SENSORS

MEASUREMENT & INSPECTION

Light Gauging **page 295**

- LT3
- LT7
- LH
- LG

Ultrasonic **page 308**

- QT50U
- S18U
- QS18U
- T30U/T30UX
- M25U
- T18U
- Q45U
- Q45UR

Measuring Arrays **page 340**

- EZ-ARRAY™
- High-Resolution MIN-ARRAY®
- MINI-ARRAY®

Radar **page 354**

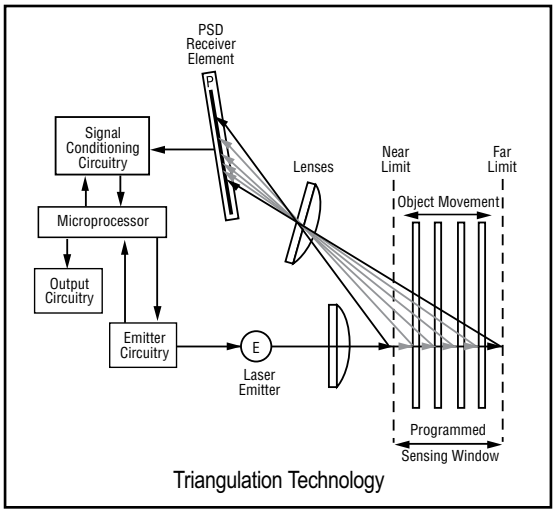
- QT50R

Light Gauging Sensors

Light gauging sensors utilize either "Time of Flight" or triangulation technology to detect the presence and position of targets.

Time of Flight: Measurement of the amount of time that emitted light takes to travel to the target and return to the sensor. This technology is used in long-range sensing applications.

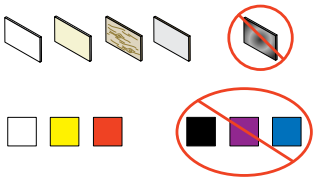
Triangulation: An emitter transmits visible light through a lens, towards a target. The beam bounces off the target, returning some light to the sensor's Position Sensitive Device (PSD) receiver element. The target's distance from the receiver determines the angle at which the light travels to the receiver element. This angle, in turn, determines where the received light will fall along the PSD receiver element. The position of the light on the PSD receiver element is processed through analog and/or digital electronics to calculate the appropriate output value.



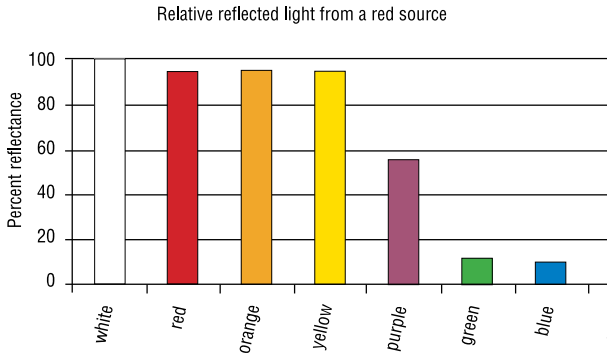
Triangulation Technology

Color Effects

The color of the object being measured can affect the resolution and accuracy of the readings. White, red, yellow and orange targets will reflect more light than green, blue or black targets. The resolution for dark targets may be up to four times less than for white targets.



The graph below shows the relative amount of received light that is reflected from various target colors, using visible red light. The resolution is roughly affected according to the square of the received light. For example, reducing the amount of light by a factor of nine will degrade the resolution by a factor of three.



Surface Reflectivity and Texture

Triangulation sensors depend on the diffuse reflections of light from the target. A diffuse reflection is one in which the light tends to scatter equally in all directions from the target. If the target surface is mirror-like, then light will tend to reflect in only one direction (If this target is not perpendicular to the sensor, the light will be reflected away from the sensor).

Triangulation sensors also require a non-porous, opaque surface for accurate operation. Measurement errors will result from semi-transparent targets such as clear plastic, or from porous materials such as foam.

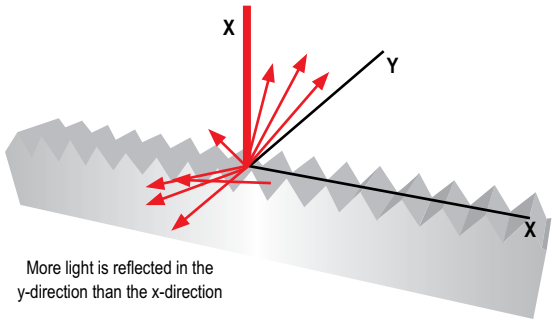
Diffuse targets (e.g., matte finish white ceramic) reflect light consistently in all directions

Specular targets (e.g., a mirror) reflect light in only one direction

Mixed targets (most objects) display traits of both diffuse and specular targets

Metal Surfaces

Bare metal surfaces do not exhibit consistent reflectivity across their surfaces. As a result, the repeatability from one point on a metal surface to another, even at the same distance from the sensor, will degrade. This effect varies from metal to metal and is dependent upon surface finish.



More light is reflected in the y-direction than the x-direction

Total Expected Measurement Error

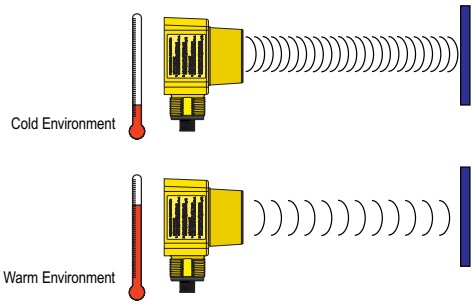
Keep in mind that the overall expected accuracy of an analog sensor is the combination of several performance parameters, not simply the sensor's resolution. Linearity and temperature effect can also affect accuracy.

Ultrasonic Sensors

Ultrasonic sensors emit a pulse of energy which travels at the speed of sound. A portion of this energy is reflected off of a target and travels back to the sensor. The sensor measures the total time required for the energy to reach the target and return to the sensor and calculates the distance from the sensor to the target.

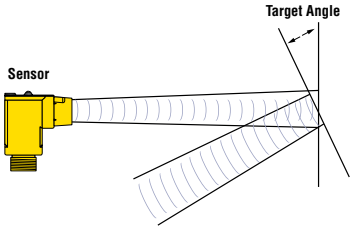
Temperature Effect

The speed of sound depends on chemical composition, pressure and temperature of the gas in which it is traveling. In most ultrasonic applications, the composition and pressure of the gas are relatively fixed, while the temperature is not. The speed of sound increases roughly 1% per 10° F (6° C) temperature increase.



Target Angle

A flat target that is perpendicular to the beam axis will reflect the most sound energy back to the sensor. As the target angle increases, the amount of energy received by the sensor decreases. For most ultrasonic sensors, the target angle should be 10˚ or less.

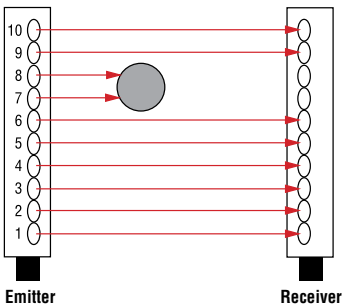


Air Currents

Air currents due to wind, fans, pneumatic equipment or other sources can deflect or disturb the path of the ultrasonic energy, so a sensor may fail to recognize the correct location of the target.

Measuring Light Screens

Banner light screens have a vertical array of photoelectric emitters and receivers: The emitters in one housing, the receivers in another. An object placed between the emitter and receiver will block the emitted light from reaching the corresponding receivers.



Synchronous Scanning

Identifies which of the beams is blocked, by enabling one emitter channel to pulse light while simultaneously directing its corresponding receiver to look for a signal. The system records which beam channels are blocked and which are clear, and then outputs a signal, either analog or discrete.

Sensor Response Time

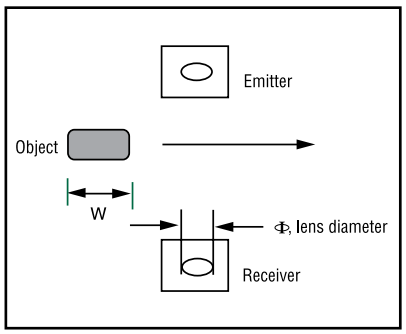
The time required for an array system to “see” an object varies depending on which channel is blocked, when the object blocks a particular channel and when that particular channel is scanned. The result is that the minimum response time is equal to 1 ms; the maximum response time is equal to twice the scan time. The scan time, in turn, varies according to array length and scanning mode, and is specified in the product literature.

Minimum Object Detection

The minimum object detection size is a function of the lens diameter for an individual channel and the spacing between channels. The minimum object detection size is defined as the smallest diameter rod that can be detected reliably.

Maximum Part Speed

The maximum speed of a passing part is a function of the part size, the lens diameter and the maximum response time of the system.



Measuring Modes

Banner’s measuring light screens can be configured, with a simple Windows setup program, for several measuring modes for both analog and discrete outputs. For example, the output can be based on the:

- First beam blocked
- Last beam blocked
- Total number of beams blocked
- First beam made
- Last beam made
- Total number of beams made
- Center beam of several blocked beams
- Number of transitions from blocked to made
- Highest number of contiguous beams blocked

L-GAGE® LIGHT GAUGING SENSORS

LT3 page 296

- 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 300

- 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.

LH page 303

- High-precision laser displacement sensor provides reliable measurement results on real-world targets, such as machined metal, wood, ceramic and paper.
- Non-contact sensor provides precise measurement on moving processes, hot parts, machined parts, and soft or sticky parts.
- Ranges are up to 200 mm, depending on model.
- Two sensors self-synchronize for easy thickness measurements and calculations.

LG page 305

- 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.

SENSORS

L-GAGE® LT3

Laser Distance-Gauging Sensors

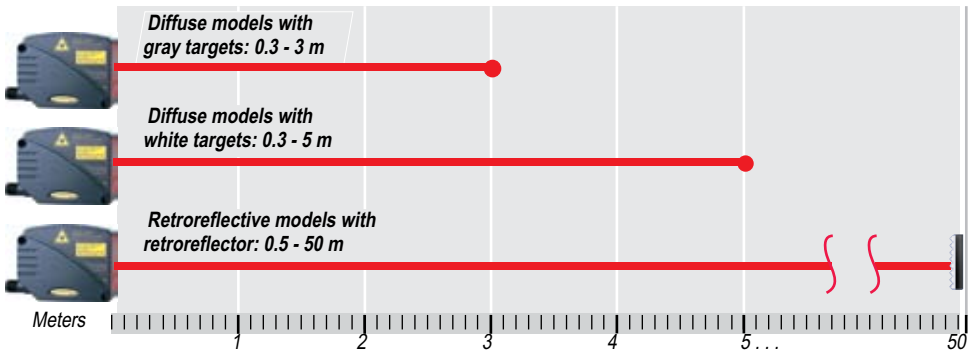
- Uses advanced “time-of-flight” technology for precise, long-distance gauging at the speed of light
- Available in diffuse-mode models with ranges to 5 m and retroreflective models with a 50 m range
- Offered in dual-discrete or analog/discrete models
- Features push-button TEACH-mode programming for custom sensing windows
- Offers remote programming for added security and convenience
- Includes push-button programming for three output response speeds
- Simplifies alignment with a bright, visible laser spot
- Emits one million pulses per second
- Reliably detects angled targets
- Uses rugged construction to withstand demanding sensing environments—rated IEC IP67; NEMA 6

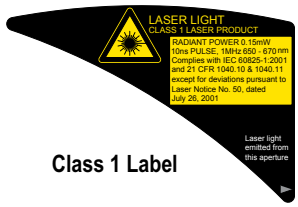
ACCESSORIES page 299

LASER DIFFUSE

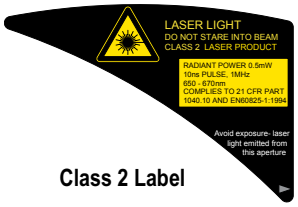
RETRO LASER

LT3 Sensing Ranges





Class 1 Label



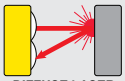
Class 2 Label

QPMA EURO-STYLE PIGTAIL PUR CABLE CALL FACTORY

ONLINE
AUTOCAD, STEP, IGES & PDF

L-GAGE® LT3, 12-24V dc

Visible Red Laser

Sensing Mode/LED	Laser Class	Sensing Distance	Connection	Analog Output	Models NPN	Models PNP
 DIFFUSE LASER	Class 2	0.3 to 5 m for 90% reflectivity white card (see Performance Curve RRC-1 on page 299 for more information)	2 m	None	**LT3BD** (Dual NPN or PNP selectable)	
			8-pin Euro QD		**LT3BDQ** (Dual NPN or PNP selectable)	
			2 m	0 to 10V dc	**LT3NU**	**LT3PU**
			8-pin Euro QD		**LT3NUQ**	**LT3PUQ**
			2 m	4 to 20 mA	**LT3NI**	**LT3PI**
			8-pin Euro QD		**LT3NIQ**	**LT3PIQ**
 LASER RETRO	Class 1	0.5 to 50 m† (see Performance Curve RRC-2 on page 299 for more information)	2 m	None	**LT3BDLV** (Dual NPN or PNP selectable)	
			8-pin Euro QD		**LT3BDLVQ** (Dual NPN or PNP selectable)	
			2 m	0 to 10V dc	**LT3NULV**	**LT3PULV**
			8-pin Euro QD		**LT3NULVQ**	**LT3PULVQ**
			2 m	4 to 20 mA	**LT3NILV**	**LT3PILV**
			8-pin Euro QD		**LT3NILVQ**	**LT3PILVQ**

Connection options: A model with a QD requires a mating cordset (see page 299).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LT3BD W/30**).

