Features

- Special emitter/receiver infrared wavelength tuned to the absorption band of water
- Powerful enough to burn through many types of plastic and glass containers
- Water-based liquids will attenuate the signal; this enhances contrast on difficult sensing applications found on bottle-filling lines
- Excellent noise immunity and crosstalk avoidance
- Easy-to-read operating status indicators
- Bipolar discrete outputs, PNP and NPN; analog model also available
- Light Operate and Dark Operate models are available
- Models available with 2 m or 9 m (6.5 ft or 30 ft) cable, or 150 mm (6 in) pigtail with quick-disconnect fitting
- Rugged IP67 (NEMA 6) housing for harsh environments; 1200 psi washdown rated per NEMA PW12
- Compact housing, mounting versatility — 30 mm threaded barrel- or side-mount

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Models

Standard models (standard emitters will only work with standard receivers)

Model	Description	Sensing Beam and Range	Supply Voltage	Output
QS30EXH2O	Emitter	1450 nm infrared 3 mm effective beam dia.	10 to 30 V DC	--
QS30ARH2O	Receiver, light operate	2 m (6.5 ft) range		Bipolar (NPN and PNP)
QS30RRH2O	Receiver, dark operate			
QS30ARXH2O	High-gain receiver, light operate	4 m (13 ft) range		
QS30RRXH2O	High-gain receiver, dark operate			
QS30RXH2OU	High-gain receiver, analog		15 to 30 V DC	0 to 10 V Analog

Super high-power models (super high-power emitters will only work with super high-power receivers)

Super High-Power Models				
Model	**Description**	**Sensing Beam and Range**	**Supply Voltage**	**Output**
QS30EXSH2O	Super high-power emitter	1450 nm infrared 13 mm effective beam dia.	10 to 30 V DC	--
QS30ARXSH2O	Super high-power receiver, light operate	8 m (26 ft) range		Bipolar (NPN and PNP)
QS30RRXSH2O	Super high-power receiver, dark operate			

Sensors can be used at ranges greater than listed for applications that require less excess gain. Please contact Banner for assistance on your long-range applications.

Only 2 m (6 ft) cables are listed.

- To order 9 m (30 ft) cable models, add suffix "**W/30**" to the model number (for example, **QS30EH2O W/30**).
- To order 150 mm (6.5 in) cable with a 5-pin M12 connector models, add suffix "**Q5**" to the model number (for example, **QS30EH2OQ5**).
- Models with a QD connector requires a mating cordset (see "QS30H2O Quick-Disconnect (QD) Cordsets" on page 7).

136166
p/n: 136166 Rev. D

Overview

The Banner QS30H2O series water sensor was developed to detect the presence of water. Its electro-optical components are tuned to one absorption band of water in the long infrared spectrum. The emitted infrared light penetrates many types of plastic and glass containers, but will not pass through water-based fluids, nor through opaque substances such as wood, metal or cardboard. Accessory apertures are available to attenuate or shape the beam for low-gain applications, for example, clear water in a clear bottle.

Low-gain models are recommended for sensing applications where the liquid container is transparent or when the thickness of liquid being detected is small. Some examples are clear glass test tubes and clear PET beverage bottles. High-gain models are recommended when the liquid container is light-blocking (translucent) and when the thickness of liquid being detected is large. Some examples are HDPE milk containers, colored PET beverage bottles, and etched glass containers. Super High-Power models are recommended for thick, opaque containers that require maximum burn-through power at a slower response speed.

For all applications, the sensors must be installed to maximize the optical contrast between the clear and blocked states. The installer can use apertures and mechanical alignment of the sensors to achieve the best results . The QS30H2O sensor enhances the available contrast by taking advantage of the absorption band of water.

Features

1. Emitter power LED (green)
2. Output conducting (amber, discrete models only)
3. Receiver power LED (green)
4. AID™ indicator (amber)

For advanced applications, a 0–10 V analog output is available. The analog output allows the user to directly measure the amount of signal attenuation. The analog output value can be filtered and a switching threshold determined in a PLC or computer as required for the application. Please consult the factory for more information on using the analog output.

Each discrete output model has two bipolar outputs that switch simultaneously: one each NPN (sinking) and PNP (sourcing). Light Operate and Dark Operate models are available.

