



*Issue: January 2009*

<b>User Manual for the Overfill Diagnostic Instrument</b>
<b>Operating Instructions</b>

The Maximus™ systems use ultrasonics to measure liquid level in pressurized tanks.

This manual contains information to help the reader become familiar with the Maximus™ Overfill Diagnostic Instrument (ODI) and Continuous Level Gauge (CLG). Please read carefully before using the Maximus™.

The manufacturer and/or the distributor do not accept responsibility for any incidental or consequential damage to the Maximus™. In particular, the manufacturer, nor the distributor, is liable for damage resulting from poor product maintenance or using incorrect batteries.

The manufacturer and/or the distributor reserve the right to modify this document at anytime, and without notice.

<b>Contents:</b>
------------------

<b>Maximus™ – CLG/ODI</b> .....	2
<b>Where to Collect the Tank Specifications</b> .....	3
<b>Selecting Operating Modes (CLG/ODI)</b> .....	3
<b>ODI – Overfill Detection Operations</b> .....	4
<b>CLG – Continuous Level Operations</b> .....	6
<b>Look-Up Tables</b> .....	7
<b>Technical Specifications</b> .....	14

# ADEPT SCIENCE & TECHNOLOGIES, LLC

## Maximus - CLG/ODI - Contents of Package

- **Hand-Held Assembly**



(Note: Not to scale)

- **Display Screen**



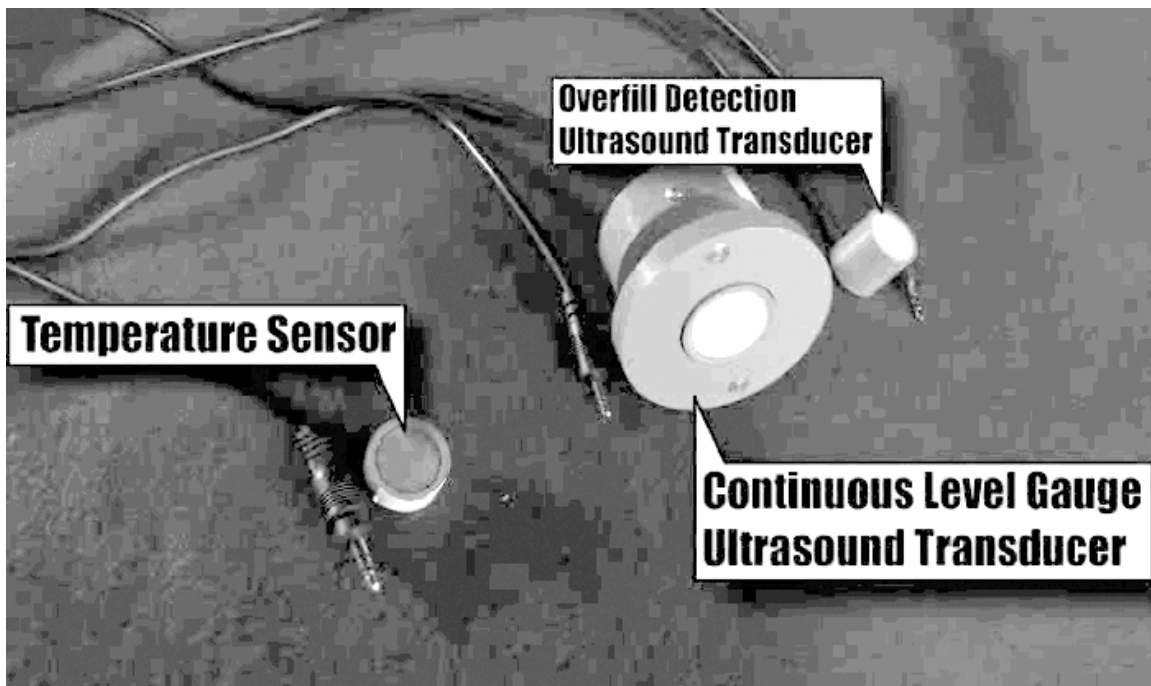
(Note: Not to scale)

- **Grease Pen** (or “Marker”)

- **Cloth Measuring Tape**  
(Tailor’s Tape)

