrete: Bipolar:** One current sourcing (PNP) and one current sinking (NPN) open-collector transistor. **Analog:** One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2.
Output Ratings	**Discrete:** 150 mA max. (each) **OFF-state leakage current:** less than 25 µA at 24V dc **ON-state saturation voltage**: less than 1.5V at 10 mA; less than 2.0V at 150 mA **Analog: Voltage sourcing:** 0 to 10V dc, 10 mA max. **Current sourcing:** 4 to 20 mA, 1 to 500 Ω impedance
Performance Specifications	**Short Range** / **Long Range** **Analog resolution or discrete repeatability:** ± 0.1% of sensing distance (± 0.25 mm min.) / ± 0.1% of sensing distance (± 0.5 mm min.) **Analog Linearity:** 1% of full scale / 1% of full scale **Temperature effect:** 0.05% of sensing distance/ ° C with temp. comp. 0.2% of sensing distance/ ° C without temp. comp. / 0.05% of sensing distance/° C **Min. window size:** 10 mm / 25 mm **Hysteresis (discrete output):** 5 mm / 10 mm
Response Curves	**Short Range:** See charts RC-2 and RC-4 on page 516. **Long Range:** See charts RC-3 and RC-5 on page 516.
Adjustments	The following may be selected by a 4-position DIP switch located on top of the sensor, beneath a transparent o-ring sealed acrylic cover: **Discrete: Switch 1:** Output normally open/normally closed (pump in/pump out) **Switch 2:** High/Low level control mode or ON/OFF presence sensing mode **Switch 3 & 4:** Response speed selection (digital filter) **Analog: Switch 1:** Output slope positive or output slope negative **Switch 2:** Current output mode or voltage output mode **Switch 3:** Loss of echo min/max mode or loss of echo Hold Mode **Switch 4:** Loss of echo min/max default output value
Indicators	**Discrete: Three status LEDs:** **Green ON steady:** power to sensor is ON **Green flashing:** output is overloaded **Yellow ON steady:** outputs are conducting (Yellow LED also indicates programming status during setup mode) **Red flashing:** indicates relative strength of received echo **Analog: Three status LEDs:** **Green ON steady:** power to sensor is ON **Green flashing:** current output fault detected (the 4-20 mA current path to ground has been opened) **Yellow ON steady:** target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) **Red flashing:** indicates relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window.

More on next page

U-GAGE® Q45U Specifications (cont'd)	
Construction	Molded PBT polyester thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a ½"-14NPS internal conduit thread.
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m attached cable, or 5-pin Mini-style or 5-pin Euro-style QD fitting. QD cables are ordered separately. See pages 415 and 421.
Operating Conditions	**Temperature:** -25° to +70° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	**Short Range: Min. target size:** 10 x 10 mm aluminum plate at 500 mm 35 x 35 mm aluminum plate at 1.4 m **Long Range: Min. target size:** 50 x 50 mm aluminum plate at 3 m **Discrete:** Enable/Disable; Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 40 milliseconds for the sensor to enable or disable.
Certifications	CE
Hookup Diagrams	MI17 (p. 536)

U-GAGE® Q45UR
Remote Ultrasonic Sensors

Precise sensing for hard-to-access or difficult applications
The U-GAGE® Q45UR remote ultrasonic sensors are available with analog or bipolar discrete output. They offer the same advanced features as standard Q45U models, with the additional choice of three remote sensing heads for use in confined or difficult environments.

- Sensing head choices are 18 mm diameter threaded barrel housing in plastic or stainless steel, or ultra-compact plastic Flat-Pak.
- Sensing range is 50 to 250 mm.
- All models feature built-in temperature compensation and an operating temperature range from -25° to 70° C.
- Environmental rating is IEC IP65 and NEMA 4.
- Digital filtering provides immunity from random electrical and acoustic noise.

Push-button setup
Push-button TEACH-mode programming enables you to program exact sensing ranges and sensing windows, either by separately setting the lower and upper limits or by selecting the midpoint of a specific sensing window.

BRACKETS
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QD CABLES
5-Pin Euro + 5-Pin Mini
PAGE 415 & 421

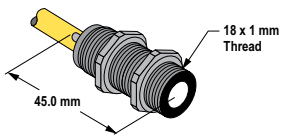
Analog and discrete output
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.
- Adjustable response time is from 10 to 320 milliseconds for analog output sensors and 40 or 160 milliseconds for discrete output sensors.
- Analog models feature a selectable positive or negative output slope.
- Resolution is 0.1 mm for analog models and 0.6 mm for bipolar discrete models.

U-GAGE® Q45UR Sensors

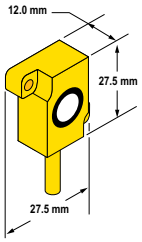
- *5-segment target position indicator*
- *2 m or 9 m attached cable, or Mini- or Euro-style quick-disconnect*
- *Stainless steel barrel or plastic threaded barrel, and Flat-Pak transducer available*
- *Simple push button for programming limits of sensing window*
- *Remote sensing heads with built in temperature compensation*
- *5-pin Mini- or Euro-style QD cables with shield ordered separately (see pages 415 and 421)*

Q45UR Controllers
(S18C2.0 Remote Sensor separate)

MORE INFO ONLINE Detailed Dimensions



M18C2.0 & S18C2.0 Remote Sensors



Q13C2.0 Remote Sensors

U-GAGE® Q45UR Discrete Output, 12-24V dc

MORE INFO ONLINE Download PDF

Kit Models	Kit Includes Controller Model	Kit Includes Sensor Model		Sensor Range	Controller Cable*	Controller Output	Data Sheet
Q45UR3BA63CK	Q45UR3BA63C		M18C2.0 Stainless Steel Barrel	50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQK	Q45UR3BA63CQ				5-pin Mini QD		
Q45UR3BA63CQ6K	Q45UR3BA63CQ6				5-pin Euro QD		
Q45UR3BA63CKQ	Q45UR3BA63C		Q13C2.0 Flat-Pak	50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQKQ	Q45UR3BA63CQ				5-pin Mini QD		
Q45UR3BA63CQ6KQ	Q45UR3BA63CQ6				5-pin Euro QD		
Q45UR3BA63CKS	Q45UR3BA63C		S18C2.0 Molded Barrel	50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQKS	Q45UR3BA63CQ				5-pin Mini QD		
Q45UR3BA63CQ6KS	Q45UR3BA63CQ6				5-pin Euro QD		

U-GAGE® Q45UR Analog Output, 15-24V dc

MORE INFO ONLINE Download PDF

Kit Models	Kit Includes Controller Model	Kit Includes Sensor Model		Sensor Range	Controller Cable*	Controller Output	Data Sheet
Q45UR3LIU64CK	Q45UR3LIU64C		M18C2.0 Stainless Steel Barrel	50 - 250 mm	2 m	Selectable 0 to 10V dc or 4 to 20 mA	59323
Q45UR3LIU64CQK	Q45UR3LIU64CQ				5-pin Mini QD		
Q45UR3LIU64CQ6K	Q45UR3LIU64CQ6				5-pin Euro QD		
Q45UR3LIU64CKQ	Q45UR3LIU64C		Q13C2.0 Flat-Pak	50 - 250 mm	2 m		
Q45UR3LIU64CQKQ	Q45UR3LIU64CQ				5-pin Mini QD		
Q45UR3LIU64CQ6KQ	Q45UR3LIU64CQ6				5-pin Euro QD		
Q45UR3LIU64CKS	Q45UR3LIU64C		S18C2.0 Molded Barrel	50 - 250 mm	2 m		
Q45UR3LIU64CQKS	Q45UR3LIU64CQ				5-pin Mini QD		
Q45UR3LIU64CQ6KS	Q45UR3LIU64CQ6				5-pin Euro QD		

* For 9 m cable, add suffix **W/30** to 2 m model number (example, **Q45UR3BA63CK W/30**). A model with a QD requires a mating cable (see pages 415 and 421).

U-GAGE® Q45UR High-Gain Controllers

Product P/N	Version	
63060	Q45UR3BA63CQ6-63060	Discrete
63667	Q45UR3LIU64CQ6-63667	Analog

NOTE: Special High-Gain controllers are available for small object detection. Contact factory for more information.

U-GAGE® Q45UR Remote Sensors Specifications

Supply Voltage and Current	**Discrete:** 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) **Analog:** 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)
Ultrasonic Frequency	400 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Protection Circuitry	Both outputs are protected against continuous overload and short circuit
Output Rating	**Discrete:** 150 mA max. (each output) **OFF-state leakage current:** less than 25 µA at 24V dc **ON-state saturation voltage:** less than 1.5V at 10 mA; less than 2.0V at 150 mA **Analog:** **Voltage sourcing:** 0 to 10V dc, 10 mA max. **Current sourcing:** 4 to 20 mA, 1 to 500 Ω impedance
Output Configuration	**Discrete: Bipolar:** One current sourcing (PNP) and one current sinking (NPN) open collector transistor **Analog:** One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2
Performance Specifications	**Discrete: Response Speed:** 40 or 160 milliseconds (switch selectable) **Repeatability*:** ±0.2% of measured distance **Temperature stability:** ±0.03% of the window limit positions per ° C from 0° to 50° C (±0.05% per ° C over remainder of operating temperature range) **Sensing window width:** 5 to 200 mm, when independent near and far limits are taught; 1, 2, 3, or 4 mm (switch selectable), when a sensing distance set point is taught **Hysteresis:** 0.5 mm **Ultrasonic beam angle:** ±3.5˚ **Analog: Response Speed:** 10 to 320 milliseconds (2 to 64 cycles) selectable **Resolution*:** 0.2% of sensing distance at 320 milliseconds response 0.4% of sensing distance at 10 milliseconds response **Linearity*:** 1% of full scale **Temperature stability:** ±0.03% of sensing distance per ° C from 0° to 50° C (±0.05% per ° C over remainder of operating temperature) **Ultrasonic beam angle:** ±3.5˚ * Repeatability and analog resolution and linearity are specified using a 50 x 50 mm aluminum plate at 22° C under fixed sensing conditions (Analog: using the 4 to 20 mA output @ 15V dc)
Response Curves	See chart RC-6 on page 516.
Adjustments	**Discrete:** The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed acrylic cover and beneath the black inner cover **Switch 1:** Output normally open (output is energized when target is within sensing window limits), or normally closed (output is energized when target is outside sensing window limits) **Switches 2 & 3:** Sensing window size (1, 2, 3 or 4 mm) **Switch 4:** Response speed selection (40 or 160 milliseconds) **Analog:** Push-button TEACH-mode programming of window limits. The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed acrylic cover and beneath the black inner cover **Switch 1:** Output slope: output value increases or decreases with distance **Switch 2:** Output mode: current output or voltage output **Switches 3 & 4:** Response to loss of echo **Response Speed Adjustment:** Single-turn potentiometer selects six response values from 10 to 320 milliseconds

More on next page

U-GAGE® Q45UR Remote Sensors Specifications (cont'd)

