

## Model ULTM Ultrasonic Level Transmitter

### Specifications - Installation and Operating Instructions



**Mercoid** Series ULTM  
Ultrasonic Level Transmitter Model

Model No. 41-87-7C-1V	FCC
Serial No. 45200	Temperature Rating: -4°F To 130°F
Part No. 25242	Power Supply: 5-32 VDC
S.C. 21-359	Reference: 11/11/12

LB0001

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- Series ULTM must be installed, connected and operated in accordance with the instructions of this manual and with the Series ULTM certifications. Specific local regulations may also apply.
- Do not open or disassemble Series ULTM except as required for electrical connections.
- Any type of modifications and repairs are permissible only upon the manufacturer or re-seller written approval and by pre-qualified personnel. Never reuse defective parts.

## Chapter 1: Introduction

### 1. Description

Series ULTM is an ultrasonic level meter with integrated GSM cellular modem and USB interface. Optional items include external temperature sensor and programmable timer switch.

Series ULTM measures distance for targets such as liquid or solids. Measurement is continuous and does not require contact with the target. The system can accurately measure steady or agitated target surfaces. The system can also rapidly track filling and emptying of vessels. The system measurement distance spans 5.9 in (15 cm) to 26 ft (8 m). In addition to distance, the ULTM can also measure temperature of the environment.

Series ULTM makes use of the measured distance to calculate additional information such as target level and volume.

Series ULTM operates at an ultrasonic frequency of 75 kHz, making it perfect for noisy conditions. The sensor is made of PVDF, therefore providing good chemical resistance to corrosive targets.

Series ULTM may be used with 8 to 33 VDC power. The low power mode is available for use with batteries and is supported using a Programmable Timer Switch (PTS).

Series ULTM is equipped with a large graphic display and keypad allowing a simple wizard-driven setup of the system. The keypad and display allow configuration of many ULTM configuration parameters. Complete setup of all ULTM parameters can be executed using a USB equipped PC or laptop. This method of configuration allows for rapid cloning of multiple ULTM systems.

Series ULTM transmits measurement information to a predefined destination – (either cellular phone or cellular PC modem) via SMS with user-programmable reporting intervals. The system also identifies and sends an alert in boundary events such as full and empty situations. The system can also be programmed to identify or alert for rapid changes of level, indicating theft and refuel quantities. The system can also transmit on/off contact state information.

This user manual is intended for users and operators of Series ULTM. The manual covers system description, installation, operation and troubleshooting for the Series ULTM.

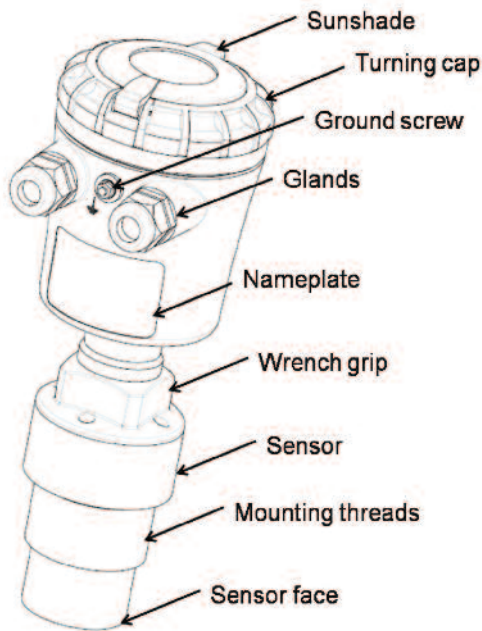


Figure 1: Series ULTM Parts.

## SPECIFICATIONS

### Measuring range

Maximum Range for Liquids: 26.25' (8 m);  
Maximum Range for Solids: 19.69' (6 m).

### Accuracy – Precision – Resolution -Tracking

Accuracy:

- 15 cm < range < 60 cm: 0.59" (1.5 mm);
- 60 cm < range < 5 m: 0.3% of measured range;
- 5 m < range < 8 m: 0.2% of maximum range.

Repeatability: 0.2% of measured range.

Display Resolution: 0.04" (1 mm).

SMS Resolution: 0.04" (1 mm).

Max Tracking Rate: 0.55 ft/sec (10 m/min).

Beam Angle: 5° @ 3 dB point.

### Electrical Specifications

Power Supply: 8 to 33 VDC on ULTM ports.

Low Power Mode: Programmable sleep mode.

Current Consumption @ 24 VDC:

Continuous: Less than 10 mA;

During SMS transmission: Less than 40 mA;

Short spikes at switch and SMS: Less than 160 mA.

Data Interface: Serial COM over USB at 115,200 bps.

USB Port: Firmware upgrade.

Display: 64X128 graphic LCD, viewing size 50X25 mm<sup>2</sup>.

### Cellular Modem Specifications

Band: Quad band 850/900/1800/1900 mHz.

Output Power: Class 4 (33dBm) for EGSM850/EGSM900.

Class 1 (30dBm) for GSM1800/GSM1900.

SMS: Point-to-point MO and MT.

GPRS: Multi-slot class 10.

### Reports

Displayed: Level and percentage level;

Distance and percentage distance;

Volume;

Temperature (internal and external);

Echo strength;

Global operating hours;

Resettable operating hours.

Data Sent by SMS: Level, distance, volume, temperature, status.

Alerts Sent by SMS: Full, empty, over consumption, refill, custom.

### Temperature Characteristics

Operational Temperature Range: -4 to 158°F (-20°C to 70°C).

Temperature Sensors: Internal and optional external.

Temperature Compensation: Built-in based on internal sensor, external sensor or average of the two.

Temperature Display: Internal and external temperature; Instantaneous and recorded high/low.

### Mechanical Specifications

Enclosure Material: Plastic PC/ABS+UV.

Sensor Material: PVDF.

Sealing Rating: IP65/IP67; IP68 - 96 hours at 5.91' (1.8 m) depth in water.

Mounting Orientation: Vertical.

Mounting Threads: 1.5" BSP or 1.5" NPT.

Cable Entries: Conduit 1/2" NPT.

Weight: 1.95 lb (884.51 g).

\*To measure external temperature, contact factory for ULTM-EXT for external temperature sensor.

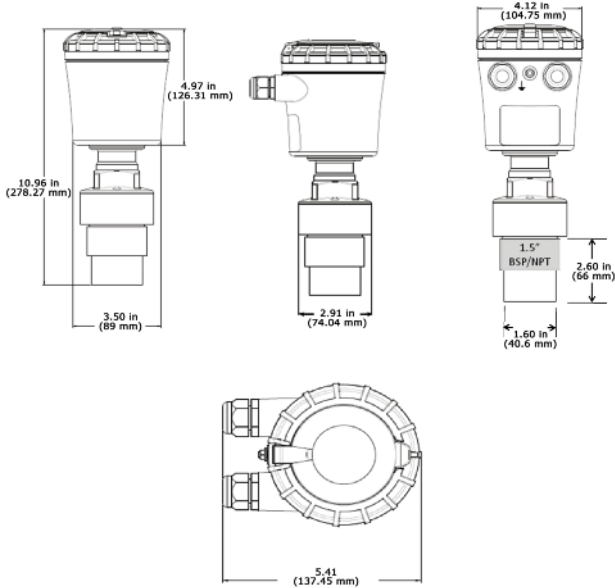


Figure 2: Series ULTM Dimensions.

## Chapter 2. Physical and Electrical Installation Guidelines

This chapter is a list of guidelines for proper physical installation of the Series ULTM on tanks, including electrical connections. In the final section of this chapter, there is a short and concise list of instructions—the “Must-Be pamphlet”. Always ensure that the Series ULTM is installed in an area that meets the stated ratings of this product including temperature and technical specifications.

### 1. Physical Guidelines

- ULTM systems are installed above the target (e.g. water, fuel) being measured and should not make contact with the target at any time. Typically, the unit is installed on top of a tank through a hole on the roof of the tank. In outdoor applications, the ULTM may be attached to a metal arm extending above the target attached nearby.
- Series ULTM should be located as far as possible from vertical tank walls and from other physical obstructions such as filling inlets. Keep a minimum gap of: 12 in (30 cm) plus 4 in (10 cm) for each 3.3 ft (1 m) of measurement range.
- For best results, place the unit away from sources of acoustic noise or sources of vibrations.

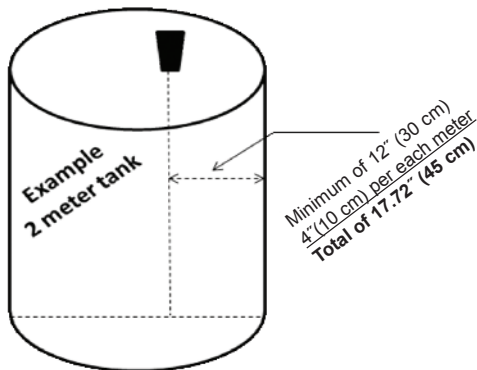


Figure 3: Minimum Gap.

- Series ULTM should be perpendicular to the surface of a liquid target. The angular displacement should be less than 5° from the vertical axis.

- Proper physical installation is accompanied by software setup. Setup includes defining parameters such as tank height, and may include additional parameters such as Near Blocking Distance (NBD), Far Blocking Distance (FBD), False echo scan and more. For additional information refer to the section in Chapter 8 reference guide: “Application Dimensions and Constraints” (p.14).

### 2. Tank Fitting

Series ULTM is equipped with a 1.5” BSP or 1.5” NPT thread allowing for two fitting options: direct fitting in a threaded flange, or fastened with a 1.5” BSP / 1.5” NPT nut through a thread-free flange.

For outdoor installations, use a stable arm and firmly attach the sensor to the arm using a through-hole and threaded nut. Alternatively, it may be possible to attach the sensor to a threaded hole which is built-in the arm.

Always verify thread compatibility between the Series ULTM and flange or nut. Do not use excessive force when using threads. Preferably, tighten by hand only. If a wrench is used, grip Series ULTM at the wrench grip surfaces only (see Figure 1 Series ULTM parts) and exert light force.

### 3. Dead Zone

Refer to Chapter 8 reference guide: “Application Dimensions and Constraints” (p.14). A gap must be kept between the face of sensor and the topmost level of the target. This gap must be at least the size of the specified “dead zone”. If the target level passes the dead zone, measurements may be unpredictable. Therefore, it is recommended to keep a marginal gap between the expected topmost level and the dead zone border. In the case where the top most level is too close to the tank roof, an extension pipe is required for the installation of the unit as described below.

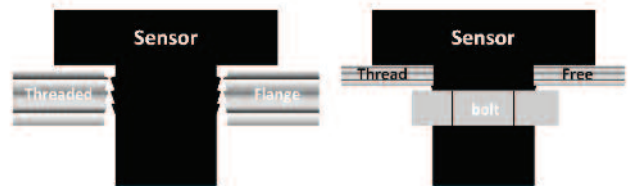


Figure 4: Threaded Flange (left) Thread-Free Flange (right).

### 4. Extension Pipe

Refer to Chapter 8 reference guide: “Application Dimensions and Constraints” (p.14). An extension pipe is required for installation where the top most target level is too close to the roof of the tank. In such cases, an extension pipe is installed on the tank and the sensor is installed on top of the extension pipe at a safe distance from the top most level of the target. The lower border of the dead zone may fall inside the tank as seen in the right hand side of the figure below. In this case no further software settings are required. The lower border of the dead zone may also fall within the extension pipe as described in the left hand side of the figure below. In such cases, the Near Blocking Distance (NBD) should be configured in the software.