- **A level bubble device**

- **Transducers**



(Note: Not to scale)

*From left to right:*

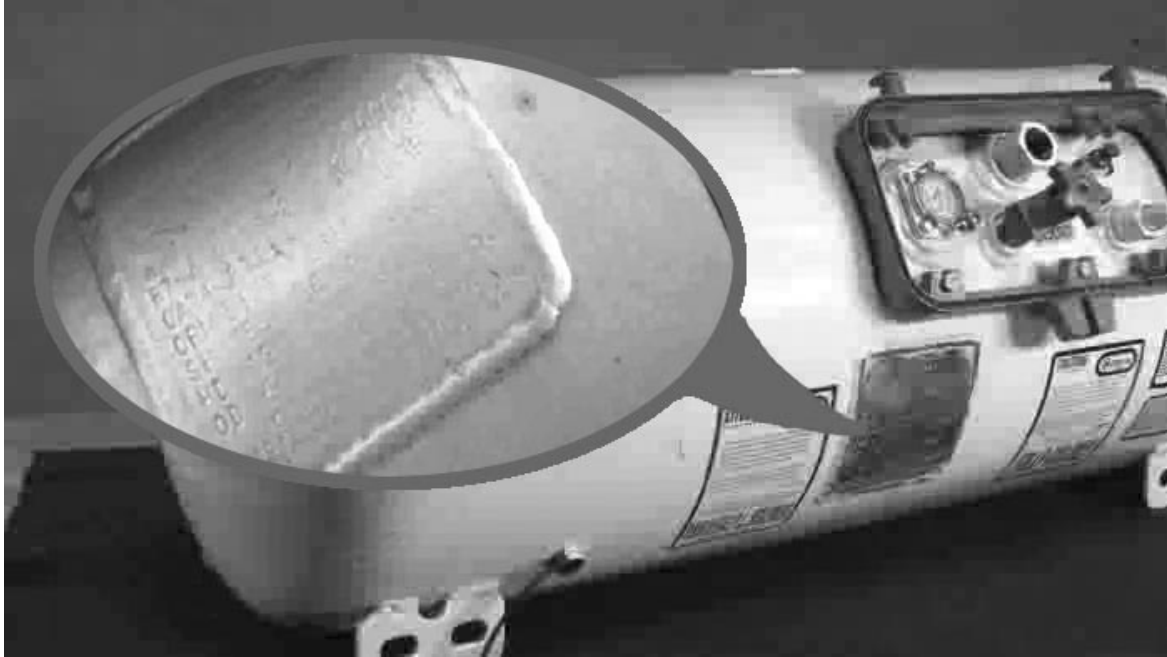
**Temperature sensor**

**Overfill Detection Ultrasound Transducer (for ODI mode only)**

**Continuous Level Gauge Ultrasound Transducer (for CLG mode only)**

## Where to Collect the Tank Specifications

From the name plate attached to the tank by the manufacturer, record the tank's **Outside Diameter** and **Shell Thickness**.

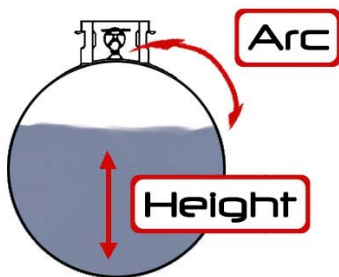


### Instrument Range (Tank Size/Limitations):

- Diameter: 1- 6 feet (0.304 - 1.828 m)
- Shell thickness: 0.1 – 0.75in (2.54 - 19.05 mm)
- Overall tank length: No limitations.

## Selecting the Operating Mode (CLG mode or ODI mode)

The Maximus™ has two Operating Modes: (1) as an Overfill Diagnostic Instrument (ODI), and (2) as a Continuous Level Gauge (CLG).



### (1) ODI - Overfill Diagnostic Instrument

The Overfill Diagnostic Instrument allows the user, after the refill process is completed, to determine if the tank is at or near 80% full; or if it has been overfilled, to measure by how much it has been overfilled.

### (2) CLG - Continuous Level Gauge

The Continuous Level Gauge can accurately measure the height of the liquid in the LP Gas tank.