Indicators	**Discrete: Three status LEDs:** **Green ON steady:** Power to controller is ON **Green flashing:** Output is overloaded **Yellow ON steady:** Output are conducting (Yellow also indicates programming status during setup) **Red flashing:** Relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window **Analog: Three status LEDs:** **Green ON steady:** Power to controller is ON **Green flashing:** Current output fault detected (indicates that the 4 to 20 mA current path to ground has been opened) **Yellow ON steady:** Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) **Red flashing:** Relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window
Construction	**Controller:** Molded thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware **Sensors:** **M18C2.0:** Stainless steel M18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, polyurethane rear cover **S18C2.0:** Thermoplastic polyester S18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, polyurethane rear cover **Q13C2.0:** Molded 30% glass reinforced thermoplastic polyester housing, ceramic transducer, fully epoxy-encapsulated
Environmental Rating	**Controller:** IEC IP67; NEMA 6P **Sensor:** IEC IP65; NEMA 4
Connections	**Controller:** 2 m or 9 m attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting. See pages 415 and 421. **Sensor:** 2 m attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller.
Operating Conditions	**Controller and sensor:** -25° to +70° C **Relative humidity:** 85% (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A Vibration: 10 to 60Hz max., double amplitude 0.06" (maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	**Discrete:** The TEACH-mode function of the controller is used to set the sensing distance set point. The sensing window size is set using DIP switches #2 and #3. The sensing distance set point is centered within the sensing widow. The size of the sensing window may be adjusted at any time, with or without power applied, and without re-teaching the sensing distance set point. The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using the Remote TEACH input (see hookup diagrams). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor. **Analog:** The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using the Remote TEACH input (see hookup diagrams). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.
Certifications	CE
Hookup Diagrams	MI17 (p. 536)

U-GAGE® T18U
Opposed Dual Range Sensors

Dual ranges and response times

The versatile U-GAGE® T18U offers a choice of two combinations of range and response time in the same unit:

- Response time of 2 milliseconds and range of 600 mm for longer-range applications
- Ultra-fast response time of 1 millisecond with a range of 300 mm for high-speed applications such as counting

Reliable sensing of clear materials

- Uses high-frequency acoustic emitter and tuned receiver for accurate sensing in bright light and to reliably detect clear materials such as glass
- Offers high immunity to electrical and acoustic noise
- Operates at temperature range from -40° to 70° C
- Includes signal strength indicator to make alignment easy

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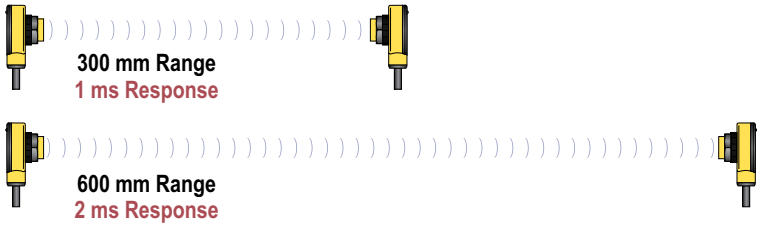
4-Pin Euro
PAGE 412

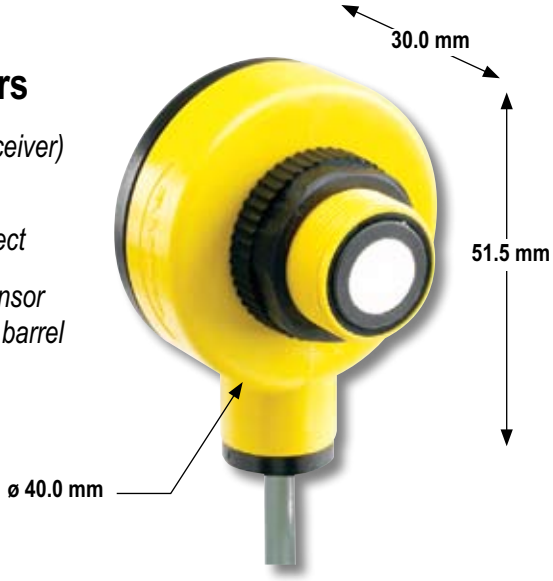
Popular patented housing

- Housed in T-style right-angle sensor package with 18 mm threaded mounting hub, for versatile mounting
- Measures only 40 mm in diameter and 30 mm deep
- Available with 4-pin Euro-style quick-disconnect or integral cable



U-GAGE® T18U Sensors

- *Dual LED indicator system (receiver)*
- *2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect*
- *Patented T-style right-angle sensor package with 18 mm threaded barrel*



MORE INFO ONLINE Detailed Dimensions

U-GAGE® T18U, 12-30V dc

MORE INFO ONLINE Download PDF

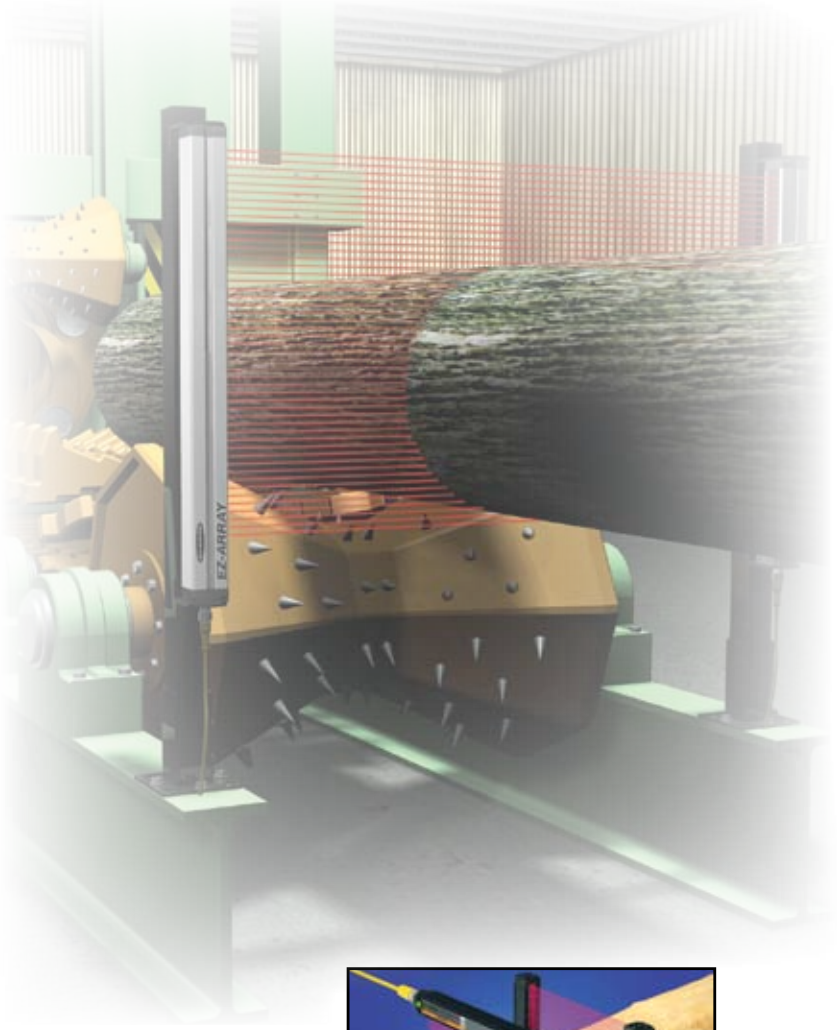
Models*		Range	Cable**	Output	Response Time	Data Sheet
T186UE	Emitter	NORMAL resolution: 600 mm HIGH resolution: 300 mm	2 m	—	NORMAL resolution: 2 ms or HIGH resolution: 1 ms	40124
T186UEQ			4-pin Euro QD			
T18VN6UR	Receiver		2 m	NPN		
T18VN6URQ			4-pin Euro QD			
T18VP6UR	Receiver		2 m	PNP		
T18VP6URQ			4-pin Euro QD			

* Sensor pair requires one emitter and one receiver.
** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T18VN6UR W/30**). A model with a QD requires a mating cable (see page 412).

U-GAGE® T18U Specifications	
Sensing Range (no minimum range)	**NORMAL resolution mode:** to 600 mm **HIGH resolution mode:** to 300 mm
Supply Voltage	12 to 30V dc, 10% max. ac ripple. 50 mA (emitters); 35 mA (receivers), exclusive of output load.
Ultrasonic Frequency	Ultrasonic, 230 kHz
Minimum spacing (adjacent pairs)	50 mm for emitter-to-receiver separations of up to 150 mm. Add 10 mm of adjacent-pair spacing for every 100 mm of emitter-to-receiver spacing beyond 150 mm.
Receiver Output Configuration	**T18VN models:** NPN sinking, NO and NC (complementary) **T18VP models:** PNP sourcing, NO and NC (complementary)
Receiver Output Rating	150 mA max. each output at 25° C, derated to 100 mA at 70° C (derate ≈ 1 mA per ° C). Both outputs may be used simultaneously. **ON-state saturation voltage:** less than 1.5V at 10 mA; less than 2.0 V at 150 mA **OFF-state leakage current:** less than 1 µA at 30V dc **Output protection:** Overload and short-circuit protected. No false pulse upon receiver power-up: false pulse protection causes a 100 millisecond delay upon power-up.

More on next page

U-GAGE® T18U Specifications (cont'd)	
Output Response Time	**NORMAL resolution mode:** 2 milliseconds ON/OFF **HIGH resolution mode:** 1 millisecond ON/OFF
Rep Rate	**NORMAL resolution mode:** 125 Hz max. **HIGH resolution mode:** 200 Hz max.
Mechanical Sensing Repeatability at 300 mm range	**NORMAL resolution mode**: less than 2 mm **HIGH resolution mode**: less than 1 mm
Beam Angle (-3dB full angle)	15 ± 2˚
Indicators	Emitters have a green LED for dc power ON. Receivers have two LED's, one yellow and one green. Indications are as follows: **Green ON steady:** dc power ON **Green flashing:** output overloaded **Yellow flashing:** sonic signal received (flash rate is proportional to received signal strength; flash is from full to half intensity).
Construction	T-style yellow PBT polyester housing with black PBT polyester back cover. Transducer housing is threaded M18 x 1. Mating jam nut is supplied for mounting. Acoustic face is epoxy reinforced. Circuitry is epoxy-encapsulated.
Environmental Rating	IEC IP67; NEMA 6P
Connections	**Emitters:** 2 m long attached PVC- covered 2-wire cable or 4-pin Euro-style quick-disconnect fitting. **Receivers:** 2 m long attached PVC-covered 4-wire cable or 4-pin Euro-style quick-disconnect fitting. 9 m long cables are available by request. Mating Euro-style quick-disconnect cables are also available. See page 412.
Operating Temperature	-40° to +70° C
Vibration and Mechanical Shock	Meets Mil.Std 202F requirements. Method 201A (Vibration: frequency 10 to 60 Hz, max., and double amplitude 0.06-inch, maximum acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operation; 100G for non-operation) Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Certifications	CE
Hookup Diagrams	**Emitter Models:** MI20 (p. 536) **NPN Models:** MI18 (p. 536) **PNP Models:** MI19 (p. 536)



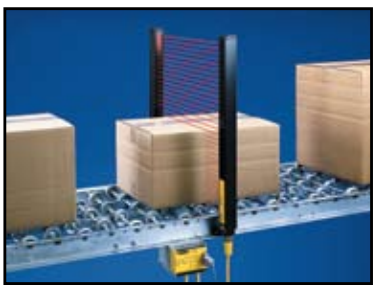
A-GAGE®
Measuring Light Screens

EZ-ARRAY™ **page 288**

- Applications include edge and center-guiding, loop tension control, hole sizing, parts counting and on-the-fly product sizing and profiling.
- Closely spaced infrared beams detect objects as small as 5 mm wide; edge resolution is 2.5 mm.
- Controller functionality is built into the receiver, so basic setup requires no controller, software, or PC.
- Easy-to-use software is included for advanced configuration, using a PC.
- Configuration options include 14 measurement modes, three scanning methods, two analog and two discrete outputs and a serial output.
- Range is 4 meters.
- Array heights range from 150 to 2400 mm.