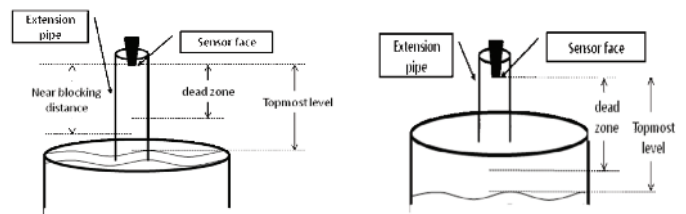


Figure 5: Possible Extension Pipe Fittings.

A typical structure of an extension pipe is shown in Figure 6 below. Closely follow these guidelines when using an extension pipe:

- Internal pipe diameter should be at least 3" (7.62 cm) wide.
- The diameter of the hole on the flange or tank should not be smaller than the pipe diameter.
- Pipe length (measured from sensor face) should be no longer than 20" (50 cm).
- The pipe should not protrude into the tank.
- Pipe should be exactly perpendicular to the surface of the target.
- Sensor must be located at the center of the pipe.
- Pipe should have a smooth interior surface.
- The hole in the flange or tank should have a smooth edge and welding spots must be avoided.

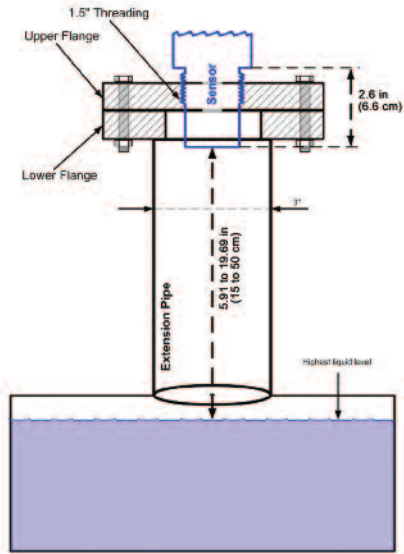


Figure 6: Possible Extension Pipe Fittings.

**5. Temperature Considerations and Temperature Sensors**

Also refer to Chapter 8 reference guide: "Temperature Sensors, Units and Display" (p.17).

When using an external temperature sensor, place the sensor at a location that best represents temperature of the air between the sensor face and the target. Connect the sensor internally as described in the electrical connection section to the Thermistor pins. External temperature sensors may be ordered from the manufacturer or may be purchased independently. Use Thermistor NTC 10 K  $\Omega$  5% (minimum), ULTM-EXT or equivalent.

When using the internal temperature sensor, avoid situations where the Series ULTM is exposed to different thermal conditions other than its environment, such as direct sunlight. Direct sunlight may overheat the system and cause measurement inaccuracies, measurement variations in time, and even failure of the system in extreme cases. If the Series ULTM is exposed to direct sunlight, construct a local sunshade ("umbrella") over the ULTM.

In areas of large temperature variations, take into consideration volume changes of the target due to temperature expansion.

**6. Electrical Connections**

Carefully follow these steps when connecting a power supply to the Series ULTM. Power supply must fulfill the proper rating requirements as defined in the specifications chapter above.

- 6.1 Turn off Series ULTM.
- 6.2 Turn the ULTM top cap counter-clockwise and expose the electrical connections board. Identify the elements as shown in the following figure.

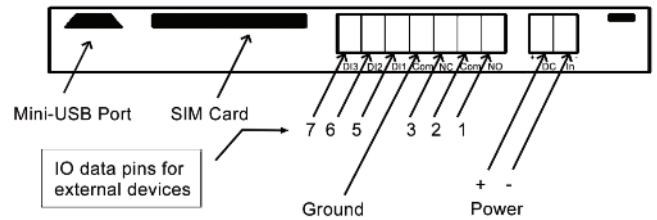


Figure 7: Electrical Connections.

- \*GROUND (Pin 4) is a ground and not a common.
- \*Pins 1-3 are not used on this device.

- 6.3 Insert power cables into the Series ULTM through one of the glands. Ensure that high voltage sources or cables are at least 3.28' (1 m) away from Series ULTM and cables. Keep the electrical supply lines away from electromagnetic interference sources. When inserting a cable through the gland, use round cables with a minimum diameter of 0.24" (6 mm) to ensure that the unit remains sealed to IP67 rating. Connector terminals may be pulled up for easy wire connection and then re-inserted back again.
- 6.4 Connect the power cables to the appropriate terminals. Note: The Series ULTM operates from a DC power supply of 8 to 33 VDC. Always make sure that sufficient voltage is present on the Series ULTM power terminals, disregarding of any voltage drop along the supply lines.
- 6.5 When using an external temperature sensor or ULTM-EXT, connect the thermistor to data pins 6 and 7. \*Do not wire ULTM-PTS and ULTM-EXT at the same time.
- 6.6 When using an external Programmable Timer Switch ULTM-PTS, connect the switch to pins 6 and 7.
- 6.7 When using a contact alert, connect short/open between pins 5 and 4 (ground). See the section about contact alerts in the Chapter 8 reference guide.
- 6.8 The mini-USB port is a USB device-side supporting virtual COM ports. The port may be used for firmware upgrades, field monitoring and remote setup. Details about firmware upgrade are provided in the Chapter 5: Firmware Updates (p.12).

**7. Low Power Mode and Programmable/Timer Switch (PTS), ULTM-PTS**

Series ULTM supports low power mode for extended external battery lifetime. This mode of operation requires the external Programmable Timer Switch (PTS) ULTM-PTS to be connected between Series ULTM and battery.

PTS connections:

- First connect the 5-wire cable from the ULTM-PTS to Series ULTM through one of the glands.
  - Connect the Brown (+) wire to the power plus (+) on Series ULTM.
  - Connect the Yellow (-) wire to the power minus (-) on Series ULTM.
  - Connect the White wire to pin 6 on the electrical port panel (see Figure 7 above).
  - Connect the Green wire to pin 7 on the electrical port panel.
  - Connect the Blue (ground) wire to the ground port on Series ULTM.
- Then connect the 3-wire cable from the ULTM-PTS to the battery.
  - Connect the Brown (+) wire to the battery plus (+).
  - Connect the Yellow (-) wire to the battery minus (-).
  - Connect the Blue wire to a local ground at or nearby the battery.

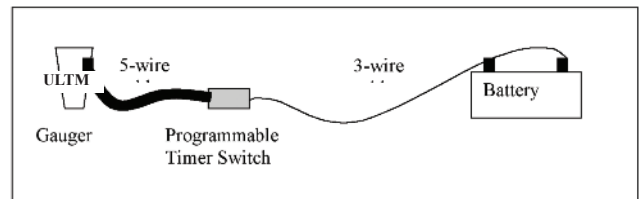


Figure 8: Programmable Timer Switch Connections.

See PTS software configuration in Chapter 8: Reference Guide.

## 8. SIM Card\*

A Mini-SIM card must be inserted in the Series ULTM to allow use of the cellular feature. Never insert or take out a SIM card when Series ULTM power is on. Follow these instructions regarding your SIM card:

- 8.1 The SIM card must support SMS services with your local cellular operator. You do not need any voice or browser capabilities in your cellular service. Depending on your cellular operator – you might be required to use a USIM card.
- 8.2 Deactivate the SIM PIN code if the PIN code is active before inserting in the ULTM. Deactivation is preformed by inserting the SIM card into a cellular phone and following the instructions of the phone manufacturer. PIN code configuration is usually found in your phone Settings – Security Settings – PIN Code Request or similar.
- 8.3 Always test your SIM card before inserting into Series ULTM. Test the SIM card by inserting the card into a cellular phone and sending an SMS. Verify that no PIN code is required, that the proper operator serves the cellular link and that the SMS reaches its destination.
- 8.4 Turn off Series ULTM. Turn the Series ULTM top cap counter-clockwise and expose the electrical connections board. Insert the SIM card into the proper slot as described in the following figure. The SIM may be pulled out by pressing it downward again. Insert as shown in Figure 9 below.

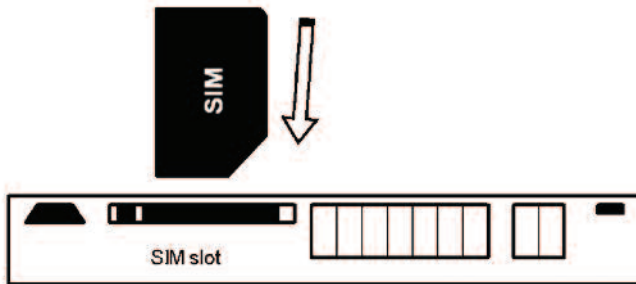


Figure 9: SIM Card.

- 8.5 Aim Series ULTM to proper target (e.g. floor), turn on Series ULTM and closely observe the lower status line on the display (status lines are explained in the Operating Instructions Chapter 3- Measurement Screen sub-chapter).

You should observe the report “GSM Initializing” for 30 to 60 seconds. Then you should observe several additional status reports including “GSM Active”. This indicates proper SIM card operation.

\*Series ULTM only supports AT&T and T-Mobile mini-SIM cards. Make sure unit will work with carrier.

## 9. Must Be Pamphlet

1. Choosing Location		
Distance to Tank Walls	<b>MUST BE</b>	At least 11.81” (30 cm) from walls +3.94/39.37” (+10 cm /1 m) range.
Flange	<b>MUST BE</b>	Fixed on a horizontal surface.
Acoustic Noises	<b>MUST BE</b>	Far away from acoustic noises and vibrations.
Electrical Interference	<b>MUST BE</b>	Shielded away from power and sensor cables.
Tank Installation	<b>MUST BE</b>	Far away from tank inlets, outlets, physical obstacles.
Sensor	<b>MUST BE</b>	Exactly perpendicular to the surface of the target.
External Thermistor	<b>MUST BE</b>	In shaded location, attached to the tank body.
2. Handling Dead Zone		
Extension Pipes (1)	<b>MUST BE</b>	Of at least 3” (7.62 cm) internal diameter and 5.91” (15 cm) above target (from sensor face).
Extension Pipes (2)	<b>MUST BE</b>	With completely smooth interior surface.
Extension Pipes (3)	<b>MUST BE</b>	Installed with a flange/not protruding into the tank.
3. Power Source		
Voltage	<b>MUST BE</b>	At least 8 VDC on unit terminals.
Battery (Internal/External)	<b>MUST BE</b>	Rated higher than 8 VDC due to voltage drop.
Ripple and Noise	<b>MUST BE</b>	Not exceeding 100 mV.
Type	<b>MUST BE</b>	Preferably regulated switching power supply.
USB Power Source	<b>MUST BE</b>	Accompanied by power source for field operations.
4. Cellular Communications		
SIM Card with SMS Service	<b>MUST BE</b>	Inserted in the SIM card slot.
Destination Phone Number	<b>MUST BE</b>	Set and formatted correctly.
SMS Alerts	<b>MUST BE</b>	Defined using correct limits.
5. Measurement Configuration		
Full/Empty, Level/Distance	<b>MUST BE</b>	Configured correctly.
Filling Rate	<b>MUST BE</b>	Defined (consider the application).
False Echo Scan	<b>MUST BE</b>	Executed when the tank is empty.
Near Blocking Distance (NBD)	<b>MUST BE</b>	Set up in flange and extension pipe installations.