Each Maximus™ operating mode provides the user with a different measurement that leads to the “% full” liquid volume inside the tank:

- The **ARC length** is displayed by the **ODI**,
- The **HEIGHT length** is displayed by the **CLG**.

## I. ODI

The tank overfill diagnostic process includes the following steps:

### (A) Activating the ODI



- Insert the 3.5mm jack of the temperature sensor in the 3.5mm receptacle in the hand-held assembly. Push in jack firmly to ensure a good connection.
- Insert the 2.5mm jack of the ODI ultrasound transducer in the 2.5mm receptacle. Again, push firmly to ensure a good connection.

### (B) Preparing the ODI and the tank

- **Record the tank diameter and shell thickness** from the tank name plate (attached to the tank by the tank manufacturer).
- **Mark the center top of the tank** using a grease marker. A level bubble device is used to find the upmost center point of the tank (*Note: Vehicle must be parked on level ground*).
- **Affix the temperature sensor to the tank.** The temperature sensor head is magnetized. It will stick to the tank. Place this sensor close to the bottom of the tank where it is certain there is liquid inside the tank. Allow enough time for the temperature sensor to reach tank temperature (**wait ~ 5 min**).
- **Push the “ON” button** on the handheld device.

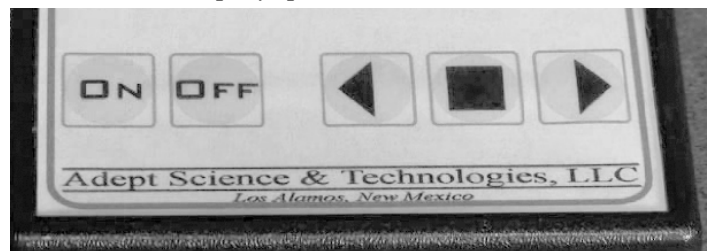
*The display will first show the ASCENT logo and then it will indicate “Diam=12.0”. Next, the operator inputs the tank diameter (shown on the tank name plate)*

### (C) Inserting tank specs into the ODI

#### ▪ **Enter the Tank Diameter**

*Use the left and right arrows at the bottom of the hand-held instrument to decrease or increase the tank diameter value in the range from 12 inches to 45 inches. When the correct value for the tank diameter is shown on the display, push the “Enter” button (the button marked with a square).*

*The display will then read “Thick=0.100”. This indicates that the device is ready for the next steps.*



#### ▪ **Enter the Tank Shell Thickness**

*Input the wall thickness from the tank name plate. Use the arrows as in the previous steps to change the display to the correct value. Press the “Enter” button when the correct wall thickness value is shown on the screen.*

Next, the display will show the operator that it is ready to make the selection between the ODI and CLG operating modes.

## ▪ **Select the ODI Mode**

Push the left arrow to select the ODI.

The device will then prompt the operator to place the ODI ultrasound transducer on top of the tank to begin the calibration process.

### (D) Steps to Find the Liquid Level inside the Tank

- **Apply a small amount of ultragel** on the ware plate<sup>1</sup> of the Overfill Detection Ultrasonic Transducer.
- **Place this transducer on top of the tank** (where it is known that there is no liquid LP Gas) in contact with the inside wall of the tank. Make sure that the transducer is not placed on a weld spot.

- **Press “Enter”**.

The display will read **“Please wait”**.

- **Do Not Move the ODI Transducer** until the device performs several self-calibration and noise reduction steps (~30 seconds).

When these steps are completed, the display will show **“NO LIQUID”**. This display is expected as there should be no liquid at the top of the tank.

- **Remove the transducer and add more gel** on its ware plate.

- Next, **place the sensor to about the 75% full line** (about half way down from the top center to the half full line).

If there is liquid on the other side of the tank wall, the display will read **“LIQUID”**. If there is no liquid on the other side of the tank wall, the display will read **“NO LIQUID”**

- **Move the transducer up and down** in small increments from the 75% full line (in a “stud-finder” fashion **holding sensor in place for >1sec.**) until the vapor-liquid interface is located.

