# RPS-4000

## Features

- Simple Calibration
- Non-Contact Measurement
- Temperature Compensation
- Analog 4 - 20mA Output
- Sensitivity Control
- Self-Contained
- LED Indicator
- Quick Disconnect
- Easy Installation
- Microprocessor Design

The RPS-4000 self-contained long range Ultrasonic Sensor has a 4 - 20mA analog output. The sensor can be used for level control of both liquid and bulk materials. This gives the user a viable alternative to bubblers, floats, capacitance probes and pressure transmitters. With a 40 foot sensing range many large tanks are within reach of the RPS-4000.

The incorporation of a microprocessor design makes it possible to achieve signal conditioning. This gives the sensor the ability to process the return ultrasonic echo and distinguish between false targets and real targets. With the incorporation of a microprocessor into the design of the RPS-4000 many of the common problems facing long range sensing applications have been overcome. Software is written to optimize the performance characteristics of the sensor. The artificial intelligence analyzes and conditions the return ultrasonic echo. This process filters out any false echoes and electrical noise. An additional task that the microprocessor does is temperature compensation.

The sensor has three methods of calibration. Method One the momentary contact closure method. Method Two hard wiring the sensor for a factory pre set range. Method Three calibrating with remote potentiometers or resistors. These calibration methods make the sensor extremely versatile. For Method Two the output will be 20mA at 2' and 4mA at the far distance of the sensing range. Method One and Method Three can be used to invert the 4 - 20mA output.

The RPS-4000 has an LED indicator to help with setup and operation of the sensor. When the LED is green the sensor is not detecting a target. The LED color can vary from yellow to bright red when detecting a target, depending on how strong the return echo is from the target. Yellow indicates a weak signal and bright red indicates a strong signal.

The sensor also has field adjustable sensitivity (Gain Control). This allows the operator to tune the sensor for optimum performance to meet different tank or material conditions. If set points are required in addition to the sensor's analog output, look up the Migatron SPC-701, SPC-704 and M-1000* control products. The SPC-704 can also be used as a power supply for the RPS-4000.

* M-1000 can not be used as a power supply for the RPS-4000.

## Features of the RPS-4000

**SIMPLE CALIBRATION:** The sensing window can be adjusted by using one of three easy methods. NOTE: When the sensor is powered up and the control lines not used, it is factory preset to the maximum range with an output of 20mA at 2' and 4mA at 40'.

**NON-CONTACT:** The use of ultrasonic sound to measure distance means that the sensor does not need to come in contact with the target.

**TEMPERATURE COMPENSATED:** This is accomplished by means of a temperature probe that is built into the transducer head.

**ANALOG OUTPUT:** The sensor provides a 4 - 20mA analog output that is proportional to the changing distance. The output can also be inverted.

**SENSITIVITY CONTROL:** This enables the gain of the sensor to be adjusted to work best in different tanks and on different materials.

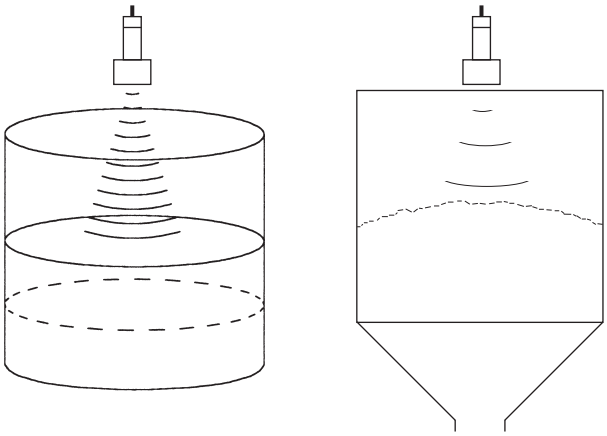
**EASY INSTALLATION:** The sensor is contained in a standard 30mm housing. It comes with two jam-nuts for simple mounting.

**SELF-CONTAINED:** There are no remote boxes to mount with this sensor. All necessary electronics are contained within the sensor.