### Chapter 3. Operating Instructions

This chapter describes the keypad and display of the Series ULTM. The keypad and display add the following functionality to Series ULTM:

- Viewing measurement results and viewing information related to the system
- Configuring Series ULTM

This chapter focuses on the structure and operation of the keypad and display. Configuration of the system via a PC is described in following chapters. Expose the keypad by turning the cap counterclockwise all the way.

#### 1. Keypad

##### 1.1 Navigation Keys

Use the navigation keys to scroll through the display.

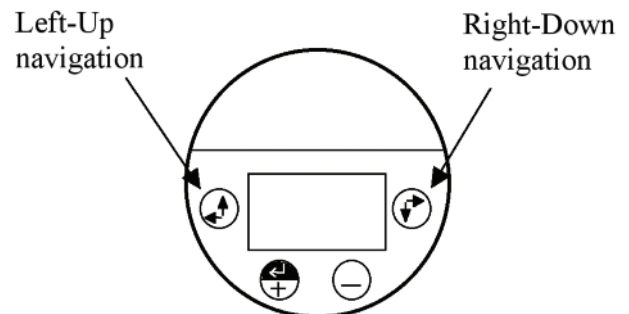


Figure 10: Navigation Keys.

**1.2 Execution Keys**

Use the execution keys to change a digit or to execute a command (Back, Next or Sub-menu).  
 To change a digit: navigate to the digit and press the plus (+) key or the minus (-) key.  
 To execute a command: navigate to the command and press the enter (+) key.  
 Remember—some changes are saved only after returning to the measurement screen. If you shut down Series ULTM before you return to the measurement screen, your changes may be lost.

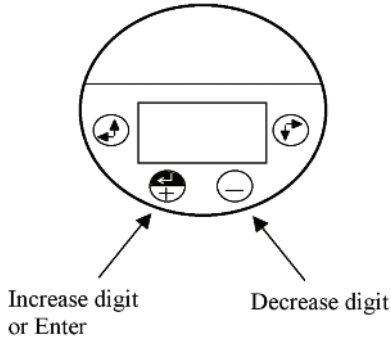


Figure 11: Execution Keys.

**2. Navigation Through Menus**

Series ULTM supports two menu styles that are used throughout the setup operations and are described below. False echo scan employs a third menu style and is described in the relevant section below.

**2.1 Sub-Menu Style**

The Sub-Menu style presents a list of vertical choices. An arrow may appear on the right hand side of the screen if additional items can be reached when scrolling down. The scrolling is cyclic, meaning that when you reach the last (first) item, the next step will lead you to the first (last) item. Scroll up or down, using the navigation keys, to your selected choice and press Enter (+). This action will lead you to the next sub-menu.  
 The last item in the list of choices is **\*\*back\*\***. Select **\*\*back\*\*** to return to the previous menu. The previous menu will be displayed such that your last selection will appear first on the menu. For example:

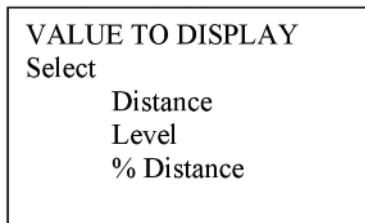


Figure 12: Sub Menu Screens.

**2.2 Numeric Menu Style**

The numeric menu style presents you with a multi-digit number which may be modified. Navigate to each digit and modify the digit as required by using the plus (+) or minus (-) keys.

When you are done with all digits, select Next to move on. Select Back to ignore the changes and return to the previous sub-menu. Modifications will become permanent (survive a reset) when you navigate back to the measurement screen. For example:

By repeatedly pressing the Right-Down navigation key, you will follow this route:

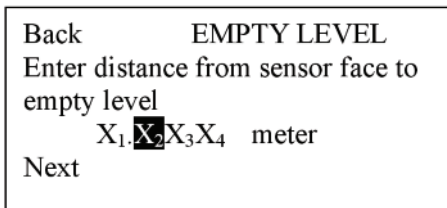


Figure 13: Numeric Menu.

X1 → X2 → X3 → X4 → Next → Back → X1 → X2 → ...

Conversely, by repeatedly pressing the Left-Up navigation key, you will follow the opposite route.

After pressing Next, ULTM will check the validity of your numerical entry. If your entry is outside the acceptable boundaries, an ILLEGAL VALUE screen will be presented. You need to press any key to return to the previous screen. A default value will replace your wrong entry. If so needed, modify the numerical entry and press Next again.  
 The top line presents the current measurement information.

**2.3. Menu and Sub-Menu Organization**

ULTM menus and submenus are organized in a tree-like format. The organization is described in the following figure:



Figure 14: Menu and Sub-Menu Organization.

**3 Measurement Screen**

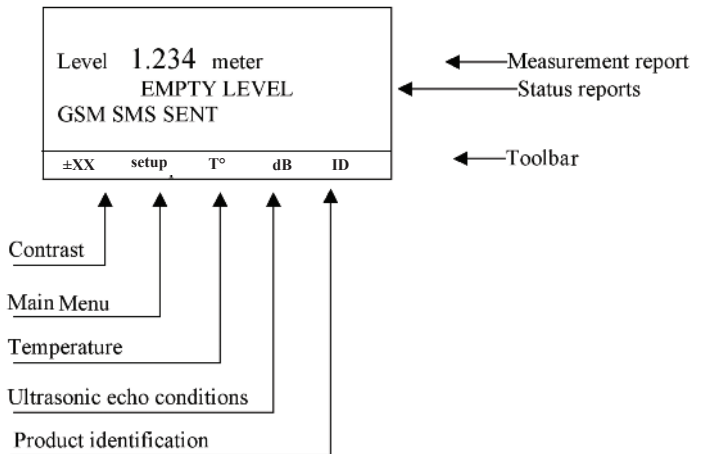


Figure 15: Measurement Screen.

**3.1 Status Reports**

Status reports appear beneath the measurement result. On the first line, reports related to ultrasonic monitoring issues are presented. On the next line, cellular communication related reports are displayed. Ultrasonic reports include messages such as: FULL LEVEL, EMPTY LEVEL, ECHO SEARCH, THEFT, START FILL, END FILL and others. Cellular related reports include messages such as SMS SENT, SMS ACTIVE, REGISTRATION FAILED and more.

The bottom line on the screen presents a toolbar with choices. Navigate through the toolbar and select an action or report. ULTM halts any operations (including measurements) during navigation. ULTM will automatically resume operations 30 seconds after last key has been pressed.

**3.2 Contrast**

Press the plus (+) or minus (-) keys to change visual contrast of the display.

**3.3 Main Menu / Setup**

Navigate to setup and press Enter (+) to configure ULTM. The actual configuration process is explained in a following chapter.

### 3.4 Temperature Readings

Navigate to the T° symbol on the toolbar and press Enter (+). The following table will be displayed:

The table is explained in the Chapter 8 reference guide section: "Temperature Sensors, Units and Display" (p.17). Press reset to reset recorded high / low temperatures, or press done to return to the measurement screen.

Sens:	Cur	High	Low
Int	29.5	31.0	26
Ext	29.4	32	23.3
Reset		Done	

Figure 16: Temperature Readings.

### 3.5 Ultrasonic Echo Conditions

Navigate to the dB symbol and press enter (+). You will be presented with the measured echo amplitude and the maximum amplitude available. The amplitudes are presented in dB relative to a system threshold amplitude. Echo amplitude should be above threshold amplitude for reliable measurement. Echo strength between 3 dB and 8 dB (maximum) is reliable. Echo amplitude refers to the echo measured just prior to navigating through the toolbar. Press done to return to the measurement screen.

### 3.6 Product Identification Details

From the measurement screen, navigate to the ID symbol on the toolbar and press Enter (+). Product information will be displayed: serial number and part number. Press Back to return to the measurement screen or navigate to one of the options: Software Information (SW), Hardware Information (HW), or Manufacturing Date Information (Date). SW screen will display firmware versions of the embedded application and of the embedded boot-loader. Press Back to return to the previous menu. HW screen will display product information regarding sensor type and model type. Press Back to return to the previous menu. Date screen will present the date of manufacturing. Press Back to return to the previous menu.

### 4. Quick Setup

Set ULTM for operation by a quick 7-step wizard-driven procedure using the basic menu option.

**Note:** Configuration using the display and keypad supports metric units only. For English units, use the PC configuration method as described in the Chapter 5 describing Configuration with a PC (p.9).

- Turn on ULTM and wait for the measurement screen to show up. Navigate through the toolbar and select setup.
- Scroll and select Basic Setup from the Main Menu.
- Scroll and select application (Low power or High power). For additional details about the application type refer to the reference guide under Chapter 8: "Application Type" (p.15).
- Determine distance to empty level. For additional details about the empty level, see the reference guide section Chapter 8: "Application Dimensions and Constraints" (p.14). When you are done press Done.
- Determine distance to the full level. For additional details about the full level, see the reference guide section Chapter 8: "Application Dimensions and Constraints" (p.14). When you are done press Done.
- Scroll and select value to display. For additional details about value-to-display, see the reference guide section: Chapter 8: "Distance Units and Value to Display" (p.15).
- Skip or perform false echo search. See the section "False Echo Scan" in Chapter 8, the reference guide chapter (p.16).

### 5. False Echo Scan

Perform a false echo scan when obstructions are nearby the target or sensor. Preferably, false echo scan should be performed when the tank is empty. If you choose to perform false echo scan, wait for about a minute and then you will be presented with a list of echoes.

False Echo Select		1
1	0.17 ✓	1408
2	New 0.25	1207
Save		Next

Figure 17: False Echo Scan Screen.

Scroll through the listed echoes and press Enter (+) on each echo you would like to ignore during measurement. Each such echo will be designated by a ✓ sign. The number of selected echoes is presented on the top-right edge of the screen. Press Save to store your selection and Next to proceed to the next sub-menu. To un-

select an echo, scroll to that echo and press Enter (+) again. If you choose to perform false echo scan a second time, new echoes which were not identified during the first scan will be reported as "new".

The ULTM is now ready for measurements.

Parameters which are not determined during quick setup procedure will take their default value and may be modified later using the Advanced Setup menu.

**Note:** Always verify then re-verify that your basic settings are correct including distance to empty level, distance to full level, level or distance choice. Most wrong readings originate from incorrect basic setup.

### 6. Advanced Settings

ULTM supports a set of advanced settings. These settings are classified under three categories: GSM, Algorithm and Device state. The following items may be modified under each category:

Category	Sub Menu Items	See Section in Chapter 8 Reference Guide...	Notes
<b>GSM</b>			
	Destination phone number	"Destination Phone Number"	
	Reporting interval	"GSM reporting Interval"	1-Enable 0-Disable
	Full and empty alerts		
	Theft/Refill alerts active once value is set for rate and level	"Theft Alerts" "Refill Alerts"	1-Enable 0-Disable
<b>Algorithm</b>			
	Far blocking distance	"Application Dimensions & Constraints"	
	Near blocking distance	"Application Dimensions & Constraints"	
	Filling rate	"Filling Rate"	
	Temperature units	"Temperature Sensors, Units and Display"	
<b>Device state</b>			
	Reset to defaults	"Reset and Operating Hours"	
	Operating hours	"Reset and Operating Hours"	

To execute any of the advanced settings, follow these steps: Turn ON ULTM and wait for the Measurement screen to show up. Navigate and select Setup. Then scroll and select Advanced Setup from the Main Menu. Now select the required category (GSM, Algorithm or Device state) and follow the screen instructions. When done, scroll and press \*\*back\*\* to return to the Main Menu, then scroll and select the measurement display.