In light operate (LO) mode, the output is ON when the target returns the same or more light to the sensor and OFF when the sensor detects less light than the configured/taught target. In dark operate (DO) mode, the output is ON when the target returns less light to the sensor than the configured target and OFF when the sensor detects more light than the configured/taught target. In **opposed** sensing modes, light operate means the output is on when the beam is unblocked and dark operate means the output is on when the beam is blocked.

The versatile housing provides multiple mounting configurations in a minimum of space. These sensors are extremely rugged, powerful and leakproof, with epoxy-encapsulated electronics for maximum resistance to mechanical shock and vibration. They are powerful enough to burn through dust and many types of industrial and process contamination.

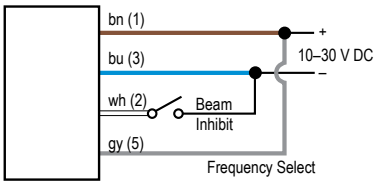
The sensors' innovative circuitry provides excellent EMI/RFI noise immunity. For applications where optical crosstalk between multiple sensor pairs may be a problem, either of two modulation frequencies may be selected. (Set each emitter to the same frequency as its receiver, via the sensor wiring; see "QS30H2O Sensor Configuration" on page 3 or "QS30H2O Wiring" on page 3.)

Indicators—Each sensor has a green Power ON/OFF indicator, visible from 360°. Receivers also have an amber AID indicator that flashes to show signal strength. (The higher the flash rate, the more light is received; a solid AID LED indicates an excellent signal.) Discrete models also have a large amber LED that is on when an output is conducting.

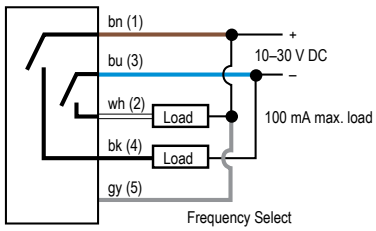
Wiring

Cable and quick disconnect (QD) connections are functionally identical

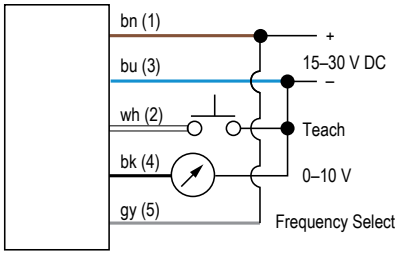
Emitter - Frequency A



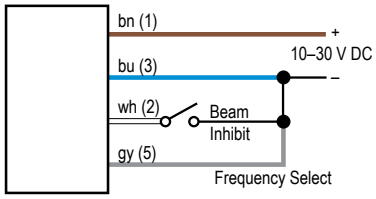
Receiver Frequency A, Discrete



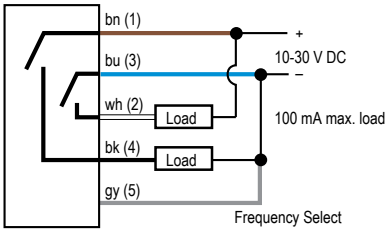
Receiver Frequency A, Analog



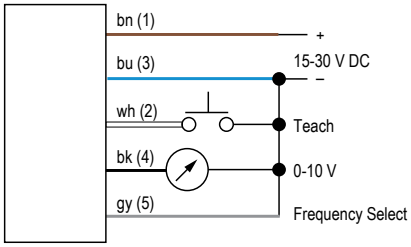
Emitter - Frequency B



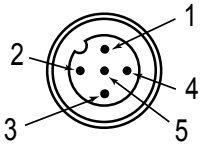
Receiver Frequency B, Discrete



Receiver Frequency B, Analog



5-pin M12 male quick disconnect



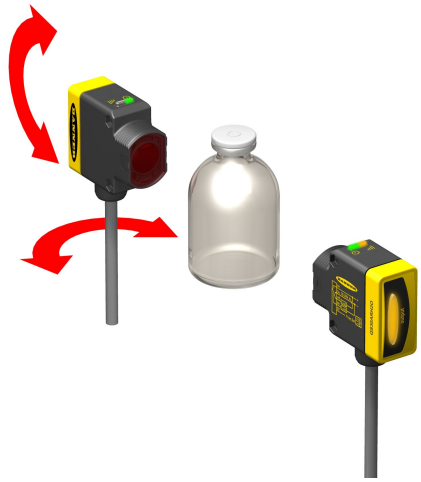
Sensor Configuration

Teaching Limits

Discrete models require no configuration; simply align the emitter to the receiver to maximize contrast between the clear and blocked conditions.