† Retroreflective range is specified using a BRT-TVHG-8X10P high-grade target.
Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

Photoelectrics Sensors
Fiber Optic Sensors
Special Purpose Sensors
Measurement & Inspection Sensors
Vision
Wireless
Lighting & Indicators
Safety Light Screens
Safety Laser Scanners
Fiber Optic Safety Systems
Safety Controllers & Modules
Safety Two-Hand Control Modules
Safety Interlock Switches
Emergency Stop & Stop Control

ACCESSORIES page 299

LIGHT GAUGING
LT3
LT7
LH
LG
ULTRASONIC
MEASURING ARRAYS
RADAR

L-GAGE® LT3 Specifications

Sensing Beam	**Typical beam diameter:** 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	

More on next page

L-GAGE® LT3 Specifications (cont'd)

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 299.	
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 299.	
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)	
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. See data sheet for delay time on enable.	
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 cordsets are ordered separately. See page 299.	
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	CE c UL us	
Hookup Diagrams	**Discrete/Analog Models: NPN:** MI01 (p. 758) **PNP:** MI02 (p. 758) **Dual-Discrete Models: NPN:** MI03 (p. 758) **PNP:** MI04 (p. 758)	

Cordsets

Euro QD (With Shield)	
See page 689	
Length	Threaded 8-Pin Straight
2 m	MQDC-806
5 m	MQDC-815
9 m	MQDC-830

Additional cordset information available. See page 679.

Brackets

LT3			
 pg. 650	 pg. 657	 pg. 657	 pg. 658
SMBAMSLT3IP	SMBLT31	SMBLT32	SMBLT3IP

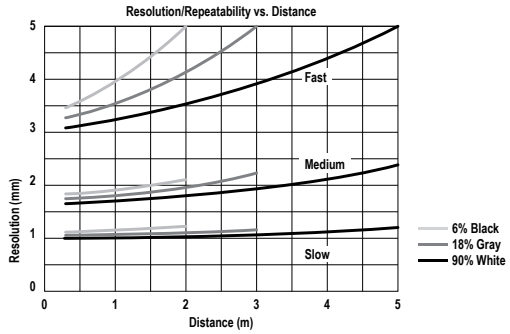
Additional brackets and information available. See page 620.

REFLECTORS
PAGE 710

Repeatability/Resolution Curves

= Visible Red Laser

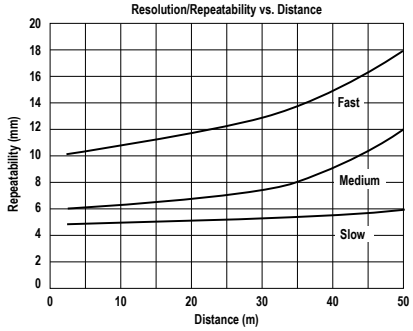
LT3



RRC-1

Range: 5 m	Mode: Diffuse	LED:

LT3



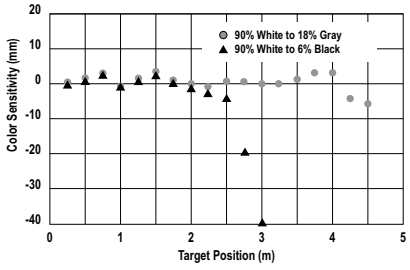
RRC-2

Range: 50 m	Mode: Retroreflective	LED:

Color Sensitivity Curves

= Visible Red Laser

LT3



CSC-1

Range: 5 m	Mode: Diffuse	LED:

SENSORS

L-GAGE® LT7

Highly Accurate Time-of-Flight Laser Gauging Sensors

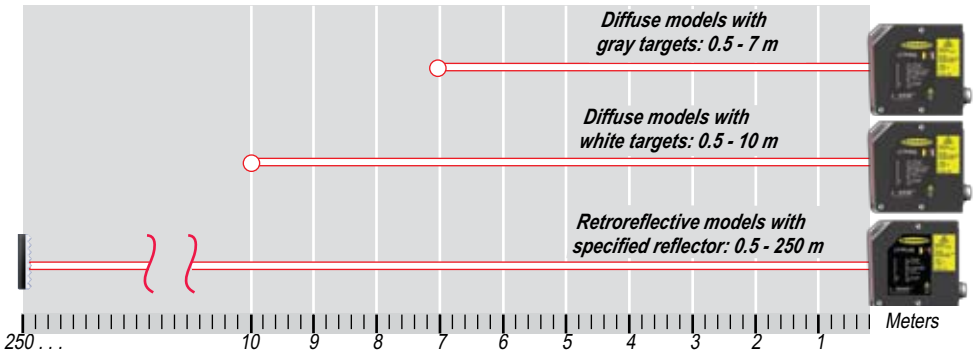
- Available in extremely long-range retroreflective models with ranges to 250 m or in diffuse models with ranges to 10 m
- Provides two alarm outputs with ongoing LCD display for easy troubleshooting
- Offered in dual-discrete or analog/discrete models
- Features TEACH-mode programming using integrated push buttons or a serial interface
- Continually displays 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

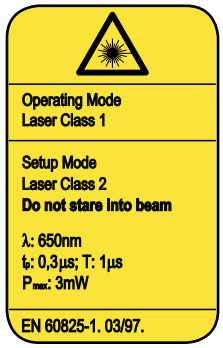
ACCESSORIES page 302

LASER DIFFUSE

RETRO LASER

LT7 Sensing Ranges



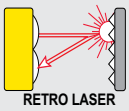
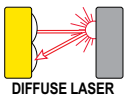


ONLINE

AUTOCAD, STEP, IGES & PDF

L-GAGE® LT7, 18-30V dc

Infrared Laser

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

Connection options: A model with a QD requires a mating cordset (see page 302).

* Diffuse-mode range specified using a 90% reflectance white card.
Retroreflective range is specified using a BRT-250, BRT-540 or BRT-700 retroreflective target (see page 710).

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 Cordset 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

More on next page

L-GAGE® LT7 Specifications (cont'd)

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
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 detailed 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 302.
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. 759)

Cordsets

M16 QD

See page 697

Length	Threaded 12-Pin Straight	Threaded 12-Pin Right-Angle
3 m	MQDC-1210ST	MQDC-1210RA
10 m	MQDC-1230ST	MQDC-1230RA
30 m	—	MQDC-1290RA

Additional cordset information available. See page 679.

Brackets

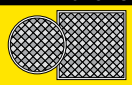
LT7

pg. 658

SMBLT7

Additional brackets and information available. See page 620.

REFLECTORS



PAGE 710

Operating Mode
Laser Class 1

Setup Mode
Laser Class 2
Do not stare into beam

λ: 650nm
t_p: 0,3µs; T: 1µs
P_{max}: 3mW

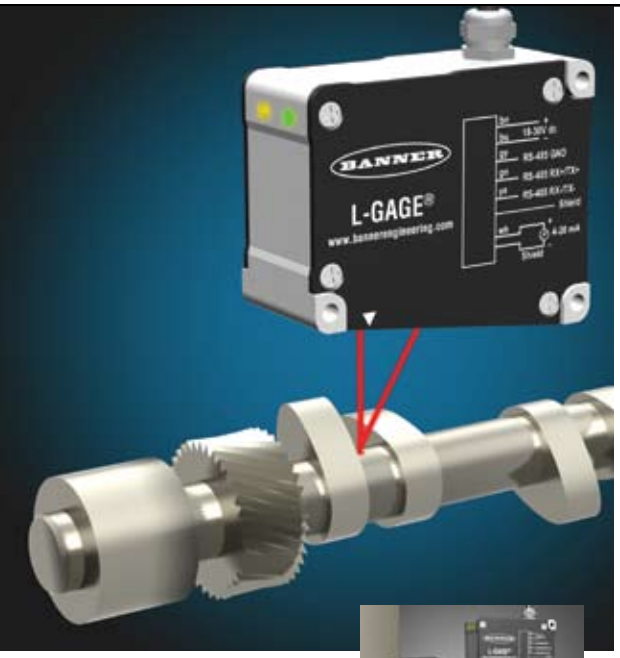
EN 60825-1. 03/97.

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® LH

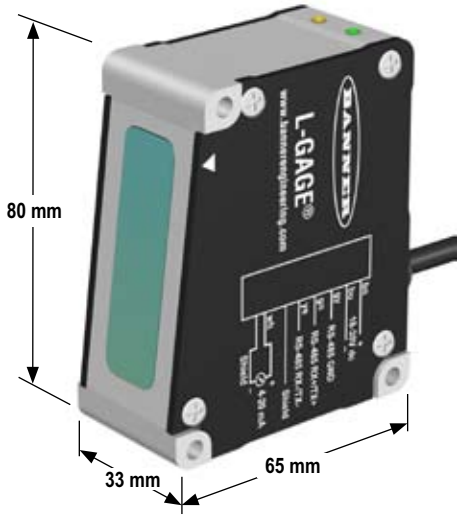
High-Precision Laser Sensors for Displacement & Thickness Measurements

- Extremely accurate, robust and self-contained laser displacement sensing using a 1024 pixel CMOS linear imager
- Reliable and accurate measurement results on real world targets, such as machined metal, wood, ceramic, paper and painted targets
- Non-contact precise measurement on moving processes, hot parts, machined parts, and soft or sticky parts
- Precise red laser spot for easy alignment to the target
- Target displacement or thickness measurement with high-resolution 4-20 mA or RS-485 serial communication outputs
- Automatic laser power and measurement rate control for reliable measurement under changing or challenging target condition
- Two sensors self-synchronize for thickness measurements and thickness calculation within the sensors; no external controller required
- Serial communication for use of multiple sensors in multi-track or process control applications
- Dedicated software for sensor setup and performance monitoring

Two sensors self-synchronize for thickness measurements and calculation within the sensors.

ACCESSORIES page 304

DIFFUSE LASER



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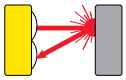
AUTOCAD, STEP, IGES & PDF

L-GAGE® LH, 18-30V dc

Visible Red Laser

Sensing Mode/LED	Laser Class	Measurement Span	Start of Measurement Range	Reference Distance	End of Measuring Range	Connection	Output	Spot Size at Reference Distance	Models
 DIFFUSE LASER	Class 2	10 mm	25 mm	30 mm	35 mm	8-pin Euro Pigtail QD	Analog 4-20 mA & RS-485	50 micron	**LH30IX485QP**
		40 mm	60 mm	80 mm	100 mm			125 micron	**LH80IX485QP**
		100 mm	100 mm	150 mm	200 mm			225 micron	**LH150IX485QP**

Connection options: A model with a QD requires a mating cordset (see page 304).

L-GAGE® LH Specifications

Sensing Beam	670 nm (1mW) visible red IEC and CDRH Class 2 laser
Supply Voltage and Current	18 to 30V dc (10% maximum ripple); 250 mA max @ 24V dc (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient over voltages
Delay at Power-up	1.25 seconds
Temperature Effect	0.01% of measurement range/°C
Linearity	0.1% of measurement range
Resolution	**LH30:** 1 µm **LH80:** 4 µm **LH15:** 10 µm Resolution obtained with an average of 64 readings on a white ceramic target.
Ambient Light	≤ 3000 Lux
Measurement Frequency	Dynamically adjusted from 300 to 4000 Hz depending on target conditions, or locked via LH Series configurator square.
Adjustments	None on sensor; Configuration through LH Series Configurator Software
Indicators	**Green:** Power ON; Flashing = target at reference distance **Orange:** Target inside measurement range
Construction	**Housing:** Aluminum **Cover:** Aluminum **Lens:** Glass **Cable:** PVC and nickel-plated brass
Environmental Rating	IP67
Connections	150 mm 8-pin M12/Euro-style pigtail quick-disconnect. Mating QD cordsets are ordered separately. See page 304).
Output Configuration	**Analog current output**: 4 to 20 mA (current sourcing) **Analog output rating:** 1 kΩ max @ 24V dc, max load resistance = [(Vcc-4.5)/0.02]Ω
Output Response	User adjustable output filtering via LH series configurator software.
Serial Communication Interface	RS-485, optically isolated, up to 230 KBaud
Data Formats	LH-Ring Serial Protocol
Operating Conditions	**Operating Temperature:** –10° to +45° C **Storage Temperature:** 0° to +80° C **Maximum relative humidity:** 85% 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	Allow 30-minute warm-up for specified performance
Factory Default Settings	**Mode:** Displacement Mode **Sensor Address:** Unset (address 0) **Baud Rate:** 115200 **Analog Output:** 4-20 mA, positive slope, full range
Certifications	CE
Hookup Diagrams	MI06 (p. 759)

Cordsets

Euro QD (With Shield)

See page 689

Length	Threaded 8-Pin Straight
2 m	MQLH-806-F
5 m	MQLH-815-F
9 m	MQLH-830-F

Additional cordset information available. See page 679.

Euro QD—Double Ended (With Shield)

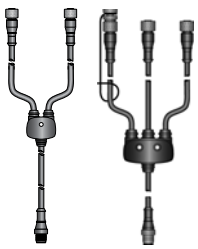
See page 691

Length	Threaded 8-Pin Straight Male to Straight Female	Threaded 8-Pin Straight Male to Straight Male
0.3 m	—	MQLH-801-MM
2 m	MQLH-806-MF	—
5 m	MQLH-815-MF	—
9 m	MQLH-830-MF	—

Euro QD—Splitter

See page 692

Length Branches	Length Trunk	Threaded 8-Pin
2 x 0.6 m	0.3 m	CSB-M1281M1282-LH
2 x 0 m	0.3 m	CSB-M1281M1280-LH
3 x 0.6 m	0.3 m	CSB3-M1281M1282-LH



Brackets

LH			
 pg. 657	 pg. 657	 pg. 657	 pg. 657
SMBLH1	SMBLH30	SMBLH80	SMBLH150

Additional brackets and information available. See page 620.

Serial Adapters

See page 739		Model
	USB to RS-485 serial adapter with integral communication cordset and USB cable for easy configuration of a single sensor or a network of sensors.	INTUSB485-LH

L-GAGE® LG
Short-range Laser Sensors

- Replaces large, two-piece laser gauging sensors with a completely self-contained, compact housing measuring only 55 x 82 x 20 mm
- Does not touch parts it measures, so can be used with moving processes, hot parts and sticky parts
- Houses discrete (switched) and analog outputs in the same unit, each independently programmable
- Automatically scales the analog output over the width of the programmed sensing window
- 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
- Offers remote programming for added security and convenience
- Uses push-button programming for other output response speeds

ACCESSORIES page 307

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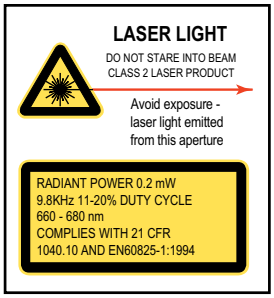


DIFFUSE LASER

L-GAGE® LG5, 12-30V dc

Visible Red Laser

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

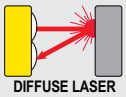
Connection options: A model with a QD requires a mating cordset (see page 307).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LG5A65PU W/30**).