High-Resolution MINI-ARRAY® **page 291**

- High-resolution array excels at high-speed, precise process monitoring and inspection applications.
- Available heights range from 163 to 1951 mm.
- Closely spaced beams detect objects as small as 2.5 mm.
- Emitters and receivers can be up to 1.8 m apart.
- Controllers can be configured for a variety of measurement modes, scan modes and output configurations.

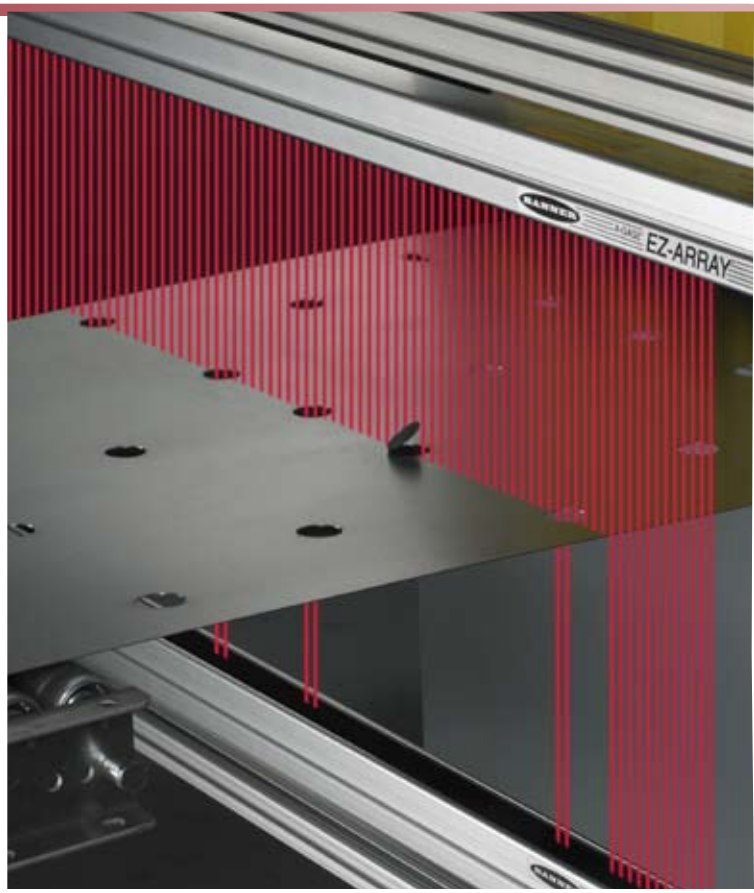


MINI-ARRAY® **page 296**

- Low-profile light screen pairs are designed for profiling and inspections.
- Available heights range from 133 to 1819 mm.
- Depending on the model's beam spacing, the array detects objects as small as 19 to 38 mm.
- Emitters and receivers can be up to 6 m apart or up to 17 m apart, depending on model.
- Configuration options include blanking, sensitivity and scanning mode.
- Controllers are available with DeviceNet™ Compatibity output.

A-GAGE® EZ-ARRAY™

Two-Piece Measuring Light Screens

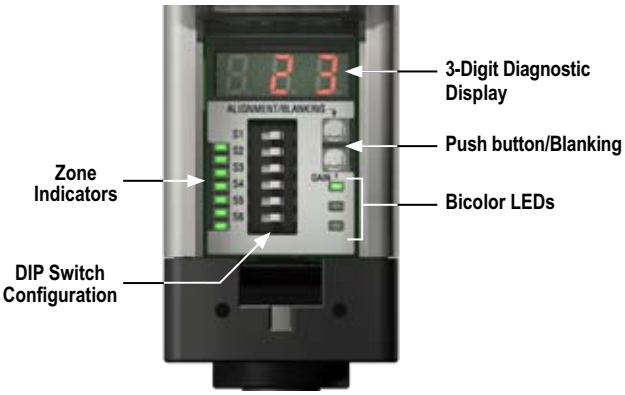


High accuracy monitoring and inspection

EZ-ARRAY™ excels at high-speed, precise process monitoring and inspection, profiling and web-guiding applications. It offers quick and simple installation with the sophistication to handle the toughest sensing applications.

- Two-piece design eliminates the needs for a separate controller.
- Two push buttons are provided for gain method selection and alignment/ blanking.
- High-excess-gain option for detecting opaque objects and maximizing range in dirty environments.
- Edge resolution of 2.5 mm on opaque objects in single and double edge scan mode.
- Low-contrast sensing of semi-transparent materials and objects as small as 5 mm.
- Seven Zone LED's provide instant alignment and beam blockage information.
- Remote TEACH-wire option is included for alignment, blanking, sensitivity, inverted display and DIP switch enabled/disabled.
- Aluminum housing is compact and rugged for demanding applications.

BRACKETS PAGE 373
QD CABLES 8-Pin Euro PAGE 416
ENCLOSURES PAGE 436
STANDS PAGE 441
LENS SHIELDS PAGE 439

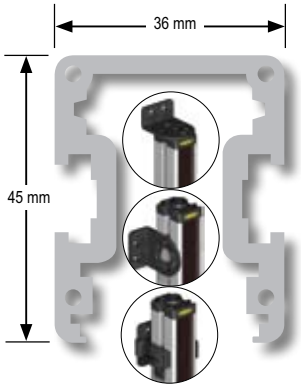


Provides powerful configuration capabilities

- Straightforward applications can be configured using six-position DIP switch on front of the receiver.
- Easy-to-use graphic user interface software is included for advanced configuration using a PC (USB serial adapter required–sold separately).
- Integrated 3-digit diagnostic display indicates number of beams blocked, blanking configuration and troubleshooting codes.
- Bicolor LEDs indicate system and serial communication status.
- Array lengths range from 150 to 2400 mm.
- Working range is 400 mm to 4 m, with 5 mm beam spacing.

Versatile mounting

- T-nut slots on both sides of the housing
- Mount at end caps, housing side or both



INTUSB485-1 Serial Adapter

Optional USB sensor adapter provides advanced configuration using a PC (see page 448)

A-GAGE® EZ-ARRAY™ Light Screen

- *Twelve array lengths*
- *Minimum object detection size of 5 mm*
- *Edge resolution of 2.5 mm for opaque objects*
- *Emitter/receiver separation up to 4 m*
- *Durable aluminum housing*
- *System status indicators and diagnostic display*
- *8-pin Euro-style quick-disconnect fitting*

MORE INFO ONLINE Detailed Dimensions

EZ-ARRAY Light Screen	
W = 36.0 mm	D = 45.2 mm

Emitter/Receiver Models	Housing Length (L)
EA5E150Q Emitter EA5R150..Q Receiver	227 mm
EA5E300Q Emitter EA5R300..Q Receiver	379 mm
EA5E450Q Emitter EA5R450..Q Receiver	529 mm
EA5E600Q Emitter EA5R600..Q Receiver	678 mm
EA5E750Q Emitter EA5R750..Q Receiver	828 mm
EA5E900Q Emitter EA5R900..Q Receiver	978 mm
EA5E1050Q Emitter EA5R1050..Q Receiver	1128 mm
EA5E1200Q Emitter EA5R1200..Q Receiver	1278 mm
EA5E1500 Emitter EA5R1500..Q Receiver	1578 mm
EA5E1800Q Emitter EA5R1800..Q Receiver	1878 mm
EA5E2100Q Emitter EA5R2100..Q Receiver	2178 mm
EA5E2400Q Emitter EA5R2400..Q Receiver	2478 mm

