Remote Tank Level Monitoring System
Executive Summary

Remote tank level monitoring (RTLM) systems allow marketers to optimize their delivery schedules and ensure that customers have a reliable and constant supply of propane. The Propane Education & Research Council (PERC) contracted Battelle Memorial Institute to evaluate the performance of commercially available RTLMs. Using PERC's Remote Propane Tank Level Monitoring Systems Matrix, Battelle identified 13 RTLM models from 9 manufacturers and measured each system's radio frequency range, fuel level accuracy, installation difficulty, and overall system cost (see back page for details). The following RTLM models were the top performers* for the different characteristics that an RTLM system can have.

System Characteristics		Top-Performing Models	
Communication Method	Analog phone with cellular or satellite option	• Robertshaw (analog and cellular)	• Independent Technologies (analog and satellite)
	Internet dialer	• Enertrac (Internet)	• Remote Sensing Systems (Internet and analog)
	Cellular or satellite	• Independent Technologies (satellite) • Robertshaw (cellular)	• Silicon Controls (cellular) • Schmitt Systems (satellite)
	Visual	• Tank Q (visual warning indicator without remote reporting)	
Radio Frequency	Long range	• Enertrac • Remote Sensing Systems	• Independent Technologies (standard or deluxe)
	Long range with analog or Internet	• Enertrac • Independent Technologies (analog)	• Remote Sensing Systems • Robertshaw (analog)
Diagnostic Capabilities	Multiple tanks in isolation	• Enertrac • Fuel Web	• Independent Technologies (standard, deluxe, or satellite) • Remote Sensing Systems
	Difficult sites	• Silicon Controls (cellular) • Schmitt X-Act (satellite)	• Independent Technologies (analog and satellite) • Remote Sensing Systems (analog and Internet)
Operation Mode	Ultrasonic reader	• Schmitt X-Act (alternative ultrasonic technology)	
	Solar-powered	• Fuel Web	• Remote Sensing Systems

*Individual manufacturer responses can be found in the appendix of the full report on www.propaneresearch.com.

Look inside for more detail on the performance of each RTLM model.

For complete results and testing procedures, download the full report at **www.propaneresearch.com.**

Detailed Results

Tank Features

- (#) Tanks monitored by system (U=unlimited)
- Solar-powered
- Solar-powered option

System Cost

- $ = <$300
- $$ = $300–600
- $$$ = >$600

Costs are current as of December 2010.

Communication Method

- Analog phone
- Cell phone
- @ Internet
- Satellite
- Visual

Fuel Level Accuracy

- = <2% error
- = 2–5% error
- = >5% error
- = Not tested

Radio Frequency Range

- N No barrier
- W Wood fence
- C Chain link fence
- B Block wall
- I Industrial setting

- = >1,800 ft.
- = 1,300–1,800 ft.
- = 800–1,300 ft.
- = <800 ft.
- = Received almost all transmissions
- = Received almost no transmissions

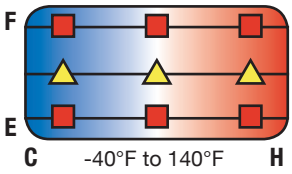
Installation Difficulty

- = Easy/fast
- = Average
- = Poor/slow

MANUFACTURER: Enertrac MODEL: Big Drops

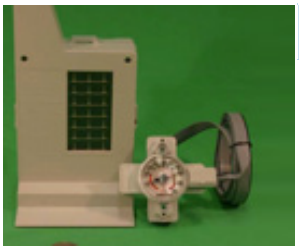
- Superior radio frequency range.
- Advertised to handle an unlimited number of propane tanks.

Fuel Level Accuracy



Radio Frequency Range: N C W B I

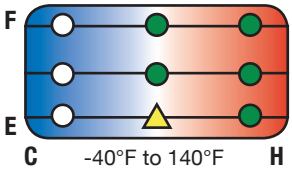
System Cost:	$$$
Communication Method:	@
Radio Frequency:	433.0 MHz
System Tank Capacity:	U
Installation (Easy/Difficult site):	● / ■



MANUFACTURER: Fuel Web MODEL: e-Fuel

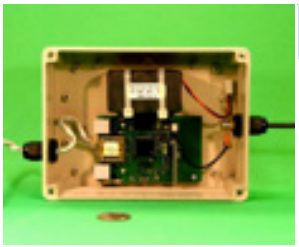
- Solar-powered transmitter.
- Comes with a tank installation guide.