Each item may either present a selection of sub-items to choose from or may require entry of a numeric field.

If you are not sure what sub-item to select or how the numeric field should be modified, leave the default values as is.

### 7. Settings Available in PC Configuration Only

Some advanced settings are available in a PC configuration only and cannot be configured with the display/keypad. These settings are defined in the following table.

Setting	Options	PC Command
Units	Meter, feet, liter, gallon	UNT
Value to Display	Volume	VAL
USB Monitoring	Enable and disable	ENDT, DSDT
Tank Shape and Dimensions	Cubic, cylindrical	CUB, CYLV, CYLH
Theft and Refill Alerts for Volume		ATF, ARF
Programmable Timer Switch	Level and duration	LPST



## Chapter 4. Configuration with a PC

### 1. Introduction

ULTM is pre-configured at the factory to default settings. See reference guide section in Chapter 8: "Default Values" (p.15). The system is delivered to the user ready for operation. Some configuration parameters should be re-configured by the user for proper field application. ULTM can be configured by a simple PC tool.

Configuration by PC may be used in lieu of configuring with the integral keypad and display. PC configuration provides the user with the full set of configuration items. Furthermore, configuration by PC allows the user to clone fielded ULTM systems. For this cloning process, the user is required to prepare one text file and download that file into all relevant ULTM systems. Once this configuration file is prepared, the downloading process takes a few seconds and makes redundant any manual keypad based operation.

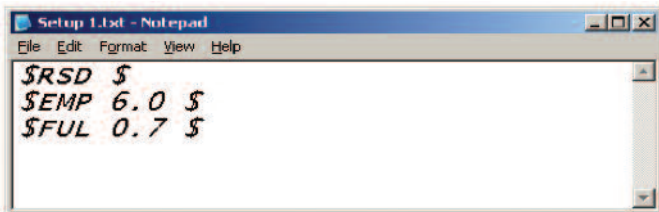
Section 2 below begins by demonstrating a sample configuration text file.

Section 3 handles the downloading operation. The download process involves use of a standard Windows application – HyperTerminal. The setup of HyperTerminal is explained in the second section, and parts of it may be skipped by those who are already familiar with this tool. Section 4 presents possible responses from ULTM—whether good or erroneous responses. Section 5 is a list of all configuration items. Section 6 provides some configuration file example.

### 2. Preparing a Configuration Text File

#### 2.1 A Simple Sample File

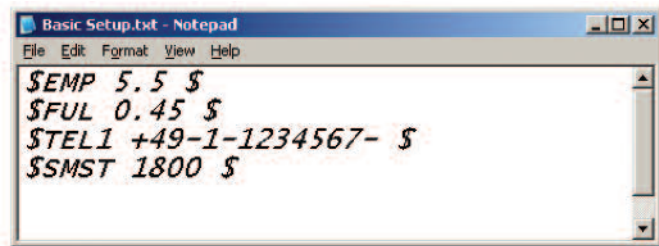
The following text file was created using Windows Notepad application and demonstrates the essence of the configuration file:



Digest:

- The first line resets ULTM to its default values.
- The second line instructs ULTM to set its EMPTY LEVEL to a distance of 6.0 meters.
- The third line instructs ULTM to set its FULL LEVEL to a distance of 0.70 meters.

If you are unfamiliar with terms such as empty level or full level, read reference guide section Chapter 8: "Application Dimensions and Constraints" (p.14). Next is a slightly more complex configuration file:



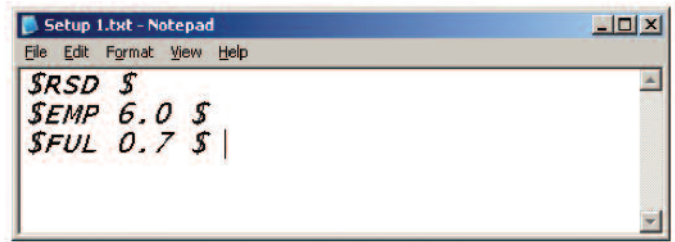
Digest:

- The first line instructs ULTM to set its EMPTY LEVEL to a distance of 18 ft (5.5 m).
- The second line instructs ULTM to set its FULL LEVEL to a distance of 1.5 ft (0.45 m).
- The third line instructs ULTM to set up the destination phone number to +49-1-1234567 (10 digits only).
- The fourth and last line instructs ULTM to set up SMS interval time to 1800 seconds.
- Each instruction is implemented as a specific command such as EMP or FUL.

Notes:

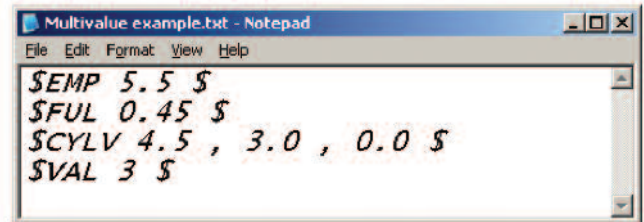
- Each line begins, and ends, with a \$ sign.
- All commands are made of capital letters.
- Each command is immediately adjacent to the first \$ sign.
- There is a blank between the command and the related parameter.
- There is a blank between the parameter and the ending \$ sign.
- **Do not forget** to press Enter after the last line.

The next example looks fine but the Enter button was not pressed. This will cause an error.



#### 2.2 Multi Value Commands

Some configuration items are assembled from two values or more. For example, the dimensions of a vertical cylindrical tank (prefix CYLV) are height and diameter. These two values are both included with a comma between the two values. The next figure illustrates the use of the comma.



The third line instructs ULTM to set the tank as a vertical cylindrical tank with height of 4.5 meter and diameter of 3.00 meters. The last item instructs ULTM to display volume results (rather than level or distance). The comma should always separate between values.

### 3. Download Operation

#### 3.1 General Procedure

ULTM can be configured by downloading the text configuration file from your PC into ULTM. The previous chapter described the making of the configuration file. This chapter describes the download procedure. The download process can be preformed using HyperTerminal – a Microsoft® standard application which is part of most operating systems such as Windows XP®.

Prior to using the HyperTerminal, you must connect ULTM to the PC and install a USB-Serial driver on the PC. You can do that by following the instructions in the Chapter 8: "USB driver installation on a PC" (p.13).

You should find out the COM port number that ULTM is using on the PC. ULTM must be in the measurement screen during download procedure. Two PC applications trying to access ULTM will conflict with each other. Avoid having two such applications running at the same time.

#### 3.2 Launching and Setting Up HyperTerminal

This section assumes you are using Windows XP®. Similar procedures apply to other operating systems.

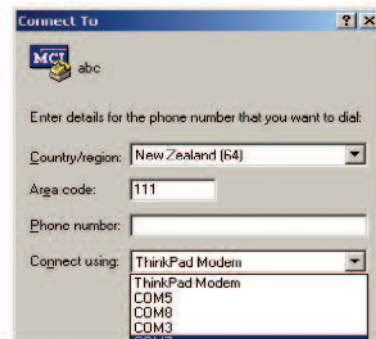
3.2.1 Go to Start Menu and then Open Programs.

3.2.2 Open Accessories, then Open Communications then Open HyperTerminal.

3.2.3 Press NO when asked about "default telnet program".

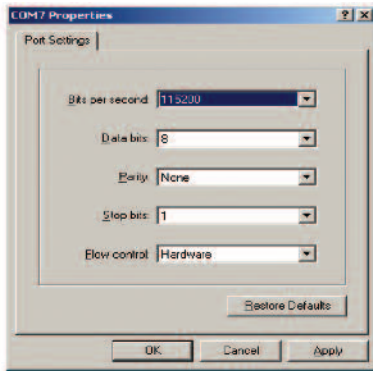
3.2.4 When prompt for a name, choose any name and press OK.

3.2.5 In the next window "Connect to", select the COM port that you intend to use for ULTM. This part is described in the next figure:

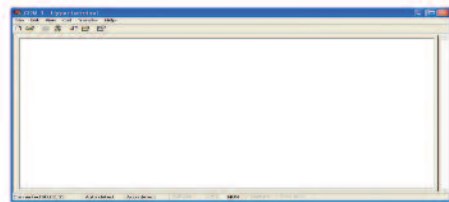


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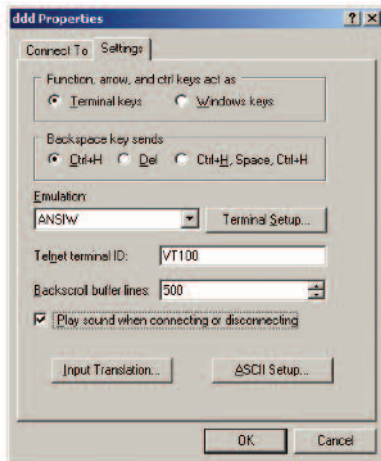
3.2.6 In the next window "COM properties - port settings", set the parameters as described below:



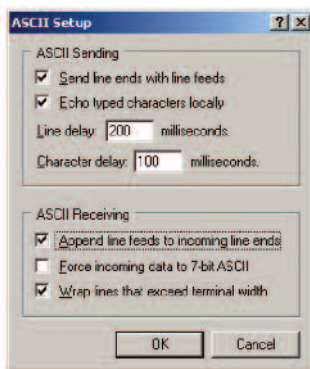
3.2.7 Now you should see the HyperTerminal screen:



3.2.8 Select the File tab (on the top left side) and choose Properties, then Settings, and set the parameters as described below:



3.2.9 Now press on ASCII setup (bottom right side) and set the parameters as described below:



Especially note the "Line Delay" and the "Character Delay", which are not the default values of HyperTerminal.

**Note:** When using the USB port for local serial data monitoring (see appropriate chapter), you should return to the default values of the screen above and specifically uncheck "Append Line Feeds to Incoming Line Ends". And vice versa, if you revert to configuration of ULTM through the USB interface, make sure to set the parameters of the screen above correctly.

3.2.10 Press OK and then OK again – you are all set to configure ULTM.

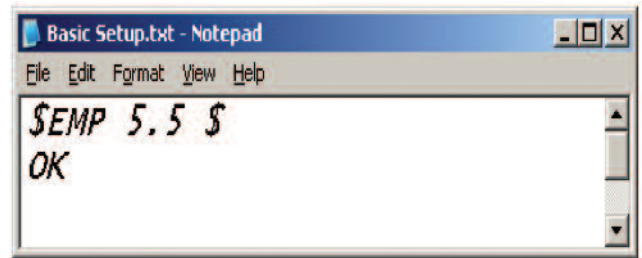
### 3.3 Downloading a Configuration File

- 3.3.1 From the HyperTerminal screen select transfer (top right side tab) and then select "Send File".
- 3.3.2 Browse to the directory where you stored the configuration text file (the one you prepared in the previous section) and select that file. Double click on the file to transmit it.
- 3.3.3 Alternatively, you can key each configuration item line by line directly from the HyperTerminal screen. As a quick test of this configuration, key the following command:  
\$VAL 1 \$  
Watch ULTM integral display and verify that measured data is level.  
Now key the following command:  
\$VAL 2 \$  
Watch ULTM integral display and verify that measured data is distance.

