BW TECHNOLOGIES

RRJ Transmitter with Sensor

4-20 mA H_2S Gas Monitor

Installation and Instruction Sheet

Introduction

The RRJ gas monitor ("the monitor") provides continuous monitoring for H_2S hazards in ambient air. The monitor is a 2-wire 4-20 mA transmitter with sensor. The monitor is factory calibrated and tested.

Model	Gas Monitored	Maximum Operating Life
RRJ-RH04	Hydrogen sulfide (H_2S)	2 years

International Symbols

Symbol	Meaning
⏚	Earth (ground) terminal
⚠	Caution (refer to accompanying documents)
SP C US	Certified intrinsically safe Class I, Div. 1, Gr. A, B, C, D T6

⚠ *Safety Information - Read First*

Users of the detector require a full understanding of the installation, operating and maintenance instructions, otherwise protection provided by the monitor may be impaired. Read the following warnings before using the monitor.

- ⇒ Install according to local electrical regulations and codes.
- ⇒ Installation should be performed by qualified personnel.
- ⇒ Do not activate the monitor after the date on the package.
- ⇒ Make sure the sensor screen is free of dirt and debris.
- ⇒ Make sure the sensor screen is not covered.
- ⇒ Do not expose the monitor to electrical shock and/or continuous mechanical shock.
- ⇒ Do not expose the sensor to high pressure water spray.
- ⇒ Do not install in atmospheres containing ketones, alcohols, or acids.
- ⇒ Do not use the monitor if it is damaged. Before use, inspect the monitor. Look for cracks, missing metals or plastics. If the monitor is damaged, contact BW Technologies immediately.
- ⇒ The warranty will be voided if the customer or any unauthorized service personnel attempts to repair the unit.

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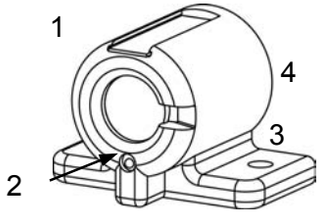
iERP: 115329

Elements Drawing



1	Transmitter with sensor
2	LED indicator
3	Mounting flanges
4	Plug-in connector

Installation – Sensor Locations

The following suggestions should be considered to assure detection of the target gas. Select the most suitable location for each sensor.

- *Air Currents:* If there are fans, wind, or other sources of air movement, gases may tend to rise or collect in certain areas of a facility. The local air currents should be assessed to aid in selecting the sensor location. Air convection can often be more important in determining gas concentration areas than factors of vapor density.
- *Gas Emission Sources:* As a rule, at least one sensor should be located in close proximity to each point where an emission is likely to occur.

Mounting the Enclosure

The monitor is equipped with two predrilled mounting flanges. Simply fix where desired.
Caution: Install sensor facing down or sideways. Do not install facing up as water or debris may fill the sensor wall.

System Design Specifications

Supply voltage:	10 to 28 Vdc (24 Vdc nominal) supplied by controller
Power consumption:	24 mA @ 24 Vdc maximum 4 mA @ 24 Vdc nominal
Power supply:	50 mA
Loop resistance:	650 ohms maximum
Output current:	Normal operation: 4-20 mA
	Fault: 2 mA signal
	Sensor expired: 2 mA signal
	Over range: 24 mA signal (maximum)
Recommended cable:	2-wire 18 to 24 AWG

Shielded Cable: Use only shielded cable to avoid RF or EMI interference. The shield (including mylar) must be grounded at the controller.
Note: BW manufactured cables are shielded.

4-20 mA Loop Installation

Cable Routing: Separate cables are required for each RRJ Transmitter.

***Power Supply*:** Power is supplied by the RRJ-4000 Controller.

Recommend: BW recommends regulating the power supply if using any other controller.
Important: Supply voltage to be 24 V nominal. Fluctuations not to exceed 28 Vdc or go below 10 Vdc (applicable for any 2-wire, loop-powered, 4-20 mA transmitter that can operate down to 10 volts).

Connect the Controller (PLC etc.) and Power Supply

Ensure that all connections are made and the monitor is complete with cable connectors correctly in place before applying power. Follow the procedures and recommendations in the control systems manual to complete installation.
Shields and any unused wires should be tied to the controller ground as outlined in the National Electrical Code Practices.
Attach wires to the controller and power as described in the controller manual.