Fuel Level Accuracy



Radio Frequency Range: N C W B I

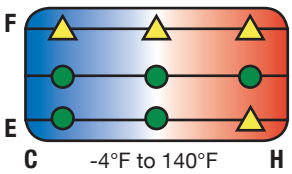
System Cost:	$$
Communication Method:	)
Radio Frequency:	905.0 MHz
System Tank Capacity:	8
Installation (Easy/Difficult site):	● / ▲



MANUFACTURER: Fueling Technologies MODEL: FTI Monitor

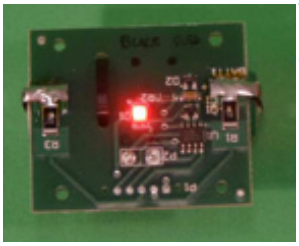
- Outdoor receiver in weatherproof box.
- Propane distributor needs to install own server.

Fuel Level Accuracy



Radio Frequency Range: N C W B I

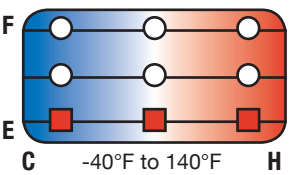
System Cost:	$, $$$ for server setup
Communication Method:	)
Radio Frequency:	315.0 MHz
System Tank Capacity:	9
Installation (Easy/Difficult site):	▲ / ▲



MANUFACTURER: Tank Q MODEL: Tank Q

- Simple, low-cost system.
- Tank-mounted LED flashes when propane level drops below 25 percent.

Fuel Level Accuracy



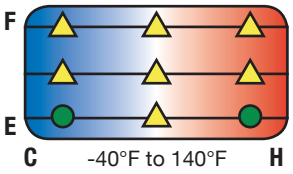
Radio Frequency Range: N/A

System Cost:	$
Communication Method:	👁
Radio Frequency:	N/A
System Tank Capacity:	1
Installation (Easy/Difficult site):	● / N/A

MANUFACTURER: Independent Technologies
MODELS: Wesroc mini receiver (M), standard receiver (S), deluxe receiver (D), and satellite base unit (SB)

- One transmitter can be used with all four receiver types.
- Repeaters can increase radio frequency range almost indefinitely.

Fuel Level Accuracy



Radio Frequency Range:

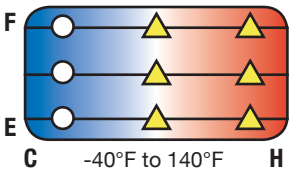
N C W B I (M) N C W B I (S, D) N C W B (SB)

System Cost:	$$, $$$ (SB)
Communication Method:	(SB)
Radio Frequency:	916.48 MHz, 1611.25/1618.75 MHz (SB)
System Tank Capacity:	1 6 8 15
Installation (Easy/Difficult site):	/ / (Solar SB)

MANUFACTURER: Remote Sensing Systems
MODELS: RSS analog (A) and Internet (I)

- Both Internet and phone capability in single model.
- Self-test ensures reliable radio frequency connection.

Fuel Level Accuracy



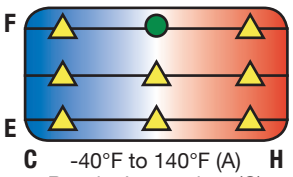
Radio Frequency Range: N C W B I

System Cost:	$$ (A) $ (I)
Communication Method:	@
Radio Frequency:	903.8 MHz
System Tank Capacity:	6
Installation (Easy/Difficult site):	/

MANUFACTURER: Robertshaw
MODELS: Centeron analog (A) and cellular (C)

- Easy battery replacement.
- Remote-ready hall effect sensor monitors float gauge.