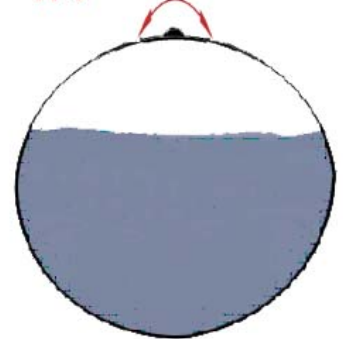
- Using a grease marker, **mark on the surface of the tank where the center** of the sensor head is positioned once you found the vapor liquid interface. This mark shows where the liquid level is inside the tank.

### (E) Using the Look-up Table to determine the “% Full” amount

- Using a cloth tailor-measuring tape, **measure the arc length** from top dead center of the tank down to the grease pen mark you just made on the tank.

- **Search on the look-up table** (see on page 8 and after) for the tank full percentage corresponding to the measured arc length.

Apply Sensor in this Area



<sup>1</sup> The Ware Plate is the surface of the ultrasonic sensor head that comes in contact with the tank surface.

## II. CLG – Continuous Level Gauge Operation Mode

The Continuous Level Gauge process includes the following steps:

### (A) Connecting the CLG



- Insert the 3.5mm jack of the temperature sensor in the 3.5mm receptacle in the hand-held assembly. Push the jack in firmly to ensure a good connection.
- Insert the 2.5mm jack of the ODI ultrasound transducer in the 2.5mm receptacle. Again, push firmly to ensure a good connection.

### (B) Preparing the CLG and the tank

- **Record the tank diameter and shell thickness** from the tank name plate.
- **Affix the temperature sensor on the tank.** The temperature sensor is magnetized. It will stick to the tank. Place the sensor close to the bottom of the tank where it is certain there is liquid inside the tank. Allow enough time for the temperature sensor to reach tank temperature (**wait ~ 5 min**).
- **Push the “ON” button** on the hand-held device.

*The device will display the ASCENT logo and then it will show “Diam=12.0”.  
Next, the operator must input the tank diameter (shown on the tank name plate.)*

### (C) Setting-up the tank specs into the CLG

#### ▪ **Enter the Tank Diameter**

*Use left and right arrows to decrease or increase the tank diameter value in the range from 12 inches to 45 inches. When the correct value is displayed, push the “Enter” button (the button marked with a square).*

*The display will then show “Thick=0.100”.*

#### ▪ **Enter the Tank Shell Thickness**

*Input the wall thickness (from the tank name plate.) Use the arrows as in the previous steps to change the display to the correct value. Press the “Enter” button when the correct value is indicated.*

*The device will next display a screen that allows the operator to choose between the ODI and the CLG modes of operation.*

#### ▪ **Select the CLG Mode**

*Push the right arrow for the CLG mode of operation.*

*The device then prompts the operator to place the CLG ultrasound transducer on the bottom of the tank.*

## (D) Checking the Liquid Level inside the Tank

- Apply a small amount of ultragel on the ware plate of the CLG ultrasound transducer.
- Place the CLG ultrasound transducer on the bottom of the tank (*avoid welds*)
- Press “Enter”.

