Technical Brief

MTU Installation Guidelines

A product of
Aclara Technologies LLC
Confidential and Proprietary

(Y20355-TEB Rev C)

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WARNINGS, CAUTIONS, AND NOTES

Always consult and adhere to all local and national safety codes, regulations, and standards.WARNING, CAUTION and Note statements are used throughout this anual to emphasize important and critical information to help you ensure safety and prevent product damage.These statements are defined below.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious physical injury.

CAUTION indicates a situation, which, if not avoided, could result in damage to equipment, damage to software, loss of data or invalid results.

NOTE indicates important supplemental information.

FCC / IC Compliance

The following statements cover the RF exposure guide and the field calibration procedure.

FCC / IC RF Exposure Guide

Aclara Technologies LLC low power RF devices and their antennas must be fixed-mounted on indoor or outdoor permanent structure(s) providing a separation distance of at least 20 cm from all persons during normal operation. This device is not designed (and it has no external connection) to operate in conjunction with any other antennas or transmitters. No other operating instructions for satisfying RF exposure compliance are needed.

Field Calibration Procedure

Aclara Technologies LLC low power RF devices have passed through extensive and multitask testing and calibration procedures while in the factory. Therefore, no additional calibration or adjustment is required in the field. Aclara Technologies LLC low power RF devices are shipped to the customer in the sealed enclosures. Thus, no adjustments can be made in the field, without breaking the factory sealed enclosure.

OVERVIEW

Meter Transmission Units (MTUs) are the endpoints of the STAR system. MTUs are permanently sealed devices that transmit regularly scheduled meter readings on an FCC licensed frequency to a Data Collector Unit, or DCU. Every remote mount Meter Transmission Unit (MTU) installation location presents its own set of variables. This document is intended to help guide installers by providing general information about UHF radio transmissions, MTUs, and Aclara recommended practices for installation. Failure to adhere to these guidelines may be detrimental to system operation.

Introduction

This document is intended to help guide installers by providing general information about UHF radio transmissions, MTUs, and Aclara recommended practices for installation. Failure to adhere to these guidelines may be detrimental to system operation.

Support

The Aclara Customer Portal (http://customer.aclaratech.com) provides a wide range of information that can serve as a starting point when you have a question. If, at any time, you would like to speak with a Aclara representative about any product or service or if you do not have a user name and password to access the Portal, please contact Support:

Email: support@aclara.com
Phone: 1-800-892-9008

Deployment Process

MTU deployment can be broken down into three basic steps. These are:

1. Mounting the MTU
2. Routing and connecting the wiring
3. Programming and configuring the MTU

The scope of this document is limited to the mounting and wiring portions of the deployment process. For more information on programming MTUs, please refer to the following manuals:

STAR Programmer Software Installation Instructions (Y20318-TUM)

Provides detailed instructions for installing the STAR Programmer Software on handheld PCs and Meter Shop PCs.

STAR Programmer Software User Guide (Y20348-TUM)

Provides information that enables you to program and configure MTUs using the STAR Programmer Software.

