

Manhole Monitor

Installation Manual



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FCC ID Q1PPH8



Certified Class I, II, III, Division 1 Groups D-G, T1 and Intrinsically Safe.

Thank you for choosing Mission Communications for your monitoring needs!

The Manhole Monitor sends alarms in real-time and it communicates status information daily. You can remotely access from your Mission web portal. The device features an LCD that simplifies startup and facilitates advanced configuration options. A versatile mounting bracket and quick connecting floats ease installation. Mounting hinges allow you to rotate the device to view the LCD. The enclosure is solid aluminum, chemically treated and powder coated. Floats are connected with watertight bayonet connectors.

In most cases, the RTU is delivered with an active cellular data plan. Contact technical support to deactivate the RTU if the installation will be delayed for more than one month. Technical support will reactivate the unit when you are ready to complete the installation.

We encourage you to get familiar with the Manhole Monitor away from the distractions of traffic. Prior planning ensures system reliability and speeds installation. Confirm that the site location has adequate cellular coverage before mounting the RTU in the manhole.

Weekly training webinars are available most Wednesdays at 2:00 P.M. EST. We encourage you to join us and learn more about the Mission system. Visit www.123mc.com to sign up. You will also find our training videos and newsletter archives.

Our technical support staff is available at (877) 993-1911 option 2 for assistance.

