WORLD-BEAM QS30H2O Series

High-Power Water Sensor

For the latest technical information about this product, including specifications, dimensions, and wiring, see *www.BannerEngineering.com*

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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 available
- Models available with 2 m or 9 m (6.5' or 30') cable, or 150 mm (6") 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

Models

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

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 30V dc	--
QS30ARXSH2O	Super high-power receiver, light operate	8 m (26') range	10 to 30V dc	Bipolar (NPN and PNP)
QS30RRXSH2O	Super high-power receiver, dark operate	8 m (26') range	10 to 30V dc	Bipolar (NPN and PNP)

* Only 2 m (6') cables are listed. For 9 m (30') cable, add suffix "**W/30**" to the model number (e.g., **QS30EH2O W/30**). For 150 mm (6.5") pigtail with a 5-pin Euro-style connector, add suffix "**Q5**" to the model number (e.g., **QS30EH2OQ5**). A model with a QD connector requires a mating cordset (see *Quick-Disconnect (QD) Cordsets* on page 7).
** Standard emitters will only work with standard receivers. Super High-Power emitters will only work with Super High-Power receivers.
† Sensors can be used at ranges greater than listed for applications that require less excess gain. Please consult the factory for assistance on your long-range applications.

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⚠️ **WARNING: Not To Be Used for Personnel Protection**
Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death. This product does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

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 (see page 3). The QS30H2O sensor enhances the available contrast by taking advantage of the absorption band of water.
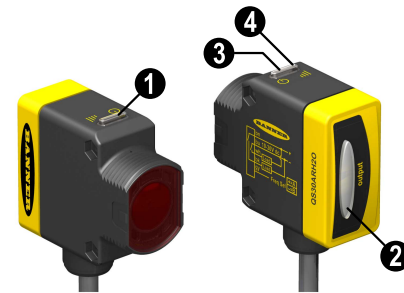
Figure 1. Features

1	Emitter Power LED (Green)
2	Output Conducting (Yellow, Discrete Models Only)
3	Receiver Power LED (Green)
4	AID Indicator (Yellow)

For advanced applications, a 0–10V 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.

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 hookup; see *Figure 2. Sensor Alignment Procedure* on page 3 or *Hookups* on page 7.)

Indicators

Each sensor has a green Power ON/OFF indicator, visible from 360° (see Figure 1). Receivers also have a yellow AID indicator that flashes to show signal strength. (The higher the flash rate, the more light is received; a solid AID LED indicates excellent signal.) Discrete models also have a large yellow LED that lights when an output is conducting.

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 (see *Figure 2. Sensor Alignment Procedure* on page 3).

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 *Hookups* on page 7 and teach procedure on page 4). Analog output slope also can be inverted from positive to negative or back.

Sensor Alignment — When Empty Container Can Be Presented

1. Position both the emitter and the receiver loosely in their mounting position. See Figure 2.
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.
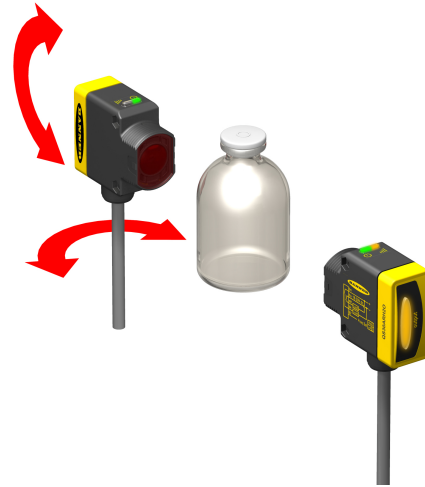
Figure 2. Sensor Alignment Procedure

Sensor Alignment — When 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 *Hookups* on page 7). 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 Hookups).

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 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.
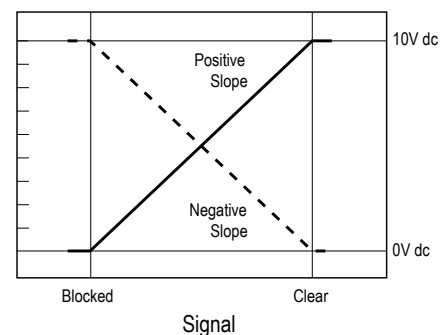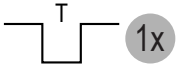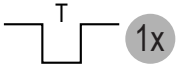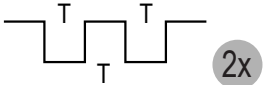

Figure 3. Analog Static Teach
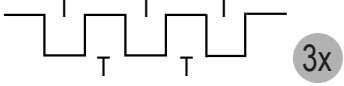
Step	Remote Line 0.04 seconds ≤ T ≤ 0.8 seconds	Result
Access TEACH Mode/ **Learn 1st Condition**	• Present 1st condition. • Single-pulse remote TEACH line. T 1x	**Power LED:** OFF **AID LED:** Double-flash
Learn 2nd Condition	• Present 2nd condition. • Single-pulse remote TEACH line. T 1x	**TEACH Accepted** **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-flash Sensor returns to "Learn 1st Condition."