A-GAGE® EZ-ARRAY™ Light Screens, 12-30V dc–5 mm Beam Spacing

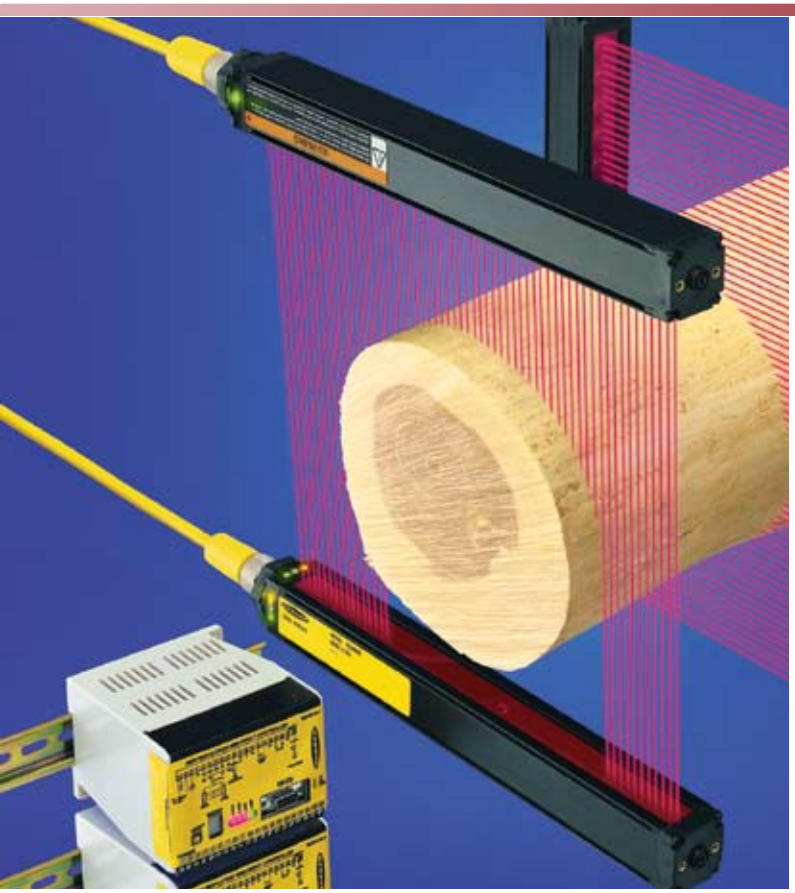
MORE INFO ONLINE Download PDF

Emitter Model	Receiver Model NPN Outputs	Receiver Model PNP Outputs	Range	Analog Output	Array Length	Total Beams	Quick Start
EA5E150Q	EA5R150NIXMODQ EA5R150NUXMODQ	EA5R150PIXMODQ EA5R150PUXMODQ	400 mm-4 m	Current (4–20 mA) Voltage (0–10V)	150 mm	30	126701
EA5E300Q	EA5R300NIXMODQ EA5R300NUXMODQ	EA5R300PIXMODQ EA5R300PUXMODQ		Current (4–20 mA) Voltage (0–10V)	300 mm	60	
EA5E450Q	EA5R450NIXMODQ EA5R450NUXMODQ	EA5R450PIXMODQ EA5R450PUXMODQ		Current (4–20 mA) Voltage (0–10V)	450 mm	90	
EA5E600Q	EA5R600NIXMODQ EA5R600NUXMODQ	EA5R600PIXMODQ EA5R600PUXMODQ		Current (4–20 mA) Voltage (0–10V)	600 mm	120	
EA5E750Q	EA5R750NIXMODQ EA5R750NUXMODQ	EA5R750PIXMODQ EA5R750PUXMODQ		Current (4–20 mA) Voltage (0–10V)	750 mm	150	
EA5E900Q	EA5R900NIXMODQ EA5R900NUXMODQ	EA5R900PIXMODQ EA5R900PUXMODQ		Current (4–20 mA) Voltage (0–10V)	900 mm	180	
EA5E1050Q	EA5R1050NIXMODQ EA5R1050NUXMODQ	EA5R1050PIXMODQ EA5R1050PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1050 mm**	210	
EA5E1200Q	EA5R1200NIXMODQ EA5R1200NUXMODQ	EA5R1200PIXMODQ EA5R1200PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1200 mm**	240	
EA5E1500Q	EA5R1500NIXMODQ EA5R1500NUXMODQ	EA5R1500PIXMODQ EA5R1500PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1500 mm**	300	
EA5E1800Q	EA5R1800NIXMODQ EA5R1800NUXMODQ	EA5R1800PIXMODQ EA5R1800PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1800 mm**	360	
EA5E2100Q	EA5R2100NIXMODQ EA5R2100NUXMODQ	EA5R2100PIXMODQ EA5R2100PUXMODQ		Current (4–20 mA) Voltage (0–10V)	2100 mm**	420	
EA5E2400Q	EA5R2400NIXMODQ EA5R2400NUXMODQ	EA5R2400PIXMODQ EA5R2400PUXMODQ		Current (4–20 mA) Voltage (0–10V)	2400 mm**	480	

* A model with a QD requires a cable (see page 416).

** Models with array lengths 1050 mm and longer ship with a center bracket and two end-cap brackets.

A-GAGE® EZ-ARRAY™ Specification	
Supply Voltage (Limit Values)	**Emitter:** 12 to 30V dc **Receiver Analog Current Models:** 12 to 30V dc **Receiver Analog Voltage Models**: 15 to 30V dc
Supply Power Requirements	Emitter/Receiver Pair (Exclusive of discrete load): Less than 9 watts **Power-up delay**: 2 seconds
Emitter/Receiver Range	400 mm to 4 m
Field of View	Nominally ± 3°
Beam Spacing	5 mm
Light Source	Infrared LED
Minimum Object Detection Size	**Straight Scan, Low-Contrast:** 5 mm **Straight Scan, High-Excess-Gain:** 10 mm
Sensor Positional Resolution	**Straight Scan:** 5 mm **Double-Edge Scan:** 2.5 mm **Single-Edge Scan:** 2.5 mm
Teach Input (Receiver Gray Wire)	**Low:** 0 to 2 volts **High:** 6 to 30 volts or open (input impedance 22 kΩ)
Two Discrete Outputs	Solid-State NPN or PNP (current sinking or sourcing) **Rating:** 100 mA max. each output **OFF-State Leakage Current: NPN:** less than 200 uA @ 30V dc **PNP:** less than 10 uA @ 30V dc **ON-State Saturation Voltage: NPN:** less than 1.6V @ 100 mA **PNP:** less than 2.0V @ 100 mA Protected against false pulse on power-up and continuous overload or short circuit.
Two Analog Outputs	**Voltage Sourcing:** 0 to 10V (maximum current load of 5 mA) **Current Sourcing:** 4 to 20 mA (maximum resistance load = (V_{supply} –3) / 0.020)
Serial Communication Interface	EIA-485 Modbus RTU (up to 15 nodes per communication ring) RTU binary format **Baud Rate:** 9600, 19.2K or 38.4K 8 Data Bits, 1 Stop Bit, and Even, Odd, or 2 Stop Bits and No Parity
Scan Time	Scan times depend on scan mode and sensor length. Straight scan times range from 2.8 to 26.5 milliseconds.
Status Indicators	**Emitter:** Red Status LED ON Steady—Status OK Flashing at 1 hz—Error **Receiver:** 7 Zone Indicators Red—Blocked channels within zone Green—All channels clear within zone 3-digit 7-segment indicators for measurement mode / diagnostic information Sensor Status Bicolor Indicator LED Red—Hardware Error or Marginal Alignment Green—OK Modbus Activity Indicator LED: Yellow Modbus Error Indicator LED: Red
System Configuration (Receiver Interface)	6-position DIP switch: Used to set scanning type, measurement modes, analog slope and discrete output 2 function. Alternate software GUI interface provides additional options; see full manual (p/n 130426).
Push Buttons (Receiver Interface)	Two momentary push buttons for alignment and gain level selection.
Connections	**Serial communication:** The receiver uses a PVC-jacketed, 5-conductor 22-gauge quick-disconnect cable, 5.4 mm diameter. QD cables are ordered separately. See page 422. **Other Sensor connections:** 8-conductor quick-disconnect cables (one each for emitter and receiver), ordered separately (may not exceed 75 m long), PVC-jacketed cables measure 5.8 mm diameter, have shield wire; 22-gauge conductors. QD cables are ordered separately. See page 416.
Construction	Aluminum housing with clear-anodized finish; acrylic lens cover
Environmental Rating	IEC IP65
Operating Conditions	**Temperature:** –40° to +70° C **Relative humidity:** 95% at 50° C (non-condensing)
Hookup Diagrams	**NPN models:** MI23 (p. 537) **PNP models:** MI24 (p. 537)



A-GAGE® High-Resolution MINI-ARRAY®

High-Resolution Inspection and Profiling Light Screen

The A-GAGE® High-Resolution MINI-ARRAY® has 120 sensing beams per foot, for reliable detection of objects as small as 2.5 mm. It features a 2 m range with easy, forgiving alignment and a unique TEACH setup routine that equalizes the gain of each sensing channel to the optimum level and automatically blanks any blocked areas along the length of the light screen.

Ultra-precise monitoring & inspection

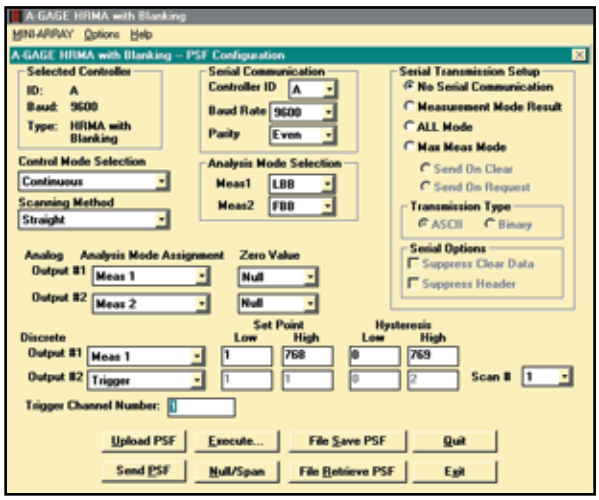
High-Resolution MINI-ARRAY systems excel in high-speed, precise monitoring and inspection applications, including on-the-fly sizing, profiling, precision edge and center guiding, and hole detection. Setup software allows system configuration using a PC.

- Delivers reliable 2.5 mm minimum detection throughout the array
- Available with discrete or analog outputs
- Offers programmable blanking, hysteresis and serial communication
- Reliably detects variable object size at a high resolution and fast response speed

A choice of 12 array heights to fit your precision measurement applications

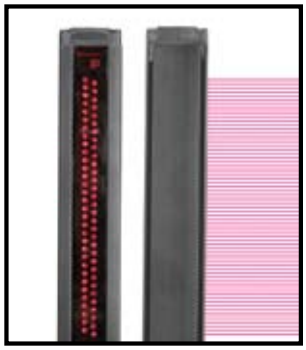
- Available in heights from 163 to 1951 mm
- Features 7 measurement modes and 3 scanning methods

BRACKETS PAGE 373
QD CABLES 5-Pin Mini PAGE 421
ENCLOSURES PAGE 436
STANDS PAGE 441
LENS SHIELDS PAGE 439



Many options, yet easy to program

- Software included with the control module makes it easy to configure the many options with a PC-compatible computer.
- Storable scanning programs eliminate reprogramming for repeated applications.
- Non-volatile memory of controller stores alignment settings.



Unique staggered LED array allows for industry's tightest sensing tolerance.

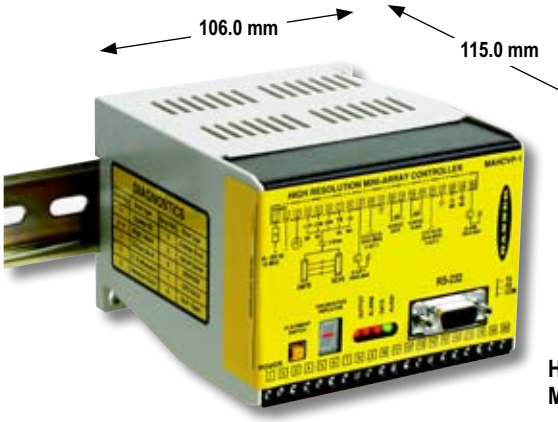
A-GAGE® High-Resolution MINI-ARRAY® System

- *Twelve array lengths*
- *Minimum object detection size of 2.5 mm*
- *Emitter/receiver separation up to 1.8 m*
- *Configurable controller*
- *Rugged aluminum housing*

MORE INFO ONLINE Detailed Dimensions

High-Resolution MINI-ARRAY Sensors	
W = 38.1 mm	D = 38.1 mm

Emitter/Receiver Models	Housing Length (L)
MAHE6A Emitter MAHR6A Receiver	233 mm
MAHE13A Emitter MAHR13A Receiver	396 mm
MAHE19A Emitter MAHR19A Receiver	559 mm
MAHE26A Emitter MAHR26A Receiver	721 mm
MAHE32A Emitter MAHR32A Receiver	884 mm
MAHE38A Emitter MAHR38A Receiver	1046 mm
MAHE45A Emitter MAHR45A Receiver	1212 mm
MAHE51A Emitter MAHR51A Receiver	1374 mm
MAHE58A Emitter MAHR58A Receiver	1537 mm
MAHE64A Emitter MAHR64A Receiver	1700 mm
MAHE70A Emitter MAHR70A Receiver	1862 mm
MAHE77A Emitter MAHR77A Receiver	2025 mm



High-Resolution MINI-ARRAY Controller

A-GAGE® High-Resolution MINI-ARRAY® Controllers†, 16-30V dc

MORE INFO ONLINE Download PDF

Controller Models	Inputs	Solid-State Discrete Outputs	Analog Outputs	Serial Output	Data Sheet
MAHCVP-1	1 Sensor pair & Trigger (Gate)	2 PNP	(2) 0-10V Sourcing	RS-232 & RS-485	64118
MAHCVN-1		2 NPN	(2) 0-10V Sourcing		
MAHCIP-1		2 PNP	(2) 4-20 mA Sinking		
MAHCIN-1		2 NPN	(2) 4-20 mA Sinking		

† One controller and an emitter/receiver pair (of matching length) required per system.