SENSORS

L-GAGE® LG10, 12-30V dc

Visible Red Laser

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

Connection options: A model with a QD requires a mating cordset (see page 307).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LG10A65PU W/30**).

ACCESSORIES page 307

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 **Analog Voltage output:** 2.5 kΩ min. load impedance
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) or 0 to 10V dc (voltage sourcing), depending on model
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-1 on page 307 **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-2 on page 307
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
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)

More on next page

L-GAGE® LG5 and LG10 Specifications (cont'd)

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 cordsets are purchased separately. See page 307.
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. 759) **PNP Models:** MI07 (p. 759)

Cordsets

Euro QD (With Shield)	
See page 689	
Length	8-Pin Threaded Straight
2 m	MQDC-806
5 m	MQDC-818
9 m	MQDC-830

Additional cordset information available. See page 679.

Brackets

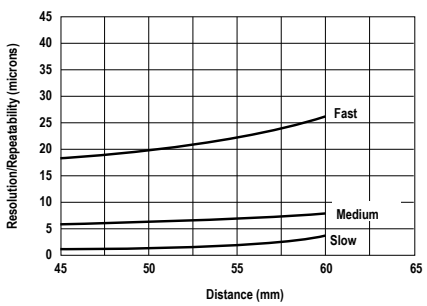
LG5/LG10	
 pg. 656	 pg. 656
SMBLG	SMBLGA

Additional brackets and information available. See page 620.

Repeatability/Resolution Curves

✸= Visible Red Laser

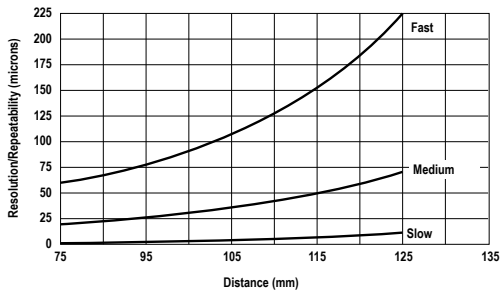
LG5



RRC-1

Range: 60 mm	Mode: Diffuse	LED: ✸

LG10



RRC-2

Range: 125 mm	Mode: Diffuse	LED: ✸

U-GAGE® ULTRASONIC SENSORS

QT50U **page 309**

- Long-range ac or dc sensor with 8 m range and minimal dead zone
- Advanced programming capability with a unique temperature compensation feature
- Retrosonic mode with a reduced dead zone
- Two independent near and far limits for each output
- Optional Teflon® coating for resistance to harsh chemicals

S18U **page 314**

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

QS18U **page 317**

- Compact 18 mm universal housing
- Compensation for air temperature fluctuations
- Encapsulated models for a range of harsh conditions

T30U/T30UX **page 320**

- Right-angle T-style housing with 30 mm threaded lens
- Analog and discrete outputs in the same sensor
- A choice of programmable sensing windows, depending on response time
- T30UX models with temperature compensation, longer sensing ranges and shorter dead zones
- Optional Teflon® coating for resistance to harsh chemicals

M25U **page 328**

- Features smooth 316 stainless steel construction to withstand tough sanitary environments
- Rated IP69K with fully encapsulated electronics
- Withstands high-temperature sprays of up to 80° C and 1500 psi

T18U **page 330**

- 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

Q45U **page 332**

- 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 336**

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

Teflon® is a registered trademark of Dupont™.

Chemically resistant models

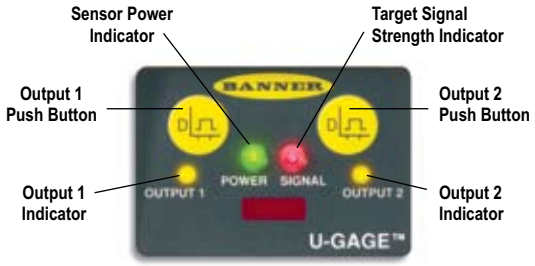
U-GAGE® QT50U
Long-Range Ultrasonic Sensor

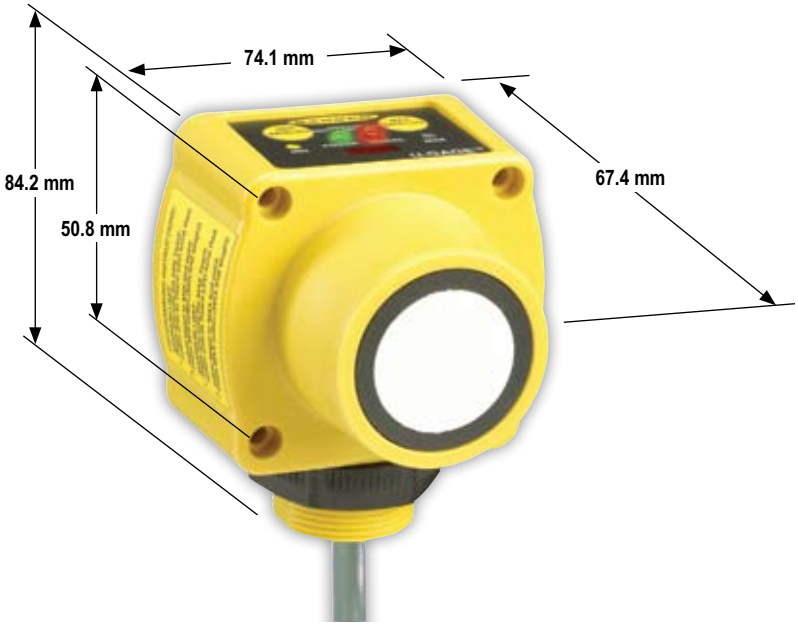
- Senses extended range of up to 8 m
- Features ultrasonic dead-zone of only 2.5% of the total range—75% less than comparable products
- Available in analog or discrete dc models and in ac/dc universal voltage models with electromechanical relay output
- Offers retrosonic sensing mode
- Features a completely 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
- Features push-button programing for easy setup
- 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
- Compensates for temperature for greatest sensing accuracy

Photoelectrics Sensors
Fiber Optic Sensors
Special Purpose Sensors
Measurement & Inspection Sensors
Vision
Wireless
Lighting & Indicators
Safety Light Screens
Safety Laser Scanners
Fiber Optic Safety Systems
Safety Controllers & Modules
Safety Two-Hand Control Modules
Safety Interlock Switches
Emergency Stop & Stop Control

ACCESSORIES page 312

LIGHT GAUGING
ULTRASONIC
QT50U
S18U
QS18U
T30U/T30UX
M25U
T18U
Q45U
Q45UR
MEASURING ARRAYS
RADAR





DC and Universal Voltage Models

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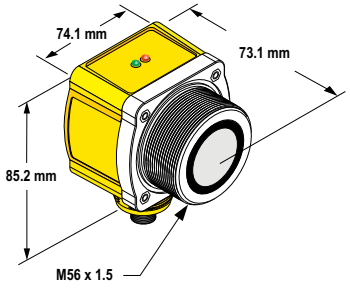


Teflon®-protected Models (Suffix -CRFV)

Teflon® is a registered trademark of Dupont™.

U-GAGE® QT50U, 10-30V dc

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

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

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

ACCESSORIES page 312

Connection options: A model with a QD requires a mating cordset (see page 312).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QT50ULB W/30**).

* For sensors with Teflon®-protected face and transducer, add suffix **-CRFV** to the model number (example, **QT50ULB-CRFV**).
Teflon® is a registered trademark of Dupont™.

U-GAGE® QT50U DC Specifications

Effective Beam	See Charts EBPC-1, EBPC-2 and EBPC-3 on page 313.
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

More on next page

U-GAGE® QT50U DC Specifications (cont'd)

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
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 cordsets are ordered separately. See page 312.
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
Certifications	CE
Hookup Diagrams	**Analog Models:** MI09 (p. 760) **Discrete Models:** MI10 (p. 760)

U-GAGE® QT50U Universal Voltage Specifications

Effective Beam	See Charts EBPC-1, EBPC-2 and EBPC-3 on page 313.
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

More on next page

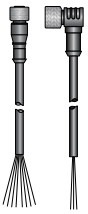
U-GAGE® QT50U Universal Voltage Specifications (cont'd)	
Hysteresis	**Window-limit sensor models:** 5 mm **Fill-level control sensor models:** 0 mm
Output Response Time	Selectable 1600, 400 or 100 milliseconds
Minimum Window Size	20 mm
Adjustments	**Sensing limits:** TEACH-Mode programming of near and 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 cordsets are ordered separately. See page 312.
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	CE
Hookup Diagrams	UN09 (p. 755)

Cordsets

Euro QD (With Shield)

See page 687

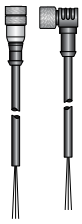
Length	Threaded 5-Pin Straight	Threaded 5-Pin Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Micro QD (With Shield)

See page 699

Length	Threaded 5-Pin Straight	Threaded 5-Pin Right-Angle
2 m	MQVR3S-506	MQVR3S-506RA
5 m	MQVR3S-515	MQVR3S-515RA
10 m	MQVR3S-530	MQVR3S-530RA



Mini QD (With Shield)

See page 701

Length	Threaded 5-Pin Straight
2 m	MBCC2-506
4 m	MBCC2-512
10 m	MBCC2-530

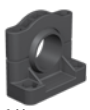
Additional cordset information available. See page 679.

Brackets

QT50U

pg. 639 — SMB30A

pg. 640 — SMB30MM

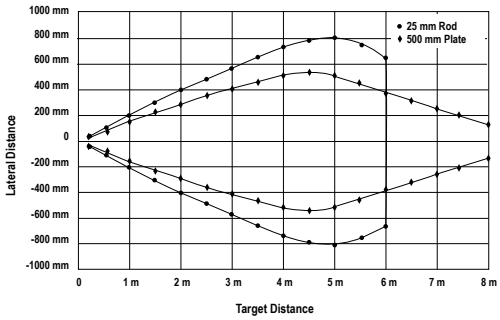


pg. 641 — SMB30SC

Additional brackets and information available. See page 620.

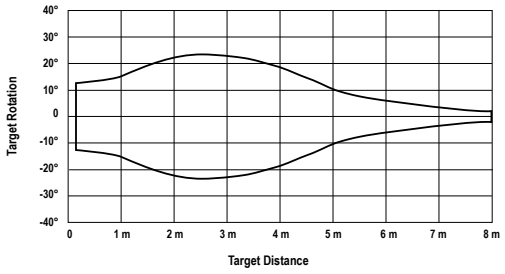
Effective Beam Patterns

QT50U (Typical)



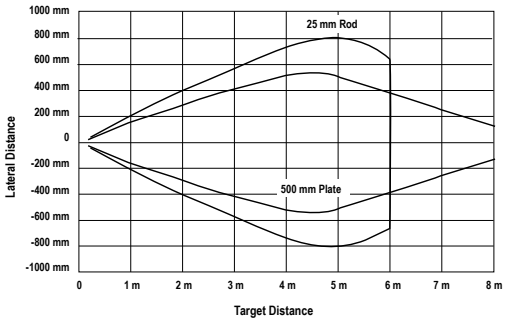
EBPC-1

QT50U (with 500 mm Plate) Maximum Target Rotation Angle



EBPC-2

QT50U Teflon®-Encapsulated (Typical)



EBPC-3

SENSORS

U-GAGE® S18U
Compact Barrel-Mount Ultrasonic Sensor

- Senses from 30 to 300 mm
- Available in analog or discrete models
- Features minimal dead zone and eliminates dead zone if used in retrosonic mode
- Ideal for material handling and packaged goods applications, such as bottling or liquid level detection and control for small containers
- Available in straight or right-angle versions with a wide variety of mounting hardware for enhance sensing versatility
- Offers programmable background suppression
- Compensates for temperature for greatest sensing accuracy
- Simplifies setup with push-button and remote TEACH-mode programming
- Shows status during setup and operation, using highly visible LEDs indicators

ACCESSORIES page 316

Accessory wave guides are available for narrowing sensing beam. (see page 316)

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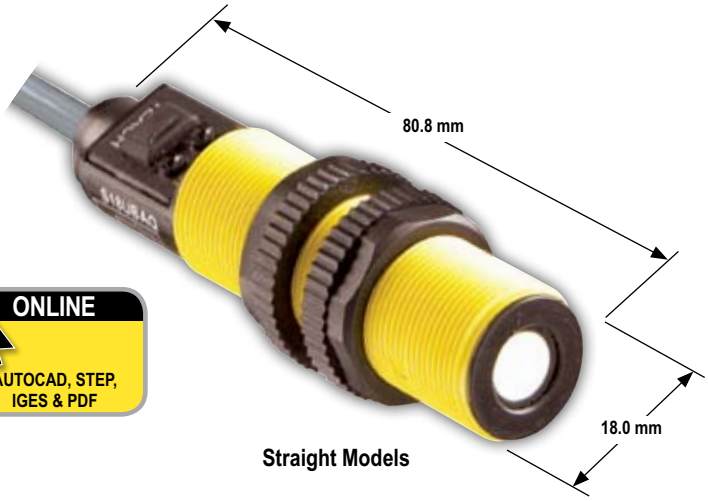
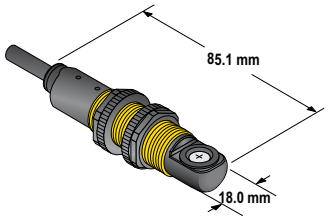


Straight Models



S18U Right-Angle Models

U-GAGE® S18U, 10-30V dc

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

Connection options: A model with a QD requires a mating cable (see page 316).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **S18UUA W/30**).

