# CONNECTING TO A 4-20MA LEVEL SENSOR

## Introduction

This application note discusses the connection of a Senquip ORB-X1-W to a 4-20mA level sensor that would typically be used to measure the depth of a water tank or dam.

Connecting the level sensor to an ORB will allow water level data to be delivered to the internet or a remote server anywhere in the world.

The Sensor being used in this application can measure water in the range 0 to 5m, where 0m is represented by 4mA and 5m is represented by 20mA.

**Figure 1 – Typical 4-20mA Level Sensor**

## Hardware Interconnect

The ORB-X1 has two integrated current sources that can be used to drive 4-20mA sensors. The current supplied by each source is accurately measured and reported. The current sources on the ORB generate their own 12V source, meaning that the supply to the ORB is not critical. With an input voltage between 9V to 75V or with AA batteries, the ORB will generate 12V on the current sources. Note that with AA batteries, the measurement interval should be long to avoid draining the batteries.

Pins 1 and 2 of the ORB should be connected to power and ground. The power in this case is likely to be derived from a solar panel. If solar is used, measurements can continue to be taken outside of sunlight hours as the ORB has an internal backup battery. It is recommended that a 1A fuse be inserted between the solar panel and the power connection of the ORB. The fuse protects the battery if the ORB fails of the positive wire comes loose. A 10W solar panel will ensure that the internal backup battery remains charged even during extended periods of cloud.

Since the ORB has two current sources, it can measure two current devices at the same time. In this case however, a single level sensor is used, and it is decided to connect it to source 1. The level sensor should be connected between source 1 on pin 3 and ground.

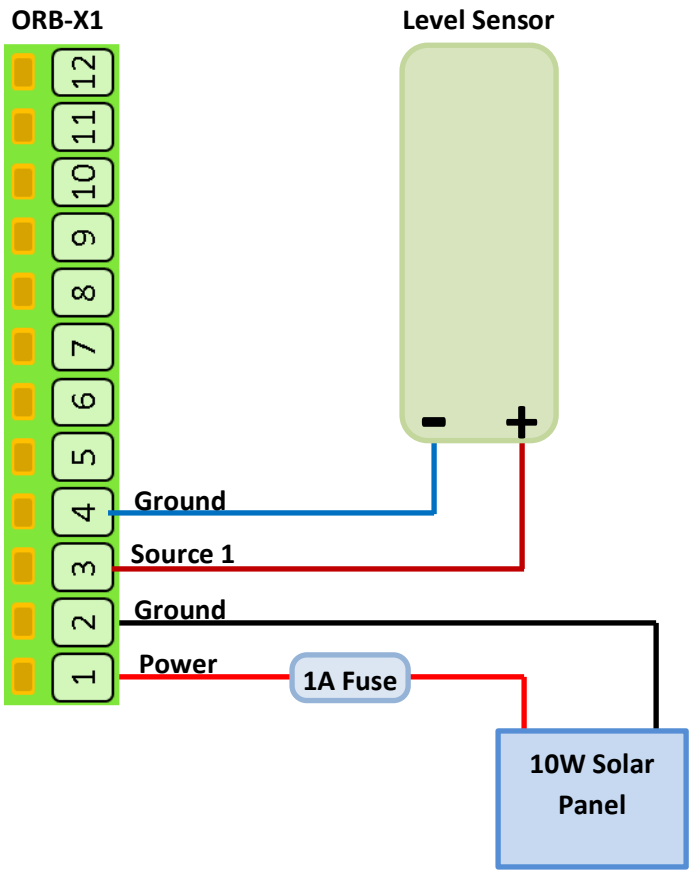



**Figure 2 – Level Sensor Wiring Diagram**

## ORB Configuration

If you are configuring the ORB for the first time, use a phone, tablet or laptop to access the ORB's integrated webserver. To activate the webserver, press the setup key on the ORB for 2 seconds and then connect to the ORB's Wi-Fi on your phone, tablet or laptop. Passwords for the ORB's Wi-Fi and webserver can be found on a tear-off sticker under the lid of the ORB. For further details on how to access the webserver, please see the "ORB-X1 User Guide". If the ORB is already available on the Senquip Portal, simply login to the Portal and make the required changes remotely.

In this application, it is assumed that the ORB is powered via solar. To conserve energy, the rate of transmission is set to 10 minutes. The ORB can be set to transmit the level via either Wi-Fi or GSM. The configuration of the transmission is not covered in this application note.

Note that only settings used in connecting the ORB to the level sensor are discussed in this application note.