## 4. Responses from Series ULTM

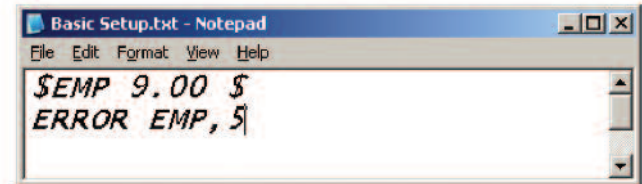
### 4.1 Good Response

ULTM should reply with an OK response to each configuration item:



### 4.2 Erroneous Responses

ULTM will reply with an ERROR or NOTE response to a wrong configuration item. For example:



The ERROR or NOTE response will be followed by the causing item (in this case EMP) and is accompanied by an error number (5 in this case). Possible error codes are listed in the following table:

Error Code	Most probable cause
1, 2	Configuration item is too long
3	\$ sign is probably missing
4	Wrong command name or command not adjacent to \$ sign
5	Value is exceeds upper legal limit
6	Value is below lower legal limit
7	Value is illegal
8	(NOTE) Command was already sent
9	(NOTE) Value is below minimum value and redefined to minimum value

### 4.3 Communication Errors

The erroneous responses described indicate that the link between PC and ULTM is operating fine and that the commands are of wrong nature.

If no responses are received from ULTM, or if the responses carry unfamiliar characters, the communication link between the PC and ULTM is not performing. In this case, you need to check the physical cabling, verify the HyperTerminal settings and then restart this application again.

## 5. Reference Guide for Configuration from a PC

### 5.1 List of Configuration Items

The following conventions apply for the list of commands. These conventions refer to the values allowed for each parameter.

#### 5.1.1 Range of Number Values

A range of number values is presented with a hyphen. For example: 0.150-8.000. This entry means that the value may be any number between 0.150 and 8.000. Always use the decimal point. The number of decimal digits may be less than three.

### 5.1.2 Range of Whole Number Values

A range of whole number values is presented with a hyphen. For example: 1 - 99. This entry means that the value may be any whole number between 1 and 99.

### 5.1.3 Several Distinct Values

When a parameter can be one of a few distinct values, each value is listed on separate lines with an explanation. For example:

Command	Command Description	Possible Values	Value Description
VAL (3)	Value to display	1	Level
		2	Distance
		3	Volume (set also tank shape)

### 5.1.4 Two Parameters for the Same Command

An entry such as **1-9999, 0.150-8.000** means that the command is made of two parameters and requires two values. A comma separates the two values. In this example the first value may be any whole number between 1 and 9999. The second value may be any number between 0.150 and 8.000.

### 5.1.5 Two Parameters with One Parameter Fixed

An entry such as **1-99, 0** means that the configuration item requires two values, but the second value must be 0. The first value in this example may be any whole number between 1 and 99.

The user may select one of two units systems: Metric or English. A separate command list is provided below for each unit system. The user can select their preferred unit system with the UNT command.

## 5.2 List for Metric Unit System

Item	Description	Possible values	Value description
<b>Basic Setup (Metric)</b>			
APP (1)	Application type	0 1	High power Low power
EMP (2)	Empty level	0.150 – 8.000	Distance in meters
FUL (2)	Full level	0.150 – 8.000	Distance in meters
VAL (3)	Value to display	1	Level
		2	Distance
		3	Volume (set also tank shape)
		4	% Level
		5	% Distance
		6	% Volume (set also tank shape)
UNT (3)	Units for VAL=1,2,4,5	1	Meter
		2	Feet (see list for English units)
UNT (3)	Units for VAL=3,6	3	Liter
		4	US Gallons (see list for English units)
<b>Advanced Setup (Metric)</b>			
FBD (2)	Far blocking distance	0.150 – 8.000	Distance in meters
NBD (2)	Near blocking distance	0.150 – 8.000	Distance in meters
RAT (4)	Filling (tracking) rate	0	1 meter / minute
		1	2 meter / minute
		2	5 meter / minute
		3	10 meter / minute
TMP (5)	Temperature unit system	3	Celsius
		4	Fahrenheit
SNS (5)	Temperature sensor	0	Internal sensor
		1	External sensor
		2	Average of both
<b>Resetting and ID Options (Metric)</b>			
RSD (6)	Reset to factory defaults	None	Response is serial number and manufacturer date: dd-mm-yyyy
RSC (6)	Reset hour counter	None	
RST (6)	Restart ULTM	None	
GMAN	Get manufacturer data	None	
ENDT (6)	Enable USB monitoring	None	
DSDT (6)	Disable USB monitoring	None	
<b>Tank Shapes and Dimensions (Metric)</b>			
CUB (7)	Cubic tank	0.00-99.99, 0.00-99.99	Width and depth (horizontal dimensions) in meter
CYLV (7)	Vertical cylindrical tank	0.00-99.99, 0.00-99.99, 0	Height of tank = EMP value in meter
			Diameter of tank in meter
CYLV (7)	Vertical cylindrical tank with concave bottom	0.00-99.99, 0.00-99.99,	Height of tank = EMP value in meter
		0.00-99.99	Diameter of tank in meter
			Breadth of bottom in meter
CYLH (7)	Horizontal cylindrical tank with curved sides	0.000-99.99, 0.000-99.99,	Length, diameter and curved breadth in meter.
		0.001-99.99	
CYLH (7)	Horizontal cylindrical tank with flat sides	0.000-99.99, 0.000-99.99, 0	Length and diameter in meter
<b>Communication and Alert Items (Metric)</b>			
TEL1 (9)	Cell-phone destination	XXXXXXXXXXXXXX	Exactly 14 digits where X is any digit 0-9 or *,+,-
SMST (10)	SMS periodic interval	0	No periodic reports
		180-3999999	Interval in seconds
AFE (11)	Full / Empty alerts	0	No alerts
		1	Alerts activate
ATF (12)	Theft alert for VAL=1,2,4,5	0, 0	No alerts
		4-99, 0	Normal consumption in mm/minute
ATF (12)	Theft alerts for VAL=3,6	0, 0	No alerts
		4-99, 0	Normal consumption in mm/minute
ARF (13)	Refill alerts for VAL=1,2,4,5	0, 5-500	Normal consumption in liter/minute
		0, 0, 1	No alerts
ARF (13)	Refill alerts for VAL=1,2,4,5	4-99, 0, 1-3	Minimal alerted level change in mm and minimum fill duration in minutes
		0, 0, 1	No alerts
		4-99, 0, 1-3	Minimal alerted level change in mm and minimum fill duration in minutes
ARF (13)	Refill alerts for VAL=3,6	0, 3-500, 1-3	Minimal alerted level change in liters and minimum fill duration in minutes



Communication and Alert Items (English)			
LPST (14)	Low power timer	1-99999, 0.50 – 26.00, 1-99999, 0.50 – 26.00, 0-1, 0-1	Long standby interval in minutes Distance to low level in feet Short standby interval in minutes Distance to high level in feet Disable (0) or enable (1) 0 - No SMS are sent when in the "Long Standby Mode". 1 – SMS are sent when in "Long Standby Mode".

All notes are explained in sections 5.4.

**5.4 Notes**

Note Number	See Detailed Information in Reference Guide Chapter...
(1)	Section: "Application Type"
(2)	Section: "Application Dimensions and Constraints"
(3)	Section: "Distance Units and Value to Display"
(4)	Section: "Filling Rate"
(5)	Section: "Temperature Sensors, Units and Temperature Display"
(6)	Section: "Reset and Operating Hours"
(7)	Section: "Volume Measurement"
(8)	See Chapter 6: "Serial Data Monitoring"
(9)	Section: "Destination Phone Number"
(10)	Section: "GSM Reporting Interval"
(11)	Section: "Full and Empty Alerts"
(12)	Section: "Refill Alerts"
(13)	Section: "Theft Alerts"
(14)	Section: "PTS Configuration"
(15)	Section: "Trigger Alerts"
(16)	Section: "GPRS Architecture"

**6. Useful Examples**

**6.1 Basic Setup**

\$RSD \$	Reset to factory defaults
\$APP 0 \$	Application is high power
\$EMP 8.0 \$	Distance to empty level is 8 meter
\$FUL 0.15 \$	Distance to full level is 0.15 meter
\$VAL 1 \$	Value to display is level

**6.1 Advanced Setup**

\$DATA D \$	SMS messaging
\$VAL 1 \$	Value to display is level
\$FBD 8.0 \$	Far blocking distance is 8 meters
\$NBD 0.4 \$	Near blocking distance is 0.4 meters
\$RAT 3 \$	Tracking rate is 10 meters per minute
\$TMP 3 \$	Temperature unit is Celsius
\$SNS 0 \$	Temperature sensor is the internal
\$TEL1 +49-25-4678911- \$	Cell-phone destination is +49-25-4678911
\$SMST 1800 \$	Interval between periodic SMS messages is 1800 second
\$SAFE 1 \$	Empty and full event alerts are on
\$ATF 4, 0 \$	Theft alerts ON and for rate above 4 mm per minute (for VAL=1)
\$ARF 8, 0, 2 \$	Refill alerts ON for minimum refill of 8 mm during 2 minutes
\$CYLV 5.0, 2.0 \$	Tank is vertical cylindrical, height 5 m and diameter 2 m
\$LPST 60, 6, 10, 3, 1 \$	Low power timer is ON: Low level sleep time of 60 minutes when the distance to target above empty-level and longer than 6 meters. High level sleep time is 10 minutes and occurs when distance to target is more than 3 meters, but still less than 6 meters. ULTM will operate continuously when the distance to target is less than 3 meters.

**Note:** Always verify then re-verify that your basic settings are correct including distance to empty level, distance to full level, level or distance choice. Most wrong readings originate from incorrect setup.

**Chapter 5. Firmware Updates**

**1. Introduction**

ULTM firmware can be upgraded in the field. The upgrade procedure takes less than 5 minutes, but should be done carefully to avoid damage to the system. This feature is useful for adding new features to your ULTM system and for fixing bugs.

- Perform firmware upgrade only when authorized to do so by the manufacturer.
- While upgrading ULTM, record your steps and also record any messages that appear on-screen. This will aid in troubleshooting a defective upgrade process.
- Most stored settings will usually not be lost when upgrading the firmware.
- Use only the updated firmware provided by the manufacturer or re-seller.

**2. You Will Need**

- (A) PC with minimum requirements: Windows XP® Service Pack 2 or Windows® 7/16 /bit, CD drive, USB port, and administrator rights. The firmware upgrade tool was also tested on Windows® 7/32 bit.
- (B) ULTM Installation CD.
- (C) New ULTM firmware which is authorized for upgrading your ULTM.

**3. Installation of Firmware Upgrade Tool and USB Driver**

- (A) Insert the installation CD, select and run Setup.exe in the main directory of the CD.
- (B) Follow the on-screen instructions. When prompted for an installation directory, keep the default installation directory: ("c:\program files\solidat\ULTMFirmwareUpgradeTool" or choose another directory).
- (C) When complete, check for new icon on your desktop and new program entry in the programs list.
- (D) Install ULTM USB driver by following instructions in Chapter 7: "USB driver installation on a PC".