A-GAGE® High-Resolution MINI-ARRAY® Sensors–2.5 mm Beam Spacing

Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
MAHE6A MAHR6A	5-pin Mini QD	233 mm	64	163 mm	2.5 mm	0.4 - 1.8 m	64118
MAHE13A MAHR13A		396 mm	128	325 mm			
MAHE19A MAHR19A		559 mm	192	488 mm			
MAHE26A MAHR26A		721 mm	256	650 mm			
MAHE32A MAHR32A		884 mm	320	813 mm			
MAHE38A MAHR38A		1046 mm	384	975 mm			
MAHE45A MAHR45A		1212 mm	448	1138 mm			
MAHE51A MAHR51A		1374 mm	512	1300 mm			
MAHE58A MAHR58A		1537 mm	576	1463 mm			
MAHE64A MAHR64A		1700 mm	640	1626 mm			
MAHE70A MAHR70A		1862 mm	704	1788 mm			
MAHE77A MAHR77A		2025 mm	768	1951 mm			

* "E" and "R" in model numbers denotes "Emitter" and "Receiver" respectively. Sold separately.

•• A model with a QD requires a mating cable (see page 421).

A-GAGE® High-Resolution MINI-ARRAY® Controller Specifications

Power Requirements	16 to 30V dc @ 1.0 A (typical: 0.5 A @ 16V dc)
Inputs	**Sensor input**: Emitter and receiver wire in parallel to five terminals. **Trigger (Gate) input**: Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for gate signal **Remote alignment input**: Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for alignment sequence signal
Discrete (Switched) Outputs	**NPN outputs**: Open collector NPN transistor rated at 30V dc max., 150 mA max. **PNP outputs**: Open collector PNP transistor rated at 30V dc max., 150 mA max. **All discrete outputs**: **OFF-state leakage current:** less than 10 µA @ 30V dc **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.5V @ 150 mA
Serial Data Outputs	RS-232 or RS-485 interface. (Up to 15 control modules may be given unique addresses on one RS-485 party line.) ASCII or binary data format 9600, 19.2K or 39.4K baud rate 8 data bits, stop bit, and even, odd or no parity

More on next page

A-GAGE® High-Resolution MINI-ARRAY® Controller Specifications (cont'd)	
Analog Outputs	**Voltage-sourcing outputs**: 0 to 10V dc (25 mA current limit) **Current-sinking outputs**: 4 to 20 mA (16 to 30V dc input) **Resolution**: Span / Number of sensing channels **Linearity**: 0.1% of full scale **Temperature variation**: 0.01% of full scale per ° C
Output Configuration	**MAHCVP-1:** Two PNP discrete (switched), two 0-10V voltage sourcing **MAHCVN-1:** Two NPN discrete (switched), two 0-10V voltage sourcing **MAHCIP-1:** Two PNP discrete (switched), two 4-20 mA current sinking **MAHCIN-1:** Two NPN discrete (switched), two 4-20 mA current sinking
System Programming	Via RS-232 interface to PC-compatible computer running Windows® 95, 98, NT, ME, XP or 2000 and using software supplied with each control module.
Status Indicators	**Output 1(Red):** Lights to indicate Discrete Output #1 is active **Alarm (Red):** Lights to indicate Discrete Output #2 is active **Gate (Red):** Lights to indicate Trigger (Gate) is active **Align (Green):** Lights to indicate emitter and receiver are aligned **Diagnostics indicator:** (Key on controller side label) Identifies System errors and status
Construction	Polycarbonate housing; mounts to flat surface or directly onto 35-mm DIN rail
Environmental Rating	NEMA 1; IP20
Operating Conditions	**Temperature:** 0° to +50° C **Relative humidity:** 95% @ 50˚ C (non-condensing)
Certifications	CE
Hookup Diagrams	**0-10V sourcing:** MI25 (p. 538) **4 to 20 mA voltage:** MI26 (p. 538)

A-GAGE® High-Resolution MINI-ARRAY® Sensor Specifications	
Emitter/Receiver Range	380 mm to 1.8 m
Minimum Object Sensitivity	2.5 mm
Sensor Scan Time	1.8 to 58.4 milliseconds, depending on scanning method and sensor length plus 1 millisecond post processing time for controller.
Power Requirements	12V dc ±2%, supplied by controller
Connections	Sensors connect to controller using two 5-conductor quick-disconnect cables (one each for emitter and receiver), ordered separately. Use only Banner cables, which incorporate a "twisted pair" for noise immunity. Cables measure 8.1 mm in diameter and are shielded and PVC-jacketed. Conductors are 20 gauge (0.9 mm). Emitter and receiver cables may not exceed 75 m long, each. See page 421.
Status Indicators	**Emitter:** Red LED lights to indicate proper emitter operation **Receiver:** Green indicates sensors aligned Yellow indicates marginal alignment of one or more beams Red indicates sensors misaligned or one or more beam(s) blocked
Construction	Aluminum, with black anodized finish; acrylic lens cover
Environmental Rating	NEMA 4, 13; IP65
Operating Conditions	**Temperature:** 0° to +50° C **Relative humidity:** 95% at 50° C (non-condensing)
Certifications	CE

System Configuration

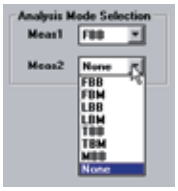
Many options, yet easy to program.

The software included with the control module makes it easy to configure the **High-Resolution MINI-ARRAY®** using your PC-compatible computer*. Simply load the software, access the program, perform the "Ping" procedure to select the desired controller and access the Edit PSF Configuration screen, shown below. Each option is easily selectable, using your mouse and the pop-up menu-style selections.

*Running Windows® 95, 98, NT, ME, XP or 2000

Selected Controller
Identifies the specific control module being configured.

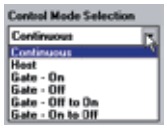
Analysis (Measurement) Mode Selection
Choose the measurement option that best tells you the size and/or position of objects as they relate to the array.

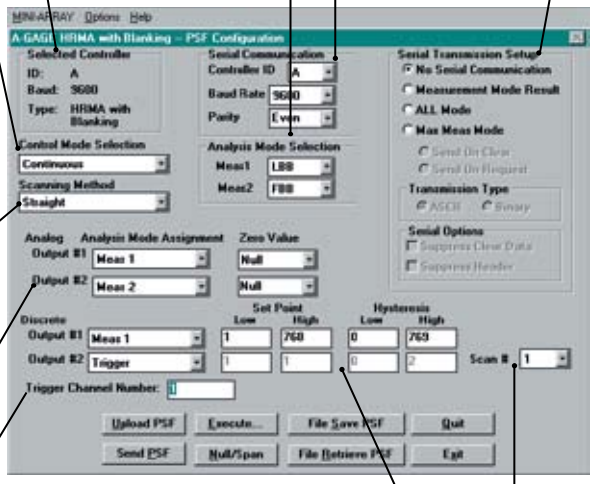


Serial Communication
Changes the identification and baud rate of the controller being configured.

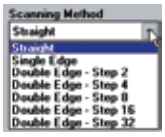
Serial Transmission
Specifies the type of data transmitted from the control module to its host after each scan.
Measurement Mode Result: Data transmitted will reflect the Analysis Mode selections.
All Mode: Transmits all data.
Max. Meas. Mode: Sends only the largest measurement in each measuring event, to decrease transmission size and speed response. Choose to send when the array is clear or send at the host's request.
Transmission Type: ASCII or Binary, defines the format in which the data will be sent.
Serial Options: Suppress Clear Data or Suppress Header to decrease transmission size and speed response.

Control Mode Selection
Continuous Mode: The control module constantly polls the array for status.
Host Mode: The control module polls the array for status when prompted by a host controller.
Gate Mode: The control module polls the array for status when prompted by an input from a Gate sensor.





Scanning Method
Straight scan polls each beam sequentially to determine the target object's overall size. This is the most accurate and precise measurement, but also the most time-consuming.
Single Edge scan requires the target object to block beam 1 (closest to the sensors' cabled ends), then conducts a time-saving binary search to "hunt" for the target's overall height (one variable edge).
Double Edge scan conducts a binary search of the entire array to "hunt" for the target's overall width (two variable edges).



Trigger/Trigger Channel Number
May be used to trigger (or gate) the scan sequence of another **A-GAGE High-Resolution MINI-ARRAY** controller; in straight scanning mode, it defines when during each scan discrete Output #2 will change state.

Scan #: (1-9) Analog outputs are updated with an average value of the data received during the selected number of scans; discrete outputs respond only if the received data is identical for all of the selected number of consecutive scans.

Analog and Discrete Output Assignment
Assigns an analysis (measurement) mode to each output.

Alarm: Causes the control module to turn on discrete Output #2 whenever the System detects a sensing error or if the optical signal becomes marginal.

Set Point and Hysteresis Selection
Assigns the set point to determine where within the array the output(s) will respond and hysteresis values to smooth output response.

MORE INFO ONLINE Download Software

Downloadable Software
To test and verify software, download High-Resolution MINI-ARRAY with blanking version 1.0 (61330.exe) at www.bannerengineering.com.

A-GAGE® MINI-ARRAY®

Inspection and Profiling Light Screens

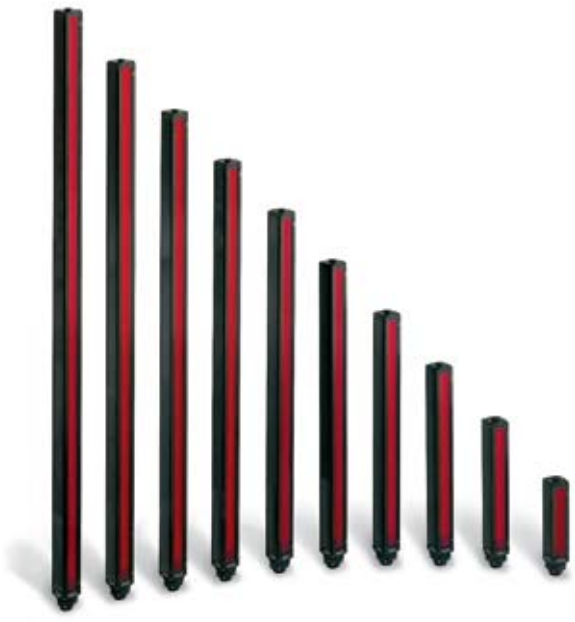
A compact workhorse for inspection and profiling

The programmable A-GAGE® MINI-ARRAY® measuring light screen system is ideal for inspection and profiling applications. Each system includes an emitter/receiver pair, one of nine controller modules and cables. Programmable controller modules offer a selection of measurement modes, scanning modes and output configurations.