For analog models in high-contrast applications, alignment may be the only configuration needed. For more challenging applications using analog models, use the TEACH procedure to maximize contrast. This procedure is accomplished by pulsing the receiver's white wire (see "QS30H2O Wiring" on page 3 and "Analog Static TEACH" on page 4). Analog output slope also can be inverted from positive to negative or back.

Sensor Alignment Procedure



Sensor Alignment — When an Empty Container Can Be Presented

1. Position both the emitter and the receiver loosely in their mounting position. See "Figure: Sensor Alignment Procedure" on page 4.
2. Present the “clear” condition for the application (an empty container).
3. Verify that both emitter and receiver are wired for the same modulation frequency (see below).
4. Adjust the emitter first, then the receiver. Adjust the emitter’s position until the receiver AID indicator is ON steady, or is flashing at its fastest rate.
5. Tighten the emitter mounting hardware, then repeat step 4 for the receiver.
6. Block the sensor beam with the target and verify that the output changes state.

Sensor Alignment — When an Empty Container Cannot Be Presented

For this procedure, the clear condition is no container at all.

1. Mount loosely and mechanically align the emitter and the receiver such that their faces are parallel to one another. (The AID indicator should be ON steady.)
2. Rotate the emitter in one direction until the receiver AID indicator begins to flash. Repeat in the other direction. Position the emitter midway between those two positions and tighten the emitter mounting hardware.
3. Repeat step 2 for the receiver.
4. Block the sensor beam with the target and verify that the output changes state.

Frequency Selection

The modulation frequency (A or B) is selected by the state of the gray wire (on cabled models; pin 5 on QD models — see "QS30H2O Wiring" on page 3). A “+” voltage or no connection selects frequency A; connecting it to “–” selects frequency B. Each emitter must be set to the same frequency as its receiver.

Emitter Inhibit

To disable (or inhibit) the emitter LED (useful for testing the receiver operation), connect the white wire to “–” voltage.

Analog Static TEACH

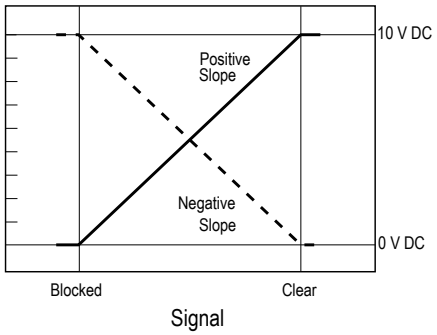
Analog TEACH is performed remotely, by pulsing the white TEACH wire (see "QS30H2O Wiring" on page 3).

Restore Factory TEACH: Reverts the sensing limits to the factory default limits (max contrast); output slope is not affected.

Analog Output Slope: Toggles the analog output to send a high signal when the object is absent (positive slope) or present (negative slope). Analog slope can be selected based on the TEACH order (first taught condition is always 0V; second taught condition is 10V) or by using the slope select procedure below. If the slope select procedure is used, it must be used *after* teaching the limits. To determine the current slope setting, measure the output signal during object present and absent conditions.

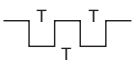
The duration of each button click or remote input pulse is defined as T, where T is: 0.04 s < T < 0.8 s.

Analog Static Teach



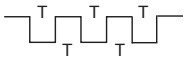
Step	Remote Line	Result
Access TEACH Mode/Learn 1st Condition	Present 1st condition, then single-pulse remote TEACH line. 	**Power LED:** OFF **AID LED:** Double-flash
Learn 2nd Condition	Present 2nd condition, then single-pulse remote TEACH line. 	**TEACH Accepted** **Power LED:** Flashes 3 times, then ON **AID LED:** AID mode (flash rate varies depending upon signal strength)Sensor returns to RUN mode.
		TEACH Not Accepted Power LED: OFF **AID LED:** Single-flashSensor returns to “Learn 1st Condition.”