Thank you,

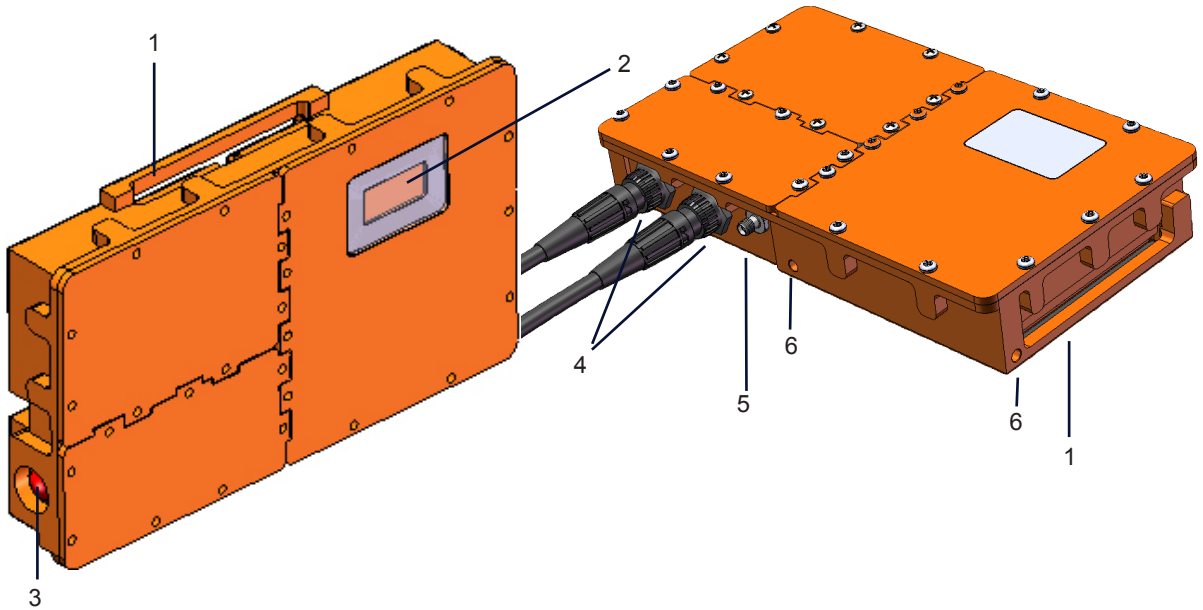
The Mission Team

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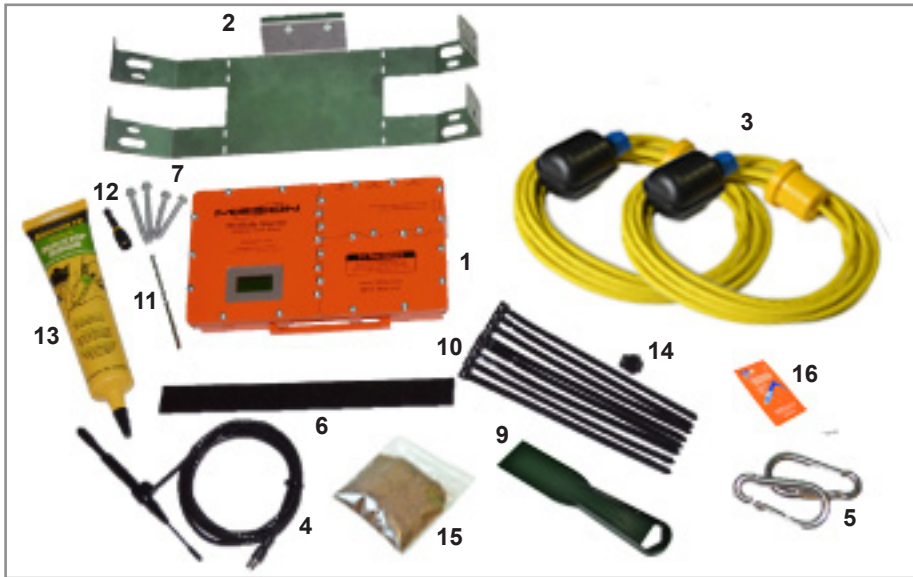
Chapter 1: Becoming Familiar with the Manhole Monitor

Manhole Monitor At A Glance



- 1. Horizontal and vertical mounting hinge** — Hang the device horizontally or vertically from these hinges.
- 2. Display** — The display is used for startup and optional configuration. It briefly shows the current mode and status information for the device per transmission.
- 3. Pushbutton Switch** — The pushbutton switch is used to awaken the unit for current status information and to navigate through the display.
- 4. Float connections** — Two waterproof float connections are available to monitor high and surcharge levels with the provided floats.
- 5. Antenna connection** — The in-ground antenna connects to this waterproof antenna connection to transmit daily check-in status and real-time alarm events.
- 6. 1/4" x 20 hole thread** — Use with optional “under the manhole lid” bracket.

Included Parts



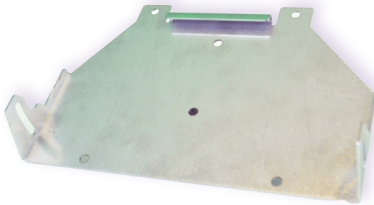
1. Manhole Monitor
2. Mounting bracket
3. (2) Normally-closed floats; 20' float cable
4. In-ground antenna
5. (2) Latching carabiners
6. Strip of moldable black tape
7. (4) 1/4 x 1 3/4" TapCon stainless steel, self tapping concrete anchors
8. (2) 1/4 x 2 1/4" TapCon stainless steel, self tapping concrete anchors (not shown)
9. Asphalt sealant applicator
10. (8) Tie wraps
11. 3/16" x 4" masonry bit
12. 5/16" hex nut driver
13. Asphalt sealant cartridge, 5.5 oz.
14. Float connection cap
15. Packet of drying agent
16. Packet of dialectic grease

Required Installation Tools

- Hammer drill (battery operated)
- Angle grinder or circular saw with masonry blade (battery operated)
- 3/8" x 24" masonry drill bit (Mission PN 427)
- Standard hand tools (Phillips screw driver, adjustable wrench, measuring tape, etc.)

Optional Accessories

- Above-ground antenna (PN 446)
- Replacement in-ground antenna (PN R8001)
- Replacement battery (PN P8202)*
- 10' normally-closed floats (PN I8503)
- 20' normally-closed floats (PN I8502)
- 30' normally- closed floats (PN I8504)
- 3/8" x 24" masonry drill bit (PN 427)
- Quick connect terminal kit, solderable (PN A8401)
- Optional mounting bracket for underneath manhole lid



*Ultralife battery pack (PN UB0029). Battery must be changed only in a location known to be non-hazardous to reduce the risk of ignition of a flammable or explosive atmosphere.