Recommended Equipment

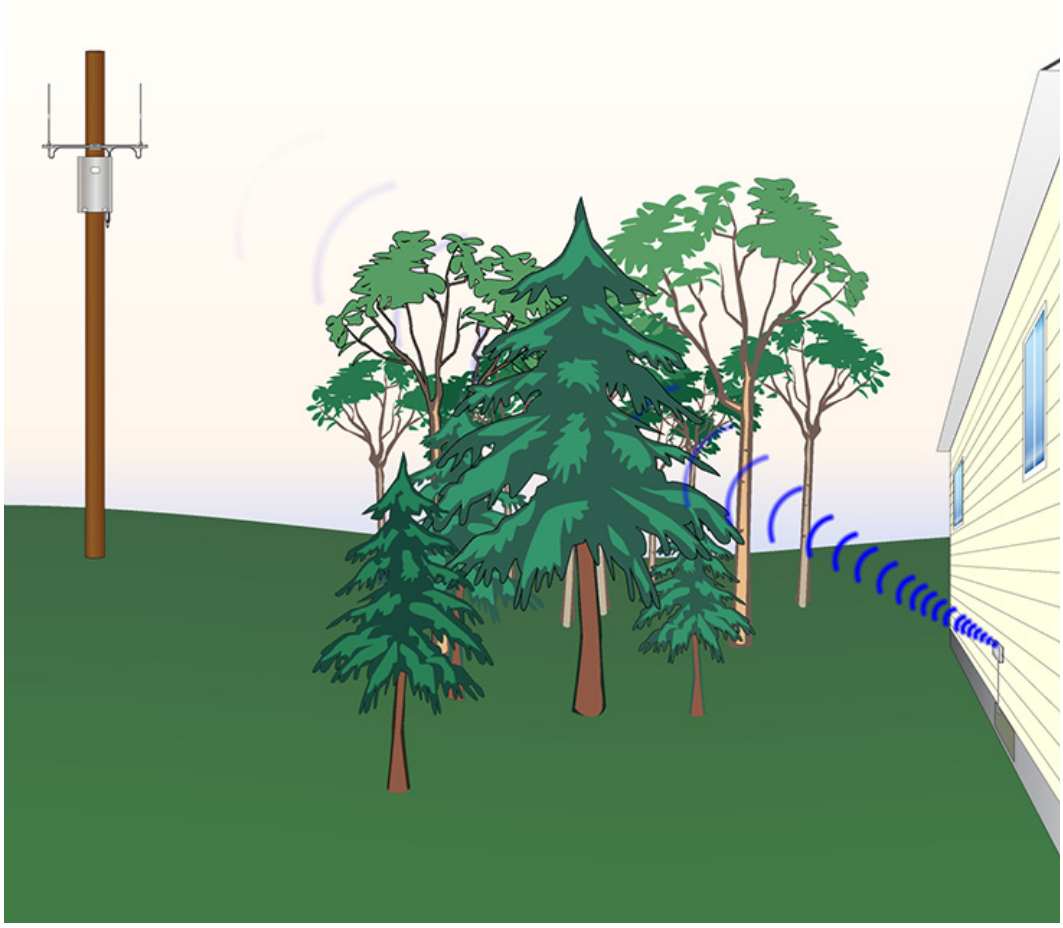
Aclara recommends installers have the following equipment available during installation. A more detailed list for specific installations evironments is provided in Appendix A.

- Cable ties
- Staple gun
- 9/16" rounded crown staples
- Fine point permanent marker
- #6 x 1"Plastic anchors for screws
- 8" x 1-3/4" exterior screws
- Hammer
- Flashlight
- Diagonal cutters
- Wire stripper
- Drill bits
- #6 x 1-5/8" drywall screws
- Cordless drill
- Screwdrivers and screwdriver bits
- Silicone gel filled electrical insulating IDCs (Aclara #043-1913)
- Connector appropriate crimping tool
- Cellular phone (for relative signal strength)
- Room Temperature Vulcanizing (RTV) sealant
- 3 conductor, 22 AWG, single-strand, black UV jacket cable
- 3 conductor, 22 AWG, single-strand, gray UV jacket cable
- Known operational MTU
- Known operational meter equivalent to meter at premise
- Direct bury splice kit (Aclara #043-1912)

Signal Propagation

The STAR Network operates in the range of 450 - 470 Megahertz (MHz). Frequencies in this range are specifically licensed by the FCC for business use, and are considered to be part of the Ultra-High Frequency (UHF) band of radio communications. As with all UHF communications, there are certain factors that affect the propagation of the radio transmissions. The STAR Network is designed to overcome these factors, but it is possible that failure to follow recommended intallation guidelines may create conditions that exceed the limits of the STAR Network.

All devices that operate in the UHF band are considered to use line of sight transmission, and operate best when the path between the transmission point and the reception point is unobstructed.



Every Meter Transmission Unit (MTU) installation location presents its own set of variables, and this document is intended to help guide installers by providing general information about UHF radio transmissions and MTUs. Failure to adhere to these guidelines may be detrimental to system operation.