Restore Factory Default (Maximum Contrast) Setting

Step	Remote Line	Result
Access TEACH Mode	Single-pulse remote TEACH line 	**Power LED:** OFF **AID LED:** Double-flash
Restore Factory Default Setting (Maximum Contrast Setting)	Double-pulse remote TEACH line 	**Power LED:** Flashes 3 times, then ON **AID LED:** AID mode (flash rate varies depending upon signal strength)Sensor returns to RUN mode with maximum contrast setting.

Analog Output Slope Invert

Teach sensing limits before inverting the output slope.

Step	Remote Line	Result
Toggle Analog Output Slope	Triple-pulse remote TEACH line 	Analog output slope toggles between positive and negative.

Specifications

NOTE: Specifications are subject to change without notice.

Supply Voltage

Emitter: 10 to 30 V DC (10% maximum ripple) at less than 80 mA

Discrete Receiver: 10 to 30 V DC (10% maximum ripple) at less than 65 mA (exclusive of load)

Analog Receiver: 15 to 30 V DC (10% maximum ripple) at less than 65 mA (exclusive of load)

Beam

Infrared, 1450 nm , 13 mm effective beam diameter

Sensing Range

Low-gain models: 2 m (6.5 ft)

High-gain models: 4 m (13 ft)

Super High-Power models: 8 m (26 ft)

Output Configuration

Discrete models: Bi-polar current sinking (NPN) white wire; current sourcing (PNP) black wire

Analog models: 0–10 V (black wire)

Output Rating

Discrete models: 100 mA maximum load @ 25° C

OFF-state leakage current: less than 10 µA

ON-state saturation voltage: PNP: less than 1.2V at 10 mA; less than 2.5V at 100 mA

NPN: less than 200 mV at 10 mA; less than 1 V at 100 mA; protected against false pulse on power-up and continuous overload or short circuit

Analog models: 2 KΩ minimum impedance

Output Response

Discrete models:

- **10x excess gain or more**

  Standard models: 1 ms ON and OFF response; 500 µs repeatability
  Super High-Power models: 10 ms ON and OFF response; 5 ms repeatability

- **2x to 10x excess gain**

  Standard models: 3 ms ON and OFF response; 2.5 ms repeatability
  Super High-Power models: 30 ms ON and OFF response; 25 ms repeatability

Analog models: 25 ms for a 95% step change

Adjustments

Light Operate/Dark Operate — depending on model selected

Frequency — selected via gray wire

A: Gray (+)
B: Gray (–)

Emitter only: LED inhibit — selected via white wire; white (–) turns emitter LED OFF (to allow verification of receiver operation)

Indicators

Green LED on housing top: Power ON

Receiver only:

Yellow AID LED on housing top: Flashes to indicate signal strength (faster flash = better signal)
Yellow LED (large oval on housing back): Discrete output conducting

Environmental Rating

Leakproof design rated IEC IP67 (NEMA 6); PW12 1200 psi washdown per NEMA PW12

Construction

Housing: plastic (PC/ABS blend)

Front window: plastic (PMMA -acrylic)

Cable: PVC

Pigtail QD: PVC and nickel-plated brass

Connection

5-wire 2 m or 9 m cable (6 ft or 30 ft) or 150 mm (6 in) pigtail with 5-pin M12 quick-disconnect fitting

Operating Conditions

Temperature: –20 °C to +60 °C (–4 °F to +140 °F)

Humidity: 90% maximum relative humidity (non-condensing)

Certifications

CE

FCC Part 15 Class A for Unintentional Radiators

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

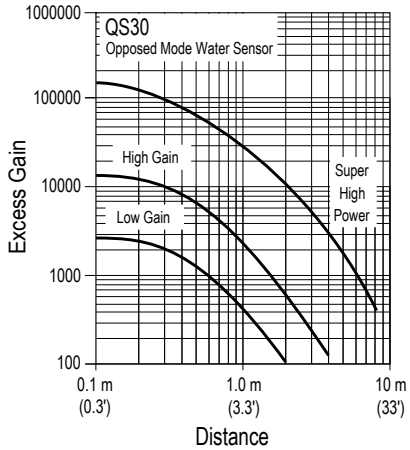
Industry Canada ICES-003(A)

This device complies with CAN ICES-3 (A)/NMB-3(A). Operation is subject to the following two conditions: 1) This device may not cause harmful interference; and 2) This device must accept any interference received, including interference that may cause undesired operation.