- Features compact emitter/receiver footprint—just 38 square mm
- Offers choice of controllers for output in discrete (switched), analog, serial (ASCII or binary) or DeviceNet™
- Includes advanced configuration software
- Available in two models that have 16 discrete outputs

Ten emitter/receiver heights

- Offers 10 array lengths, from 130 mm to 1.8 m, to fit a wide range of applications
- Available with 9.5 or 19 mm beam spacing
- Makes status monitoring easy with indicators visible from three sides



DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.

Optional built-in DeviceNet™ fieldbus

Two controller models allow central monitoring and control of the operation status and diagnostics of several light screens at once over a DeviceNet control network. MINI-ARRAY communications are available through DeviceNet and can use change-of-state protocol or polled communication protocol.

Heated enclosures for severe environments

The MINI-ARRAY is available with heated enclosures for outdoor applications such as vehicle scanning in tollbooths and similar uses. The heated enclosures are available in 1.2, 1.5 and 1.8 m array lengths, in both painted aluminum and stainless steel for all environments. Optional power supplies are available for the heated enclosures.

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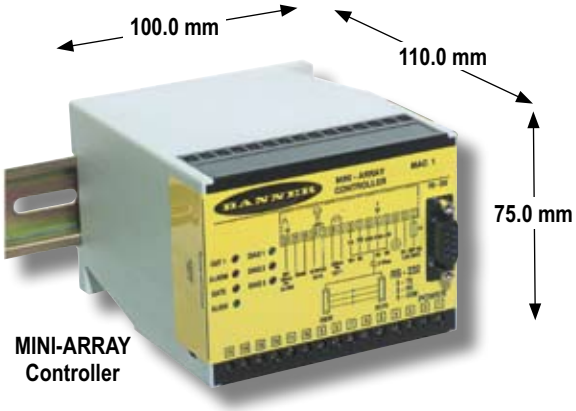
A-GAGE® MINI-ARRAY® System

- *Ten array lengths*
- *Minimum object detection size of 19 or 38 mm*
- *Emitter/receiver separation up to 17 m*
- *Configurable controller*
- *Rugged aluminum housing*
- *5-pin Mini-style QD cables with shield and "twisted pair" ordered separately (see page 421)*

MORE INFO ONLINE Detailed Dimensions

Emitter/Receiver Models	Housing Length (L)
BMEL6..A Emitter BMRL6..A Receiver	201 mm
BMEL12..A Emitter BMRL12..A Receiver	356 mm
BMEL18..A Emitter BMRL18..A Receiver	505 mm
BMEL24..A Emitter BMRL24..A Receiver	659 mm
BMEL30..A Emitter BMRL30..A Receiver	810 mm
BMEL36..A Emitter BMRL36..A Receiver	963 mm
BMEL42..A Emitter BMRL42..A Receiver	1115 mm
BMEL48..A Emitter BMRL48..A Receiver	1267 mm
BMEL60..A Emitter BMRL60..A Receiver	1572 mm
BMEL72..A Emitter BMRL72..A Receiver	1877 mm



MINI-ARRAY Controller

MINI-ARRAY Sensors	
W = 38.1 mm	D = 38.1 mm

A-GAGE® MINI-ARRAY® Controllers†, 16-30V dc

MORE INFO ONLINE Download PDF

Controller Models	Inputs	Solid-State Discrete Outputs	Analog Outputs	Serial Output	Data Sheet
MAC-1	1 Sensor pair & Trigger (Gate)	1 Reed & 1 NPN	–	RS-232 & RS-485	43298
MACN-1		2 NPN	–		
MACP-1		2 PNP	–		
MACV-1		1 NPN	(2) 0-10V Sourcing	RS-232	
MACI-1		1 NPN	(2) 4-20 mA Sinking		
MAC16N-1	1 Sensor pair & Trigger (Gate)	16 NPN	–	RS-232	43298
MAC16P-1		16 PNP	–		
MACNXDN-1*	1 Sensor pair & Trigger (Gate)	2 NPN	–	–	59437
MACPXDN-1*		2 NPN	–	–	

* DeviceNet™ models

† One controller and an emitter/receiver pair (of matching length and resolution) required per system.
DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.

A-GAGE® MINI-ARRAY® Sensors–19.1 mm Beam Spacing

Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
BMEL616A BMRL616A	5-pin Mini QD	201 mm	8	133 mm	38.1 mm Interlaced Mode: 25.4 mm	0.9 - 17 m	43298
BMEL1216A BMRL1216A		356 mm	16	286 mm			
BMEL1816A BMRL1816A		505 mm	24	438 mm			
BMEL2416A BMRL2416A		659 mm	32	591 mm			
BMEL3016A BMRL3016A		810 mm	40	743 mm			
BMEL3616A BMRL3616A		963 mm	48	895 mm			
BMEL4216A BMRL4216A		1115 mm	56	1048 mm			
BMEL4816A BMRL4816A		1267 mm	64	1200 mm		0.9 - 14 m	
BMEL6016A BMRL6016A		1572 mm	80	1505 mm			
BMEL7216A BMRL7216A		1877 mm	96	1810 mm			

A-GAGE® MINI-ARRAY® Sensors–9.5 mm Beam Spacing

Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
BMEL632A BMRL632A	5-pin Mini QD	201 mm	16	143 mm	19.1 mm Interlaced Mode: 12.7 mm	0.6 - 6.1 m	43298
BMEL1232A BMRL1232A		356 mm	32	295 mm			
BMEL1832A BMRL1832A		505 mm	48	448 mm			
BMEL2432A BMRL2432A		659 mm	64	600 mm			
BMEL3882A BMRL3882A		810 mm	80	752 mm			
BMEL3632A BMRL3632A		963 mm	96	905 mm			
BMEL4232A BMRL4232A		1115 mm	112	1057 mm			
BMEL4832A BMRL4832A		1267 mm	128	1210 mm		0.6 - 4.6 m	
BMEL6032A BMRL6032A		1572 mm	160	1514 mm			
BMEL7232A BMRL7232A		1877 mm	192	1819 mm			

* "E" and "R" in models numbers denotes "Emitter" and "Receiver" respectively. Sold separately.

** A model with a QD requires a mating cable (see page 421).

A-GAGE® MINI-ARRAY® Controller Specifications

Power Requirements	16 to 30V dc @ 1.25 amps max. (see current requirements for sensors); controller alone, (without sensors connected) requires 0.1 amp.
Inputs	**Sensor input (5 connections):** Emitter and receiver wire in parallel to five terminals **Trigger (Gate) input:** Optically isolated, requires 10 to 30V dc (7.5K input impedance) for gate signal
Discrete Outputs	**MAC-1:** Output 1 (OUT 1) - Reed relay contact rated 125V ac/dc max., 10 VA max. resistive load (non-inductive). Output 2 (ALARM) - Open collector NPN transistor rated 30V dc max., 150 mA max, short-circuit protected; may be configured as a second data analysis output, a system alarm output, or a scan trigger output for a parallel array **OFF-state leakage current:** less than 10 µA @ 30V dc **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.5V @ 150 mA **MACN-1:** (2) Open collector NPN transistor outputs **MACP-1:** (2) Open collector PNP transistor outputs; transistor rated 30V dc max. 150 mA max, short circuit protected; may be configured as a second data analysis output, a system alarm output, or a scan trigger output for a parallel array **OFF-state leakage current:** less than 10 µA @ 30V dc **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.5 V @ 150 mA **MACV-1/MACI-1:** Alarm - Open collector NPN transistor rated 30V dc max. 150 mA max, short circuit protected; may be configured as a data analysis output, a system alarm output, or a scan trigger output for a parallel array **OFF-state leakage current:** less than 10 µA @ 30V dc **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.5 V @ 150 mA **MAC16P-1:** Sixteen open collector PNP transistor outputs **MAC16N-1:** Sixteen open collector NPN transistor outputs 30V dc max, 150 mA max., short circuit protected **OFF-state leakage current:** less than 10 µA **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.9V @ 150 mA
Serial Data Outputs	RS-232, ASCII or binary data format **Baud Rate:** 9600, 19.2K, or 38.4K, 8 data bits, 1 start bit, 1 stop bit, even parity Clear data may be suppressed Header string may be suppressed in binary format **MAC-1:** Up to 15 controllers may be given unique address for RS-485 party line
Analog Outputs	**MACV-1:** 0-10 Volts sourcing adjustable Null and Span (20 mA current limit) **MACI-1:** 4-20 mA current sinking adjustable Null and Span (16 to 30V input) **Resolution:** Span/(Number of sensor channels) **Linearity:** 0.1% of Full Scale **Temperature variation:** 0.01% of Full Scale/° C
Controller Programming	**All models:** Via RS-232 PC-compatible computer running Windows® 95, 98, NT, ME, XP or 2000 operating system and using Banner supplied software
Sensor Scan Time	**All models:** 55 microseconds per beam plus processing time. The processing time is dependent on the scan analysis and the number of active outputs. This timing assumes a straight scan, continuous, and TBB mode **MAC-1, MACN-1 & MACP-1:** 1 millisecond processing time **MACV-1 & MACI-1:** 1.5 milliseconds processing time **MAC16N-1 & MAC16P-1:** 2.3 to 7 milliseconds processing time
System Response Time	Outputs are not active for 5 seconds after system power up. Maximum response time for the system is two sensor scan cycles. A scan cycle includes a sensor scan plus any serial data transmission. Serial transmission (if activated) follows every sensor scan.
Status Indicators	The following status LEDs are located on the top surface of the module: **MACV-1 & MACI-1:** V OUT (Red) - (also called I OUT) Indicates that the analog outputs are active **MAC-1, MACN-1 & MACP-1:** OUT 1 (Red) - Indicates that output 1 is energized **MAC16N-1 & MAC16P-1:** OUT (Red) - Indicates that at least one output is active ALARM (Red) - Indicates that Output 2 is active/MAC16N-1 & MAC16P-1: Indicates output 16 is active GATE (Red) - Indicates voltage is applied to Trigger (Gate) input ALIGN (Green) - Indicates sensor aligned (excess gain > 1x) DIAG1 (Green) - Indicates power is applied to the module* DIAG2 (Red) - Indicates receiver failure DIAG3 (Red) - Indicates emitter failure

Condition	DIAG1 (Green)	DIAG2 (Red)	DIAG3 (Red)
Normal condition	on	off	off
Receiver error	on	on	off
Emitter error	on	off	on

More on next page

A-GAGE® MINI-ARRAY® Controller Specifications (cont'd)	
Construction	Polycarbonate
Environmental Rating	NEMA 1; IP20
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 95% (non-condensing)
Certifications	CE UL LISTED
Hookup Diagram	**MAC-1:** MI27 (p. 538) **MACN-1/MACP-1:** MI28 (p. 538) **MACV-1/MACI-1:** MI29 (p. 539) **MAC16N-1/MAC16P-1**: MI31 (p. 539)