**LED INDICATOR:** This indicates the detect state of the sensor as well as the strength of the return echo. This feature helps to insure proper alignment during installation.

**AFFORDABILITY:** This sensor was designed to be cost competitive, and to solve applications.

**MICROPROCESSOR DESIGN:** The incorporation of a microprocessor allowed software to be written to solve many of the common problems that needed to be overcome with long range applications.



## How to Calibrate

**Method One:** (and possibly the most direct way to calibrate the sensing range) is as follows (see Figure B).

**Step 1:** Tie the Red/Yel wire (20mA control line) and the Red/Blue wire (4mA control line) together.

**Step 2:** With the material level at the 4mA point, usually the low level, connect these lines to ground (Green wire) for four seconds.

**Step 3:** With the material level at the 20mA point, usually the high level, connect these lines to plus (Red wire) for four seconds.

The sensor is now calibrated and will generate the analog 4 - 20mA output between these two points.

**NOTE:** When completed, the two control lines must remain tied together. To change the window, disconnect these two wires for one second and then reconnect them. Then repeat steps 2 and 3. The far point should always be programmed first, then the near point.

**Method Two:** calibrates the sensor by using the following table also see Figure C.

| Sensing Range | Red/Blue Wire 4mA Control Line | Red/Yel Wire 20mA Control Line |
|---|---|---|
| 2 - 40' | OPEN | OPEN |
| 2 - 36' | OPEN | LOW |
| 2 - 32' | OPEN | HIGH |
| 2 - 28' | LOW | OPEN |
| 2 - 24' | LOW | LOW |
| 2 - 20' | LOW | HIGH |
| 2 - 16' | HIGH | OPEN |
| 2 - 12' | HIGH | LOW |
| 2 - 8' | HIGH | HIGH |

**Open:** This indicates that the control line is not tied to anything. It is left floating.

**High:** The control line is tied to plus (Red Wire).

**Low:** The control line is tied to ground (Green Wire).

When using the chart to calibrate the sensor the analog output will occur over the full range of the selected sensing window. The 20mA point will be at the near distance and the 4mA point will be at the far distance.

One advantage of calibrating the sensor this way is that there is no need to fill the tank to the high and low limits. Another advantage is that once the sensor is installed there is no need to go back to it for programing. This can be done at a remote location at the end of the sensor's cable.

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**Method Three:** calibrates the sensors by using resistors tied to the control lines (see Figure D). These resistors are installed between the control lines and ground (Green Wire). The following resistance formula applies for distance:

**1k Ohm = 1 foot**

For example if a range of 5 - 15' is desired with an analog output of 20mA at 5', and 4mA at 15', the following resistor values should be selected:

15' = 15k Ohm resistor tied to 4mA control line (Red/Blue)
5' = 5k Ohm resistor tied to 20mA control line (Red/Yellow)

The output will now start with 20mA at 5' and decrease with distance to 4mA at 15'. The output can be scaled in the opposite direction by reversing the values:

5' = 5k Ohm resistor tied to 4mA control line (Red/Blue)
15' = 15k Ohm resistor tied to 20mA control line (Red/Yel)

The output will now start with 4mA at 5' and increases with distance to 20mA at 15'.

Potentiometers can be used in place of fixed resistors and then the proper distances can be dialed in.

The advantage with this method, as with the second way of calibrating, is that the tank does not need to be filled to its high and low limits during setup. In addition these set points can be adjusted at a later time without going to the top of the tank.

## How to Use the Gain Control:

The RPS-4000 sensor provides the user with gain control. This is adjusted by the Red/White wire (see Figure E). When this wire is left open (floating) the sensor is operating at maximum gain/sensitivity. The sensor's gain/sensitivity can be reduced by doing the following:

Install a 100k Ohm potentiometer or a fixed value resistor across the gain control line (Red/White Wire) and ground (Green Wire). With the potentiometer set at 100k Ohm, the gain/sensitivity of the sensor is at its maximum. When the potentiometer is set at 75k Ohm, the gain/sensitivity is 75% of maximum. If the potentiometer is turned all the way down which is equivalent to shorting the gain control to ground, the sensor is at minimum gain/sensitivity.