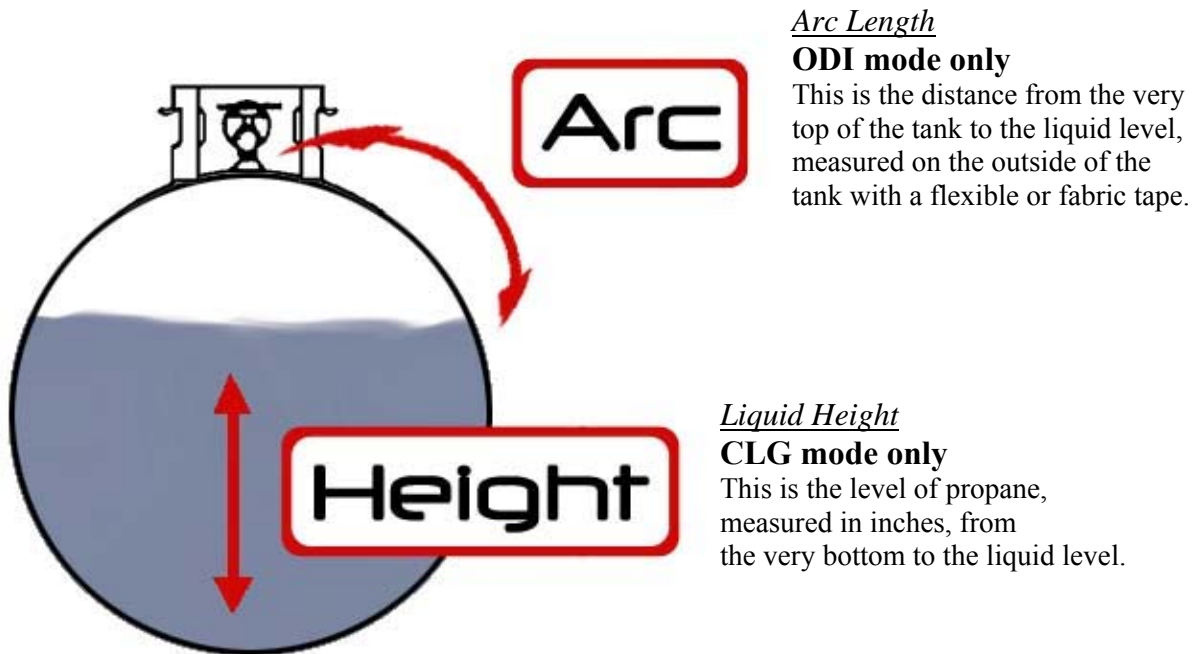
The display will show “Please wait”.

- **Do not move the transducer** until the device perform the self calibration and noise reduction steps (~30 seconds.)

When this is done, the display will show the liquid height inside the tank in millimeters (or in inches) as well as the tank temperature and the CLG signal high voltage value.

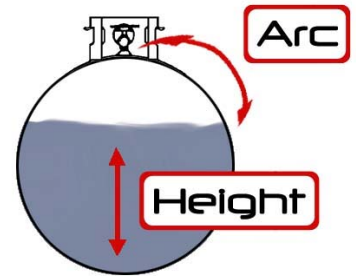
Next, this height reading is used to find in the look-up table what the liquid full % is for the tank being tested.

### Look-Up Table



## 12" Diameter Motorfuel Tank

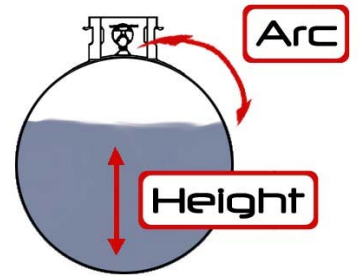
Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
7.87	200	69.56	7.52	191
8.07	205	71.53	7.31	186
8.27	210	73.48	7.10	180
8.46	215	75.39	6.89	175
8.66	220	77.28	6.67	169
8.86	225	79.14	6.45	164
9.06	230	80.95	6.22	158
9.25	235	82.73	5.99	152
9.45	240	84.46	5.75	146
9.65	245	86.15	5.51	140
9.84	250	87.78	5.25	133
10.04	255	89.36	4.99	127
10.24	260	90.87	4.72	120
10.43	265	92.31	4.44	113
10.63	270	93.68	4.14	105
10.83	275	94.97	3.82	97
11.02	280	96.16	3.47	88
11.22	285	97.24	3.09	78
11.42	290	98.21	2.67	68
11.61	295	99.03	2.16	55
11.81	300	99.67	1.51	38





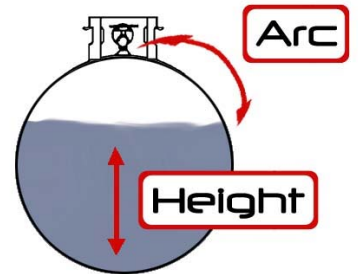
## 14" Diameter Motorfuel Tank

Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
9.25	235	70.12	8.70	221
9.45	240	71.81	8.49	216
9.65	245	73.48	8.28	210
9.84	250	75.12	8.07	205
10.04	255	76.75	7.85	199
10.24	260	78.35	7.63	194
10.43	265	79.92	7.41	188
10.63	270	81.47	7.18	182
10.83	275	82.98	6.95	177
11.02	280	84.46	6.71	170
11.22	285	85.91	6.47	164
11.42	290	87.32	6.22	158
11.61	295	88.69	5.96	151
11.81	300	90.01	5.69	145
12.01	305	91.29	5.42	138
12.20	310	92.51	5.13	130
12.40	315	93.68	4.83	123
12.60	320	94.79	4.51	115
12.80	325	95.83	4.17	106
12.99	330	96.79	3.80	97
13.19	335	97.67	3.40	86
13.39	340	98.46	2.95	75
13.58	345	99.13	2.43	62
13.78	350	99.67	1.76	45
13.98	355	99.99	0.58	15