U-GAGE® S18U Specifications

Effective Beam	See Charts EBPC-1 and EBPC-2 on page 316.
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
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 (Discrete models)	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 cordsets are ordered separately. See page 316.
Operating Conditions	**Temperature:** -20° to +60° C **Relative humidity:** 100%

More on next page

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

U-GAGE® S18U Specifications (cont'd)

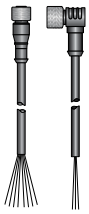
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Application Notes	Objects passing inside the specified near limit may produce a false response.
Certifications	
Hookup Diagrams	**Analog Models:** MI11 (p. 760) **Discrete Models:** MI10 (p. 760)

Cordsets

Euro QD (With Shield)

See page 687

Length	Threaded 5-Pin Straight	Threaded 5-Pin Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Additional cordset information available. See page 679.

Brackets

S18U

pg. 637	pg. 638	pg. 638
SMB18A	SMB18FM	SMB18SF

Additional brackets and information available. See page 620.

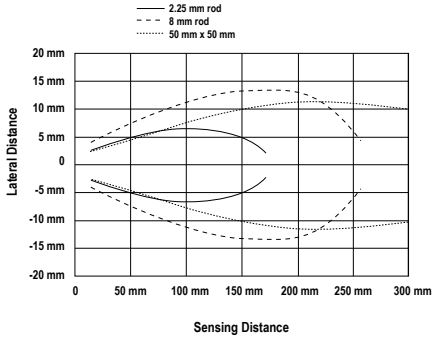
Ultrasonic Wave Guides

pg. 737

Inside Diameter	Model
5.0 mm	UWG18-5.0
6.4 mm	UWG18-6.4

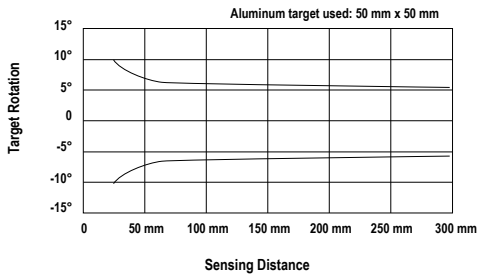
Effective Beam Patterns

S18U (Typical)



EBPC-1

S18U (with 500 mm Plate) Maximum Target Rotation Angle



EBPC-2

QS18U

Ultrasonic WORLD-BEAM® Sensor

- Features a universal housing with an 18 mm threaded lens or side mounts
- Senses clear or transparent material and color variations, including clear web material, clear or shiny bottles, highly reflective surfaces and liquid or dry bulk materials from inside cramped locations
- 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
- Featuring wide operating range of -20° to +60° C
- Offers retrosonic sensing mode
- Delivers bright LED operating indicators visible from 360°

ACCESSORIES page 319

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Accessory wave guides are available for narrowing sensing beam. (see page 319)

WORLD-BEAM® QS18U, 12-30V dc

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

Connection options: A model with a QD requires a mating cordset (see page 319).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QS18UNA W/30**).
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**).

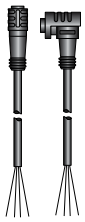
† Models are epoxy-encapsulated, IP68; NEMA 6P with remote TEACH programming

WORLD-BEAM® QS18U Specifications

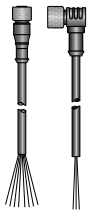
Effective Beam	See Charts EBPC-1 and EBPC-2 on page 319.
Sensing Range	50 to 500 mm
Supply Voltage and Current	12 to 30V dc (10% max. ripple); 25 mA max. (exclusive of load)
Ultrasonic Frequency	300 kHz, rep. rate 7.5 milliseconds
Supply Protection Circuitry	Protected against reverse polarity and transient 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. (see Application Note 1) **OFF-state leakage current:** less than 10 µA (sourcing); less than 200 µA (sinking); See Application Note 2 **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; UL type 1
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 page 319.
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
Application Notes	1. If supply voltage is > 24V dc, derate maximum output current 5 mA/°C above 50°C. 2. NPN OFF-state leakage current is < 200 µA for load resistances > 3 kΩ or optically isolated loads. For load current of 100 mA, leakage is < 1% of load current. 3. Objects passing inside the specified near limit may produce a false response.
Certifications	CE
Hookup Diagrams	MI13 (p. 761)

Cordsets

Pico QD (With Shield)		
See page 681		
	Snap-On 4-Pin	
Length	Straight	Right-Angle
2 m	PKG4S-2	PKW4ZS-2

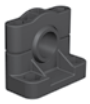


Euro QD (With Shield)		
See page 683		
	Threaded 4-Pin	
Length	Straight	Right-Angle
2 m	MQDEC2-406	MQDEC2-406RA
5 m	MQDEC2-415	MQDEC2-415RA
9 m	MQDEC2-430	MQDEC2-430RA



Additional cordset information available. See page 679.

Brackets

QS18U		
 pg. 637	 pg. 638	 pg. 638
SMB18A	SMB18FA..	SMB18SF

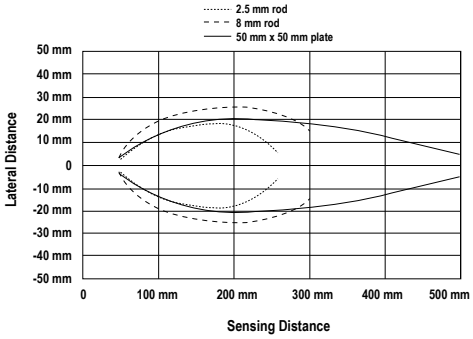
Additional brackets and information available. See page 620.

Ultrasonic Wave Guides

	Inside Diameter	Model
 pg. 709	5.0 mm	UWG18-5.0
	6.4 mm	UWG18-6.4

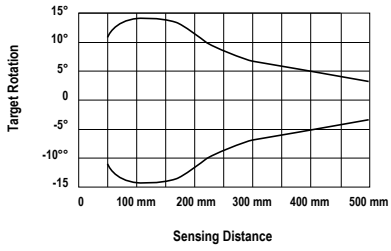
Effective Beam Patterns

QS18U (Typical)



EBPC-1

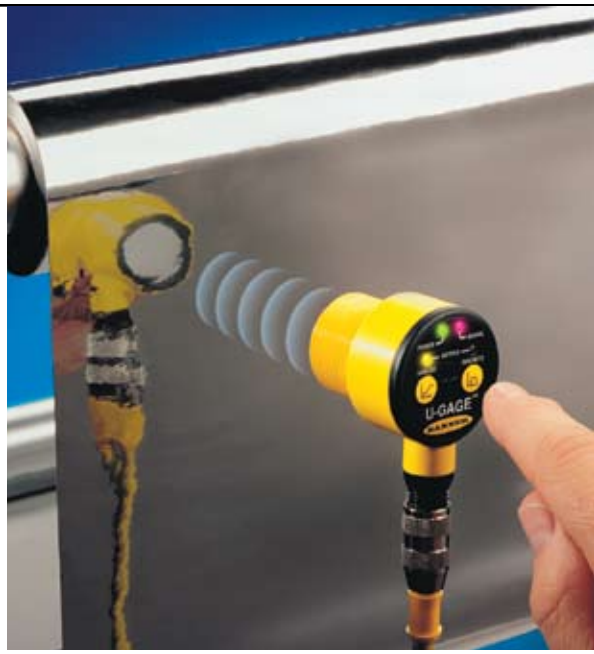
QS18U Maximum Target Rotation Angle



EBPC-2

U-GAGE® T30UX/T30U

Compact Sensors in Universal Housing



- Features T-style right-angle sensor package with popular 30 mm threaded barrel and a wide variety of mounting brackets
- Offers choice of three ranges for reliable sensing from 100 mm to 3 m
- Includes models with a single analog or single discrete, two discrete, or analog and discrete in the same sensor
- Simplifies setup with push-button TEACH programming of custom sensing window
- Allows remote programming with an external switch, computer or controller for added security and convenience
- Presents sensor operating status using highly visible indicators LEDs
- Resists harsh environments with rugged IP67 (NEMA 6) housing and fully encapsulated electronics
- Provides digital filtering for exceptional electrical and noise immunity

ACCESSORIES page 325

T30UX

- Built-in temperature compensation for high-accuracy across a wide range of ambient temperatures
- Extended sensing ranges and short dead zones with 100 mm to 1 m, 200 mm to 2 m or 300 mm to 3 m
- Models with either analog or configurable discrete output
- Analog output models for applications requiring a continuous current or voltage output
- Wide operating temperature range of -40° to +70° C

T30U

- Range of 150 mm to 1 m or 300 mm to 2 m, depending on model
- Models with either dual-discrete or analog/discrete outputs
- Dual-discrete models for ON/OFF switching or pump/level control
- Independently programmable outputs
- Analog output models for applications requiring a continuous current or voltage output
- Chemically resistant models with a Teflon® coating to protect the transducer

U-GAGE® T30UX/T30U Sensors

T30UX and T30U (Long-range) Models

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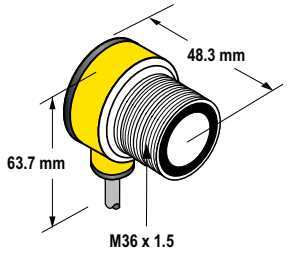
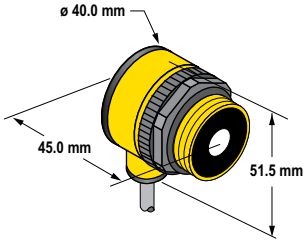
AUTOCAD, STEP, IGES & PDF



T30U Teflon-protected Models
Suffix -CRFV



T30U (Short-range) Models

U-GAGE® T30UX, 10-30V dc

Range	Frequency	Connection	Response Time	Output	Models*
100 mm to 1 m	224 kHz	2 m	45 ms	Discrete: NPN, PNP, NO, NC, Selectable	T30UXDA
		4-Pin Euro QD			T30UXDAQ8
200 mm to 2 m	174 kHz	2 m	92 ms		T30UXDB
		4-Pin Euro QD			T30UXDBQ8
300 mm to 3 m	114 kHz	2 m	135 ms		T30UXDC
		4-Pin Euro QD			T30UXDCQ8
100 mm to 1 m	224 kHz	2 m	Selectable 45 or 105 ms	Analog: 0 to 10V dc	T30UXUA
		4-Pin Euro QD			T30UXUAQ8
		2 m		Analog: 4 to 20 mA	T30UXIA
		4-Pin Euro QD			T30UXIAQ8
200 mm to 2 m	174 kHz	2 m	Selectable 92 or 222 ms	Analog: 0 to 10V dc	T30UXUB
		4-Pin Euro QD			T30UXUBQ8
		2 m		Analog: 4 to 20 mA	T30UXIB
		4-Pin Euro QD			T30UXIBQ8
300 mm to 3 m	114 kHz	2 m	Selectable 135 or 318 ms	Analog: 0 to 10V dc	T30UXUC
		4-Pin Euro QD			T30UXUCQ8
		2 m		Analog: 4 to 20 mA	T30UXIC
		4-Pin Euro QD			T30UXICQ8

Connection options: A model with a QD requires a mating cordset (see page 325).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UXDA W/30**).
QD models: For a 4-pin 150 mm Euro-style PUR pigtail QD, add suffix **QPMA** the 2 m model number (example, **T30UXDAQPMA**).

* Contact factory to request chemically resistant flange or fill-level control models.

U-GAGE® T30U, 12-24V dc

Range	Frequency	Connection	Response Time	Discrete Output(s)	Analog Output	Models*
150 mm - 1 m	228 kHz	2 m	48 ms	NPN	4 to 20 mA	T30UINA
		5-pin Euro QD				T30UINAQ
		2 m		PNP		T30UIPA
		5-pin Euro QD				T30UIPAQ
300 mm - 2 m†	128 kHz	2 m	96 ms	NPN	4 to 20 mA	T30UINB
		5-pin Euro QD				T30UINBQ
		2 m		PNP		T30UIPB
		5-pin Euro QD				T30UIPBQ
150 mm - 1 m	228 kHz	2 m	48 ms	Dual NPN	None	T30UDNA
		5-pin Euro QD				T30UDNAQ
		2 m		Dual PNP		T30UDPA
		5-pin Euro QD				T30UDPAQ

Connection options: A model with a QD requires a mating cordset (see page 325).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UINA W/30**).

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix **-CRFV** to the model number (example, **T30UINB-CRFV**).
† Teflon®-encapsulated models have a range of 300 mm - 1.5 m.
Teflon® is a registered trademark of Dupont™.

U-GAGE® T30U, 12-24V dc

Range	Frequency	Connection	Response Time	Discrete Output(s)	Analog Output	Models*
300 mm - 2 m†	128 kHz	2 m	96 ms	Dual NPN	None	T30UDNB
		5-pin Euro QD				T30UDNBQ
		2 m		Dual PNP		T30UDPB
		5-pin Euro QD				T30UDPBQ
150 mm - 1 m	228 kHz	2 m	48 ms	Pump/Level Control Dual NPN	None	T30UHNA
		5-pin Euro QD				T30UHNAQ
300 mm - 2 m†	128 kHz	2 m	96 ms			T30UHNB
		5-pin Euro QD				T30UHNBQ
150 mm - 1 m	228 kHz	2 m	48 ms	Pump/Level Control Dual PNP	None	T30UHPA
		5-pin Euro QD				T30UHPAQ
300 mm - 2 m†	128 kHz	2 m	96 ms			T30UHPB
		5-pin Euro QD				T30UHPBQ

Connection options: A model with a QD requires a mating cordset (see page 325).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UDNB W/30**).

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* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix **-CRFV** to the model number (example, **T30UDNB-CRFV**).
† Teflon®-encapsulated models have a range of 300 mm - 1.5 m.

U-GAGE® T30U, 15-24V dc

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

Connection options: A model with a QD requires a mating cordset (see page 325).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T30UUNA W/30**).

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix **-CRFV** to the model number (example, **T30UUNB-CRFV**).
† Teflon®-encapsulated models have a range of 300 mm - 1.5 m.

Teflon® is a registered trademark of Dupont™.