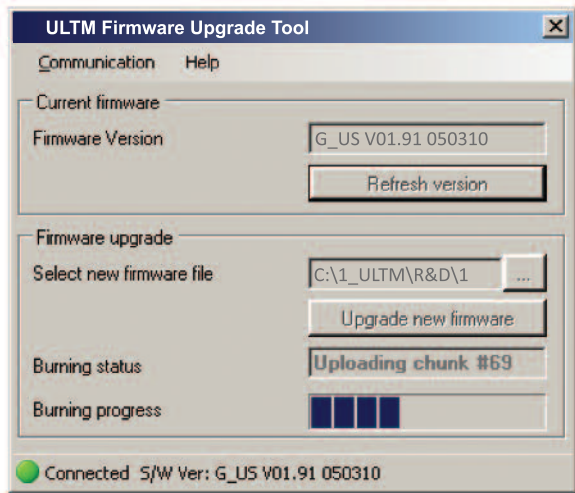
**4. Upgrade Procedure**

- (A) Copy the new ULTM firmware (e.g. xyz.bin) to a directory of your choice.
- (B) Run ULTM Firmware Upgrade Tool by clicking on the proper desktop icon.
- (C) Wait until the proper COM port is identified (the port connected with ULTM) then press OK on the pop-up window.

Verify that current firmware version is displayed on the top line.

- (D) Click on the "... " button, browse and select the new firmware (e.g. xyz.bin). When the new name appears on the windows, you can press the "upgrade new firmware" button. Follow the progress and instructions on-screen. After some time, ULTM display will be turned off – this is normal.

During the upgrade, you will see a progressive bar on the window as follows:



**Be patient!**

If you do not see the bar starting, or if the bar has stopped moving – just wait! If you disconnect the ULTM while in the middle of the upgrade process, the internal software may be impaired and may require returning to the factory. If the bar has not started or has stopped, wait for at least 10 minutes before reconnecting and restarting the process.

(E) Wait for the upgrade process to complete. The process is complete when you see the following window:



Now click OK and restart ULTM.

### 5. Troubleshooting the Firmware Upgrade Process

Symptom	Recommendation
<b>Installing Upgrade Tool</b>	
Installation of the upgrade tool halts due to .NET Framework missing.	Install .NET Framework on you PC (2.0 or above). See <a href="http://www.microsoft.com/downloads/details.aspx?familyid=0856eacb-4362-4b0d-8edd-aab15c5e04f5&amp;displaylang=en">http://www.microsoft.com/downloads/details.aspx?familyid=0856eacb-4362-4b0d-8edd-aab15c5e04f5&amp;displaylang=en</a>
Installation of the upgrade tool halts due to user permissions	Verify that you are a local administrator on the PC.
<b>Upgrading the Firmware</b>	
COM port is not found or Current firmware version is not displayed	(1) Make sure ULTM is turned on. Disconnect and then connect again the USB cable. (2) Select the Communication tab. Try automatic port selection then try manual port selection. (3) Shut off the Upgrade Tool, then verify with the Windows® Task Manager that a ULTM process is not running. Run the Upgrade Tool again.
Upgrade process has halted	Wait for 10 minutes. Restart the application. Restart your PC and try again.
ULTM display stays blank after installation and restart	Restart your PC and try again.

## Chapter 6. Serial Data Monitoring

### 1. Introduction

ULTM may be monitored locally. ULTM may be configured to send information to a PC over the USB interface and that information may be viewed with a HyperTerminal application. This feature is useful for field monitoring and for debugging purposes.

Information being sent by ULTM includes measured data such as distance and temperature and internal system variables.

### 2. Installation and Operation

- Install the USB driver for ULTM as described in the chapter 7: "USB Driver Installation on a PC" (p.13). You may have done so already for the "PC Configuration Utility" or for the "Firmware Upgrade Application". In that case, there is no need to do it again.
- Connect ULTM to your PC using a USB cable terminated with a mini-USB connector. Refrain from utilizing USB power supply alone. It is advisable to connect a regular DC power supply to ULTM.
- Launch the HyperTerminal application on the PC. To do so, follow the instructions included in Chapter 4 "Configuration with a PC" under the sub-section "Launching and Setting up HyperTerminal".
- You need to enable the monitoring function using the ENDT command from the HyperTerminal. The command may be keyed manually or sent as text configuration file. Review the "Configuration with PC" chapter for this procedure.

The settings of HyperTerminal for configuring ULTM and for serial monitoring are identical, except for the item "Append Line Feed". When monitoring, you should uncheck the "Append Line Feed" item in the ASCII setup to avoid extra lines.

When you want to halt the monitoring function, you must prepare a configuration file with the DSDT command and send it from the HyperTerminal application. In this case the manual procedure is not applicable because ULTM is constantly transmitting its own monitoring data.

(E) Information may be simply viewed or gathered into a text file by using the Transfer/Capture Text tab of HyperTerminal. You can define this file as .txt or .csv. You can also define the file as txt and later rename it to .csv. A .csv file can then be conveniently viewed with an excel application.

Other data logging programs include Log & Forward and SMS Management Center found on the ULTM software CD. These programs use SMS messages sent directly to a PC to organize and display data from the ULTM. This requires a PC equipped with a cellular modem and a separate SIM card. Instructions for installing and running these programs are also found on the software CD in the folder, "ULTM Documents".

### 3. Record Format

A typical record on the HyperTerminal screen or text file may appear as follows:

```
220|1.53|1.53|2|1|27.67|29.8|2|32|6|0|50|62|1.53|0.02|0|3880|0|3
```

222,1.532,1.531,2,1,27.667,29.800,2,32,6,0,50,64,0.000,0.000,0, 3417, 0, 3

A .csv file will appear as follows:

In these recordings the third column from the left is the measured data (after processing) and the sixth column from the left is the measured temperature. Other columns are internal equipment variables applicable for manufacturer debugging purposes. Fields may change between software versions. Check with the manufacturer about the fields in your recording.

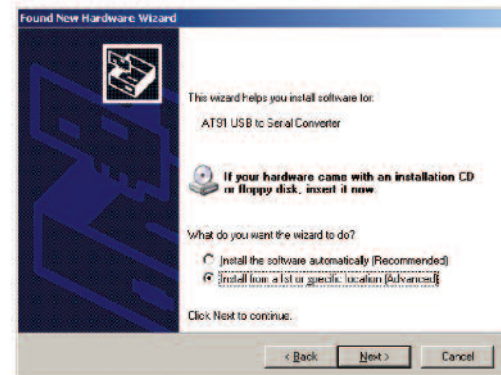
## Chapter 7. USB Driver Installation on a PC

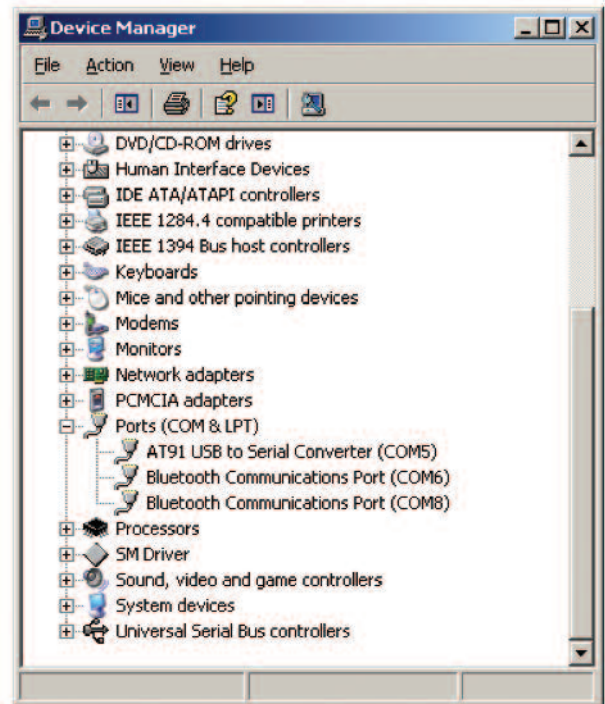
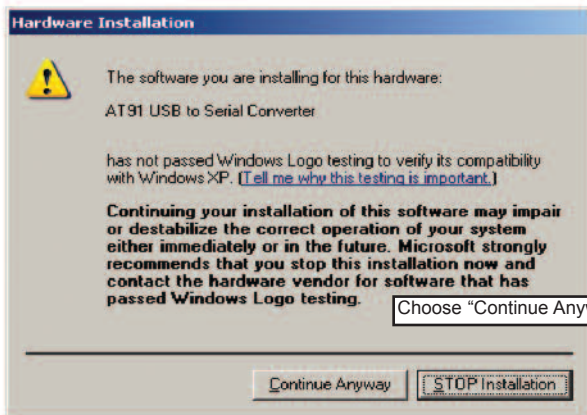
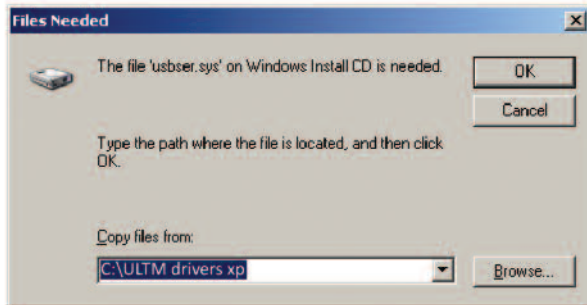
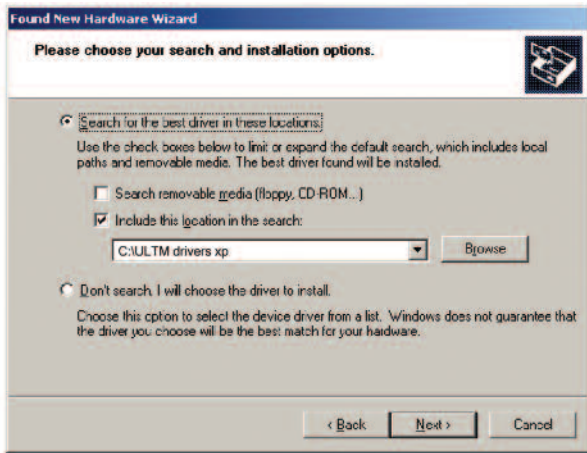
This chapter describes the installation of ULTM USB drivers on a PC. The driver installation is required when using the PC / laptop for:

- Configuration of ULTM
- Serial monitoring
- Firmware upgrade

The drivers were tested on Windows XP® and Windows® 7/32 bit systems.

- Copy the directory "ULTM Drivers XP" from the CD to your PC.
- Connect the PC to ULTM using a USB cable. Keep cable length to less than two meters. Turn ULTM on (if not already powered by the USB).
- Follow the standard driver installation instructions on the PC. Whenever prompted for a driver, select the location of "ULTM Drivers XP".
- The following set of windows may aid you when following with the installation.





You should also check proper installation by viewing the device manager. If the USB driver installation failed, a “?” sign may be listed at the “Ports” item. In other cases, the driver may be listed under “Other Devices” item. In both cases, uninstall the device and then re-install it again.