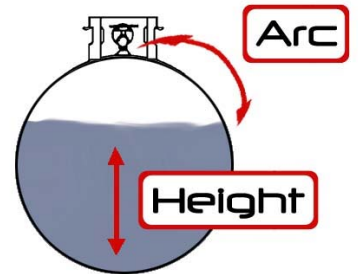
## 16" Diameter Motorfuel Tank

Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
10.63	270	70.54	9.89	251
10.83	275	72.02	9.68	246
11.02	280	73.48	9.47	241
11.22	285	74.92	9.25	235
11.42	290	76.34	9.04	230
11.61	295	77.75	8.82	224
11.81	300	79.14	8.59	218
12.01	305	80.50	8.37	213
12.20	310	81.85	8.14	207
12.40	315	83.17	7.91	201
12.60	320	84.46	7.67	195
12.80	325	85.73	7.42	189
12.99	330	86.97	7.18	182
13.19	335	88.18	6.92	176
13.39	340	89.36	6.66	169
13.58	345	90.50	6.39	162
13.78	350	91.60	6.11	155
13.98	355	92.66	5.82	148
14.17	360	93.68	5.51	140
14.37	365	94.65	5.20	132
14.57	370	95.57	4.86	123
14.76	375	96.44	4.51	115
14.96	380	97.24	4.12	105
15.16	385	97.98	3.70	94
15.35	390	98.64	3.24	82
15.55	395	99.21	2.69	68
15.75	400	99.67	2.01	51
15.94	405	99.97	0.94	24



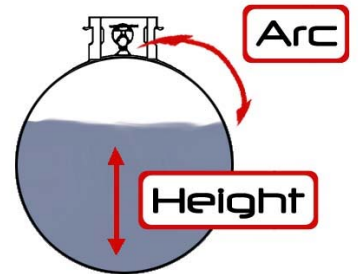
## 18" Diameter Motorfuel Tank

Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
12.05	306	71.14	11.03	280
12.24	311	72.44	10.82	275
12.44	316	73.73	10.61	269
12.64	321	75.01	10.39	263.
12.83	326	76.28	10.18	259
13.03	331	77.53	9.96	253
13.23	336	78.77	9.74	247
13.43	341	79.99	9.51	242
13.62	346	81.19	9.28	236
13.82	351	82.38	9.05	230
14.02	356	83.55	8.82	224
14.21	361	84.69	8.58	218
14.41	366	85.82	8.33	212
14.61	371	86.92	8.08	205
14.80	376	87.99	7.83	199
15.00	381	89.04	7.57	192
15.20	386	90.07	7.30	185
15.39	391	91.06	7.03	179
15.59	396	92.03	6.74	171
15.79	401	92.96	6.45	164
15.98	406	93.86	6.14	156
16.18	411	94.72	5.82	148
16.38	416	95.53	5.49	139
16.57	421	96.31	5.13	130
16.77	426	97.04	4.76	121
16.97	431	97.71	4.35	110
17.17	436	98.33	3.91	99
17.36	441	98.88	3.41	87
17.56	446	99.35	2.83	72
17.95	456	99.98	0.92	23