U-GAGE® T30UX Specifications

Effective Beam	See Chart EPBC-1 to EPBC-6 on page 326.
Sensing Range	**"A" suffix models:** 100 mm to 1 m **"B" suffix models:** 200 mm to 2 m **"C" suffix models:** 300 mm to 3 m
Ultrasonic Frequency	**"A" suffix models:** 224 kHz **"B" suffix models:** 174 kHz **"C" suffix models:** 114 kHz
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at 40 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.
Output Configuration	**Discrete (switched) output models:** SPST solid-state switch. Configurable as NPN (sinking) or PNP (sourcing) via Mode push button. Normally Open (NO) or Normally Closed (NC) operation is also selectable via Mode push button. The default setting is PNP/NO. **Analog output models:** 0 to 10V dc or 4 to 20 mA, depending on model

More on next page

U-GAGE® T30UX Specifications

Output Ratings	**Discrete output models:** 100 mA max. **OFF-state leakage current: NPN:** < 200 µA @ 30V dc (see NOTE 1) **PNP:** < 10 µA @ 30V dc **ON-state saturation voltage: NPN:** < 1.6V @ 100 mA **PNP:** < 3V @ 100 mA **Analog output models:** **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)/0.02Ω **For current output (4-20 mA) models,** ideal results are achieved when the total load resistance R = [(Vin – 4)/0.020]Ω. Example, at Vin = 24V dc, R ≈ 1 kΩ (1 watt)
Output Protection Circuitry	Protected against short circuit conditions
Output Response Time	**"A" suffix models:** 45 milliseconds **"B" suffix models:** 92 milliseconds **"C" suffix models:** 135 milliseconds
Delay at Power-up	500 milliseconds
Temperature Effect	0.02% of distance/º C
Linearity (analog models)	0.25% of distance
Repeatability/Resolution	**"A" suffix models:** 0.1% of distance (0.5 mm min.) **"B" suffix models:** 0.1% of distance (1.0 mm min.) **"C" suffix models:** 0.1% of distance (1.5 mm min.)
Sensing Hysteresis (discrete models)	**"A" suffix models:** 2 mm **"B" suffix models:** 3 mm **"C" suffix models:** 4 mm
Minimum Window Size	10 mm
Adjustments	**Sensing window limits:** TEACH-Mode configuration of near and far window limits may be set using the push button or remotely viaTEACH input **Discrete output models:** **Output Configuration:** NPN, PNP, Normally Open (NO), Normally Closed (NC) select **Advanced configuration options:** Push button enabled/disabled, temperature compensation enabled/disabled **Analog output models:** **Response speed selection:** Fast or Slow **Advanced configuration options:** Analog output slope, push button enabled/disabled, temperature compensation enabled/disabled
Indicators	**Green Power LED ON:** Power ON, RUN mode **Red Signal LED:** Target signal strength **Amber Output LED:** Output enabled; sensor receiving a signal within the window limits **Amber Mode LED:** Currently selected mode
Loss of Signal Indication (analog models)	**0 to 10V dc models:** Analog output goes to 0V **4 to 20 mA models:** Analog output goes to 3.6 mA
Construction	**Housing:** PBT polyester **Push buttons:** polyester **Transducer:** epoxy /ceramic composite
Environmental Rating	Leakproof design, rated IEC IP67 (NEMA 6)
Connections	2 m or 9 m shielded 4-conductor (with drain) PVC cable, 150 mm PUR Euro-style pigtail (QPMA), or 4-pin integral Euro-style connector (Q8). QD cordsets ordered separately. See page 325.
Operating Conditions	**Temperature:** -40° to +70° C **Relative humidity:** 95% 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	The temperature warmup drift upon power-up is less than 1% of the sensing distance.
Certifications	CE
Hookup Diagrams	**Discrete Models:** MI13 (p. 761) **Analog Models:** MI14 (p. 761)

NOTE 1: NPN < 200 µA for load impedance > 3 kΩ; for load current of 100 mA, leakage < 1% of load current

U-GAGE® T30U Specifications

Effective Beam	See Chart EPBC-7 to EPBC-11 on page 327.
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
Supply Voltage and Current	**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
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 cordsets are ordered separately. See page 325.
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 100%

More on next page

U-GAGE® T30U Specifications (cont'd)

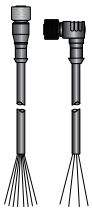
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Objects passing inside the specified 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. 761) **Dual-Discrete Models:** MI15 (p. 761)

Cordsets

Euro QD (With Shield)

See page 683

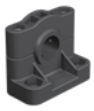
Length	Threaded 4-Pin		Threaded 5-Pin	
	Straight	Right-Angle	Straight	Right-Angle
2 m	MQDEC2-406	MQDEC2-406RA	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-415	MQDEC2-415RA	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-430	MQDEC2-430RA	MQDEC2-530	MQDEC2-530RA



Additional cordset information available. See page 620.

Brackets

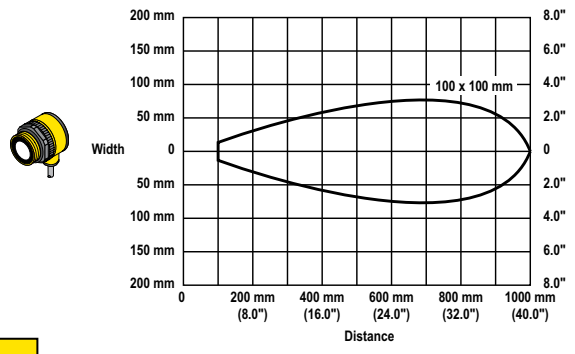
T30UX/T30U

		
pg. 637	pg. 639	pg. 640
SMB1815SF	SMB30A	SMB30FA..

Additional brackets and information available. See page 620.

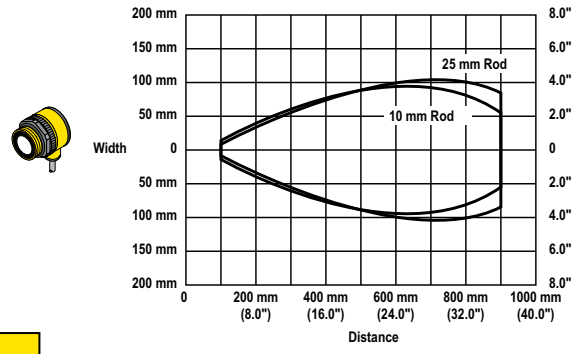
Effective Beam Patterns

T30UX with Plate Target (Typical) 1-Meter Models



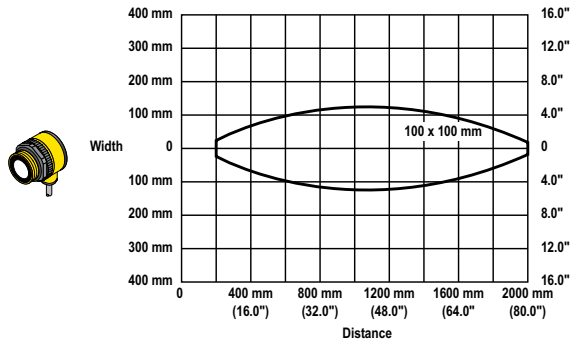
EBPC-1

T30UX with Rod Target (Typical) 1-Meter Models



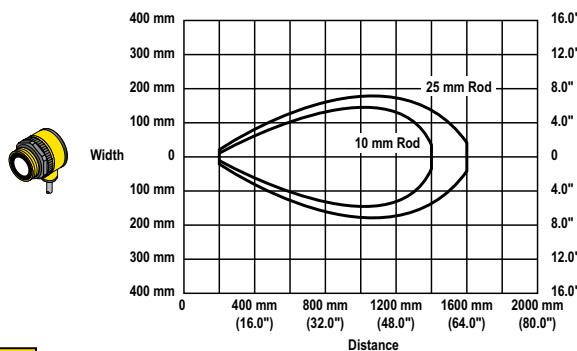
EBPC-2

T30UX with Plate Target (Typical) 2-Meter Models



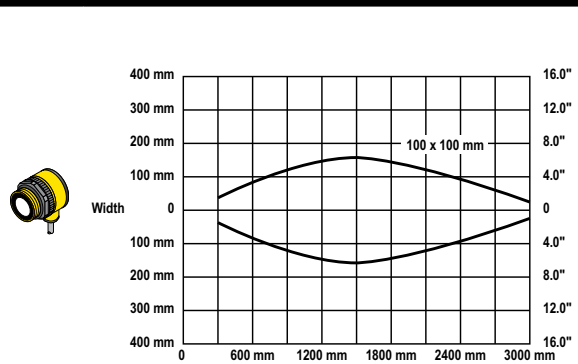
EBPC-3

T30UX with Rod Target (Typical) 2-Meter Models



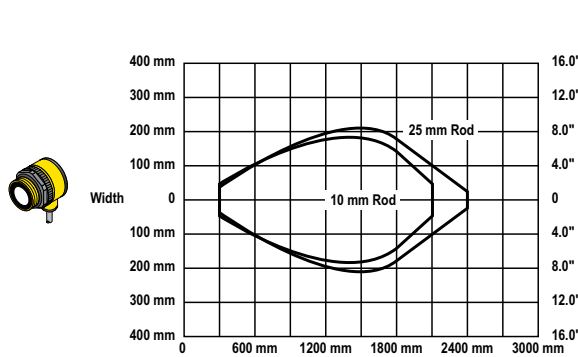
EBPC-4

T30UX with Plate Target (Typical) 3-Meter Models



EBPC-5

T30UX with Rod Target (Typical) 3-Meter Models

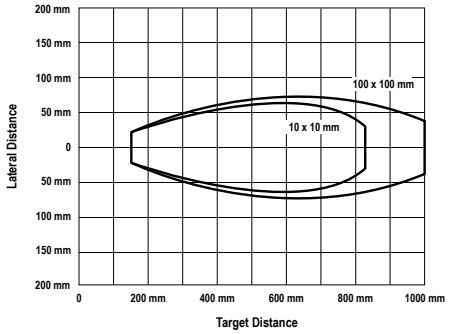


EBPC-6

More on next page

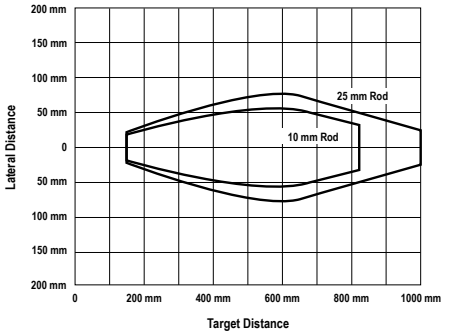
Effective Beam Patterns

T30U with Plate Target (Typical) 1-Meter Models



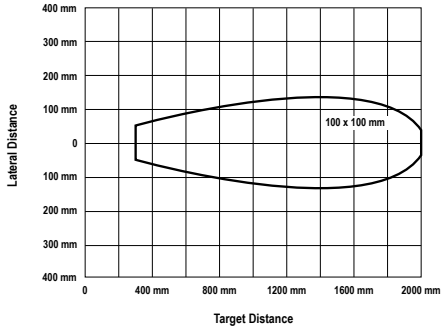
EBPC-7

T30U with Rod Target (Typical) 1-Meter Models



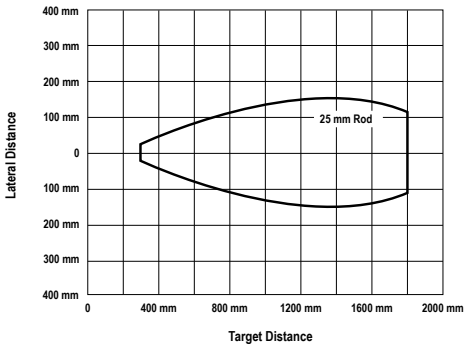
EBPC-8

T30U with Plate Target (Typical) 2-Meter Models



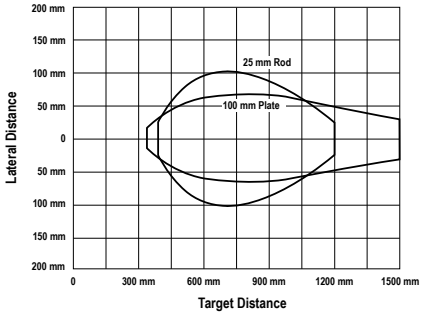
EBPC-9

T30U with Rod Target (Typical) 2-Meter Models



EBPC-10

T30U Teflon®-Encapsulated (Typical)



EBPC-11

U-GAGE® M25U

Stainless Steel Opposed-Mode Ultrasonic Sensors

- Features smooth 316 series stainless steel construction to withstand the toughest sanitary challenges
- Cleans easily with no thread, gaps or seams to trap debris
- Constructed of FDA approved materials
- Disinfects and cleans up with minimal effort
- Offers user-selectable dual range, depending on response time
- Rated IP69K, IEC IP67 (NEMA 6) with fully encapsulated electronics
- Provides a wide standard operating temperature range of -20° to +70°C
- Withstands high-temperature sprays of up to 80° C and 1500 psi occurring every few hours
- Features high immunity to ambient electrical and sonic noise
- Indicates status using highly visible LED's protected by a sealed, transparent cover

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M-GAGE® M25U, 10 to 30V dc

Range*	Frequency	Connection	Output	Response Time	Models
Normal Speed: 500 mm High Speed: 250 mm	140 kHz	4-pin Euro QD	—	—	**M25UEQ8 Emitter**
		5-pin Euro QD	Bipolar NPN/PNP	Normal Speed: 4.0 ms High Speed: 3.0 ms	**M25URBQ8 Receiver**

Connection options: A model with a QD requires a mating cordset (see page 329).

* M25U receivers may be wired for either of two speed modes: Normal or High, depending on hookup. The Normal-Speed mode offers a sensing range of 500 mm. The Normal-Speed mode maximizes sensing energy, as is required in demanding environments. The High-Speed mode offers a sensing range of 250 mm. The High-Speed mode maximizes sensing response, as is needed in high-speed counting applications.