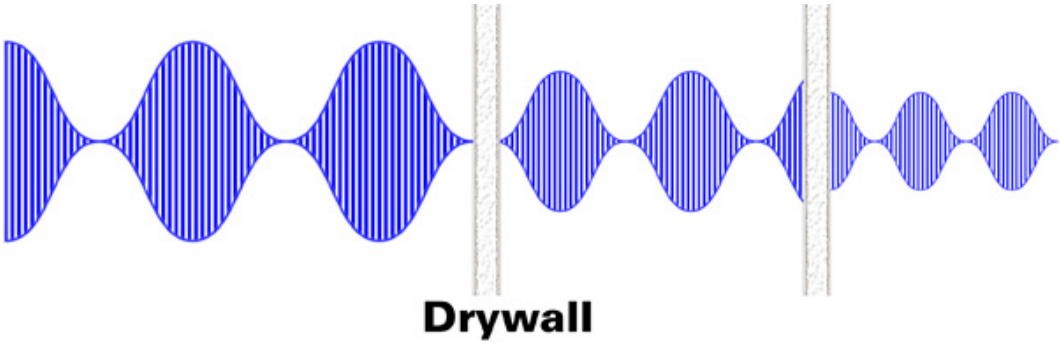
There are four main things that affect the propagation of UHF radio waves. These are free space attenuation, absorption, reflection, and shadowing.

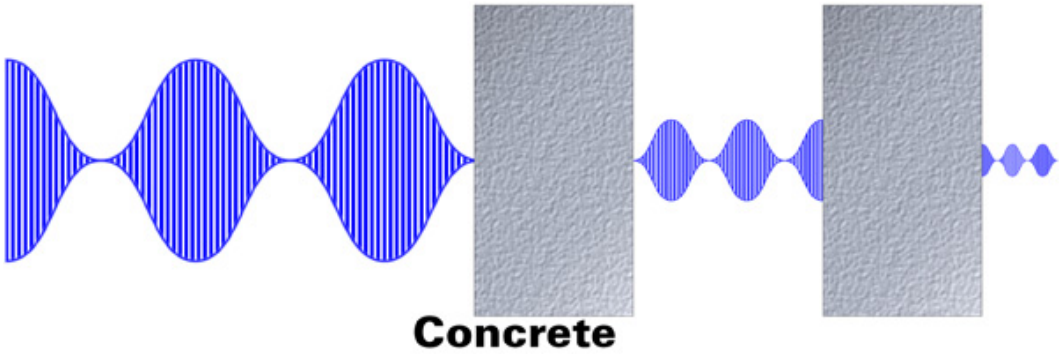
Free Space Attenuation

Free space attenuation is the natural loss in signal strength that occurs when radio waves pass through open air. This loss in signal strength is proportionate to the distance between the transmitter and the receiver. While the actual installation of the MTU will not change the free space attenuation considerably, certain locations may require the use of an extended range MTU or an increase in the number of DCUs to improve communication.

RF Absorption

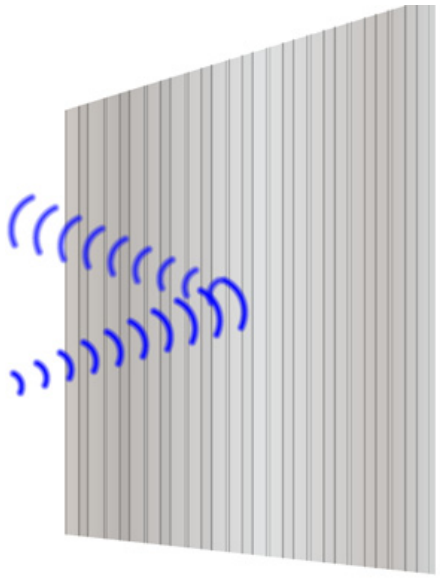
RF absorption occurs naturally with objects that are not electric conductive such as drywall, concrete, wood, and foliage. A variety of factors affect how much RF energy is absorbed by the obstruction. The following illustrates how concrete tends to absorb more RF energy than a sheet of drywall.