## Chapter 8. Reference Guide

### Application Dimensions and Constraints

#### A) Basic Dimensions

- Distance
- Level
- Dead zone
- Full level
- Empty level
- Distance to full level (FULL)
- Distance to empty level (EMPTY)
- Maximum range
- Near blocking distance (NBD)
- Far blocking distance (FBD)

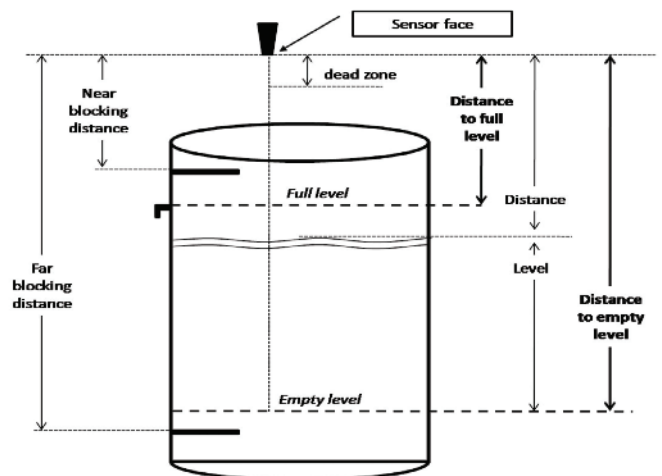


Figure 17: Application Dimensions.

These variables are shown on the following figure along with the “Fundamental Interdependency Equation”.

$$15 \text{ cm} = \text{Dead Zone} < \text{NBD} < \text{Full} < \text{Empty} < \text{FBD} < \text{Maximum range} = 8 \text{ meter}$$

See also the section: Interdependencies in this chapter.

**B) Distance to Empty Level**

Distance to empty level is defined as the distance from the face of the sensor to the bottom-most surface of the target to be measured. For typical installation in tanks, the bottom-most surface is usually the floor of the tank.

ULTM supports a maximum range of 26' (8 m) and the default value for distance to empty level is therefore 26' (8 m). The user is cautioned however that the maximum practical range depends on target characteristics. Range of 26' (8 m) may be achieved with quiet liquid surface targets. As a rule of thumb, use no more than 20' (6 m) for solids, turbulent liquids, when the air medium is not clear, or when interferences exist. You may verify proper operation by checking whether the equipment frequently enters a state of "echo search" at your maximum distance.

When ULTM enters the empty level, it will present an empty status on the display. ULTM will then exit this state when level rises at least 0.8" (2 cm) above the empty level.

**C) Distance to Full Level**

Distance to full level is defined as the distance from the face of the sensor to the top-most surface of the target to be measured. The default value for distance to full level is 5.9" (15 cm). This is also "dead zone" of ULTM and cannot be reduced under any circumstances.

The user is cautioned to prevent targets from crossing this limit, as this may result in unpredictable measurements. You can overcome this limitation by proper installation. For example, if the target can approach the tank roof, install ULTM on top of an extension pipe which is at least 5.9" (15 cm) long.

When ULTM enters the full level, it will present a full status on the display. ULTM will exit this state when level decreases by at least 0.8" (2 cm) below the full level.

**D) Far Blocking Distance (FBD)**

ULTM normally measures distance to targets which are closer than the "Empty Level".

In some circumstances, ULTM might detect an echo which is further out than the "Empty level". This echo may be the result of the actual target below the empty level, or a strong interference below the empty level. In such cases, ULTM would report "Empty" and would transmit an SMS to report the event. If you expect echoes further out than the empty level, and you prefer to avoid these event reports, you can define a Far Blocking Distance (FBD). Once defined, ULTM will completely disregard any echoes beyond the FBD. If no other echoes closer than FBD are detected, the ULTM will report loss of echo.

The default for "Far Blocking Distance" is identical to the maximum range of ULTM.

**E) Near Blocking Distance (NBD)**

If distance between the sensor face and the topmost level of the target is larger than the specified "dead zone" by at least 2.7" (5 cm), you should consider defining a Near Blocking Distance (NBD). The NBD should be defined as 0.8 to 1.2" (2 to 3 cm) shorter than the distance to the topmost level. This will ensure that the ULTM will not measure obstructions slightly above the topmost level and mistakenly report them as full level.

Similarly, when an extension pipe is used and the length of the extension pipe is larger than the "dead zone", you should define NBD which is larger by 0.8 to 1.2 in (2 to 3 cm) than the length of the extension pipe. This will ensure that you will not pick up echoes arising from the bottom end of the pipe and report them as full level.

If no other echoes further than the NBD are detected, the ULTM will report loss of echo. The default for "near blocking distance" is identical to the "dead zone".

**Application Type**

Application type allows some tuning of the internal GSM algorithm to be tuned to the application. The application may be selected as low power or high power. Always use low power for stable measurements unless your target appreciably attenuates the echo such as: powder solids, liquid with foam, or long extension pipes.

**Cellular Communication**

ULTM is equipped with an integrated cellular modem allowing periodic reports of measured data and immediate alerts. Alerts include empty and full states and excessive level change rates. Excessive level change rates may indicate theft or tank refilling or an approaching flood. The user can configure the destination phone number, periodic reporting interval, normal level change rates and more. The user can activate or deactivate specific alerts.

The modem is of the quad-band GSM type and cannot be used with other cellular standards. An antenna is connected internally within the ULTM. A SIM card must be inserted into ULTM. The SIM card must adhere to the instructions provided in the installation chapter. Carefully read and comply with these instructions.

**Contact Alert**

Contact alert identifies a change of an external on/off state and transmits an SMS alert to report the event. The contact alert does not affect other SMS message types which are initiated by ULTM. The on/off states identified by ULTM are OPEN/SHORT between pins 5 and pin 4 on ULTM connection board.

A change in state is reported only if the new state persists for more than 10 seconds. No SMS is transmitted if the state toggles for less than 10 seconds. A change to OPEN state is reported by a standard SMS message with status field "9" (last field in the SMS message). A change to SHORT state is reported by a standard SMS message with status field "8".

At ULTM turn-on, a special message is transmitted to report the initial contact state with "9" designating an OPEN state and "8" designating a SHORT state.

**Default Values**

ULTM is preset by the manufacturer to a set of default values. The user may revert at any time to these default values by performing the reset-to-default operations as described in the configuration chapters under "Device States".

Changes to the values made by the user will remain intact (survive equipment on/off) only after the user returns to the measurement screen.

The table below defines the default values. A default value may automatically change in response to a change in some other value. For example, default value of full is 5.9" (0.15 m). This value will automatically be changed to 1.6' (0.5 m) if NBD is set to 1.6' (0.5 m).

Parameter	Default Value
Distance Unit	Meter
Application	Low power
Empty Level	8.000 meter
Full Level	0.150 meter
Value to Display	Distance
FBD	8.000 meter
NBD	0.150 meter
Filling Rate	5 m/min
Temperature Units	Celsius
Temperature Sensor	Internal
GSM Report Interval	1800 seconds
Full / Empty Activation	1
Theft Activation	0
Refill Activation	0

**Destination Phone Number**

The SMS destination phone number (can be up to 14 digits) must be defined in full. Any hyphen signs ("-") are ignored. Examples:

- A 10 digit phone number 0541234567 may be entered as any of the following:
- The number \*2345 may be entered as any of the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	-	0	5	4	-	1	2	3	4	5	6	7	-
0	5	4	1	2	3	4	5	6	7	-	-	-	-
-	-	-	-	0	5	4	1	2	3	4	5	6	7

1	2	3	4	5	6	7	8	9	10	11	12	13	14
*	2	3	4	5	-	-	-	-	-	-	-	-	-
-	-	-	-	*	-	2	-	3	-	4	-	5	-
-	-	-	-	-	-	*	2	3	4	5	-	-	-



Depending on the unit's location and carrier, a country code and operator prefix may be necessary. Please add these as appropriate. It is your responsibility to insert the correct phone number as phone number schemes vary worldwide.

**Distance Units and Value to Display**

Either meter or feet may be selected for the distance unit. This selection defines the complete unit system being used by ULTM. Selecting meter as your distance unit implies the Metric unit system.



Selecting feet as your distance unit implies the Imperial (US / English) unit system. Distance units can only be modified with the PC configuration tool using the command: UNT.

ULTM built-in display may be configured to display different variables. Distance and level may always be selected as the variable to be displayed. When tank shape and dimensions are defined, ULTM may also be set to display volume of the target. Volume display may be turned on with the PC configuration tool using the VAL command. Distance or level may be set from the keypad or from the PC configuration tool.

**False Echo Scan**

False echo scan is a procedure for identifying and extracting fixed obstructions nearby the target or sensor. This procedure should be performed when the tank is empty. This procedure is initiated from the keypad only. Further information is provided in the Chapter 3 describing configuration with a keypad/display under the basic setup option.

**Filling Rate**

Filling rate allows you to tune the tracking of ULTM to fast moving targets. You should increase the filling rate figure if your target fills up or drains down rapidly. Always use the lowest possible filling rate in order to preserve accuracy of the measurement. A high filling rate will allow better tracking before lost of echo when the target moves rapidly. For nearby full (empty) levels, the tracking rate is reduced to avoid erratic entry into full (empty) level.

**Full and Empty Alerts**

You may activate or deactivate full and empty SMS alerts. Full and empty alerts co-exist with periodic alerts. A three-minute quiet interval is maintained between two alerts. Within this quiet interval time, no SMS alerts will be sent.

**GSM Display Status Reports**

The following status reports may be presented (or shown) on the display:

Error Indications	Proper Operation
GSM REGISTRATION FAIL	GSM INITIALIZING
GSM MODEM NOT READY	GSM REGISTRATION SENT
GSM TRANSMISSION FAIL	GSM ACTIVE
GSM SIM FAIL	GSM DESTINATION ASSIGNED
GSM NOT ACTIVE	GSM SMS SENT
	GSM EVENTS ONLY

**The Sequence of Status Reports is as Follows:**

When ULTM is turned ON, it first searches for a proper level target. Once found, ULTM begins to seek for a ULTM network. A status report GSM INITIALIZING will be displayed at this time. The search for GSM network may take between 10 seconds and up to a minute.

If ULTM fails to locate a GSM network, one of the error indications will be displayed. When such an error occurs, verify by using a cell-phone that the area is indeed covered by a GSM network and that the SIM card you inserted into the ULTM is good. Let ULTM do some retries for 30 seconds and then turn ULTM OFF and then ON again to try again.

If ULTM successfully locates a GSM network, the status report GSM PERIODIC ACTIVE will be displayed. When an SMS is transmitted, a sequence of status reports will show: GSM DESTINATION ASSIGNED, GSM SMS SENT, and GSM PERIODIC ACTIVE. GSM EVENTS ONLY report is displayed if the user disabled periodic SMS reports. Disabling the periodic SMS report is performed by entering 0 (zero) at the report interval, either manually or by using the PC configuration command SMST.

**ULTM Reporting Interval**

You can determine the periodic reporting interval using one of the configuration methods. The interval is defined in seconds. For example, for an SMS report once every hour, modify the interval to 3600. Report intervals lower than 180 seconds are not accepted and will revert to 180 seconds. Maximum report interval is 3,999,999 seconds, which comes up to about 45 days. A reporting interval of 0 (zero) disables the periodic reports.

**Interdependencies**

**For Metric Units**

Applicable to items	Interdependencies
1 EMP, FUL,NBD, FBD	0.15 ≤ NBD ≤ FUL ≤ EMP ≤ FBD ≤ 8.000 One and only one of the following must be configured: CUB, CYLH, CYLV
2 VAL=3,6	

**For American Units**

Applicable to items	Interdependencies
1 EMP, FUL,NBD, FBD	0.50 ≤ NBD ≤ FUL ≤ EMP ≤ FBD ≤ 26.00 One and only one of the following must be configured: CUB, CYLH, CYLV
2 VAL=3,6	

**PTS Configuration**

The Programmable Timer Switch (ULTM-PTS) is an external device for enabling low power mode of ULTM.