Chapter 2: Select the Best Site Location

Consider the criteria below for the greatest early warning value and a reliable system that is easy to install and maintain. Visit each location that is being considered to test for adequate cellular coverage.

- Cellular Reception**

The Manhole Monitor operates on a cellular network. It is critical that the unit is able to communicate under all circumstances. An antenna obstructed by a parked car or buried beneath 6’ of snow may not perform properly.

Attach the antenna and test the cellular coverage at each site. Place the antenna on the ground while testing the device. Refer to the LCD Quick Start Guide on the next page to learn how to navigate the display and the purpose of each screen. This will assist you in testing the device. Use a chart similar to the one below to record the cellular reception at each site.

- Accessibility**

The Manhole Monitor should be mounted in a location that is easily accessible to perform service and periodic maintenance tests. For example, it is more desirable to mount the device in a manhole on a side street than a busy intersection.

- Future Road Maintenance**

In-road antennas can be destroyed by road grinders or lose effectiveness if they are paved over. Choose a site location that is not likely to require future road maintenance. Mission offers an above-ground antenna option for alternative applications (in a field or near a river). Contact Mission for assistance with unique applications.

Site Selection Chart

Site	Signal	Physical (Access, Road Issues, etc.)
Harris Street	Great	Busy intersection

LCD Quick Start Guide

Step 1: Turn on the LCD



Press and hold the pushbutton for two seconds to view the device's home screen (Run Mode). The home screen scrolls through current status information.

Sequence: *Float Status > Battery Voltage > Transmit Rate > Current Time > Transmit Number > Temperature*

Definitions

- Float status – The state of each float input. Only "L" is displayed when the high float is tipped; Only "H" is displayed when the low (surcharge) float is tipped; "LH" is displayed when both floats are not tipped.
- Battery voltage – The device's power. A good battery voltage is in the range of 5-6.6V.
- Transmit rate – The transmission rate of current status information. The default transmit rate is once per day.
- Current Time – The time on the device is obtained from the cellular network.
- Temperature – The temperature of the device.

Press the pushbutton to advance to the Receive Test while the status information is scrolling. When the status information has completed scrolling, the LCD will turn off.

Step 2: Conduct a Receive Test



The screen will turn off due to inactivity after 30 seconds. The unit is operating in hibernation mode (Run Mode, but the device is "sleeping."

Sequence: *RX Test > Scanning > Signal Strength > Rating ("Best", "Good", "Poor", "No Signal")*

Once the rating is displayed, press the pushbutton to advance to the Transmit Test.

Step 3: Perform a Transmit Test

Sequence: *TX Test > Wait > progress bars > Success/Fail > Run*



If Success: Following the sequence, the device will automatically go into Run mode and the LCD will turn off after 30 seconds. When the device is in Run mode, it is operating and will send daily transmissions. The device will also transmit after each event or state change.

If Fail: The screen will display "Fail" on the first transmission and the device will either go into Run Mode and hibernate or it will display "Wait" for 60 seconds until it attempts the second transmission. If the second attempt fails, the device will go into Run Mode and wait until the scheduled transmit time to try again.

Refer to Appendix B for optional advanced configuration settings.

Chapter 3: Install the Antenna

Once you choose a site location, test the antenna at various points around the manhole. Keep in mind that signal strength can vary around the perimeter of the manhole. Perform a Receive Test at each point, then choose the location with the best signal. Avoid placing the antenna at a point around the manhole that may be obstructed by parked vehicles. Verify that the device is in Run Mode. Refer to the chart on page 11 or the chart in Appendix C for an explanation of each screen.

Next, inspect the cross sectional manhole ring. Most rings are fitted with a ~5" tall and ~5" wide L shaped ring. You will be drilling from the surface of the road into the vault, while remaining clear of the metal ring (Figure 3.1).