A-GAGE® MINI-ARRAY® Controller with DeviceNet™ Specifications	
DeviceNet Configurations	**Vendor code:** 12 (Banner Corp.) **Device type:** 110 **Product code:** 1 (MACNXDN-1) 2 (MACPXDN-1) **Connection types supported:** Explicit Message, Poll, COS **Network address:** 0-63 (network configured), default = 63 **Baud rate supported:** 125K, 250K, 500K (network configured), default = 125K
Output Configurations	**MACPXDN-1:** Two PNP discrete (switched) **MACNXDN-1:** Two NPN discrete (switched)
Power Requirements*	**Controller, emitter and receiver:** 16 to 30V dc @ 1.2 A max. (typical: 0.5 A @ 16V dc)
DeviceNet Power*	11 to 25V dc - supplied by DeviceNet BUS Network
Inputs	**Sensor input:** Emitter and receiver wire in parallel to five terminals. **Trigger (Gate) input:** Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for gate signal
Discrete Outputs	**NPN outputs:** Open collector NPN transistor rated at 30V dc max., 150 mA max. **PNP outputs:** Open collector PNP transistor rated at 30V dc max., 150 mA max. **All discrete outputs:** **OFF-state leakage current:** less than 10 µA @ 30V dc **ON-state saturation voltage:** less than 1V @ 10 mA; less than 1.5V @ 150 mA
System Programming	Via DeviceNet interface and supplied EDS files.
System Status Indicators	**Output (steady red):** Output #1 energized. **Alarm (flashing red):** Output #2 energized. **Gate (steady red):** Trigger (Gate) input status. **Alignment (steady green):** Proper emitter/receiver alignment and a clear, unblocked light screen (ON) when green or green/yellow receiver LEDs are ON. **Diag 1 (Green), Diag 2 (Red), Diag 3 (Red):** Used in combination to display System status
Network Status Indicator	**Bicolored (Red/Green) LED visible on the control module front panel indicates network status:** **Steady Green:** On-line, connected to master **Flashing Green:** On-line, address and baud rate OK **Steady Red:** Critical network fault or duplicate node address detected **Flashing Red:** Connection timeout **OFF:** No network power or off-line
Construction	Polycarbonate housing; mounts to flat surface or directly onto 35-mm DIN rail
Environmental Rating	NEMA 1; IP20
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 95% @ 50° C (non-condensing)
***Application Note**	The controller must be powered up before the DeviceNet connection in every power-up situation for proper operation
Hookup Diagrams	MI30 (p. 539)

DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.

A-GAGE® MINI-ARRAY® Sensor Specifications

Emitter/Receiver Range Max range is specified at the point where 3x excess gain remains.	**9.5 mm beam spacing** **Array Length 143 to 1057 mm:** 0.6 to 6.1 m **Array Length 1210 to 1819 mm:** 0.6 to 4.6 m **19.1 mm beam spacing** **Array Length 133 to 1057 mm:** 0.9 to 17 m **Array Length 1200 to 1810 mm:** 0.9 to 14 m
Minimum Object Sensitivity	**9.5 mm Beam Spacing** **Straight, Edge Modes:** 19.1 mm **Interlaced Mode:** 12.7 mm* **With DeviceNet Controller:** **Straight, Edge Modes:** 19.1 mm **Skip Mode:** Multiply the above by the number of skipped beams, plus 1 **Interlaced Mode:** 12.7 mm* **19.1 mm Beam Spacing** **Straight, Edge Modes:** 38.1 mm **Interlaced Mode:** 25.4 mm* **With DeviceNet Controller:** **Straight, Edge Modes:** 38.1 mm **Skip Mode:** Multiply the above by the number of skipped beams, plus 1 **Interlaced Mode:** 25.4 mm* *Assumes sensing is in the middle 1/3 of sensing range.
Sensor Scan Time	55 microseconds per beam, plus 1 millisecond post process time per scan. **DeviceNet:** Post process time will vary, based on the number of channels interrogated during each scan.
Power Requirements †Maximum current is for a 6' sensor.	**9.5 mm beam spacing** 12V dc ±2%, supplied by controller **Emitter:** 0.10 A @ 12V dc **Receiver:** 0.75 A @ 12V dc† **19.1 mm beam spacing** 12V dc ±2%, supplied by controller **Emitter:** 0.10 A @ 12V dc **Receiver:** 0.50 A @ 12V dc†
Connections	Sensors connect to controller using 5-conductor Mini-style quick-disconnect cables (one each for emitter and receiver), ordered separately. Use only Banner cables, which incorporate a “twisted pair” for noise immunity. Cables measure 8.1 mm dia. and are shielded and PVC-jacketed. Conductors are 20 gauge. Emitter and receiver cables may not exceed 75 m long, each. See page 421.
Status Indicators	**Emitter:** Red LED lights to indicate proper emitter operation **Receiver:** Green indicates sensors aligned (> 3x excess gain) Yellow indicates marginal alignment of one or more beams (1x -3x excess gain) Red indicates sensors misaligned or one or more beam(s) blocked
Construction	Aluminum, with black anodized finish; acrylic lens cover
Environmental Rating	NEMA 4, 13; IP65
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 95% at 50° C (non-condensing)

System Configuration

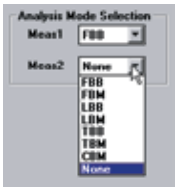
Many options, yet easy to program

The software included with the control module makes it easy to configure the **MINI-ARRAY®** using your PC-compatible computer*. Simply load the software, access the program and access the Edit PSF Configuration screen, shown below. Each option is easily selectable, using your mouse and the pop-up menu-style selections.

*Running Windows® 95, 98, NT, ME, XP or 2000

Analysis (Measurement) Mode Selection

Choose the measurement option that best tells you the size and/or position of objects as they relate to the array.

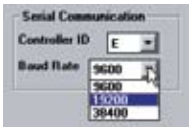


Control Mode Selection

Continuous Mode: The control module constantly polls the array for status.
Gate Mode: The control module polls the array for status when prompted by an input from a Gate sensor.
Host Mode: The control module polls the array for status when prompted by a host controller.

Serial Communication

Changes the identification and baud rate of the controller being configured.



Blanking

Allows either 1 or 2 areas of the array to be blind to the activity of the area specified.

Serial Transmission

Choose ASCII, binary or no serial communication

Invert

Allows output to be normally open (No) or normally closed (Yes)

Scan #: (1-9) Analog outputs

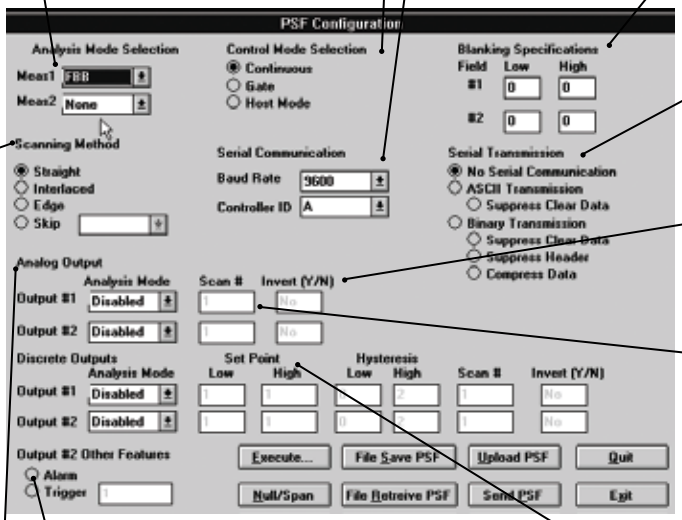
are updated with an average value of the data received during the selected number of scans; discrete outputs respond only if the received data is identical for all of the selected number of consecutive scans.

Set Point and Hysteresis Selection

Assigns the set point to determine where within the array the output(s) will respond and hysteresis values to smooth output response.

Scanning Method

Straight scan polls each beam sequentially to determine the target object's overall size This is the most accurate and precise measurement, but also the most time consuming.
Interlaced alternates a straight scan with a slanted beam scan to improve optical resolution in the center one third of the sensing range.
Edge activates only the beams located near the top edge of the object in the light screen to reduce sensing response time.
Skip - one to seven beams skipped reduces response time. Minimum object detection size increases proportionally to the number of beams skipped



Analog and Discrete Output Assignment

Assigns an analysis (measurement) mode to each output.

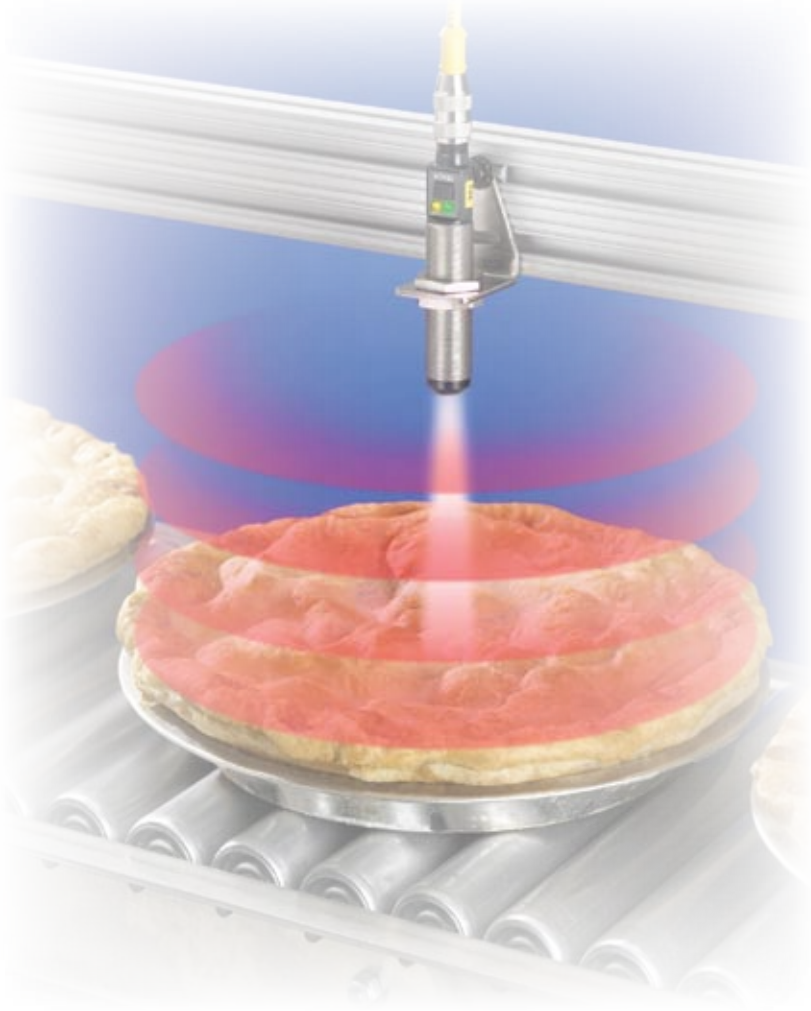
Alarm/Trigger

Output 2 may instead be programmed to serve as a trigger input for another MINI-ARRAY or ALARM for the self-diagnostic circuitry.

Downloadable Software

To test and verify software, download MINI-ARRAY version 1.3 (43989.exe) or Multiple (16) Output version 1.0 (59114_10.exe) at www.bannerengineering.com.