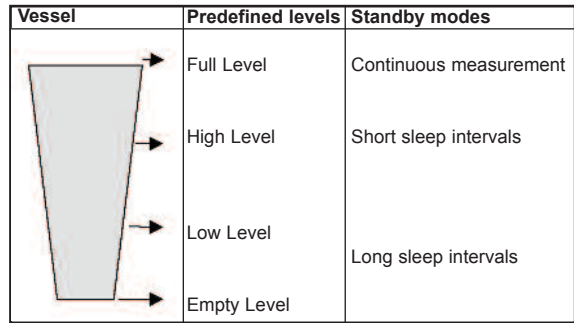
The PTS turns ULTM ON to take a measurement and to transmit the measured information. Then the PTS turns ULTM OFF for a sleeping period. ULTM is then turned ON again and so on. With this method, a 20 AH/12 V battery can typically feed ULTM for 1 to 3 years before replacement is needed.

Two different sleeping intervals may be programmed by the user: long interval and short interval.

The sleeping interval in-effect depends on the level being measured. For example, assume that a river overflows at a level of 6.6' (2.0 meters) and calm waters are defined at a level of 3.28' (1.0 meter). Then you can define a very long sleeping interval (e.g. 6 hours) when level measurement is between 0 and 3.28' (0 to 1.0 meters). You can further define a short interval of 30 minutes when the level is between 3.28' (1.0 meter) and 5.98' (1.8 meters). Finally, above 5.9' (1.8 meters) the PTS may be disabled and ULTM will operate continuously.

When operating continuously, the period between messages is defined by the ULTM reporting interval parameter.

This concept is further described in the following figure:



**Figure 18: Low Power Predefined Levels.**

PTS parameters are defined by the command LPST as described in the Chapter 4 "Configuration with a PC". Both sleep intervals must be longer than 10 minutes. The SMS messages during the long sleep interval may be cancelled. Do not configure ULTM while the system is connected to a battery through the PTS. A shutdown may be forced by the PTS causing loss of data.

**Refill Alerts**

When refill alerts are activated, ULTM identifies a refilling process. ULTM transmits an SMS soon after the refilling is identified and a second SMS soon after the refilling process has ended. The first SMS provides distance information (distance between sensor and fuel surface). The second SMS provides information about the filling quantity. This procedure allows more accurate refilling information when compared with the information that can be extracted from periodic reports.

**Reset and Operating Hours**

ULTM may be reset to their factory defaults. This operation may be performed from the keypad or from the PC configuration tool (command RSD). Once executed, the ULTM will return to the state as delivered from the factory. ULTM may also be reset to restart without any change in the pre-configured parameters (command RST).

ULTM keeps track of two counters for measuring operating hours.

- Non resettable counter (Odometer principle)
- Resettable counter (Trip-meter principle)

The non-resettable counter displays the total hours of operation since the system is out of the factory. This counter aids both manufacturer and user in keeping track of specific ULTM history. The resettable counter displays the total hours of operation since the recent turn-on of the equipment or since the last reset of this counter. This counter aids the user in keeping track of the equipment for maintenance and other operations. The resettable counter may be activated from the built-in display or using the PC command RSC.

**SMS Format**

SMS are sent in a fixed textual format: "D, L, D1, V, T1, T2, S1"

Where:

- D - Measured Distance                      Format xx.xxx (meter or feet)
- L - Measured Level                         Format xx.xxx (meter or feet)
- D1 - For S1 = 0: Measured Volume        Format xx.xxx or xxxxxx.x  
(liters or gallons)
  
- For S1 = 5: Refill Start Point             Format xx.xxx or xxxxxx.x  
(distance or volume)
  
- For S1 = 6: Refill Quantity                Format xx.xxx or xxxxxx.x  
(distance or volume)
  
- V - Measured Volume                        Format xx.xxx or xxxxxx.x  
as applicable
- T1 - Internal Temperature                 Format xx.x  
(Celsius or Fahrenheit)
- T2 - External Temperature                 Format xx.x  
(Celsius or Fahrenheit)
- S1 - Equipment Status                        Digits

S1 Value	Description
0	Good measurement and range
1	Full level
2	Empty level
3	No signal found (performing echo search)
4	Theft indication
5	Tank filling identified
6	Tank filling ended
7	Reserved
8	Contact alert is short (version 1.94 or later)
9	Contact alert is open (version 1.94 or later)

**Temperature Sensors, Units and Display**

ULTM systems implement automatic compensation of deviations due to temperature variations in the air temperature of the ultrasonic media. The temperature is sensed by a temperature sensor which is embedded within the acoustic sensor. In installations where temperature varies very rapidly in time and location, it may be preferable to install an external temperature sensor ULTM-EXT which will follow more closely the varying temperature.

For these installations, you can select the internal embedded temperature sensor or the external temperature sensor (if one is connected), or average both readings. Physical connection and installation of the external temperature sensor is described in the Chapter 2, physical installation guidelines. Temperature units may either be selected as Celsius or Fahrenheit. Temperature may be viewed on the built-in display. Temperature readings on the display present the following table:

Sens:	Cur	High	Low
Int	29.5	31.0	26
Ext	29.4	32	23.3
	Reset		Done

Figure 19: Temperature Readings.

The second line displays temperature measured by the internal temperature sensor. The third line displays temperature measured by the external temperature sensor. The column "Cur" displays the current temperature, while "High" and "Low" columns display the highest and lowest temperature recorded by the temperature sensors since the last reset was performed.

**Theft alerts**

ULTM supports theft detection alerts by examining the rate of liquid consumption. Determine the rate which would be considered as inappropriate in units of level per minute (e.g. mm/min) or volume per minute (e.g. liter/min) and modify the deviation number accordingly. Limits are defined in Chapter 4: "Configuration with PC" (p.8). Rates lower than 4 mm/min may cause excessive false alerts. Therefore, entries lower than 4 mm/min will automatically be converted to 4 mm/min. It is recommended to experiment with the specific tank and environment with this figure until no false alarms are transmitted.

Alert SMS will be transmitted within a minute following detection of an inappropriate consumption rate. Alert SMS will be sent once a minute as long as the excessive consumption rate is detected. This may aid the user in determining the duration and persistence of the implied theft. Theft alerts co-exist with periodic alerts and with full and empty alerts.

**Volume Measurement**

**A) General**

Based on measured Level, tank shape and tank dimensions, ULTM can calculate and report volume rather than distance or level. Configuration of volume elements can only be executed using the PC configuration method.

Currently, three tank shapes are supported:

- Box shaped
- Horizontal cylindrical tanks with curved or non-curved sides
- Vertical cylindrical tank with curved or non curved bottom-side

**B) Box Shaped**

Two horizontal box dimensions should be configured (X, Y), allowing volume calculation of the liquid contained within the box shaped tank. The third dimension is the level measured by the ULTM (Z).

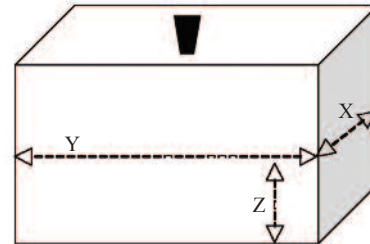


Figure 20: Box Shaped Tank.

**For Advanced Users**  
The box shaped tank may also represent any other tank if volume (V) and level (L) are linearly related in that tank. Mathematically stated, if  $V = k * L$  where k is a constant. For such a tank, enter X=1 and Y=k.

**C) Cylindrical Tanks**

Horizontal cylindrical tank with curved sides:

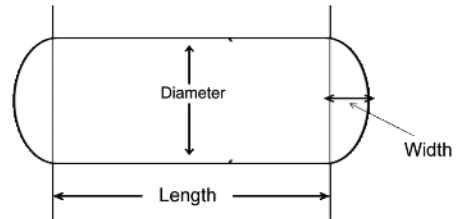


Figure 21: Cylindrical Horizontal Tank.

The width may be zero for straight ends.

Vertical cylindrical tank with concave bottom:

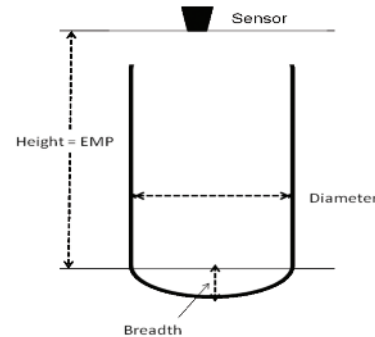


Figure 22: Cylindrical Vertical Tank.

See also the section: "Interdependencies" in this chapter (p.16).

**Chapter 9. Troubleshooting**

Symptom	Recommendation
<b>Power On Faults</b>	
ULTM does not power on	<ol style="list-style-type: none"> <li>1. Check the rating of your power supply and verify these ratings are within the specifications of the ULTM.</li> <li>2. Check the electrical cables between the power supply and the ULTM. In particular, check the connections on the ULTM.</li> </ol>
ULTM powers on but does not measure	<ol style="list-style-type: none"> <li>1. Check the rating of your power supply and verify these ratings are within the specifications of the ULTM.</li> <li>2. Check if a USB connection powers up the ULTM – do not use a USB connection to power up the ULTM.</li> </ol>
<b>Ultrasonic Related Faults</b>	
Status line 1 reports constant ECHO SEARCH	<ol style="list-style-type: none"> <li>1. Check your target is between 5.9" (15 cm) and 26.2' (8 meters) (19.7' (6 meters) for solids).</li> <li>2. Verify that the sensor is precisely directed towards the target.</li> <li>3. Check the sensor face and make sure the face is clear of dust or dirt.</li> <li>4. If you use an extension pipe, recheck all the recommendations stated in the extension pipe section in this manual.</li> </ol>
Level measurement is incorrect	1. Check that distance measurement is correct. Verify the settings of Full level and of Far Blocking Distance.
Level measurement displays Full level continuously	<ol style="list-style-type: none"> <li>1. Check and clear out physical disturbances above the empty level.</li> <li>2. If you are using an extension pipe, increase NBD to a distance which is 0.8 to 1.2" (2 to 3 cm) beyond the edge of the pipe.</li> </ol>
<b>Cellular Related Faults</b>	
Line status 2 displays error messages such as registration fail or ULTM SIM fail	<ol style="list-style-type: none"> <li>1. Verify you have properly inserted a SIM card into the ULTM.</li> <li>2. Carefully walk through the SIM instructions in the installation chapter.</li> <li>3. Reposition your cellular antenna; the cellular coverage may be weak in your area.</li> </ol>
Line status 2 displays SMS SENT but no SMS is received	1. Verify the correctness of the destination phone number that you entered into ULTM. Review the rules for entering a phone number as described in this manual. Remember, it is your responsibility to enter a valid phone number.
Line status 2 reports ULTM is OK but no SMS are sent	<ol style="list-style-type: none"> <li>1. Check if the reporting interval you entered in the ULTM is correct. Notice that reporting interval is entered in seconds so that half an hour would be entered as 1800 and five minutes would be entered as 300.</li> <li>2. Check if the reporting deviation is set to zero.</li> </ol>

**MAINTENANCE/REPAIR**

Upon final installation of the Series ULTM, no routine maintenance is required. The Series ULTM is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty).

**WARRANTY/RETURN**

Refer to "Terms and Conditions of Sale" in our catalog or on our website. Contact customer service to receive a Return Goods Authorization number before shipping your product back for repair. Be sure to include a brief description of the problem plus any relevant application notes.