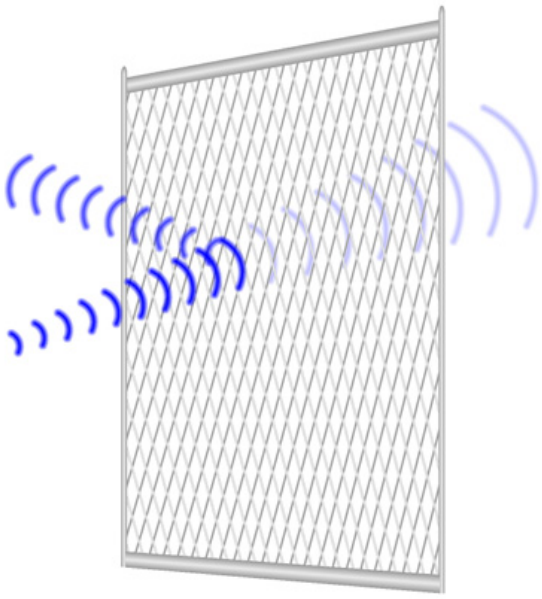


RF Reflection

RF reflection occurs when objects made of conductive materials (typically metal) are in or near the transmission path. While reflection itself may not negatively affect system performance, the RF signal may be reflected into an absorbing material such as dense foliage or the concrete foundation of a building. Common objects that reflect RF signals are metal buildings such as sheds or warehouses, metal fences, HVAC ducts, vehicles, and metal signs. It is important to note that even metal fences that are not solid (e.g. chain-link, wrought iron) will reflect ta large portion of the RF signals.