Restore Factory Default (Maximum Contrast) Setting

Step	Remote Line 0.04 seconds ≤ T ≤ 0.8 seconds	Result
Access TEACH Mode	• Single-pulse remote TEACH line T 1x	**Power LED:** OFF **AID LED:** Double-flash
Restore Factory Default Setting **(Maximum Contrast Setting)**	• Double-pulse remote TEACH line T T T 2x	**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

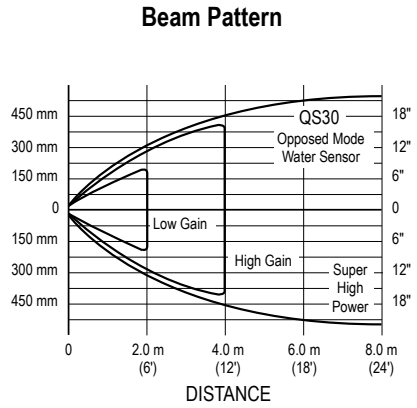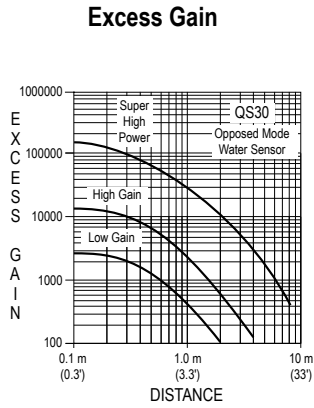Teach sensing limits before inverting the output slope.

Step	Remote Line 0.04 seconds ≤ T ≤ 0.8 seconds	Result
Toggle Analog Output Slope	• Triple-pulse remote TEACH line T T T T T 3x	Analog output slope toggles between positive and negative.

Specifications

NOTE: Specifications are subject to change without notice.

Supply Voltage	**Emitter:** 10 to 30V dc (10% maximum ripple) at less than 80 mA **Discrete Receiver:** 10 to 30V dc (10% maximum ripple) at less than 65 mA (exclusive of load) **Analog Receiver:** 15 to 30V dc (10% maximum ripple) at less than 65 mA (exclusive of load)
Beam	1450 nm, infrared 13 mm effective beam diameter
Sensing Range	**Low-gain models**: 2 m (6.5') **High-gain models:** 4 m (13') **Super High-Power models:** 8 m (26')
Output Configuration	**Discrete models:** Bi-polar current sinking (NPN) white wire; current sourcing (PNP) black wire **Analog models:** 0–10V (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 1V 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' or 30') or 150 mm (6") pigtail with 5-pin Euro-style quick-disconnect fitting
Operating Conditions	**Temperature:** −20° to +60°C (−4° to +140°F) **Relative Humidity:** 95%; non-condensing
Certifications	C E

Performance Curves

Excess Gain
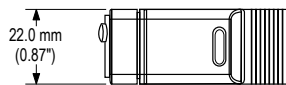

Beam Pattern

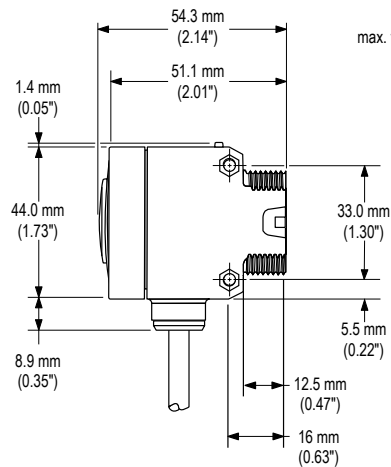### H2O Thickness vs. Excess Gain

(Typical for Distilled Water, 100% Blocked Condition)
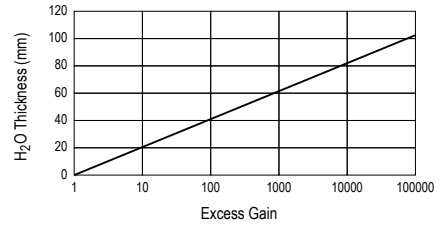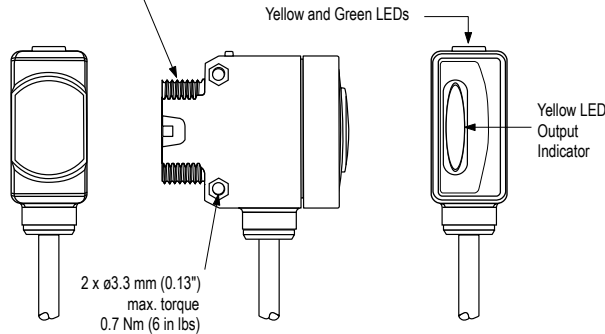