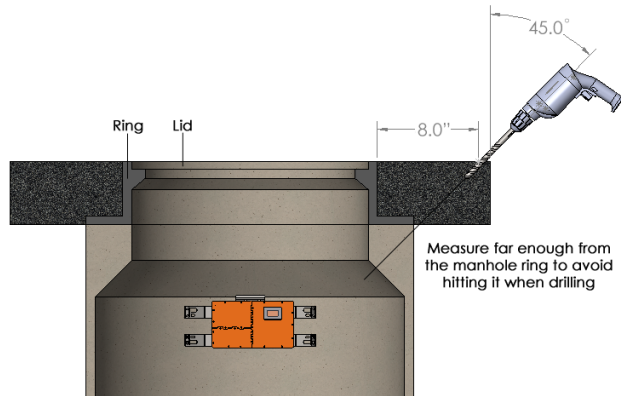


Figure 3.1

Typical Antenna Installation

1. Measure 8" to 10" from the outer edge of the manhole lid and place a mark where you will drill the hole for the antenna cable (Figure 3.2).
2. Use a 3/8" x 24" long masonry drill bit to drill through the roadbed at a 30 to 45 degree angle toward the sewer vault (Figure 3.3).



Figure 3.2



Figure 3.3

3. Using a circular saw or angle grinder, cut a groove eight inches long across the hole that was drilled for the cable (Figure 3.4). This groove will house the antenna. The groove should be tangent to the manhole ring with a depth and width large enough to embed the antenna just below the road surface. The groove should not be any deeper than the largest diameter of the antenna body. Placing the antenna lower than necessary will adversely affect the signal strength, while placing it too high will cause damage by moving vehicles.

4. Now enlarge the first inch of the cable feed-through hole with the masonry drill bit to accept the strain relief on the antenna body (Figure 3.5).



Figure 3.4

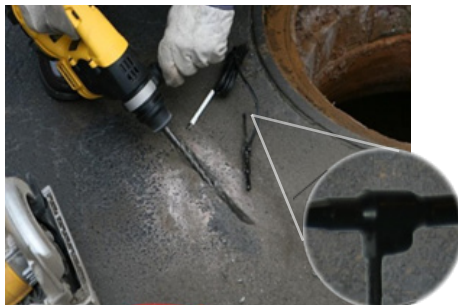


Figure 3.5

5. Brush away loose material from the antenna groove. Use the 3/8" x 24" long masonry drill bit to clear the cable feed-through hole from debris.

6. Keep the dust (cork) cap in place (Figure 3.6) and feed the antenna coaxial cable end through the hole (Figure 3.7). Reach inside of the manhole vault to retrieve the antenna cable and place to the side of the hole (Figure 3.8). Make sure the antenna body does not extend above the surface of the road.

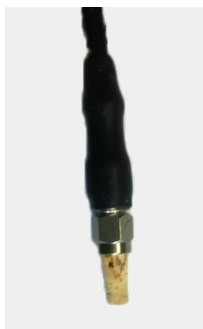


Figure 3.6



Figure 3.7

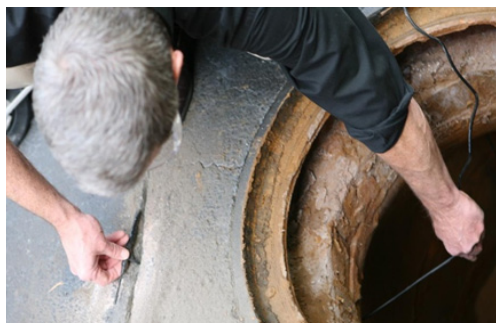


Figure 3.8

7. Use the sealant applicator to apply the asphalt sealant around and on top of the antenna body (Figure 3.9). Sprinkle the drying agent on top of the asphalt sealant (Figure 3.10).

8. Place a piece of cardboard over the area to prevent tracking (Figure 3.11). Seal the tube of sealant so it can be used in a future step. The asphalt sealant will dry in approximately four hours.



Figure 3.9



Figure 3.10



Figure 3.11

9. Remove the dust cap from the coaxial end of the antenna and verify that debris is not interfering with the water tight coax connector. Connect the antenna to the Manhole Monitor (Figure 3.12).



It is vital that the antenna is hand tight plus 1/4" turn with a wrench to ensure protection against moisture. Also, make sure the fitting is clean (Figure 3.13).