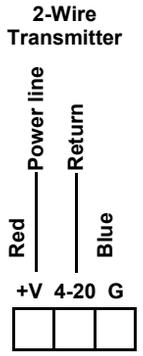
Installation: *Select A, B, or C*

You have a choice of using BW manufactured RRJ cables or providing your own cable.
Note: Do not turn on the controller power until all wiring is complete.

A. BW Plug-In Transmitter/Sensor Manufactured Cable Kits

➢ Part No. RRJ-SC###-K - Maximum distance 1,000 ft. (305 m)

The rugged, Artic black shielded cable kits come complete with molded plug-in connectors and a controller compression fitting.



RRJ-4000 Controller Wiring

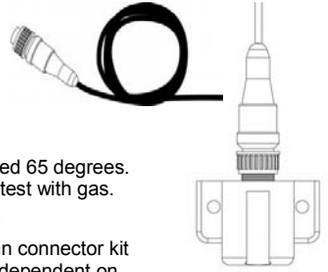
Wire to Controller

(Refer to the 2-Wire Transmitter diagram)

1. Install compression fitting on controller (supplied), if applicable. Remove outer casing (minimum 5 inches) and trim shield and all wires even with shield, exposing the 5 inch blue and red wires.
2. Strip 5/16 inch of insulation on blue and red wires.
3. Connect the red wire to the +V controller connection.
4. Connect the blue wire to the 4-20 mA return signal connector.

Plug into Transmitter

1. Plug cable into transmitter/sensor and secure outer weatherproof ring to prevent moisture invasion.



Note: If the transmitter is always mated to the same channel on the controller, the controller LCD display will only require calibration the first time the transmitter head is installed.
Note: Cable bend allowances should not exceed 65 degrees.
Next, calibrate the controller LCD display and test with gas.

B. Customer-Supplied Cable Installation

➢ Part No. RRJ-FW1-K - Field wiring plug-in connector kit

The distance the 4-20 mA signal can travel is dependent on several factors, including cable gauge. Maximum cable resistance is 650 ohms less the controller resistance.
Note: RRJ-4000 Controller and CR-4000 Controller resistance is 120 ohms.
Maximum distance: 1,000 ft. (305 m)
Important: Use 2-wire 18 to 22 AWG shielded copper wire cable. Cable should be shielded to prevent RF line interference.

Wire to Controller

(Refer to the **2-Wire Transmitter** diagram)
The DC supply is connected to the transmitter when the transmitter wiring connection is made to the applicable controller.

Caution: Polarity must be observed. If the return and supply voltage wires are reversed, the RRJ Transmitter will not work.

1. Follow the instructions in the controller manual. Connect as shown in the diagram.

➢ RRJ-4000 Controller: Power to +12 V;
Return signal line to 4-20 mA

➢ CR-4000 Controller: Power to + 24 V;
Return signal line to 4-20 mA

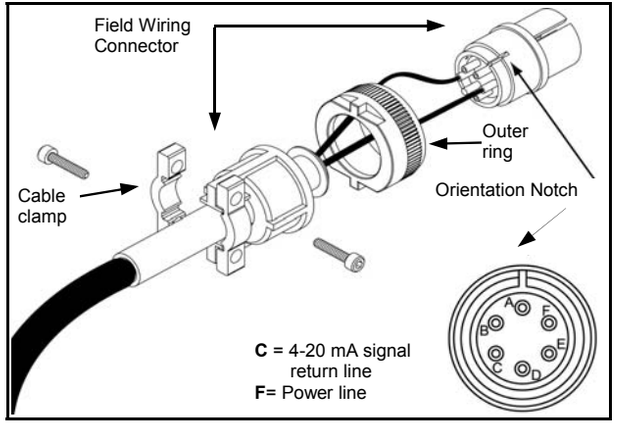
➢ Other Controllers: Check the power range specifications in the controller manual

Wire Field Connector and Connect to Transmitter

Plug-in field wiring connectors (connector kit available).

1. Feed wire through hose as shown in the diagram.
2. Solder as follows: 4-20 mA return signal line to pin C. Power line to pin F.
3. Reassemble field connector. Ensure cable clamp is securely fastened to prevent moisture invasion.
4. Plug connector into transmitter/sensor and secure outer weatherproof ring to prevent moisture invasion.

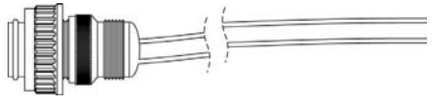
Field Transmitter Wiring with Customer Cable Diagram



C. Pigtail Assembly

➢ Part No. RRJ-PT1-K - Pigtail connector

If a cable is not needed for installation, use a pigtail connector and refer to the **2-Wire Transmitter** diagram.

