PULSAR.Q Radar Sensor

D6 Labs
Engineered IoT Solutions

Part Number: **WBL-PQ-M-DC**

WBL-PQ-M-DC

User Guide

Radar based sensor for measuring tank level

This guide was created to help you install, setup and use the PulsarQ™ radar tank level sensor. It assumes familiarity with industry standards and practices.

Warning: *This product is not to be used for Personal Protection. Never use this product as a sensing device for personal protection. Doing so could lead to injury or death. This product does NOT include the self-checking redundant circuity required to allow its use in applications for personnel safety.*

Overview

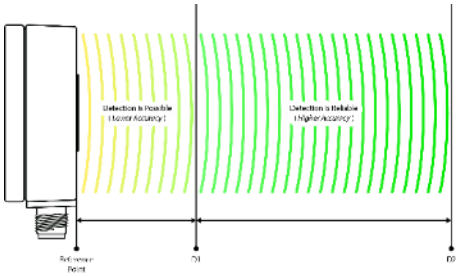
The PulsarQ™ is a low-power, 60GHz pulsed coherent radar that is optimized for tank level monitoring applications.

When used on plastic tanks, it can read tank level through the wall of the tank, eliminating the need to make an opening in the tank. For tanks with a flat spot for mounting, mounting is accomplished with our basic mounting adapter and for tanks with a rounded or sloped surface, one of our leveling adapters can be used. For metal tanks with standard NPT bung openings, we offer a 1-1/2 " NPT mounting adapter.

Features include:

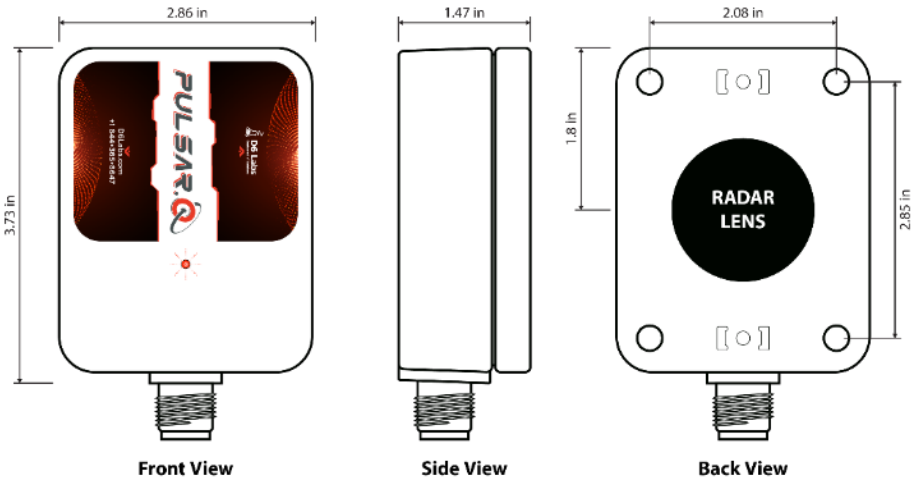
- 60GHz pulsed coherent radar
- Low power operation (<150mW)
- millimeter level accuracy
- Modbus RS-485 interface
- Simple Modbus map
- RGB status LED
- Automatic intelligent (AI) calibration

Sensing Range



Model	D0 (ft)	D1 (ft)	D2 (ft)
WBL-PQ-M-DC	0	0.49	20

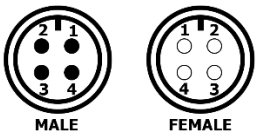
Mechanical



Status Indicator

Status	Color	Description
Calibrating	Orange	The radar will automatically calibrate on power up and any time conditions have changed that can affect accuracy (e.g. temperature)
Valid Reading	Green	The status LED will be green whenever the radar is able to obtain a valid level reading. This should be the normal status of the radar.
Peak Overflow	Purple	The distance to the surface of the liquid is outside of the measurement range of the sensor
Error	Red	The radar is unable to obtain a valid reading or has an internal error. Contact D6 Labs' technical support

Modbus Wiring



Pin #	Color	Signal
1	Brown	8-30V DC power in
2	White	Modbus B-
3	Blue	Ground
4	Black	Modbus A+

Figure 1: M12 4 Pin Connector Pinout

Modbus Map

Holding Registers

Register Address	Name	Data Type	Gain	Notes
40000	Level	Word	X100	Multiply by 0.01 to get level reading in inches.
40001	Temperature	Word	X10	Multiple by 0.1 to get temperature in °F
40002	Internal Voltage	Word	X100	Multiple by 0.01 to get internal voltage. Nominal value should be 3.3V
40003	Peak Status	Word	NA	Value is 0 when 'Level' is valid.
40004	Measurement Mode	Word	NA	Set to 0 to measure distance, 1 to measure level
40005	Tank Height	Word	NA	Tank height in inches. Require for level measurement mode.
40006	Sensor Offset	Word	NA	Sensor offset in inches.
40007	Baud Rate	Word	NA	Baud rate. Default value is 9600.
40008	Odd Parity	Word	NA	0 = No parity, 1 = Odd parity. Default value is 0.
40009	SlaveId	Word	NA	Valid range is 1 to 254. Default value is 1.