Figure 3.12

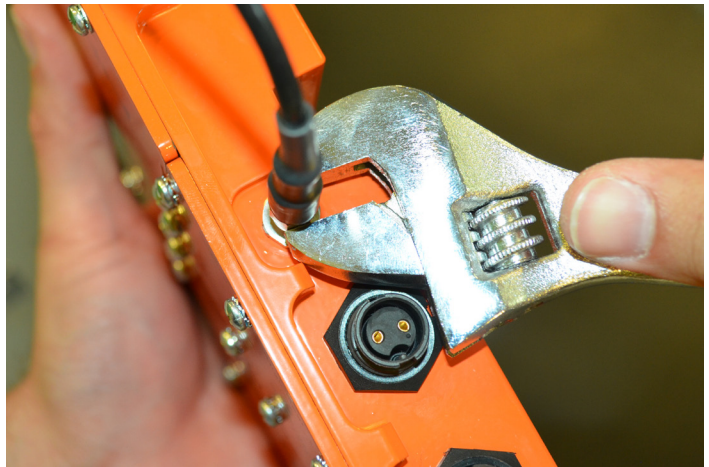


Figure 3.13

Confirm the Receive and Transmit Test values are within about 3 dB of prior readings by testing the signal strength. Refer to the LCD Quick Start Guide on page 11.

10. Wrap the strip of moldable black tape around the antenna connection to isolate this area from the elements. Wrap electrical tape over the moldable black tape for additional protection.

Chapter 4a: Install the Manhole Monitor Bracket

The Manhole Monitor can hang vertically or horizontally from the bracket. Choose a location on the manhole chimney side wall where the bracket and device will not interfere with or be struck by other objects.

An optional bracket is available for “under the lid” installations.

Mount the Bracket

1. Choose a location under the iron ring of the manhole that is close to the top for easy access, but clear of any lid protrusions. Make sure to consider the length of the antenna cable. The four bracket tabs can be bent to accommodate a tapered stack or stepped brick stack.
2. Transcribe the bolt pattern onto the side wall of the vault by using the bracket as a pattern (Figure 4.1).
3. Insert the 3/16” x 4” masonry bit into your hammer drill and bore a hole up to 2.5” deep for each cutout on the bracket (Figure 4.2).
4. Insert a small amount of asphalt sealant into each hole.
5. Place the bracket over the holes and drive the stainless steel TapCon masonry screws into the wall of the manhole with the 5/16” driver bit (Figure 4.3).

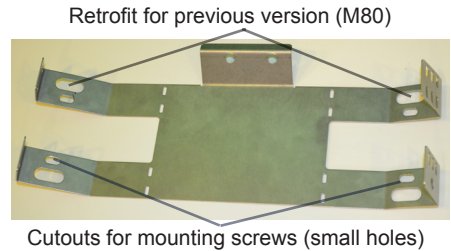


Figure 4.1



Figure 4.2

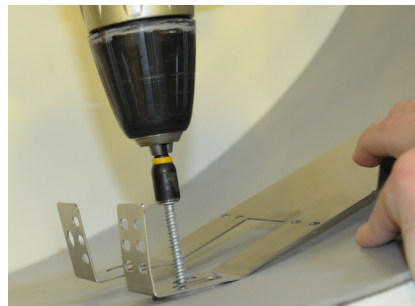


Figure 4.3

Chapter 4b: Install the Manhole Monitor

Attach the Float Cables and Hang the Manhole Monitor

6. Notice the registration pins on the quick disconnects (Figure 4.4). A small amount of dielectric grease has been placed in the float termination. Take care not to introduce debris at this stage. Make sure the pins align with the holes and insert the cable ends (Figure 4.5). Firmly push the connector inward and lock the bayonet ring by twisting it clockwise 1/2 turn. Verify that the float connectors are securely attached. If you are using one float, leave the float connection cap in place on the unused float position (not shown – refer to the Included Parts section on page 2).