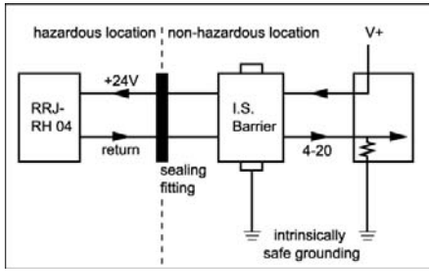


Note: If the transmitter is always mated to the same channel on the controller, the controller LCD display will only require calibration the first time the transmitter head is installed.
Note: Cable bend allowances should not exceed 65 degrees.
Next, calibrate the controller LCD display and test with gas.

The table below assumes a constant 24 volt power supply (at 20°C), copper wire and a controller resistance of 250 ohms. The signal range from the controller/PLC, etc., to the RRJ Transmitter takes into account the return loop. The distance shown is from the controller to the transmitter.

Maximum Cable Lengths between Controller and RRJ Transmitter

Conductor Size:		Distance:	
22 AWG	0.64 mm	6,709 ft.	2,045 m
20 AWG	0.75 mm	10,670 ft.	3,253 m
18 AWG	1.0 mm	22,810 ft.	5,167 m



Note: I.S. barrier required for Class I, Div. I
I.S. barrier not required for Class I, Div. 2
RRJ-RH04 requires 10V input minimum
The installation must comply with the Canadian Electrical Code (CEC) and the National Electrical Code (NEC).

RRJ-RH04 Entity Parameters

Group	A/B	C	D
Vmax (V)	12.4	21.4	30
Imax (mA)	387	224	160
Ci (µF)	1.22	1.22	1.22
Li (µH)	0	0	0

Limiting Energy

I.S. Barrier		RRJ-RH04
Open circuit voltage, VOC	≤	Vmax, maximum voltage allowed
Short circuit current, Isc	≤	Imax, maximum current allowed
Allowed capacitance, Ca	≥	Ci, internal capacitance +Ccable, cable capacitance
Allowed inductance, La	≥	Li, internal inductance +Lcable, cable inductance

Ca and La include capacitance and inductance

Power Up

Apply power. The monitor sets the operational life clock and then performs the full function sensor integrity self-test.

If the monitor passes the self-test, the sensor will stabilize in under 30 seconds. Upon a successful self-test, the red status LED will light and the transmitter will send a 4-20 mA current output to the controller equivalent to the ppm level measured by the monitor. Instructions describing what to do in the event of a self-test failure appear in the section **Self-Test Fail**.

*Sensor Calibration**

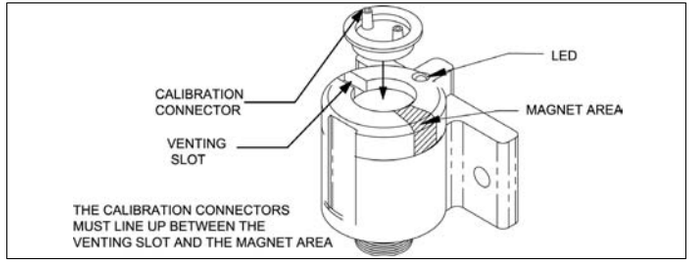
- Part No. RRJ-KEY1 - Calibration magnet key

Step 1: Confirm that the monitor is in a clean air environment.
Step 2: Place the calibration magnet key (optional accessory) on the magnet area (as indicated in the figure below). The LED will start blinking to indicate you are holding the calibration magnet in the correct location.
Step 3: The LED will blink for approximately 15 seconds before turning off. When the LED turns off, remove the magnet.
Step 4: Place the calibration cap onto the monitor as shown.
Step 5: When the LED begins to blink every two seconds apply calibration gas.
Step 6: When the blinking stops remove the gas.

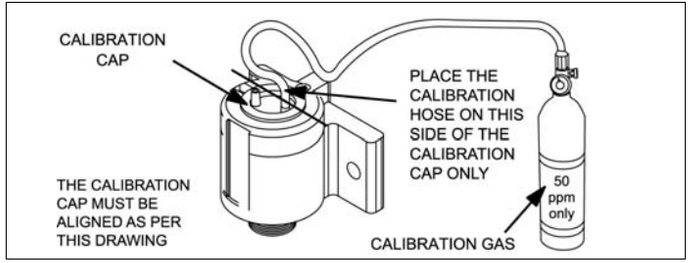
*The monitor is calibrated at the factory.