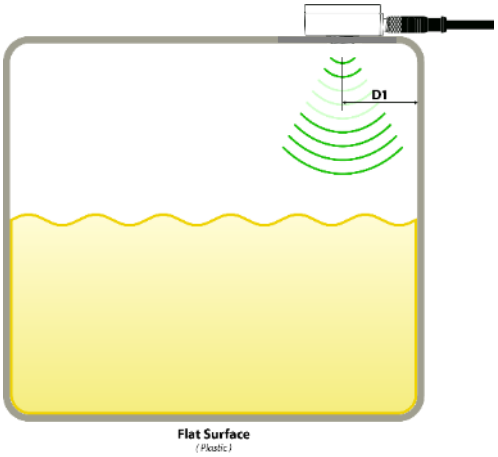
Distance Mode – When 'Measurement Mode' is set to 0, the radar will measure the distance between the surface of the radar and the surface of the target that is reflecting the radar waves. This mode is useful for non-level measuring applications such as obstacle/presence detection or ranging. In this mode, the 'Tank Height' value is not used. The 'Level' register value will reflect the actual measured distance minus the 'Sensor Offset'.

Level Mode – When 'Measurement Mode' is set to 1, the radar will measure the distance between the bottom of the tank and the surface of the liquid. For this measurement to be accurate, both 'Tank Height' and 'Sensor Offset' must be set correctly. When the 'Tank Height' register value changes, the radar will automatically start a new calibration cycle.

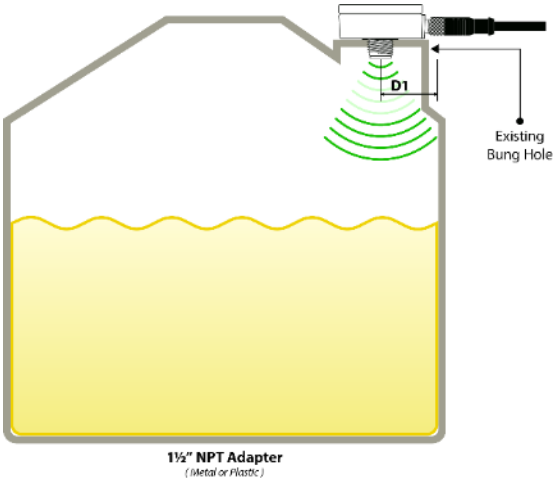
Calibration – Calibration is automatic and can take several seconds. It is a processor intensive procedure which means that the radar will not respond to Modbus register read/write requests during a calibration cycle.

Installation

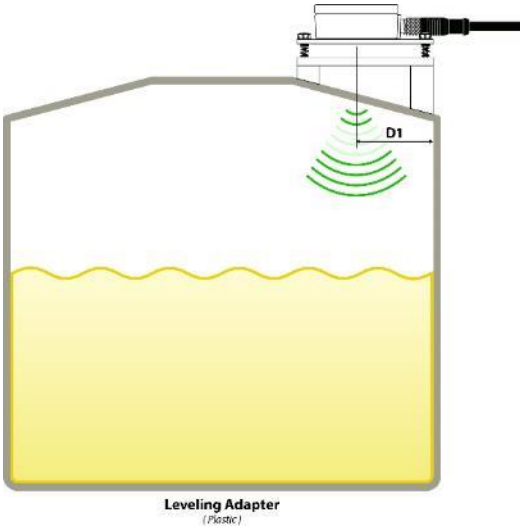
The radar beam width is approximately 20°, so it is important that the radar be mounted so that it is with 10° (½ of the beam width) of level with the surface being measured.



For plastic tanks with a flat location for mounting, the radar can be directly mounted to the tank surface using 3m VHB tape or our flat mounting adapter (p/n ADP-PQ-F1).1



For plastic or metal tanks with a NPT bung opening, the radar can be mounted using our 1-½" NPT adapter (p/n ADP-PQ-NPT)



For plastic tanks that do not have a flat spot for mounting the radar, the radar can be mounted using one of our self-leveling adapters. The leveling adapters are configured for a variety of slope angles and can correct for up to a 2.5° error in X and Y. Contact sales@d6labs.com for help determining which leveling adapter is correct for your tank.

D6 Labs offers customization services of mounting adapters for applications where our standard adapters won't work.

Regardless of the mounting method, the radar must be mounted so that the center of the radar lens on the bottom is at least 'D1' distance from the edge of the tank. See the table below for D1 values for various tank heights:

Tank Height (in)	D1 (in)
40	7.1
60	10.6
80	14.1
100	17.6
120	21.2

Specifications

Range

Detection Range: 0.15 to 6 meter (.5 to 20 feet)

Operating Principle

Pulsed Coherent Radar

Operating Frequency

60 GHz

Supply Voltage

8 VDC to 30VDC

Power Consumption

< 0.15 W

Current Consumption

< 10mA at 12 VDC

Response Time

Update rate: > 5 hz

Construction

Body: PETG-CF

Lens: PETG

Output Configuration

Modbus RS-485 (9600,N,8,1 SlaveId=1 default)