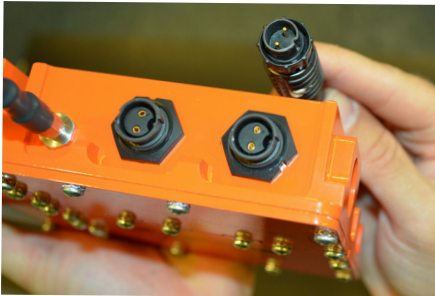


Figure 4.4



Figure 4.5

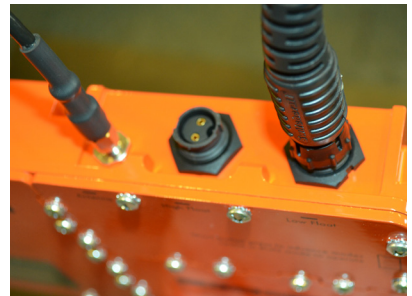


Figure 4.6

7. Use the horizontal or vertical mounting hinges to hang the Manhole Monitor on the top tab of the bracket (Figure 4.7 and 4.8).



Figure 4.7

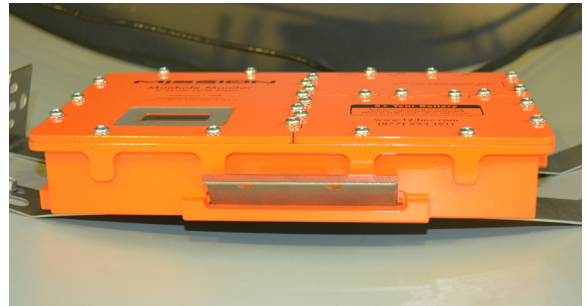


Figure 4.8

Secure the Antenna Cable

8. Feed two tie wraps through the holes on the upper tab of the bracket (Figure 4.9). Tie the extra coaxial cable in 6" circles (Figure 4.10). Do not kink the coaxial cable. Leave enough slack in the cable so the device can be rotated on the bracket and brought out to the roadside without disconnecting the cable. Secure the cable to the tab and cut the excess tie wrap (Figure 4.11).

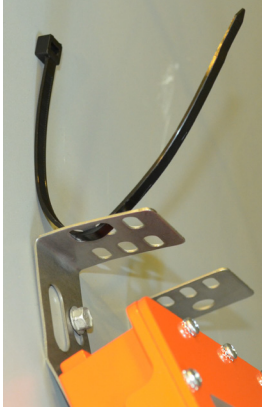


Figure 4.9



Figure 4.10

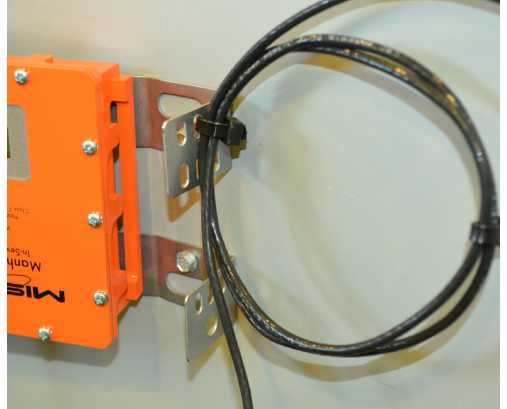


Figure 4.11

Adjust the Floats

9. Tie a secure loop or a butterfly knot in each float cable (Figure 4.12). Use the loop and carabiner to hang the assembly from the lower tabs of the mounting bracket (Figure 4.13 and 4.14). This will place stress on the carabiner/lower tab, instead of placing it on the float connection(s).



Figure 4.12



Figure 4.13

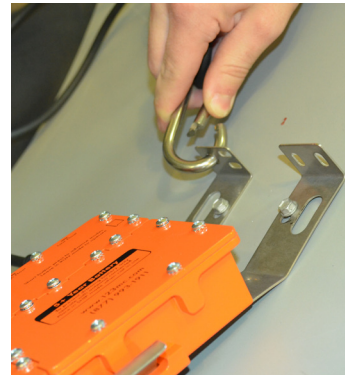


Figure 4.14

10. Adjust the low level float (surcharge float) so that a tip results when the discharge pipe is full and about to go into “surcharge.”