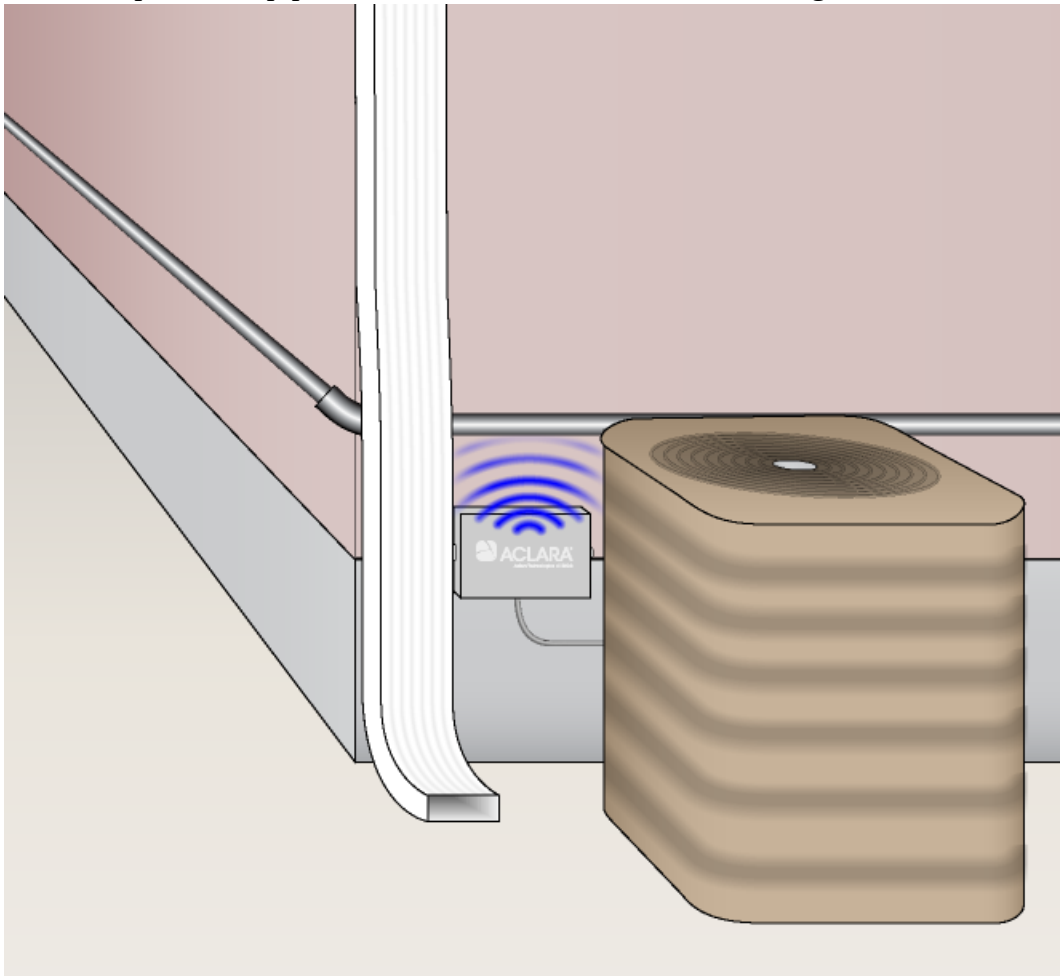
Sheet metal



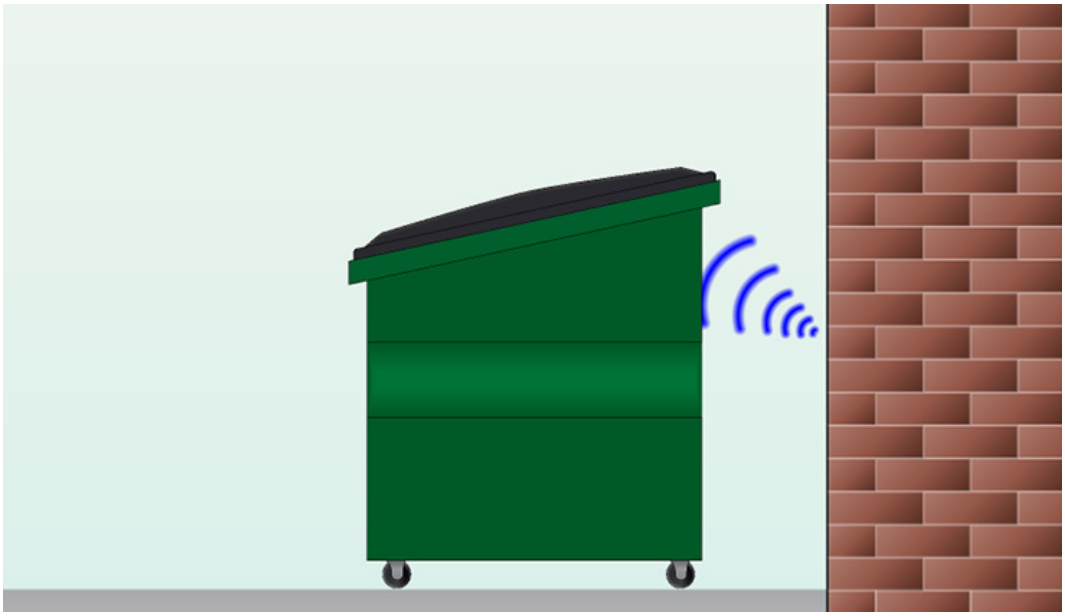
Chain-link fencing

RF Shadowing

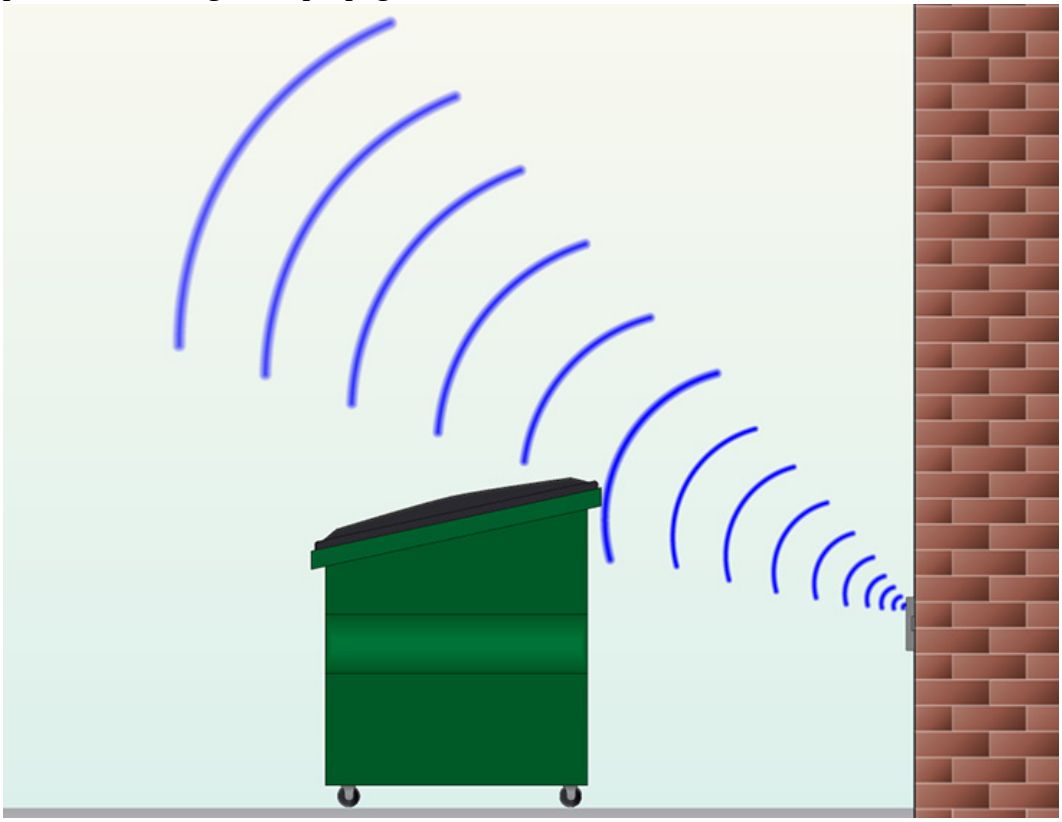
RF shadowing is a phenomenon related to absorption and reflection that occurs when a transmitter is too close to another object. The image below illustrates how the downspout, iron pipe, and the AC unit all shadow the RF signal.



