WATER-INSIGHT

Application Notes

WP2P D/A Module in a Tank Level Application

17 May 2017 – Rev A

This application involves using the 1-PD8112 WP2P Digital Analogue Module with a suitable Level Measuring device to provide a remote water tank level reporting system. The WP2P D/A does include a 900MHz transceiver allowing for remote access and data retrieval by dedicated master devices such as the EP3, INC, IMS, etc.

Hardware

The current, off the shelf, Revision C release of the WP2P D/A does have limitations when applied to this application. The main Limitation is the power supply and requirements.

Operating Voltage - +/- 12 volts
Operating Current – 42 mA while idle, rising significantly during radio operation
LED Current – 5 mA estimated from circuit diagram

Radio Transmit – 85 mA Data sheet
Radio Receive – 28 mA Data sheet

The Isolated Analogue part of the PCB was depowered by removing its power supply. This lowered the supply current to….

Operating Current – 16.2 mA LED Flashing
Operating Current – 14.8 mA LED Removed

A further change to the idle state logic levels of the SI8440 chips could reduce the operating current by a couple more milliamps. This could realize an operating target current of 12 mA.

A small modification to the WP2P D/A Revision C PCB would allow the processor to power-up the Isolated Analogue Circuitry and attached Level Sensor with Output Relay 1 for a few seconds to take a level reading and then go back into low power idle mode.

The proposed Level Sensor is a Model UE3003 manufactured by HOLYKELL. This sensor's operating specifications are…

Operating Voltage – 12 volts
Operating Current – 19 mA
Operating Level Range – 0.3 to 3 meters
Output Voltage Range – 0.5 to 5.0 volts
Accuracy - +/- 0.5% of Full Scale

The sample Level Sensor was evaluated and the level responses are showm below…..

600mm = 1.0V 900mm = 1.5V 1200mm = 2.0V 1500mm = 2.5
1800mm = 3.0V 2100mm = 3.5V 2400mm = 4.0V 2700mm = 4.5
3000mm = 5.0V

It is expected that this Tank level Monitor would be operated from a Solar/Battery power supply. Therefore the following power supply requirements can be estimated…

Operating Voltage – 12 volts
Idle Current – 12 mA
Active level measurement current – 70 mA
Active Radio Receive – 45 mA
Active Radio Transmit – 100 mA

Therefore to minimized the Solar Power Supply capacity to the minimum the following should be considered….

Measuring the tank level at measurement intervals of say 15 mins, 30 mins or 60 min intervals.

Retrieving the Tank Level Data at 2 or 4 hourly intervals or alternatively on request.

Given the above the expected operating current for the system would be less than 15mA. That represents a budget of…

Daily Battery Requirement – 360mA/Hour
Allowing for 10 days continuous standby operation would be 3.6A/H

Allowing for 50% Battery Aging Capacity Reduction then a12 A/Hr SLA Battery would be a good choice.

A 20 Watt 12 volt solar panel would provide 1.amp charging current. Therefore given an average 2 hours charging sunlight in mid winter this represents a net daily charge gain of 2A – 0.36A or 1.6 A/Day. Or, in other word about 4 days to recharge a 50% discharged battery.

If the average operating current of the Level Monitor doubles from 12 mA to 24 mA then the above Solar Power Supply capacity must be doubled to maintain the 50% redundancy/safety margin estimated above.

Consideration needs to be given as to whether the water level monitor is a point to point device, or part of an IPC Radio Mesh. A radio mesh could impact severely on the Water Level Monitors power usage

The 12 volt relays on the WP2P D/A draw approximately 25 mA and really prohibits the use of the WP2P D/As outputs. Therefore these relays are not suitable for solar powered operation.

Given all of the above the WP2P D/A will do the required Job with the appropriate software. It should be noted that the WP2P D/A analogue inputs are operated in the 0-10 volts mode. As the ADC id 12 bits, operating the analogue input to half range is quite suitable and acceptable.

Software

Most of the software functions for the WP2P D/A radio, analogue circuits etc is already written.

Thought the WP2P D/A does have a battery backed up RTC, time stamped data is not required.

The Water Level Monitor software functions can be divided into two independent functions….

1) A function that awakes via a suitable timer in the Processor, powers up the Analogue Circuitry and the Level Sensor. Waits for the system to stabilize, then takes a reading from the level sensor via the ADC circuitry. Converts this reading to a suitable scaled value and stores the value. The function would also calculate and store the, Minimum, maximum, average and now water level values. The WP2P D/A would then return to the low power idle mode until the next sampling period time out.

   The sample period could be stores in a minute's value register of say 15 to 240 minutes.

2) The processor would awake the radio and look for a data request from an associated master device. EP3, INC, IMS, etc. These data requests could include…..

   Request Water Level Data
   Set sampling period
   Reset Maximum & Minimum values.

The master device would them provide the user with the required information. This could include….

1) The level data in percentage of full, by volume eg litres. (The volume can easily be calculated by knowing the diameter and depth of the tank and of course the value of pi which is 3.14159265359
2) The ability to set the level measurement period.
3) Reset the level data.

Other nice features could include setting a tank low level alarm value and initiating alarm SMS Text notifications if the system has Cellular connectivity.