U-GAGE® M25U Specifications

Sensing Range	**Normal Speed:** 500 mm **High Speed:** 250 mm 140KHz
Supply Voltage and Current	**Emitter:** 10 to 30V dc (10% max. ripple) at less than 85 mA **Receiver:** 10 to 30V dc (10% max. ripple) at less than 38 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Receiver Output Configuration	Bipolar (1 NPN & 1 PNP) solid-state output; Normally Closed (output is activated when an object blocks the sensing beam)
Output Rating	100 mA (each output) with short circuit protection; see Note 1 **OFF-state leakage current: NPN:** < 200 µA sinking **PNP:** < 10 µA sourcing **ON-state saturation voltage: NPN:** < 1.6V @ 100 mA **PNP:** < 3.0V @ 100 mA
Output Protection Circuitry	Protected against short circuit conditions
Output Response Time	**Normal Speed:** 4.0 milliseconds **High Speed:** 3.0 milliseconds
Repeatability	1 millisecond
Delay at Power-up	< 250 milliseconds
Delay for Switching Between Normal and High Speed	20 milliseconds
Indicators	**Green Power LED:** indicates Power ON **Amber Output LED:** indicates output activated
Construction	**Housing:** 316 Stainless Steel **LED window:** Polysulfone
Connections	**Emitter:** 4-pin Euro-Style QD **Receiver:** 5-pin Euro-Style QD QD cordsets ordered separately. See page 329.
Environmental Rating	Leakproof design, rated IEC IP67 (NEMA 6), IP69K
Operating Conditions	**Temperature:** -20° to +70° C **Max. Relative Humidity:** 95% at 50° C non-condensing
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements method 201A (vibration: 10 to 60 Hz max. amplitude 0.06", max. acceleration 10G). Also meets IEC 947-5-2; 30G 11 ms duration.
Certifications	CE
Notes	1. NPN < 200 µA for load impedance > 3 KΩ; for load current of 100 mA, leakage < 1% of load current 2. When mounting the M25U, care should be taken to acoustically isolate the emitter and receiver to eliminate sound energy coupling between the sensor pair. This is best accomplished with elastomeric materials between the sensor and rigid mounting brackets.
Hookups Diagrams	**Emitter Models:** MI21 (p. 763) **Receiver Models:** MI17 (p. 762)

Cordsets

Washdown Euro QD

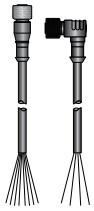
See page 6852

Length	Threaded 5-Pin Straight
2 m	MQDCWD-506
9 m	MQDCWD-530

Euro QD (With Shield)

See page 687

Length	Threaded 5-Pin Straight	Threaded 5-Pin Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Additional cordset information available. See page 679.

Brackets

M25U

pg. 659 — SMBM25A

pg. 659 — SMBM25B

Additional bracket information available. See page 620.

U-GAGE® T18U
Opposed Dual Range Sensors

- Offers response time of 2 milliseconds and range of 600 mm for longer-range applications
- Features ultra-fast response time of 1 millisecond with a range of 300 mm for high-speed applications such as counting
- 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
- Housed in T-style right-angle sensor package with 18 mm threaded mounting hub, for versatile mounting

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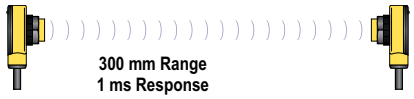

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U-GAGE® T18U, 12-30V dc

Range†	Connection	Response Time	Models* NPN	Models* PNP
NORMAL resolution: 600 mm HIGH resolution: 300 mm	2 m	NORMAL resolution: 2 ms or HIGH resolution: 1 ms	T186UE Emitter	
	4-pin Euro QD		T186UEQ Emitter	
	2 m		T18VN6UR	T18VP6UR
	4-pin Euro QD		T18VN6URQ	T18VP6URQ

Connection options: A model with a QD requires a mating cordset (see page 331).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T18VN6UR W/30**).

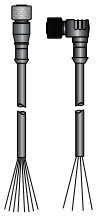
† Receivers may be wired for either resolutions: Normal or High.
* Sensor pair requires one emitter and one receiver.

U-GAGE® T18U Specifications

Sensing Range (no minimum range)	**NORMAL resolution mode:** to 600 mm **HIGH resolution mode:** to 300 mm
Supply Voltage and Current	12 to 30V dc, 10% max. ac ripple. 50 mA (emitters); 35 mA (receivers), exclusive of output load.
Ultrasonic Frequency	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.
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. **Green:** power ON **Yellow:** sonic signal received (flash rate is proportional to received signal strength; flash is from full to half intensity). See data sheet for detailed information.
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 cordsets are also available. See page 331.
Operating Temperature	-40° to +70° C
Vibration and Mechanical Shock	All models meets Mil.Std 202F requirements method 201A (Vibration: frequency 10 to 60 Hz, max., and double amplitude 0.06", maximum acceleration 10G) and 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:** MI21 (p. 763) **NPN Models:** MI19 (p. 762) **PNP Models:** MI20 (p. 762)

Cordsets

Euro QD		
See page 682		
Length	Threaded 4-Pin	
	Straight	Right-Angle
2 m	MQDC-406	MQDC-406RA
5 m	MQDC-415	MQDC-415RA
9 m	MQDC-430	MQDC-430RA



Additional cordset information available. See page 679.

Brackets

T18U		
 pg. 637	 pg. 637	 pg. 638
SMB18A	SMB18155F	SMB18FA..

Additional brackets and information available. See page 620.

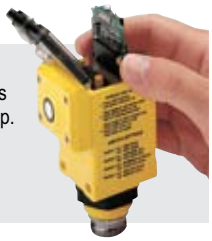
U-GAGE® Q45U
Flexible Ultrasonic Sensors

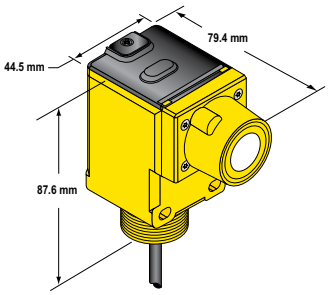
- Push-button TEACH programming makes it easy to set the near/far limits of the sensing window.
- Available ranges are 100 to 1400 mm for the short-range models and 0.25 to 3.0 m for the long-range models.
- Bipolar discrete models have switches for ON/OFF presence detection and HIGH/LOW level control.
  - 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.

ACCESSORIES page 335

Short-range Models

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 Q45UML card, and then transfer the settings to any Q45U sensor with the same available sensing range.





Long-range Models

ONLINE
AUTOCAD, STEP, IGES & PDF

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

Range	Temperature Compensation	Connection	Output Type	Response Time	Models
100 mm - 1.4 m	No	2 m	Bipolar NPN/PNP	Programmable for 20, 40, 160 or 640 ms	**Q45UBB63DA**
		5-pin Mini QD			**Q45UBB63DAQ**
		5-pin Euro QD			**Q45UBB63DAQ6**
	Yes	2 m			**Q45UBB63DAC**
		5-pin Mini QD			**Q45UBB63DACQ**
		5-pin Euro QD			**Q45UBB63DACQ6**

More on next page

Connection options: A model with a QD requires a mating cordset (see page 335).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UBB63DA W/30**).

U-GAGE® Q45U Discrete Output, 12-24V dc (cont'd)

Range	Temperature Compensation	Connection	Output Type	Response Time	Models
250 mm - 3 m†	Yes	2 m	Bipolar NPN/PNP	Programmable for 40, 80, 320 or 1280 ms	**Q45UBB63BC**
		5-pin Mini QD			**Q45UBB63BCQ**
		5-pin Euro QD			**Q45UBB63BCQ6**

U-GAGE® Q45U Analog Output, 15-24V dc

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

Connection options: A model with a QD requires a mating cordset (see page 335).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UBB63DA W/30**).

† 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	**Short Range:** Near limit: 100 mm min. **Long Range:** Near limit: 250 mm min. **Short Range:** 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 cm²)
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

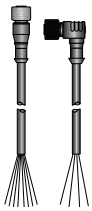
More on next page

U-GAGE® Q45U Specifications (cont'd)

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
Effective Beam	See EBPC-1 to EBPC-4 on page 335.
Adjustments	The following may be selected by a 4-position DIP switch. **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:** power ON **Yellow:** outputs are conducting (Yellow LED also indicates programming status during setup mode) **Red:** indicates relative strength of received echo **Analog: Three status LEDs:** **Green:** power ON **Yellow:** 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. See data sheet for detailed information.
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 cordsets are ordered separately. See pages 335.
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	MI18 (p. 762)

Cordsets

Euro QD (With Shield)		
See page 687		
Length	Threaded 5-Pin	
	Straight	Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Mini QD (With Shield)	
See page 701	
Length	Threaded 5-Pin
	Straight
2 m	MBCC2-506
4 m	MBCC2-512
10 m	MBCC2-530

Additional cordset information available. See page 679.

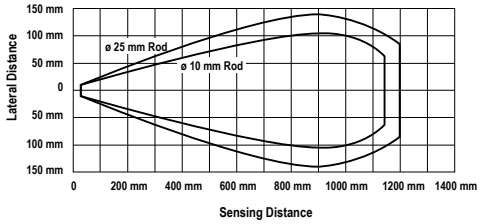
Brackets

Q45U		
		
pg. 639	pg. 640	pg. 641
SMB30A	SMB30MM	SMB30SC

Additional bracket information available. See page 620.

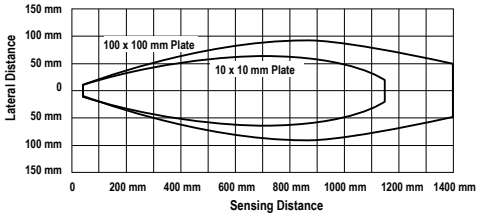
Effective Beam Patterns

Q45U Short Range with Rod Target (Typical)



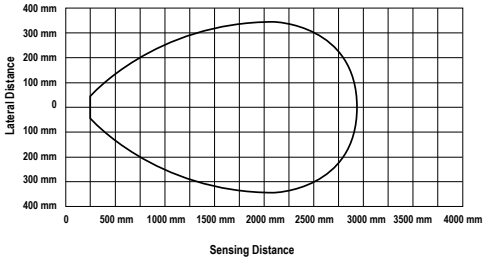
EBPC-1

Q45U Short Range with Plate Target (Typical)



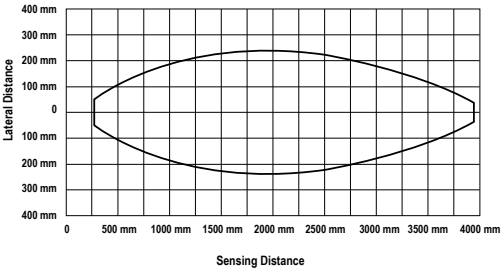
EBPC-2

Q45U Long Range with 25 mm Rod Target (Typical)



EBPC-3

Q45U Long Range with 100 x 100 mm Plate Target (Typical)



EBPC-4

U-GAGE® Q45UR
Remote Ultrasonic Sensors

- 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.
- 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.
- Push-button TEACH-mode programming enables exact programming of sensing ranges and sensing windows.
- Environmental rating is IEC IP65 and NEMA 4.
- Digital filtering provides immunity from random electrical and acoustic noise.
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.

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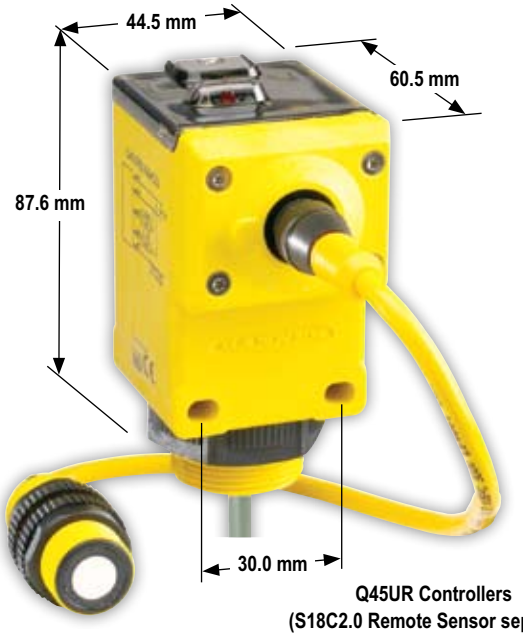
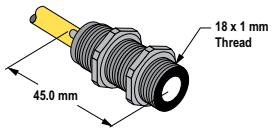
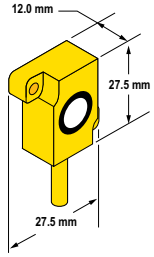


Q45UR Controllers
(S18C2.0 Remote Sensor separate)



M18C2.0 & S18C2.0 Remote Sensors



Q13C2.0 Remote Sensors

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

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

Connection options: A model with a QD requires a mating cordset (see page 339).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UR3BA63CK W/30**).

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

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

Connection options: A model with a QD requires a mating cordset (see page 339).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UR3BA63CK W/30**).

Photoelectrics Sensors
Fiber Optic Sensors
Special Purpose Sensors
Measurement & Inspection Sensors
Vision
Wireless
Lighting & Indicators
Safety Light Screens
Safety Laser Scanners
Fiber Optic Safety Systems
Safety Controllers & Modules
Safety Two-Hand Control Modules
Safety Interlock Switches
Emergency Stop & Stop Control

ACCESSORIES page 339

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.

LIGHT GAUGING
ULTRASONIC
QT50U
S18U
QS18U
T30U/T30UX
M25U
T18U
Q45U
Q45UR
MEASURING ARRAYS
RADAR

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

More on next page

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

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)
Effective Beam	See page 339.
Adjustments	**Discrete:** The following may be selected by a 4-position DIP switch **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
Indicators	**Discrete: Three status LEDs:** **Green:** Power ON **Yellow:** Output are conducting (Yellow also indicates programming status during setup) **Red:** 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:** Power ON **Yellow:** Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) **Red:** Relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window See data sheet for detailed information
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 page 339. **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.

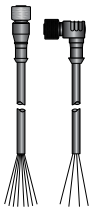
More on next page

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

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	MI18 (p. 762)

Cordsets

Euro QD (With Shield)		
See page 687		
	Threaded 5-Pin	
Length	Straight	Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Mini QD (With Shield)	
See page 701	
	Threaded 5-Pin
Length	Straight
2 m	MBCC2-506
4 m	MBCC2-512
10 m	MBCC2-530

Additional cordset information available. See page 687.