The signal is narrowest when it first leaves the MTU. The closer an object is to the MTU, the greater the impact the object will have on the signal. This is illustrated in the image below, where the close proximity of the garbage dumpster is blocking the signal from the MTU.



Simply moving the dumpster several feet away from the MTU allows a greater portion of the signal to propagate.



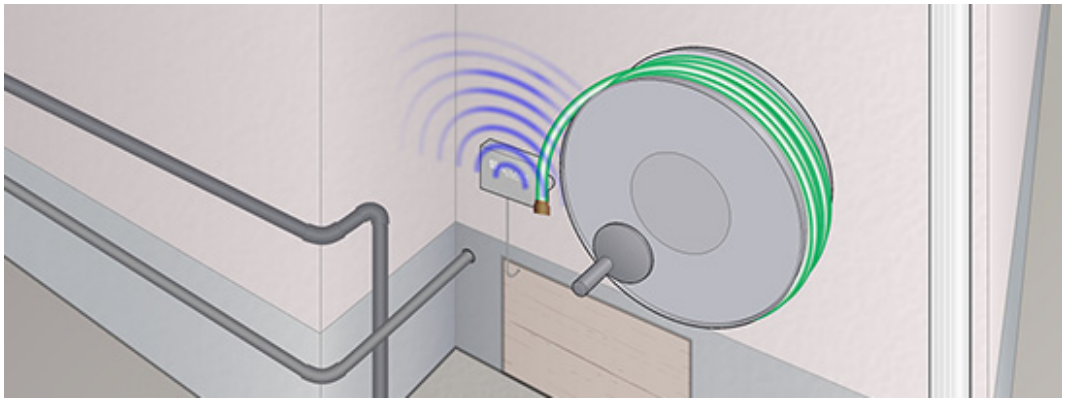
MOUNTING CONSIDERATIONS

The following sections describe the nature of RF signal transmission in the UHF frequency range, and specific factors to consider when installing an MTU on the exterior of a building, inside a building, or in a meter pit. Regardless of the installation environment, the MTU must be mounted securely.