## General Setup

For general setup, use the ***General*** tab on the ORB webserver as shown in Figure 3. Remember to save when complete.

1. Give the ORB a name that is meaningful to the user, in this case, “House Tank Level.”
2. To save energy, the ORB is set to wake up every 10 minutes (600 seconds), report the tank level and then return to sleep.
3. Set the Transmit Interval to 1 so that the position is sent each time it is measured.
4. There are no warnings or alarms used in this application that require faster updates be sent and so the Exception Interval is set to be the same as the transit interval. Note that if alerts are more important than actual levels, that the transmit interval could be set to only transmit say once a day. The ORB would wake every 10 minutes, check the levels and only transmit if there was a warning or alarms. Power would be saved in this way. If the Exception Interval was set to 1, then the ORB would transmit on every measurement whilst a warning or alarm was current.
5. The *Device Always On* and *Web Server Always On* options are both not ticked in order to save power.
6. If AA batteries are being used as a backup to power the ORB, then an alert should be set for when the batteries are low.

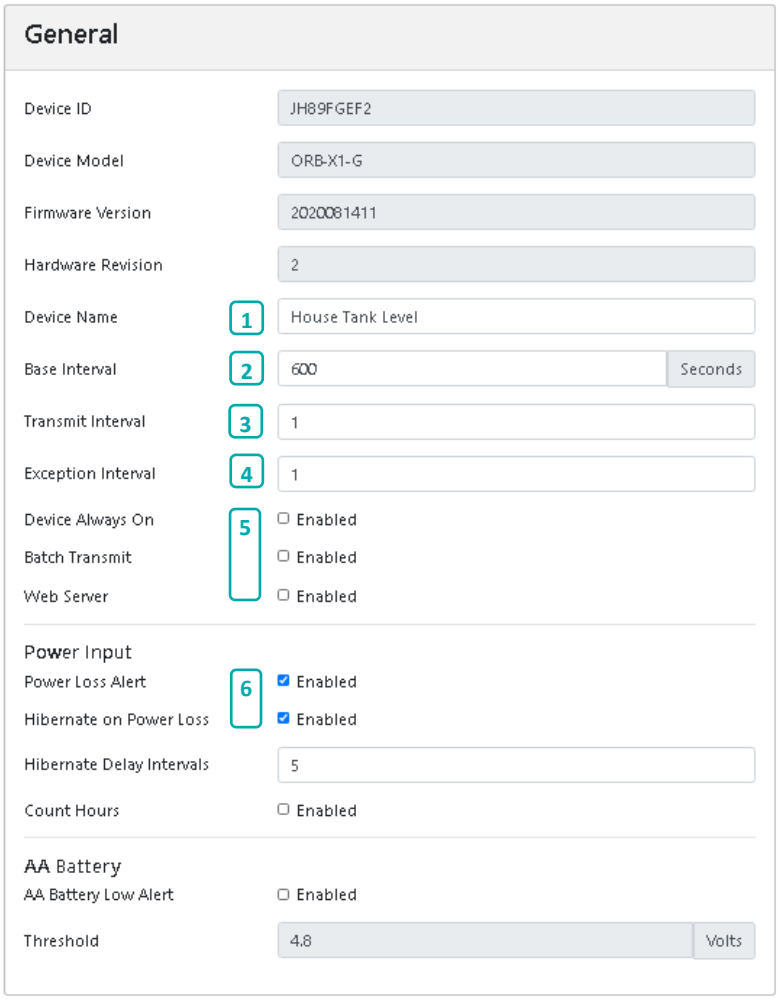



**Figure 3 - General Setup**

## Current Source 1 Setup

The level sensor is connected to Source 1 on the ORB. For current loop setup, use the ***External*** tab on the ORB Webpage or Senquip Portal and select the Current Loop 1 peripheral as shown in Figure 4.

1. Give the current data a meaningful name; in this case “Water Level”.
2. Water level is to be measured every time the ORB wakes up and so the Interval is set to 1.
3. Use the Start Time setting to apply power to the sensor a short time before the measurement is taken. This allows the sensor data to stabilise before a measurement is taken. Make this value as short as possible to save energy when operating off solar or AA batteries.
4. The water level sensor returns a reading in mA that represents a water level in metres. The ORB allows connected sensors to be calibrated. According to the water level sensor, 4mA represents 1m and 20mA represents 5m. The calibrated unit in this example is meters (m). Note that the ORBs webserver and the Senquip Portal will always report measured values in the calibrated units; meters in this case.