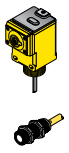
Brackets

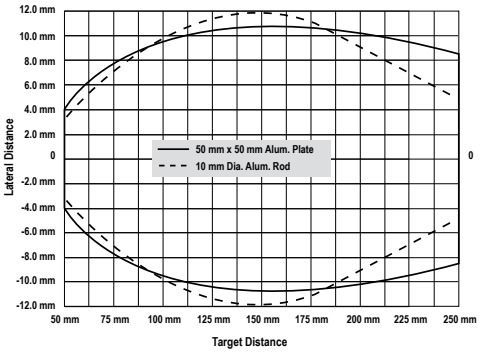
Q45UR		
		
pg. 639	pg. 640	pg. 641
SMB30A	SMB30MM	SMB30SC

Additional bracket information available. See page 620.

Effective Beam Patterns

Q45UR





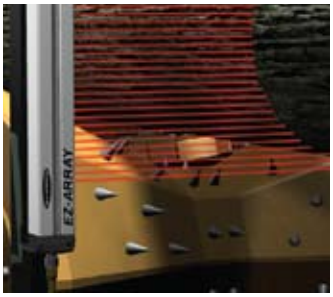
EBPC-1

MEASURING ARRAYS

EZ-ARRAY™

High-Resolution MINI-ARRAY®

MINI-ARRAY®

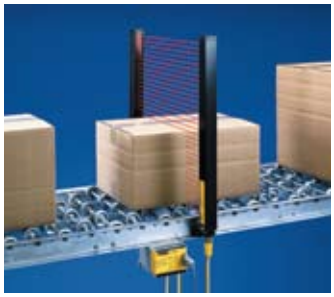


EZ-ARRAY™ **page 341**

- 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.

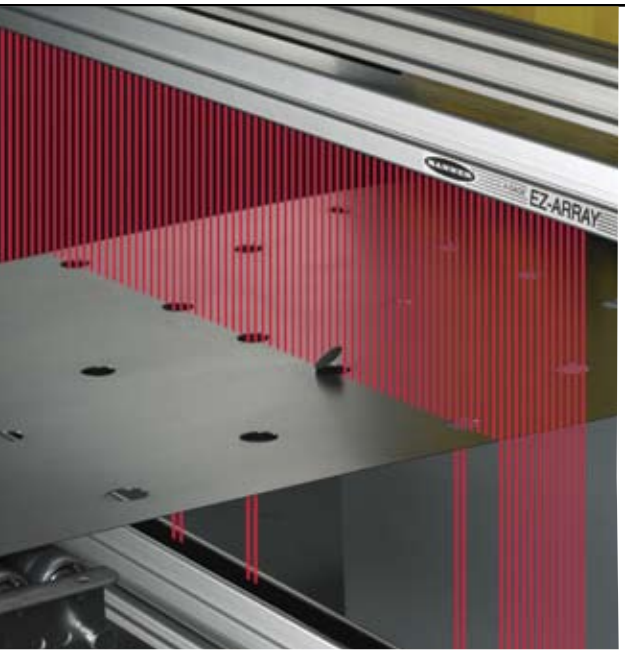
High-Resolution MINI-ARRAY® **page 344**

- 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 348**

- 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™ -compatible output.



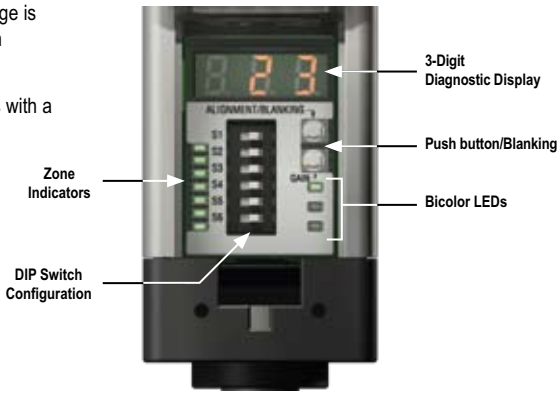
A-GAGE® EZ-ARRAY™
Two-Piece Measuring Light Screens

- Applications include edge and center guarding, loop tension control, hole sizing, parts counting and on-the-fly product sizing and profiling.
- 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.

ACCESSORIES page 343

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.
- Standard working range is 0.4 to 4 m, with 5 mm beam spacing.
- Shorter range models with a 0.3 to 1.5 m working range are available.



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

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Specialty Application Solutions

Clear Object Detection

Clear plate glass profiling (Measure width of glass)

Clear plastic bottle detection (Detect presence/absence of bottle)

- Clear object models (0.3 m to 1.5 m) are designed to detect low-contrast, translucent objects in clean industrial environments.
- Short-range and low-contrast models are available for plate glass, clear film and bottle detection.

Carpet Edge Detection

Air-to-backing and backing-to-tufting monitoring

- Short-range models with carpet-specific algorithm automatically detect both the carpet tufting and backing edges.
- Kits are available with an emitter, short-range receiver and mounting bracket for ease of installation and alignment.

Contact Banner Engineering at 1-888-373-6767 or visit bannerengineering.com/ezarray for detailed application and ordering information.

ACCESSORIES page 343

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

Housing Length (L)	Array Length	Total Beams	Connection	Range*	Analog Output	Emitter Model	Receiver Model NPN Outputs	Receiver Model PNP Outputs
227 mm	150 mm	30	8-pin Euro QD	0.4–4 m	Current (4–20 mA)	EA5E150Q	EA5R150NIXMODQ	EA5R150PIXMODQ
					Voltage (0–10V)		EA5R150NUXMODQ	EA5R150PUXMODQ
379 mm	300 mm	60			Current (4–20 mA)	EA5E300Q	EA5R300NIXMODQ	EA5R300PIXMODQ
					Voltage (0–10V)		EA5R300NUXMODQ	EA5R300PUXMODQ
529 mm	450 mm	90			Current (4–20 mA)	EA5E450Q	EA5R450NIXMODQ	EA5R450PIXMODQ
					Voltage (0–10V)		EA5R450NUXMODQ	EA5R450PUXMODQ
678 mm	600 mm	120			Current (4–20 mA)	EA5E600Q	EA5R600NIXMODQ	EA5R600PIXMODQ
					Voltage (0–10V)		EA5R600NUXMODQ	EA5R600PUXMODQ
828 mm	750 mm	150			Current (4–20 mA)	EA5E750Q	EA5R750NIXMODQ	EA5R750PIXMODQ
					Voltage (0–10V)		EA5R750NUXMODQ	EA5R750PUXMODQ
978 mm	900 mm	180			Current (4–20 mA)	EA5E900Q	EA5R900NIXMODQ	EA5R900PIXMODQ
					Voltage (0–10V)		EA5R900NUXMODQ	EA5R900PUXMODQ
1128 mm	1050 mm**	210			Current (4–20 mA)	EA5E1050Q	EA5R1050NIXMODQ	EA5R1050PIXMODQ
					Voltage (0–10V)		EA5R1050NUXMODQ	EA5R1050PUXMODQ
1278 mm	1200 mm**	240			Current (4–20 mA)	EA5E1200Q	EA5R1200NIXMODQ	EA5R1200PIXMODQ
					Voltage (0–10V)		EA5R1200NUXMODQ	EA5R1200PUXMODQ
1578 mm	1500 mm**	300			Current (4–20 mA)	EA5E1500Q	EA5R1500NIXMODQ	EA5R1500PIXMODQ
					Voltage (0–10V)		EA5R1500NUXMODQ	EA5R1500PUXMODQ
1878 mm	1800 mm**	360			Current (4–20 mA)	EA5E1800Q	EA5R1800NIXMODQ	EA5R1800PIXMODQ
					Voltage (0–10V)		EA5R1800NUXMODQ	EA5R1800PUXMODQ
2178 mm	2100 mm**	420			Current (4–20 mA)	EA5E2100Q	EA5R2100NIXMODQ	EA5R2100PIXMODQ
					Voltage (0–10V)		EA5R2100NUXMODQ	EA5R2100PUXMODQ
2478 mm	2400 mm**	480			Current (4–20 mA)	EA5E2400Q	EA5R2400NIXMODQ	EA5R2400PIXMODQ
					Voltage (0–10V)		EA5R2400NUXMODQ	EA5R2400PUXMODQ

QD models: A model with a QD requires a mating cordset (see page 343).

* Models with a range of 100 mm to 1.5 m models are available upon request. Contact factory at 1-888-373-6767 for more information.

** 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 = $(V_{supply}-3)/0.020$)

More on next page

A-GAGE® EZ-ARRAY™ Specification (cont'd)

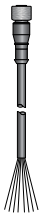
Serial Communication Interface	EIA-485 Modbus RTU (up to 15 nodes per communication ring) RTU binary format **Baud Rate:** 9600, 19.2K or 38.4K 8 Data Bits, 1 Stop Bit, and Even, Odd, or 2 Stop Bits and No Parity
Scan Time	Scan times depend on scan mode and sensor length. Straight scan times range from 2.8 to 26.5 milliseconds.
Status Indicators	**Emitter:** Red Status LED ON Steady—Status 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. **Push Buttons** 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 cordsets are ordered separately. See page 343. **Other Sensor connections:** 8-conductor quick-disconnect cordsets (one each for emitter and receiver), ordered separately (may not exceed 75 m long), PVC-jacketed cordsets measure 5.8 mm diameter, have shield wire; 22-gauge conductors. QD cordsets are ordered separately. See page 343.
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)
Certification	CE
Hookup Diagrams	**NPN models:** MI23 (p. 763) **PNP models:** MI24 (p. 763)

Cordsets

Euro QD (With Shield)

See page 689

Length	Threaded 8-Pin Straight
4.58 m	MAQDC-815
9.14 m	MAQDC-830
15.2 m	MAQDC-850

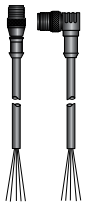


Additional cordset information available. See page 679.

Communication Cordsets

See page 703

Length	Threaded 5-Pin Straight	Threaded 5-Pin Right-Angle
1.83 m	MQDMC-506	MQDMC-506RA
4.57 m	MQDMC-515	MQDMC-515RA
9.14 m	MQDMC-530	MQDMC-530RA



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LENS SHIELDS PAGE 732

Brackets

EZ-ARRAY™

pg. 629 EZA-MBK-20

pg. 656 SMBLBCZB

Additional brackets and information available. See page 620.

Serial Adapters

See page 739		Model
	USB to RS-485 serial adapter with integral communication cordset and USB cable for advanced configuration with a PC.	EZA-USB485-01
	USB to RS-485 serial adapter for advanced configuration with a PC. NOTE: Communication cordset ordered separately.	INTUSB485-1

A-GAGE® High-Resolution MINI-ARRAY®

High-Resolution Inspection and Profiling Light Screen

- Excels at high-speed, precise monitoring and inspection applications, including on-the-fly sizing, profiling, precision edge and center guiding, and hole detection
- Requires a controller, emitter/receiver pair and interconnecting cordsets for a complete system
- Offers programmable controller with a selection of measurement modes, scan modes and output configurations
- Provides 120 sensing beams per foot, for reliable detection of objects as small as 2.5 mm
- Features a 1.8 m range with easy, forgiving alignment
- Offers programmable blanking, hysteresis and serial communications
- Includes advanced software for system configuration using a PC
- Makes status monitoring easy with indicators visible from three sides of emitter/receiver

ACCESSORIES page 347

Emitters/Receivers

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

A-GAGE® High-Resolution MINI-ARRAY® Emitters/Receivers–2.5 mm Beam Spacing

Housing Length (L)	Array Length	Total Beams	Connection	Range	Minimum Object Size	Models*
236 mm	163 mm	64	5-pin Mini QD	0.4 - 1.8 m	2.5 mm	MAHE6A MAHR6A

More on next page

QD models: A model with a QD requires a mating cordset (see page 347).

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

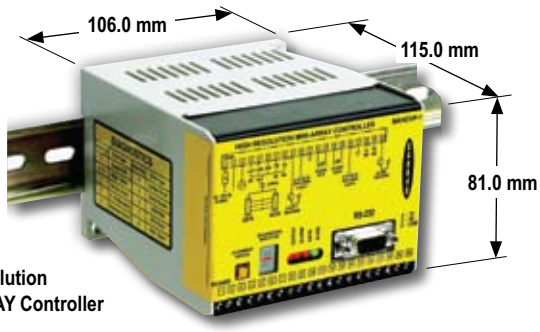
A-GAGE® High-Resolution MINI-ARRAY® Emitters/Receivers–2.5 mm Beam Spacing (cont'd)

Housing Length (L)	Array Length	Total Beams	Connection	Range	Minimum Object Size	Models*
399 mm	325 mm	128	5-pin Mini QD	0.4 - 1.8 m	2.5 mm	MAHE13A
						MAHR13A
561 mm	488 mm	192				MAHE19A
						MAHR19A
724 mm	650 mm	256				MAHE26A
						MAHR26A
887 mm	813 mm	320				MAHE32A
						MAHR32A
1049 mm	975 mm	384				MAHE38A
						MAHR38A
1215 mm	1138 mm	448				MAHE45A
						MAHR45A
1377 mm	1300 mm	512				MAHE51A
						MAHR51A
1540 mm	1463 mm	576				MAHE58A
						MAHR58A
1703 mm	1626 mm	640				MAHE64A
						MAHR64A
1865 mm	1788 mm	704				MAHE70A
						MAHR70A
2028 mm	1951 mm	768				MAHE77A
						MAHR77A

QD models: A model with a QD requires a mating cordset (see page 347).

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

Controllers



High-Resolution MINI-ARRAY Controller

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

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

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

A-GAGE® High-Resolution MINI-ARRAY® Emitter/Receiver 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 cordset (one each for emitter and receiver), ordered separately. Use only Banner cordset, which incorporate a "twisted pair" for noise immunity. Cordsets measure 8.1 mm in diameter and are shielded and PVC-jacketed. Conductors are 20 gauge (0.9 mm). Emitter and receiver cordset may not exceed 75 m long, each. See page 347.
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

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
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 c UL® us
Hookup Diagrams	**0-10V sourcing:** MI25 (p. 764) **4 to 20 mA voltage:** MI26 (p. 764)

Cordsets

Mini QD (Shielded with Twisted Pair)	
See page 702	
Length	Threaded 5-Pin Straight
4.57 m	QDC-515C
7.62 m	QDC-525C
15.2 m	QDC-550C
22.9 m	MAQDC-575C
30.5 m	MAQDC-5100C
38.1 m	MAQDC-5125C
45.7 m	MAQDC-5150C

Additional cordset information available. See page 679.