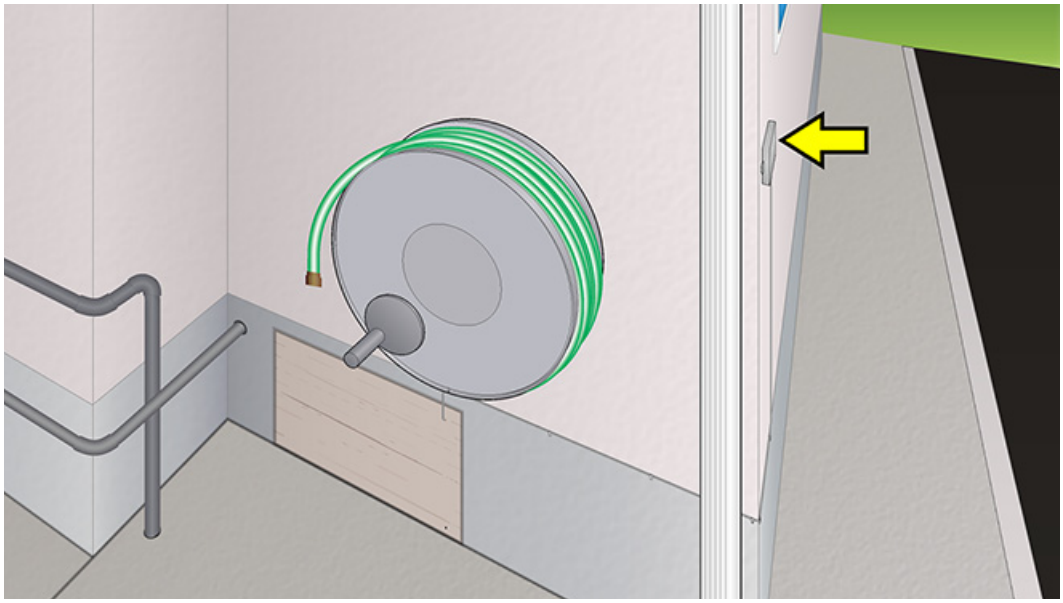
Exterior Mounting

Issues with performance of exterior mounted MTUs are typically the result of mounting the MTU too low, or mounting it in such a way that it is blocked by various obstructions.

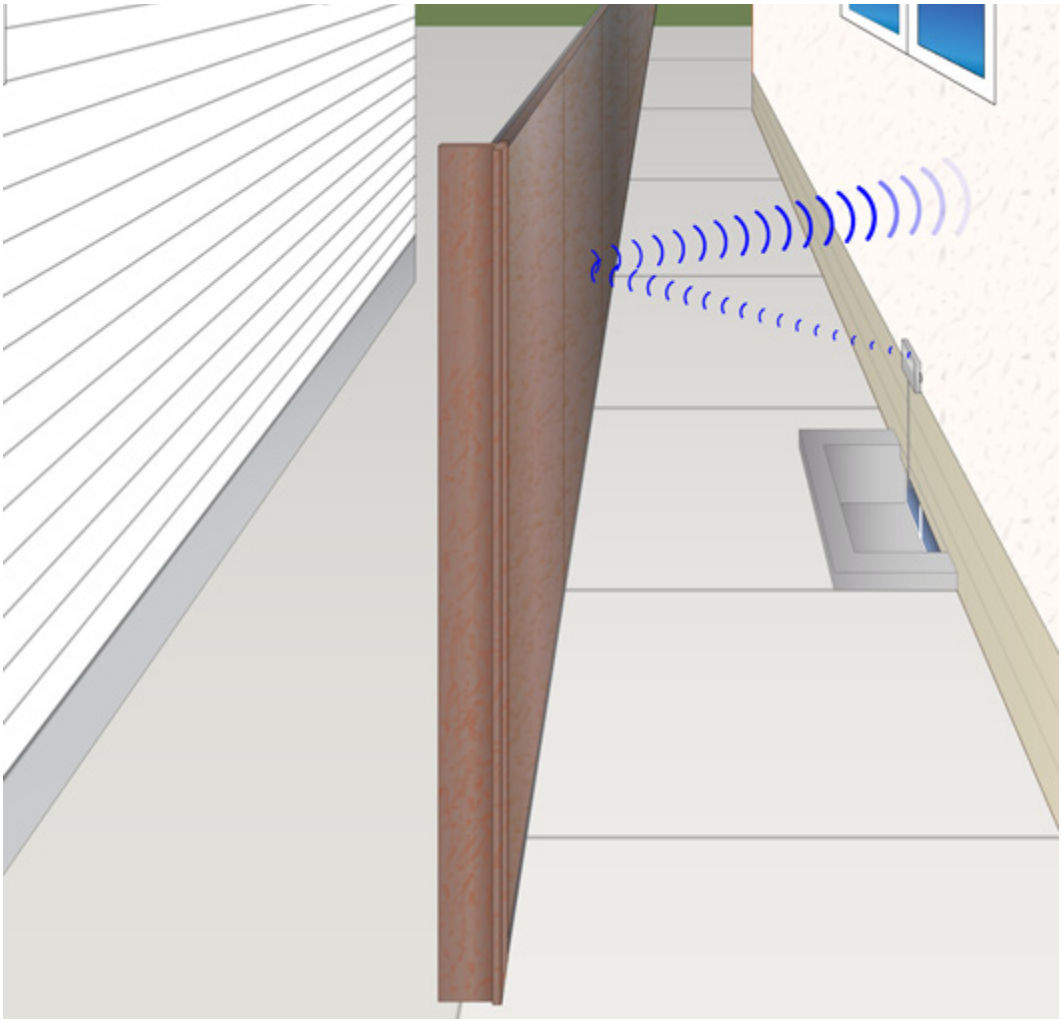
In the following real world example, the MTU is mounted between the protruding exterior wall and the hose reel, both of which absorb the RF signal.