Important: If the LED begins to blink twice every two seconds, calibration has failed. Re-calibrate the sensor. If calibration fails again, contact BW Technologies.

Magnetic Activation



Gas Calibration



Calibrate the Controller LCD

Follow the procedures and recommendations in the controller manual.
4 mA = 0 ppm (zero); 20 mA = 100 ppm (full scale)

To ensure proper operation, test with gas. Apply a known concentration of quality test gas to the sensor for 2 minutes to allow the sensor response to stabilize. The control system should read the same as the ppm of the gas being applied. If it does not, calibrate the controller.

Transmitter Status

Advise	LED Indicator	Output to Controller
Power ON	On	4-20 mA
Fault: self-test fail	Fast flashes (1 every 0.5 seconds)	2 mA
Life ending warning	Slow flashes (1 every 2 seconds)	4-20 mA
Zero calibration	Off	Approximately 4 mA
Gas calibration	Flash (1 every 2 seconds)	Approximately 4 mA
Calibration pass	On	Approximately 4 mA
Calibration fail	Flash (2 times every 2 seconds)	Approximately 4 mA
Life ended	Off	2 mA
Over range alarm	On	24 mA
Power OFF	Off	0 mA

Important: Allow a ±3% tolerance in some cases due to sensor repeatability.
The RRJ Transmitter is now ready for use.

Automatic Self-Test

The sensor is tested automatically every 24 hours while in operation and every time power is applied.

Note: A high risk gas alarm will take precedence, therefore the self-test will not be performed in the event of a High or High/High gas alarm.

Self-Test Fail

If the sensor fails the test, the LED will flash quickly and the monitor will send a 2 mA signal to the controller. If the monitor fails the self-test, replace the monitor and return the unit to BW Technologies.

Operational Life

The operational life of the RRJ-RH04 monitor is two years in normal operation. The life counter is activated when power is applied and runs continuously while the monitor is operating. If the power is interrupted or turned off, the counter will stop and resume counting once power is restored. The counter will not reset, but continue counting from the point where it was stopped.

Life-Ended Warning

When one month of the instrument life is remaining, the LED flashes slowly to advise the unit will soon require replacement.

Life-Ended Alarm

The life-ended alarm occurs when the monitor's useful life is ended. The monitor sends a 2 mA signal to the controller and the LED is shut off. The monitor is now disabled. Replace the monitor.

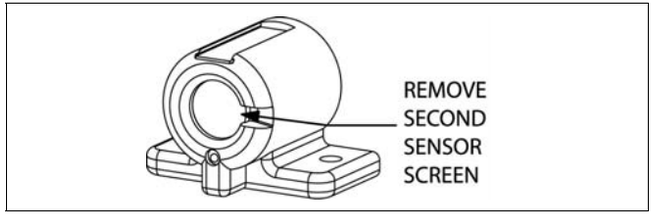
Operation

The RRJ Transmitter is factory calibrated. No further calibration is required.

Care

Visually inspect the sensor and test with gas on a regular schedule to ensure the sensor is not damaged or plugged. If the sensor screen is dirty, slide the screen out to wash or replace the screen.

Replaceable Sensor Screen



The inner sensor screen, if dirty, may be cleaned with a soft brush using warm, clean water.

In the event that the screen still appears plugged with dirt or particulate, expose the sensor to a hydrogen sulfide test gas. Verify the response to gas, to ensure the sensor is functioning. Replace a plugged or damaged sensor screen.

Specifications

Monitor:	4-20 mA H_2S transmitter
Maximum operating life:	2 years
Measuring range:	0-100 ppm

General Specifications

Operating temperature:	-40 to +122°F; (-40 to +50°C)
Operating humidity:	15 to 90% relative humidity (non-condensing)
Calibration:	Not required
Visual alarm:	Red light emitting diode (LED)
Self-test:	Daily full function sensor self-test
Monitor type:	Zero-maintenance disposable
Sensor type:	H_2S electrochemical sensor
Sensor screen:	Field replaceable
Physical:	Rugged polyurethane encapsulated sensor head
Size (dxwxh): **Weight:**	2.65 x 2.3 x 3.25 in. (6.73 x 5.84 x 8.25 cm) 6.2 oz. (175 g)
Shelf life:	1 year if stored in sealed container
Warranty:	2 years
Approvals:	Intrinsically Safe Class I, Div. 1, Gr. A, B, C, D T6

Contacting BW Technologies

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