DB9 Communication	
See page 704	
Length	9-Pin Straight
2.00 m	MASC

Brackets

High-Resolution MINI-ARRAY®	
	
pg. 628	pg. 633
DIN-35-..	MSMB-3

Additional bracket information available. See page 620.

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A-GAGE® MINI-ARRAY®

Inspection and Profiling Light Screens

- Features low-profile, programmable measuring light screen systems for inspections and profiling
- Requires a controller, emitter/receiver pair and interconnecting cordsets for a complete system
- Offers programmable controller with a selection of measurement modes, scan modes and output configurations
- Offers emitters/receivers for detecting objects as small as 12.7 mm
- Available with 9.5 or 19 mm beam spacing
- Features ranges to 17 m, depending on length and beam spacing
- Includes advanced software for system configuration using a PC
- Available in models for central monitoring and control over a DeviceNet™ control network
- Features optional heated enclosures for outdoor applications
- Makes status monitoring easy with indicators visible from three sides of emitter/receiver

ACCESSORIES page 353

Emitters/Receivers

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

A-GAGE® MINI-ARRAY® Emitters/Receivers–19.1 mm Beam Spacing

Housing Length (L)	Array Length	Total Beams	Connection	Minimum Object Size	Range	Models*
201 mm	133 mm	8	5-pin Mini QD	38.1 mm Interlaced Mode: 25.4 mm	0.9 - 17 m	BMEL616A
						BMRL616A
356 mm	286 mm	16				BMEL1216A
						BMRL1216A
505 mm	438 mm	24				BMEL1816A
						BMRL1816A

More on next page

QD models: A model with a QD requires a mating cordset (see page 353).

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

A-GAGE® MINI-ARRAY® Emitters/Receivers–19.1 mm Beam Spacing (cont'd)

Housing Length (L)	Array Length	Total Beams	Connection	Minimum Object Size	Range	Models*
659 mm	591 mm	32	5-pin Mini QD	38.1 mm Interlaced Mode: 25.4 mm	0.9 - 17 m	BMEL2416A BMRL2416A
810 mm	743 mm	40				BMEL3016A BMRL3016A
963 mm	895 mm	48				BMEL3616A BMRL3616A
1115 mm	1048 mm	56				BMEL4216A BMRL4216A
1267 mm	1200 mm	64	5-pin Mini QD	38.1 mm Interlaced Mode: 25.4 mm	0.9 - 14 m	BMEL4816A BMRL4816A
1572 mm	1505 mm	80				BMEL6016A BMRL6016A
1877 mm	1810 mm	96				BMEL7216A BMRL7216A

ACCESSORIES page 353

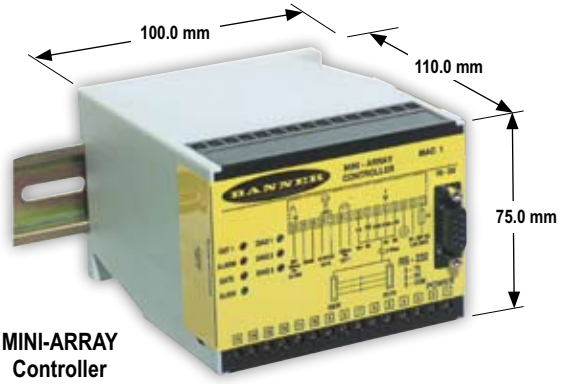
A-GAGE® MINI-ARRAY® Emitters/Receivers–9.5 mm Beam Spacing

Housing Length (L)	Total Beams	Array Length	Connection	Minimum Object Size	Range	Models*
201 mm	16	143 mm	5-pin Mini QD	19.1 mm Interlaced Mode: 12.7 mm	0.6 - 6.1 m	BMEL632A BMRL632A
356 mm	32	295 mm				BMEL1232A BMRL1232A
505 mm	48	448 mm				BMEL1832A BMRL1832A
659 mm	64	600 mm				BMEL2432A BMRL2432A
810 mm	80	752 mm				BMEL3032A BMRL3032A
963 mm	96	905 mm				BMEL3632A BMRL3632A
1115 mm	112	1057 mm				BMEL4232A BMRL4232A
1267 mm	128	1210 mm			0.6 - 4.6 m	BMEL4832A BMRL4832A
1572 mm	160	1514 mm				BMEL6032A BMRL6032A
1877 mm	192	1819 mm				BMEL7232A BMRL7232A

QD models: A model with a QD requires a mating cordset (see page 353).

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

Contollers



MINI-ARRAY Controller

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

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

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* 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® Emitter/Receiver 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* *Assumes sensing is in the middle 1/3 of sensing range.	**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*
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†

More on next page

A-GAGE® MINI-ARRAY® Emitter/Receiver Specifications (cont'd)

Connections	Sensors connect to controller using 5-conductor Mini-style quick-disconnect cordsets (one each for emitter and receiver), ordered separately. Use only Banner cordsets, which incorporate a "twisted pair" for noise immunity. Cordsets measure 8.1 mm dia. and are shielded and PVC-jacketed. Conductors are 20 gauge. Emitter and receiver cordsets may not exceed 75 m long, each. See page 353.
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
Certification	CE
Operating Conditions	**Temperature:** -20° to +70° C **Relative humidity:** 95% at 50° C (non-condensing)

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. 765)

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

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. 764) **MACN-1/MACP-1:** MI28 (p. 765) **MACV-1/MACI-1:** MI29 (p. 765) **MAC16N-1/MAC16P-1**: MI31 (p. 765)

Cordsets

Mini QD (Shielded with Twisted Pair)	
See page 702	
	Threaded 5-Pin
Length	Straight
4.57 m	QDC-515C
7.62 m	QDC-525C
15.2 m	QDC-550C
22.9 m	MAQDC-575C
30.5 m	MAQDC-5100C
38.1 m	MAQDC-5125C
45.7 m	MAQDC-5150C

Additional cordset information available. See page 679.

DB9 Communication	
See page 704	
	9-Pin
Length	Straight
2.00 m	MASC

Brackets

MINI-ARRAY®	
	
pg. 628	pg. 633
DIN-35-..	MSMB-3

Additional bracket information available. See page 620.

ENCLOSURES PAGE 728

STANDS PAGE 722

LENS SHIELDS PAGE 732

R-GAGE™ QT50R

Radar-Based Adjustable-Field & Retroreflective Sensors

- Uses Frequency Modulated Continuous Wave (FMCW) technology for detecting moving or stationary targets.
- Provides presence, absence or change information for a detected target
  - Adjustable-field sensors detect objects up to a set distance, ignoring objects and backgrounds beyond the setpoint.
  - Retro-wave sensors detect objects in front of a retroflective target, ignoring objects behind the retroflective target.
- Operates at 24 GHz in the Industrial, Scientific and Medical (ISM) telecommunication band; no special licensing required
- Rated IP67 for harsh environments
- Withstands extreme temperatures, rain, fog, snow, humidity and strong wind
- Detects vehicles at distances up to 15 m
- Includes DIP switches for sensing distance, sensitivity and output configuration
- Features bright LED indicators for easy status monitoring

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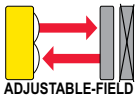
Presence sensing in a broad range of weather conditions

- Vehicle detection on roads and near intersections (AF)
- Boat detection for locks and dams (AF)
- Proximity detection for large shipyard cranes (AF)
- Car detection and counting for tollbooths, parking ramps, gated access and drive-thrus (RW/AF)
- Train, subway and light rail detection for underground tunnels and shipyard logistics (RW/AF)
- Truck trailer detection at loading docks (RW/AF)

R-GAGE™ QT50R Adjustable Field, 12-30V dc

Sensing Mode/LED	Max Range†	Connection	Telecom Approval	Output	Model
 ADJUSTABLE-FIELD	15 m	2 m	US, Canada, Mexico and Brazil	Bipolar NPN/PNP Selectable NO or NC	QT50RAF-US
			Europe (except UK), Australia and New Zealand		QT50RAF-EU
			China		QT50RAF-CN
			UK		QT50RAF-UK

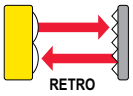
More on next page

QD models: A model with a QD requires a mating cordset (see page 356).

QD models: For 5-pin Euro-style QD, add **Q** to the 2 m model (example, **QT50RAFQ-US**).

† Range is dependent on target object.
Contact factory at 1-888-373-6767 for additional models.

R-GAGE™ QT50R Retroflective, 12-30V dc (cont'd)

Sensing Mode/LED	Max Range†	Connection	Telecom Approval	Output	Model
	12 m	2 m	US, Canada, Mexico and Brazil	Bipolar NPN/PNP Selectable NO or NC	**QT50RAF-US-R**
			Europe (except UK), Australia and New Zealand		**QT50RAF-EU-R**
			China		**QT50RAF-CN-R**
			UK		**QT50RAF-UK-R**

QD models: A model with a QD requires a mating cordset (see page 356).

QD models: For 5-pin Euro-style QD, add **Q** to the 2 m model (example, **QT50RAFQ-US-R**).

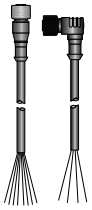
† Range is dependent on target object.
Contact factory at 1-888-373-6767 for additional models.

R-GAGE™ QT50R Specifications

Range	Sensor will detect a proper object (see below) up to 12 or 15 m, depending on model and target
Effective Beam	See charts EBPC-1 and EBPC-2 on page 356
Detectable Objects	Objects containing metal, water or similar high-dielectric material
Operating Principle	Frequency Modulated Continuous Wave (FMCW) radar
Operating Frequency	24.00-24.25 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) See data sheets for more detailed information
Response Time	DIP-switch 8 selects ON/OFF response time
Adjustments	**Adjustable-field:** DIP-switch-configurable sensitivity, sensing distance and output configuration **Retroreflective:** DIP-switch-configurable sensitivity and output configuration; remote line TEACH of the retroreflective target
Construction	**Housing:** ABS/polycarbonate **Lightpipes:** Acrylic **Access Cap:** Polyester
Operating Temperature	-40° to +65° C
Environmental Rating	IP67
Connections	2 m, 5-wire, shielded, cordset or 5-pin Euro-style QD. Mating QD cordsets are ordered separately. See page 356.
Certifications	CE and ETSI/EN 300 440 or FCC Part 15, depending on model (consult factory for other certifications)
Hookup Diagram	MI22 (p. 763)

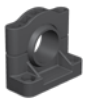
Cordsets

Euro QD (With Shield)		
See page 687		
	Threaded 5-Pin	
Length	Straight	Right-Angle
1.83 m	MQDEC2-506	MQDEC2-506RA
4.57 m	MQDEC2-515	MQDEC2-515RA
9.14 m	MQDEC2-530	MQDEC2-530RA



Additional cordset information available. See page 679.

Brackets

QT50R		
		
pg. 639	pg. 641	pg. 640
SMB30A	SMB30SC	SMB30MM

Additional brackets and information available. See page 620.

Weather Deflector Kit

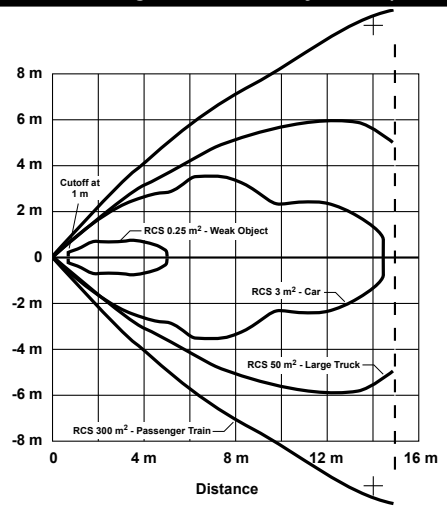
QT50RCK
- Required if R-GAGE is exposed to rain and snow
- Prevents buildup of water or ice on sensor face

Radar Target

BRTR-CC20E
- Large corner-cube reflector in protective plastic enclosure
- 7x excess gain at 6 m distance

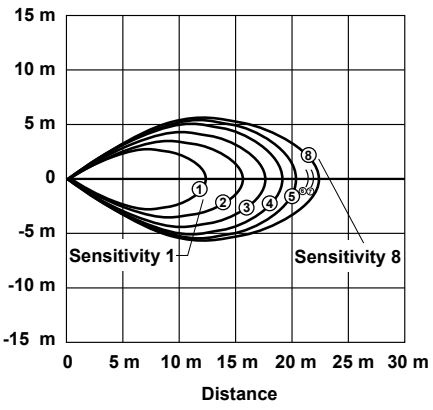
Effective Beam Patterns

QT50R Adjustable Field (Four different targets at sensitivity level 8)



EBPC-1

QT50R Adjustable Field (BRTR-CC20E, RCS=50 m²)



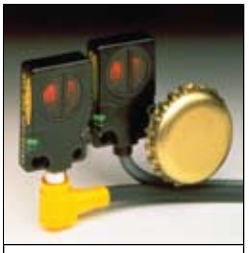
EBPC-2

The following standard products are still available from Banner.
Please go online to bannerengineering.com for full descriptions and technical references.


MINI-BEAM®2 QS12


VS1


VS4


Q08


Q10/Q14


FI22 *Expert*™


D11/D11E


ECONO-BEAM®


M12 & S18 Laser Emitters


VALU-BEAM®


Q85


Analog OMNI-BEAM™


MAXI-BEAM®


MULTI-BEAM®


MAXI-AMP™


MICRO-AMP® & Remote Sensors

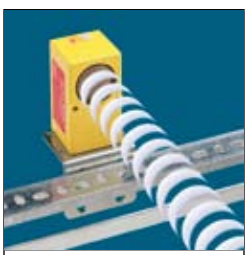

Bus-compatible Sensors


R55 & R55 *Expert*™


Magnetic Sensors


L-GAGE® Q50


T-GAGE® M18T


ULTRA-BEAM™ Sensors


LS