The gain control allows the sensor to be adjusted to work best in different tanks and on different materials. This control does not need to be used. If the sensor is installed and works well with full gain/sensitivity there is no need to reduce the gain. However if the sensor is installed and it seems to be detecting something other then the desired target, the gain can be reduced to see if the false target disappears.

## LED Indicator:

The LED is located at the back of the sensor. It provides, by way of color, various information of the sensor's function. Its primary purpose is to insure proper alignment during installation. The following colors indicate:

**Green:** The sensor has power and is in the no-detect state.

**Yellow:** The sensor has detected a target but is receiving a weak signal. It may be that the sensor is not properly aligned to the material or that the target is providing a weak return echo.

**Red:** This indicates that the sensor is detecting the target. The brighter the shade of red the stronger the return echo. This indicates the sensor is properly aligned and the target is providing a good reflective surface.

**NOTE:** It may not always be possible to get a bright red LED. This is because various materials will have different reflectivity characteristics. However, as long as the sensor stays in the yellow to red state, enough return signal is being received and the sensor will function properly.

## Analog Output:

The RPS-4000 provides an analog current output of 4 - 20mA. The output is proportional to the sensing range that has been programmed. The output load rating of the sensor is 0 - 500 Ohms.

## Quick Disconnect (QD) Connector:

At the rear of the sensor, there is a water tight quick disconnect connector. This allows for easy installation of the sensor.

## Microprocessor Design:

The RPS-4000 long range ultrasonic sensor incorporates a high speed microprocessor. The software is optimize to the performance characteristics of the sensor. This artificial intelligence analyzes and conditions the return ultrasonic echo. This process filters out any false echoes and electrical noise. An additional task that the microprocessor does is temperature compensation. This allows the sensor to have an accurate output over the entire operating temperature range. With the incorporation of a microprocessor many of the common problems facing long range sensing applications have been overcome.

# Specifications:

| | |
|---|---|
| Operational Range: | Adjustable 2 - 40' |
| Power Input: | 20 - 30VDC Reverse Polarity Protected |
| Input Current: | 125mA |
| Ambient Temperature: | -20 - 60ºC or -5 - 140ºF |
| Humidity: | 0 - 95% Non-Condensing |
| Enclosure: | PVC housing with PVC sensing face |
| Outputs: | Current Sourcing Analog Output<br>4 - 20mA Inverted & Non-Inverted<br>Load 0 - 500 Ohm Maximum<br>Short Circuit Protected |
| Transducer Frequency: | 38kHz |
| Transmit Time: | Transmit time equals the sensors maximum distance x 10ms. For example if the maximum programmed distance is 10' the transmit time is 100ms. |
| Weight: | 15 ounces |