11. Locate the high level float where it will be the most informative. Some utilities locate the second float a set number of feet above the surcharge float to determine the rate of change between the two alarm events. Other utilities place the second float below the known critical height.

12. Secure the excess float cable (Figure 4.15). Be sure there is no stress transferred from the hanging floats to the water-tight connections. Leave enough slack so the Manhole Monitor can be rotated on the bracket for viewing as well as brought onto the roadside without disconnecting the cables.



Figure 4.15

Final Test

13. Tip the float(s) for 5+ seconds and confirm end-to-end transmission success by logging on to your web portal via www.123mc.com or by calling technical support. Replace the manhole cover once you have determined the device is working properly.

14. Record the input names by using your web portal and by recording it on the included Manhole Monitor Setup Form. Submit the form to setupforms@123mc.com.

Refer to the installation checklist on the back page of this manual before leaving the site.

Appendix A – Troubleshooting

Problem	Reason	Solution
The LCD will not turn on or is not operating properly when the button is pressed.	<ul style="list-style-type: none"> • Push button not pressed properly. 	<ul style="list-style-type: none"> • Press push button for two second.
	<ul style="list-style-type: none"> • Dead battery. 	<ul style="list-style-type: none"> • Replace battery (see note on page 9). High transmission rates can drain the battery. The device is designed for ~2500 transmissions per battery set. Refer to the chart in Appendix B for instructions on how to decrease the transmission rate. Equipment other than floats may consume more power.
	<ul style="list-style-type: none"> • LCD has become inoperable. 	<ul style="list-style-type: none"> • The device will continue to operate properly. However, the LCD will cease operation below -18 degrees C.
During the RX Test, the LCD displays “Poor” as the signal strength rating.	<ul style="list-style-type: none"> • Antenna obstruction. 	<ul style="list-style-type: none"> • Make sure the top of the antenna is not obstructed by a parked vehicle or large objects. • Test the device with an antenna that is known to be working properly. • Heavy snow fall may impede the antenna signal.
	<ul style="list-style-type: none"> • Antenna is disconnected or damaged. 	<ul style="list-style-type: none"> • Connect the antenna if it is disconnected. • If the antenna is damaged, contact Mission to purchase a new antenna.
	<ul style="list-style-type: none"> • Debris is in the water tight coaxial connection. 	<ul style="list-style-type: none"> • Debris in the antenna connection can affect the signal strength. Check the antenna connection.
	<ul style="list-style-type: none"> • Antenna is buried too deep. • Antenna is buried in dirt instead of asphalt. 	<ul style="list-style-type: none"> • Verify the antenna is not installed more than a 1/2” deep in the asphalt.
	<ul style="list-style-type: none"> • Antenna cable is kinked, not coiled. 	<ul style="list-style-type: none"> • Verify that the antenna cable is coiled instead of kinked. Kinking the antenna cable will impact signal strength.
The result of the TX Test was “Fail.”	<ul style="list-style-type: none"> • The SIM card is inactive or damaged. 	<ul style="list-style-type: none"> • Call Mission technical support to verify that the SIM card is active.
	<ul style="list-style-type: none"> • Signal strength is too low 	<ul style="list-style-type: none"> • Retry the TX Test two times
Signal strength was good, but now it is out of the optimal range.	<ul style="list-style-type: none"> • Antenna obstruction. 	<ul style="list-style-type: none"> • Verify the antenna is intact and not blocked by a parked vehicle. • Remove the Manhole Monitor and test it in a different location.

Appendix B – Advanced Configuration Overview

To access the advanced configuration menu, press and hold the pushbutton for five seconds or until you see “Info.” You also can remotely access configuration options from your Mission web portal.