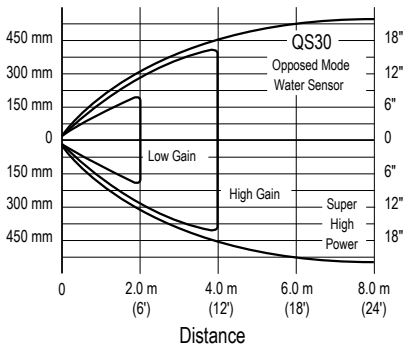
Cet appareil est conforme à la norme NMB-3(A). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

Performance Curves

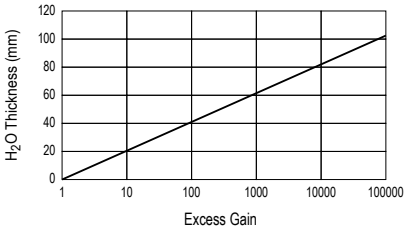
Excess Gain



Beam Pattern



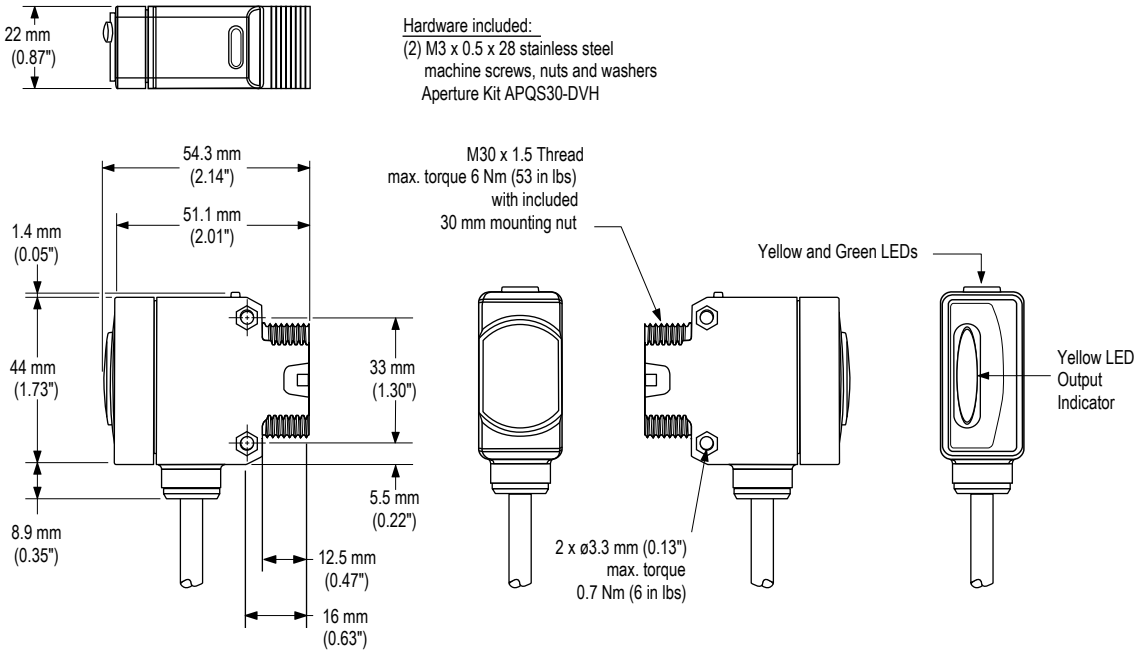
H2O Thickness vs Excess Gain



(Typical for Distilled Water, 100% Blocked Condition)

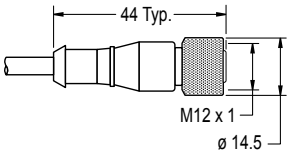
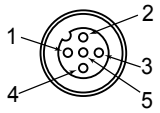
Dimensions