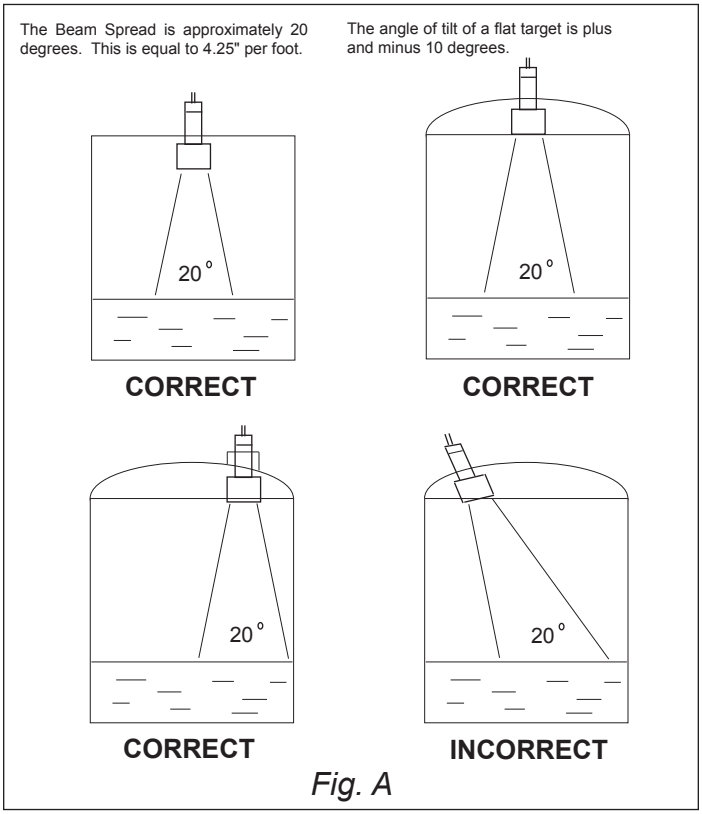


Fig. A

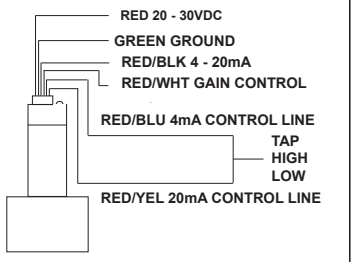


Fig. B

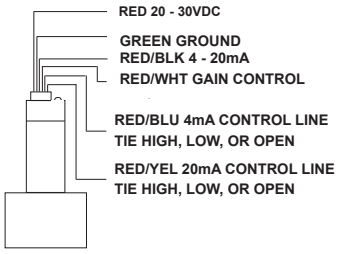


Fig. C

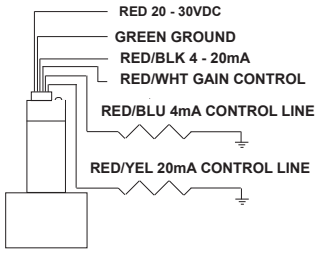


Fig. D

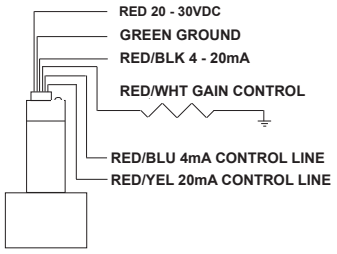
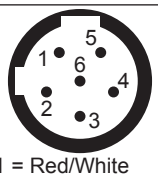


Fig. E

## Figure:

A - Installation / Beam Spread
B - Wiring Diag. for Programming Method 1
C - Wiring Diag. for Programming Method 2
D - Wiring Diag. for Programming Method 3
E - Wiring Diag. for Gain Control
F - Connector Diagram (Male View)
G - Mounting Dimensions



1 = Red/White
2 = Red
3 = Green/Yellow
4 = Red/Yellow
5 = Red/Black
6 = Red/Blue
Fig. F

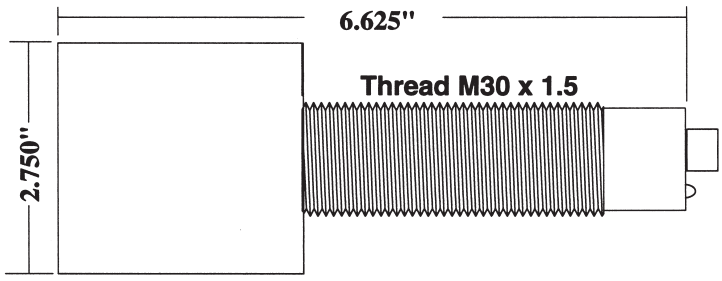


Fig. G

| PART NUMBER | RANGE | OUTPUT / DESCRIPTION |
|---|---|---|
| RPS-4000 | 2 - 40' | 4 - 20mA Analog - Cable Sold Separately |
| F32-5001272<br>F32-5001274 | | 2 meter QD Cable, 1/2"-20 6-Pin 22 AWG<br>6 meter QD Cable, 1/2"-20 6-Pin 22 AWG |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