Dimensions

Hardware included:
(2) M3 x 0.5 x 28 stainless steel machine screws, nuts and washers
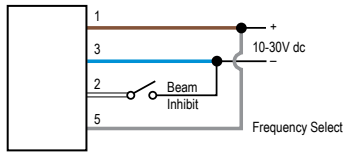Aperture Kit APQS30-DVH

M30 x 1.5 Thread
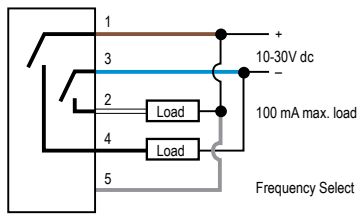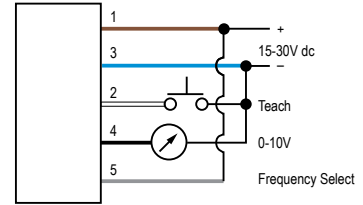max. torque 6 Nm (53 in lbs)
with included
30 mm mounting nut

Yellow and Green LEDs

Yellow LED Output Indicator

2 x ø3.3 mm (0.13")
max. torque
0.7 Nm (6 in lbs)

Hookups

Emitter	Receiver - Discrete	Receiver - Analog

Frequency A

Frequency B

Cable and QD hookups are funcionally identical
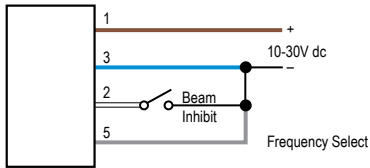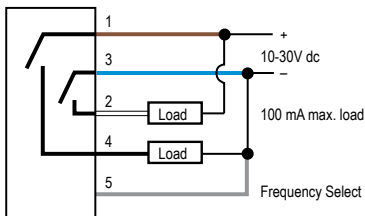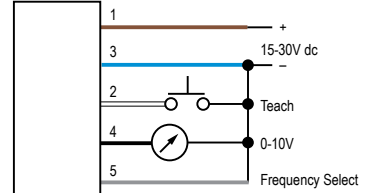
Key

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

Quick-Disconnect (QD) Cordsets

Style	Model	Length	Dimensions	Pinout
5-pin Euro-style straight	MQDC1-506	2 m (6.5')	ø 15 mm (0.6") 44 mm max. (1.7") M12 x 1	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
	MQDC1-515	5 m (15')		
	MQDC1-530	9 m (30')		

Mounting Brackets

SMBQS30L	• Right-angle bracket for cabled sensors • 14-gauge stainless steel • ± 12° tilt adjustment • Clearance for M4 (#8) hardware	SMBQS30LT	• Tall right-angle bracket for QD sensors with straight cordset connectors • 14-gauge stainless steel • ± 8° tilt adjustment
SMBQS30Y	• Heavy-duty die-cast bracket with M18 vertical mounting option • ± 8° tilt adjustment for cabled sensors • Nuts and lockwasher included	SMB30SC	• Swivel bracket with 30 mm mounting hole for sensor • Black reinforced thermoplastic polyester • Stainless steel mounting and swivel locking hardware included

Other Compatible Mounting Brackets (see Banner Photoelectric catalog for more information):

SMB30MM
SMB30A
SMB30FA

Accessory 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 attentuation table below).

Model	Description	
APQS30-040	Circular hole	1 mm (0.04") diameter – 6 each
APQS30-100		2.5 mm (0.10") diameter – 6 each
APQS30-200		5 mm (0.20") diameter – 6 each
APQS30-040H	Horizontal slot	1 x 12 mm (0.04" x 0.47") – 6 each
APQS30-100H		2.5 x 12 mm (0.10" x 0.47") – 6 each
APQS30-200H		5 x 12 mm (0.20" x 0.47") – 6 each
APQS30-040V	Vertical slot	1 x 17 mm (0.04" x 0.67") – 6 each
APQS30-100V		2.5 x 17 mm (0.10" x 0.67") – 6 each
APQS30-200V		5 x 17 mm (0.20" x 0.67") – 6 each
APQS30-DVHX2	Kit containing two of each aperture above – 18 total	
APQS30-DVH	Kit (included with each emitter/receiver) containing one each of aperture models: APQS30-040, APQS30-040H, APQS30-040V	

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.