Transmission Rate	<p>The Manhole Monitor transmits operating information once a day.</p> <p>The transmit rate can be increased or decreased by pressing the button while “Rate” is displayed. Do not change the transmission rate without prior authorization from Mission technical support.</p>
Language Selection	<p>The text can be displayed in one of three language options. Press the pushbutton when “Lang EN” is displayed on the screen to change the default display language from English (EN) to French (FR) or Spanish (SP).</p> <p>When the LCD displays the language you want to select, do not press the pushbutton again. The LCD will then display Delay Settings (described below).</p>
Alarm Delay Settings	<p>The delay feature enables you to set the amount of time that a float must remain tipped before the float state is transmitted. This feature is used to prevent nuisance alarm events.</p> <p>“DlyH: 5s” Default high float delay setting</p> <p>“DlyL: 5s” Default low float delay setting</p> <p>Press the pushbutton when “DlyH 5s” or DlyL 5s” is displayed on the screen to change the delay time for the high and/or low float.</p>
Operation Mode	<p>The Manhole Monitor has two modes of operation: “Run” and “Ship.”</p> <p>“Ship? No.” This option is selected by default and should only be changed if you intend to install the unit at a future date.</p> <p>“Ship? Yes.” > “Goodbye!” When ship mode is enabled, the device powers down to conserve battery life and will not transmit until the next time the button is pressed to turn the device back on.</p> <p>To turn the unit on, press and hold the pushbutton for two second. The device will automatically be in “Run mode.” Do not press the pushbutton again.</p>

Once the device cycles through each configuration option, the LCD will return to the home screen (Run Mode) and turn off after 30-60 seconds.

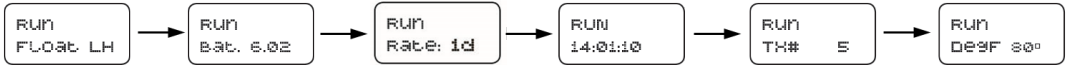
Appendix C – LCD Reference

This table displays how each screen appears for the Home Screen (Run Mode), Receive Test and Transmit Test.

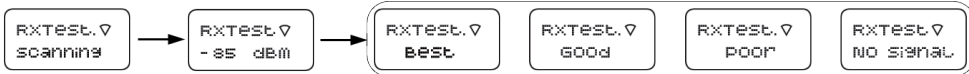
Stage	Successful Result	Unsuccessful Result
Home Screen Press and hold the pushbutton for two to three second to turn on the display.	LCD Display Is On You will see: "Run..." Battery voltage > rate of transmission > float status, time and TX number (Status Information)	LCD Does Not Turn On No text
Receive Test From the homescreen (while the LCD scrolls through the current status information), press and hold the pushbutton for one second. If the LCD turns off you will need to start from the beginning.	"RX Test" You will see: "Good" (-98 dBm to -80 dBm) OR "Best" (-81 or Higher)	"RX Test" You will see: "Scanning" > "No Signal" or "Poor" (Signal is less than -97 dBm)
Transmit Test Press and hold the pushbutton for one second.	"TX Test" "Wait" "■■■■" "Success" The device will automatically transition to "Run Mode" and scroll through status information. The LCD will then turn off.	"TX Test" "Wait" "■■■■" "Fail"

Appendix C – LCD Reference (continued)

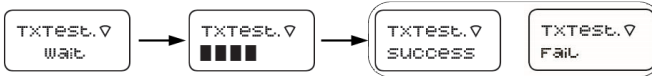
Current Status Information



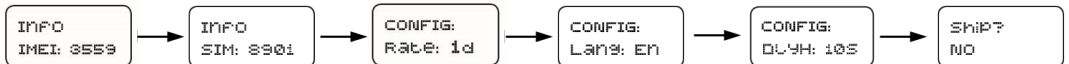
Receive Test



Transmit Test



Optional Advanced Settings



Press the push button on the “Rate”, “Lang”, “DlyH” or “DlyL” to change the configuration.

Checklist

If only one of the float connections is being used, did you leave a cap on the unused float connection?	
Are the excess cables tied securely without putting stress on the fittings?	
Was the nut on the antenna cable tightened ¼ turn past hand tight with a wrench?	
Is the antenna embedded in a road without obstructions? Did you wrap the antenna connections with the provided moldable black tape? Is the antenna flush with the road surface?	
Did test float tips show on your web portal?	



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