Fuel Level Accuracy



Radio Frequency Range: N C W B I (A)
N/A (C)

System Cost:	$$$
Communication Method:	
Radio Frequency:	923.58 MHz (A); GSM 850/900/1800/1900 MHz bands (C)
System Tank Capacity:	1
Installation (Easy/Difficult site):	/ (A) / (C)

MANUFACTURER: Schmitt Systems
MODEL: X-Act Satellite Data Link

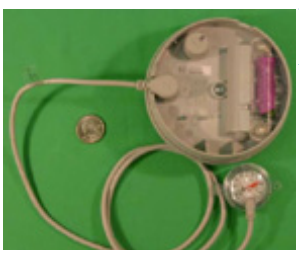
- Ultrasonic satellite system intended primarily for large tanks.
- Easy battery replacement.

Fuel Level Accuracy

Results incomplete due to late program entry.

Radio Frequency Range: N/A

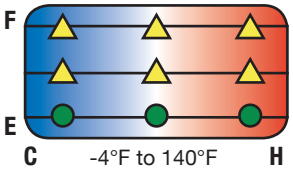
System Cost:	$$$
Communication Method:	
Radio Frequency:	1611.25/1618.75 MHz
System Tank Capacity:	1
Installation (Easy/Difficult site):	/



MANUFACTURER: Silicon Controls **MODEL: Gaslog**

- Indication LEDs improve accuracy.
- Handheld wireless diagnostic tool decreases installation difficulty.

Fuel Level Accuracy

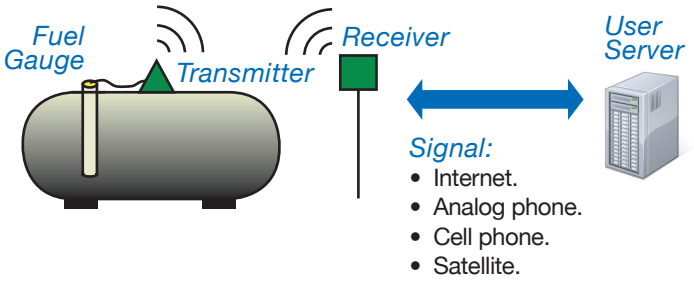


Radio Frequency Range: N/A

System Cost:	$$
Communication Method:	
Radio Frequency:	GSM 850/900/1800/1900 MHz bands
System Tank Capacity:	2
Installation (Easy/Difficult site):	/

How It Works

A typical RTLM system consists of a tank-mounted transmitter and a receiver. The transmitter uses a sensor that is mounted on a fuel gauge and sends a radio signal to the receiver indicating the fuel level. The receiver communicates with the RTLM manufacturer or propane marketer's computer server by phone or Internet. Alternatively, several manufacturers offer products that use a satellite or cellular phone connection and require only a tank-mounted transmitter.



A Closer Look: Performance Testing

Fuel Level Accuracy

Temperature may affect the RTLM system's fuel level accuracy reading. Battelle tested the systems at room temperature, hot, and cold conditions to simulate performance in different U.S. regions and evaluated the systems at three different tank levels (below 20 percent, above 80 percent, and the range between) for all three temperature ranges.

Radio Frequency Range

Commercially available RTLM systems use analog phone, cellular phone, Internet, or satellite signals to transfer information between the receiver and the server. Battelle tested RTLM signal strength in response to common obstructions, including fences and cement block walls, at different distances (less than 800 feet, 800–1,300 feet, 1,300–1,800 feet, and greater than 1,800 feet), and in an industrial setting.

Installation Difficulty

Installation difficulty of an RTLM at an "easy" site is determined by the transmitter/receiver/sensor installation time (Excellent = under 5 minutes, Good = 5–10 minutes, Poor = 10–20 minutes, Very poor = over 20 minutes). Installation at a "difficult" site consisted of an overall subjective rating that took into account problems during installation, variation from installation procedures, and troubleshooting.

System Cost

The overall system cost includes transmitter and receiver costs as well as monitoring or data costs over a five-year period with one tank, assuming one call per day. Replacement battery costs, if needed, were not included and volume discounts have not been applied. Excellent ($) is less than $300; Good ($$) is between $300 and $600; and Poor ($$$) is more than $600.

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For complete results and testing procedures, download the full report at **www.propaneresearch.com.**