MORE INFO ONLINE Download Software



T-GAGE®

M18T Temperature Sensors

- Detects temperature difference between object and surroundings
- Monitors user defined window using analog or discrete outputs
- Senses temperatures from 0° to 300° C
- Sensitive to temperature contrasts of 3° C or more
- Works even if target object is not moving
- Requires no emitter, controller or external amplifier
- Uses remote or push-button programming
- Available in 3 models for different target sizes and distances
- Equipped with a 5-wire, 2 m shielded cable or with a 5-pin Euro-style integral quick-disconnect

MORE INFO ONLINE T-GAGE® Q&A

TEMPERATURE
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QD CABLES 5-Pin Euro PAGE 415

M18T 14: 1

- Narrow field of view
- For sensing small items
- Germanium lens

M18T 8: 1

- For general use
- Integrated lens

M18T 6: 1

- Plastic lens
- Safe for use near food
- For sensing hot and cold food before or after packaging

Optional accessory interface modules and power supplies for simplified setup, wiring and additional status indication (see page 449).

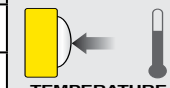
T-GAGE® M18T Sensors

- *18 mm stainless-steel barrel*
- *Rugged encapsulated housing*
- *Push-button programming*
- *2 m or 9 m unterminated cable, or 5-pin Euro-style quick-disconnect*
- *5-pin Euro-style QD cables with shield ordered separately (see page 415)*
- *Optional interface modules and power supplies for simplified setup, wiring and additional status indication (see page 449)*

MORE INFO ONLINE Detailed Dimensions

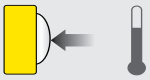
T-GAGE® M18T—Discrete, 10-30V dc

MORE INFO ONLINE Download PDF

Models	Sensor Type	Cable*	D:S Ratio	Sensing Face	Overall Length (L)	Output Type	Data Sheet
M18TB8	 TEMPERATURE	2 m	8:1	Integrated lens	81.2 mm	Bipolar NPN/PNP	120632
M18TB8Q		5-pin Euro QD			91.3 mm		
M18TB6E		2 m	6:1	Enclosed plastic face (for food industry use)	81.7 mm		
M18TB6EQ		5-pin Euro QD			91.8 mm		
M18TB14		2 m	14:1	Germanium lens	86.5 mm		
M18TB14Q		5-pin Euro QD			96.6 mm		

T-GAGE® M18T—Analog, 12-30V dc

MORE INFO ONLINE Download PDF

Models	Sensor Type	Cable*	D:S Ratio	Sensing Face	Overall Length (L)	Output† Type	Data Sheet
M18TUP8	 TEMPERATURE	2 m	8:1	Integrated lens	81.2 mm	0-10V dc Analog, plus 1 PNP Alarm	123698
M18TUP8Q		5-pin Euro QD			91.3 mm		
M18TUP6E		2 m	6:1	Enclosed plastic face (for food industry use)	81.7 mm		
M18TUP6EQ		5-pin Euro QD			91.8 mm		
M18TUP14		2 m	14:1	Germanium lens	86.5 mm		
M18TUP14Q		5-pin Euro QD			96.6 mm		

* For 9 m cable, add **W/30** to the 2 m model number (example, **M18TB8 W/30**). A model with a QD requires a mating cable (see page 415).
† 0-10V dc analog models are listed. Contact factory for 4-20 mA analog models.

T-GAGE® M18T Specifications

Temperature Measurement Range	0° to 300° C standard; custom ranges available
Sensing Range and Distance to Spot Size (D:S) Ratio	Depends on object size and sensing field of view, see chart below.

Sensor D:S Ratio	Distance From Sensor Face Versus Spot Size										
	100	200	300	400	500	600	700	800	900	1000	Distance (mm)
6:1	17	33	50	67	83	100	117	133	150	167	Spot Size ø (mm)
8:1	13	25	38	50	63	75	88	100	113	125	
14:1	7	14	21	29	36	43	50	57	64	71	

Wavelength	8 to 14 µm
Supply Voltage	**Discrete models:** 10 to 30V dc (10% max. ripple); 35 mA max. (exclusive of load) **Analog models:** 12 to 30V dc (10% max. ripple); 35 mA max. (exclusive of load)
Output Configuration	**Discrete models: Bipolar:** one NPN (current sinking) and one PNP (current sourcing) in each model **Analog models:** Analog 0-10V **Alarm:** PNP (current sourcing)
Output Protection	Protected against short circuit conditions
Output Ratings	**Discrete models:** 100 mA max. (each output) **OFF-state leakage current: NPN:** less than 200 µA; **PNP:** less than 10 µA **NPN saturation:** less than 200 mV @ 10 mA; less than 1V @ 100 mA **PNP saturation:** less than 1.2 V @ 10 mA; less than 1.6V @ 100 mA **Analog models:** **Analog:** 2.5 kΩ min. load resistance **Alarm: OFF-state leakage:** less than 10 µA **Saturation:** less than 1.2V @ 10 mA and less than 16V @ 100 mA
Output Response Time	**Discrete models:** 25 milliseconds **Analog models:** 75 milliseconds (for a 95% step change)
Delay at Power-Up	1.5 seconds
Repeatability (Relative)	**Discrete models:** 1° C **Analog models:** ±1% of measurment, or ±1° C, whichever is greater
Minimum Taught Differential	**Discrete models:** 3° C **Analog models:** 10° C
Hysteresis (discrete only)	5% of taught differential (min. 1° C)
Linearity (analog only)	**From 0° to 50° C:** ±2° C **From 5° to 300° C:** ±1° C or ±1%, whichever is greater
Adjustments	TEACH-Mode programming
Indicators	One bicolor (Green/Red) status LED, one Yellow LED **Power ON/OFF LED** **OFF** Power is OFF **ON Green** Sensor is in Run mode **ON Red** TEACH is active **Output LED** **OFF** **Run Mode:** Output is OFF **TEACH mode:** Waiting for Output OFF condition **ON Yellow** **Run Mode:** Outputs are energized **TEACH mode:** Waiting for Output ON condition **Flashing Yellow** Dynamic TEACH active
Remote Teach Input	**Impedance:** 3 kΩ
Construction	**Threaded barrel:** 304 stainless steel **Push button housing:** ABS/PC **Lightpipes:** Acrylic **Push button:** Santoprene
Operating Temperature	-20° to +70° C
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6
Temperature Warm-Up Time	5 minutes
Hookup Diagrams	**Discrete:** MI12 (p. 534) **Analog:** MI21 (p. 537)

R-GAGE™ QT50R

Radar-Based Adjustable-Field Sensor

For close and long-range presence detection in extreme weather conditions

The R-GAGE™ QT50R uses Frequency Modulated Continuous Wave (FMCW) radar to reliably detect moving or stationary targets, including cars, trains, trucks and cargo. Immune to most weather conditions, the QT50R effectively resists rain, wind, humidity and temperature.

- Provides presence, absence or change information for a detected target
- Detects objects up to a set distance, ignoring objects and backgrounds beyond the setpoint
- Operates at 24 GHz in the Industrial, Scientific and Medical (ISM) telecommunication band; no special licensing required
- Withstands extreme temperatures and strong wind
- Detects vehicles at distances up to 15 m
- Includes DIP switches for sensing distance, sensitivity and output configuration
- Provides 12 to 30V dc operation with bipolar PNP (sourcing) and NPN (sinking) output
- Features bright LED indicators for easy status monitoring

BRACKETS
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QD CABLES
5-Pin Euro
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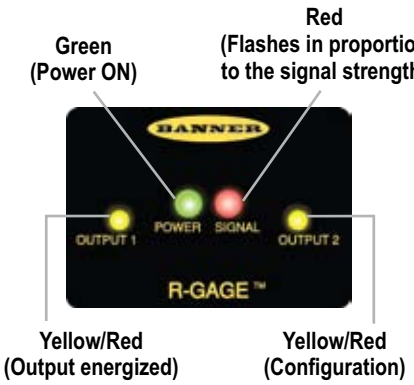
Robust operation in a simple-to-use, easy-to-configure package

- Rugged IP67 housing for harsh environments
- Integral mounting holes, 30 mm mounting base or optional mounting brackets for installation flexibility
- 2 m attached cable or 5-pin Euro-style quick-disconnect
- Operating temperature range of -40° to +65° C
- 8 DIP switches for sensing distance, sensitivity and output configuration
  - Adjustable sensing distance up to 15 m
  - Adjustable beam width for fine-tuning sensitivity
  - Selectable normally open (NO) or normally closed (NC) operation
  - Configurable response speed from 0.1 to 1.3 seconds

Presence sensing in a broad range of weather conditions

- Cargo detection on a truck bed
- Truck detection at loading dock
- Access control to parking ramps and garage doors
- Car detection in drive-thru
- Position sensing of cranes
- Car detection and counting in tollbooths
- Train and tram detection and location in tunnels



R-GAGE™ QT50R Sensors

- *DIP-switch-configurable sensitivity, sensing distance and output*
- *Rugged encapsulated design for harsh environments*
- *2 m attached cable or 5-pin Euro-style quick-disconnect*
- *Bright LED status indicators on sensor top*
- *30 mm threaded mounting base*
- *QD cables with shield, ordered separately (see page 415)*

MORE INFO ONLINE Detailed Dimensions

R-GAGE™ QT50R, 12-30V dc

MORE INFO ONLINE Download PDF

Model	Max Range†	Cable*	Telecom Approval	Output	Data Sheet
QT50RAF-US	15 m	2 m	US	**Bipolar NPN/PNP** **Selectable NO or NC**	135460
QT50RAF-EU			Australia and Europe, except France and UK		
QT50RAF-UK			UK		
QT50RAF-FR			France		
QT50RAF-CA			Canada		

* For 5-pin Euro-style QD, add **Q** to the 2 m model (example, **QT50RAFQ-US**). A QD model requires a mating cable (see page 415).
† Range is dependent on target object.

R-GAGE™ QT50R Specifications	
Range	Sensor will detect a proper object (see below) up to 15 m, depending on target
Effective Beam	See charts EBPC-13 and EBPC-14 on page 515
Detectable Objects	Objects containing metal or other high-dielectric material
Operating Principle	Frequency Modulated Continuous Wave (FMCW) radar
Operating Frequency	24 GHz, ISM Band (varies slightly by model and national telecom regulations)
Supply Voltage	12 to 30V dc, less than 100 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Delay at Power-up	Less than 2 seconds
Output Configuration	Bipolar NPN/PNP outputs, 150 mA; DIP Switch 7 selects NO (default) or NC operation
Output Protection	Protected against short circuit conditions
Indicators	**Power LED:** Green (Power ON) **Signal Strength LED:** Red, flashes in proportion to signal strength **Output LEDs:** Yellow (output energized)/Red (configuration)
Adjustments	Dip-switch-configurable sensitivity, sensing distance and output configuration
Construction	**Housing:** ABS/polycarbonate **Lightpipes:** Acrylic **Access Cap:** Polyester
Operating Temperature	-40° to +65° C
Environmental Rating	IP67
Connections	2 m, 5-conductor, shielded, PVC-jacketed cable or 5-pin Euro-style QD. Mating QD cables are ordered separately. See page 415.
Certifications	CE and ETSI/EN 300 440 or FCC Part 15, depending on model (consult factory for other certifications)
Hookup Diagram	MI22 (p. 537)