QS30H2O dimensions



Accessories

Cordsets

5-Pin Single-Ended M12 Female Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC1-501.5	0.5 m (1.5 ft)	Straight		
MQDC1-503	0.9 m (2.9 ft)			
MQDC1-506	2 m (6.5 ft)			
MQDC1-515	5 m (16.4 ft)			
MQDC1-530	9 m (29.5 ft)			
MQDC1-560	18 m (59 ft)			
MQDC1-5100	31 m (101.7 ft)			

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

Brackets

SMBQS30L

- Right-angle bracket for cable sensor models
- Clearance for M4 (#8) hardware
- ± 12° tilt adjustment
- 14-gauge stainless steel

Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25×16.3

SMBQS30LT

- Tall right-angle bracket for QD models
- ± 8° tilt adjustment
- 14-gauge stainless steel

Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25×16.3

SMBQS30Y

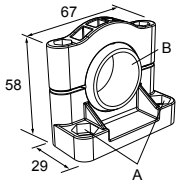
- Heavy-duty die-cast bracket
- M18 vertical mount option
- ± 8° tilt adjustment with cabled units
- Includes nuts and lock washer

Hole size: A=ø 15.3

SMB30SC

- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included

Hole center spacing: A=ø 50.8
Hole size: A=ø 7.0, B=ø 30.0



Other Compatible Mounting Brackets include:

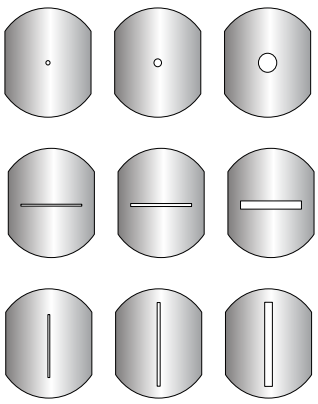
SMB30MM
SMB30A
SMB30FA

Apertures

Opposed-mode QS30 sensors may be fitted with apertures to narrow or shape the sensor's effective beam to more closely match the size or profile of the containers being sensed. A common example is the use of slot type apertures to detect edges of liquid levels.

NOTE: The use of apertures will reduce the excess gain (see attenuation table below).

Model	Description	Pieces	
Circular			
APQS30-040	1 mm (0.04 in) diameter	6	
APQS30-100	2.5 mm (0.10 in) diameter	6	
APQS30-200	5 mm (0.20 in) diameter	6	
Horizontal Slot			
APQS30-040H	1 × 12 mm (0.04 in × 0.47 in)	6	
APQS30-100H	2.5 × 12 mm (0.10 in × 0.47 in)	6	
APQS30-200H	5 × 12 mm (0.20 in × 0.47 in)	6	
Vertical Slot			
APQS30-040V	1 × 17 mm (0.04 in x 0.67 in)	6	
APQS30-100V	2.5 × 17 mm (0.10 in × 0.67 in)	6	
APQS30-200V	5 × 17 mm (0.20 in × 0.67 in)	6	
APQS30-DVHX2	Kit containing two of each aperture above	18	
APQS30-DVH	Kit containing one each of aperture models: APQS30-040, APQS30-040H, APQS30-040V	18	



NOTE: APQS30-DVH is included with each emitter/receiver.

Model	Attenuation Factor	
	Aperture on Both Emitter and Receiver	Aperture on Receiver Only
APQS30-040	5,000	90
APQS30-100	300	20
APQS30-200	20	5
APQS30-040H	60	10
APQS30-100H	13	4
APQS30-200H	4	2
APQS30-040V	60	10
APQS30-100V	13	4
APQS30-200V	4	2

Examples for Apertures and Water Thickness vs. Excess Gain

The **QS30EXH2O** / **QS30RXH2O** sensor pair is used with a horizontal aperture model **APQS30-040H** on the receiver at 1 meter sensing distance. The excess gain is reduced to approximately 200; 50 mm of water will completely block the signal.

When the same aperture is used on both the emitter and receiver at 1 meter, the excess gain is approximately 40; 35 mm of water will block the signal.

> **NOTE:** This example does not include the attenuation from the container holding the water.

Product Support and Maintenance

Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

> **IMPORTANT:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Contact Us

Banner Engineering Corp. headquarters is located at: 9714 Tenth Avenue North | Plymouth, MN 55441, USA | Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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