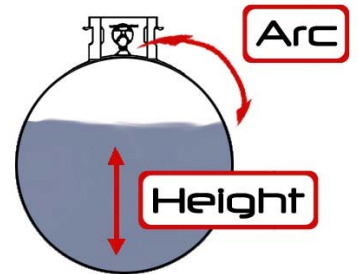
## 20" Diameter Motorfuel Tank

Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
13.19	335	69.95	12.46	316
13.39	340	71.14	12.25	311
13.58	345	72.31	12.04	306
13.78	350	73.48	11.83	300
13.98	355	74.63	11.62	295
14.17	360	75.77	11.40	290
14.37	365	76.91	11.19	284
14.57	370	78.03	10.97	279
14.76	375	79.14	10.74	273
14.96	380	80.23	10.52	267
15.16	385	81.31	10.29	261
15.35	390	82.38	10.06	256
15.55	395	83.43	9.82	249
15.75	400	84.46	9.58	243
15.94	405	85.48	9.34	237
16.14	410	86.48	9.09	231
16.34	415	87.46	8.84	225
16.54	420	88.42	8.59	218
16.73	425	89.36	8.32	211
16.93	430	90.27	8.05	205
17.13	435	91.16	7.78	198
17.32	440	92.03	7.49	190
17.52	445	92.87	7.20	183
17.72	450	93.68	6.89	175
17.91	455	94.46	6.58	167
18.11	460	95.21	6.25	159
18.31	465	95.93	5.90	150
18.50	470	96.61	5.54	141
18.70	475	97.24	5.15	131
18.90	480	97.84	4.74	120
19.09	485	98.39	4.29	109
19.29	455	98.88	3.79	96
19.49	460	99.31	3.21	159
19.88	465	99.92	1.54	150



## 22" Diameter Motorfuel Tank

Liquid Height CLG mode only		Percentage (%) of liquid inside the tank	Arc Length ODI mode only	
Inches	mm		Inches	mm
14.57	370	70.10	13.71	348
14.76	375	71.18	13.50	343
14.96	380	72.24	13.29	338
15.16	385	73.30	13.08	332
15.35	390	74.35	12.87	327
15.55	395	75.39	12.65	321
15.75	400	76.42	12.43	316
15.94	405	77.45	12.21	310
16.14	410	78.46	11.99	305
16.34	415	79.46	11.77	299
16.54	420	80.45	11.54	293
16.73	425	81.43	11.32	288
16.93	430	82.39	11.08	281
17.13	435	83.35	10.85	276
17.32	440	84.29	10.61	269
17.52	445	85.21	10.37	263
17.72	450	86.12	10.12	257
17.91	455	87.02	9.87	251
18.11	460	87.90	9.62	244
18.31	465	88.76	9.36	238
18.50	470	89.61	9.09	231
18.70	475	90.43	8.82	224
18.90	480	91.24	8.55	217
19.09	485	92.02	8.26	210
19.29	490	92.79	7.97	202
19.49	495	93.53	7.66	195
19.69	500	94.24	7.35	187
19.88	505	94.93	7.03	179
20.08	510	95.59	6.69	170
20.28	515	96.23	6.34	161
20.47	520	96.83	5.96	151
20.67	525	97.40	5.57	141
20.87	530	97.93	5.15	131
21.06	535	98.42	4.69	119
21.26	540	98.87	4.19	106
21.46	545	99.26	3.62	92
21.65	550	99.60	2.96	75
21.85	555	99.86	2.09	53



## Technical Specifications

### Tank Sizes:

- Diameter: 1- 6 feet  
(0.304 - 1.828 m)
- Shell thickness: 0.1 - 3/4in  
(2.54 - 19.05 mm)
- Overall length: No limitations.

### Operating Temperature Range:

- Device: -31°F to 185°F (-35°C to 85°C)
- Display: -4°F to 160°F (-20°C to 70°C)

### Accuracy:

+/- 1.0% (of tank diameter)

### Enclosure:

- Plastic case
- 7.5 in x 4.1 in x 1.2 in  
(190.5 mm x 104.14 mm x 30.48 mm )

### Output:

Liquid level height in inches or in millimeters. (Note: If % volume output is desired, the read-out can be pre-programmed for a specific tank set of dimensions.)  
Temperature can be displayed either in Fahrenheit or in Centigrade.

### Digital Output:

Serial Communication (Rx/Tx, 3.8V)  
16-character LCD display.

### Power Supply:

4 AA Alkaline batteries

### Power Consumption:

Active (HV pulse 200V, display off): 80mA;

Active (HV pulse 200V, display on): 85mA;

Standby (display off): <100μA;

Standby (display on): <5mA.