5. Warnings are not used in this application.
6. Alarms are enabled and are set to activate if the water level goes below 1m or above 4m. Note that if you calibrate the sensor, warning and alarm settings are in the calibrated units.
7. Hysteresis is applied when warnings and alarms are enabled. Hysteresis changes the threshold once it has been crossed to prevents multiple alerts when the measured value is oscillating around an event level. Hysteresis of 1 means that when the measured value drops below the lower threshold of 1m, that the alarm will only be de-activated when the level goes above 2m. If the water level exceeds 4m, the alarms will only be de-activated if the level goes below 3m.

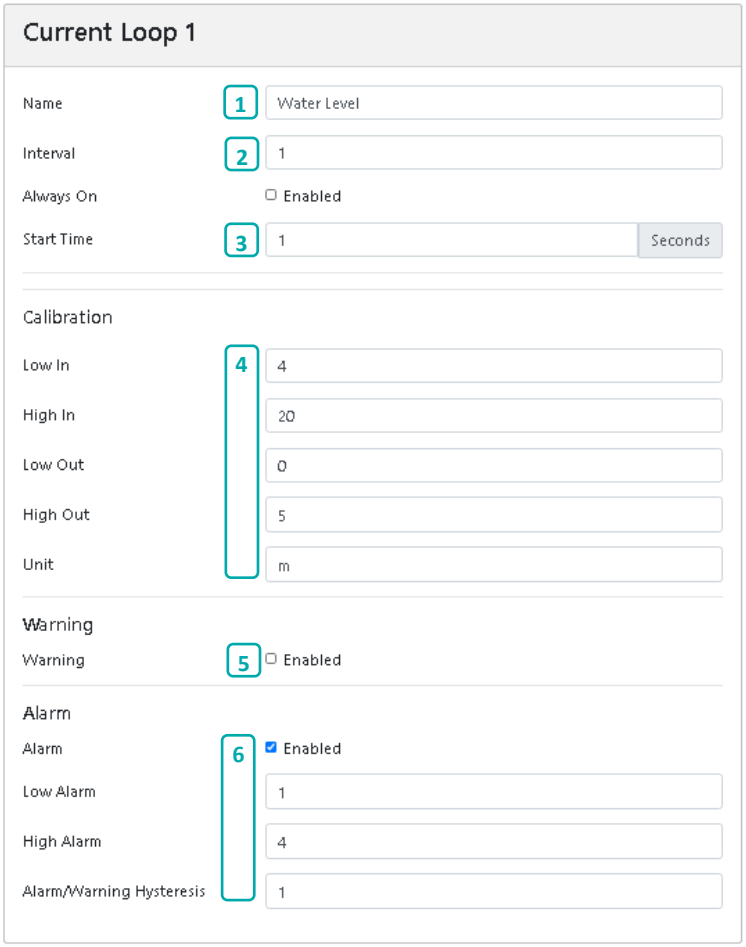


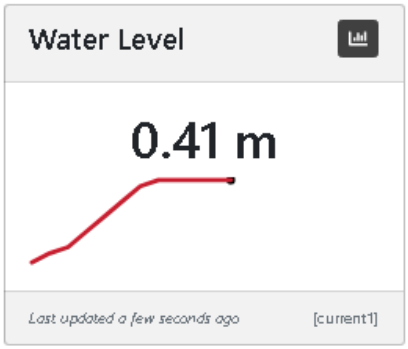

**Figure 4 - Current Source Setup**

## Access to the Water Level Data

The water level data that is being sent by the ORB can be viewed in various ways:

1) Login the ORB's webserver on your local network and view the real-time serial data being sent. In this application, we disabled the webserver to conserve power but it could be enabled if required.

2) Login to the Senquip Portal (portal.senquip.com) and view the real-time position data or alternately view or download the data from the table view under “Raw Data”.




3) Configure the ORB to send the data to a UDP, HTTP or MQTT server. In this case, the data will arrive on the remote server in in JSON format. In the example below, the ORB device ID is 4A0AC62C0. Note that Current Loop peripheral also sends the voltage that is measured on the output. This can be used to check that the current drawn by the external device is within limits and is not applying excessive load to the ORB’s 12V supply.

{“deviceid”:”4A0AC62C0”,”current1”:”0.41”, “v_current1”:”12.04”}

Since an alarm has been enabled when water level is less than 1m or greater than 4m, the Senquip portal will give a notification in the *Events* tab. The alarm condition can further be configured to activate the ORB output and SMS and email alerts can be configured.

## Conclusion

The physical connection and setup required to connect a 4-20mA level sensor to the ORB is quick and simple. Once connected, the level data provided by the level sensor can be viewed anywhere in the world on the internet or on a company server.