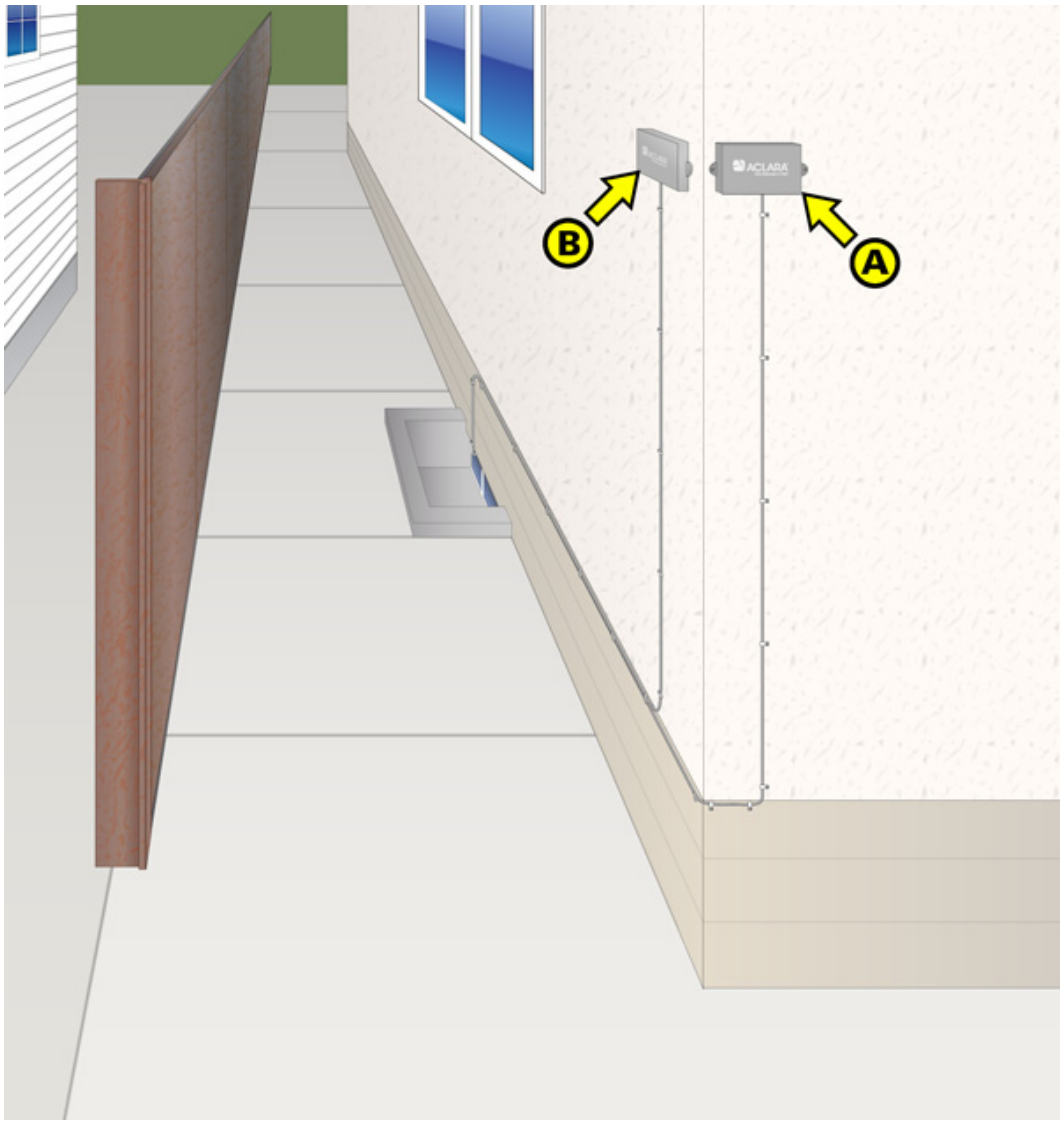
Raising the MTU above the hose reel will reduce the amount of signal absorbed, but a better solution is to move the MTU to the front of the building, as shown below.



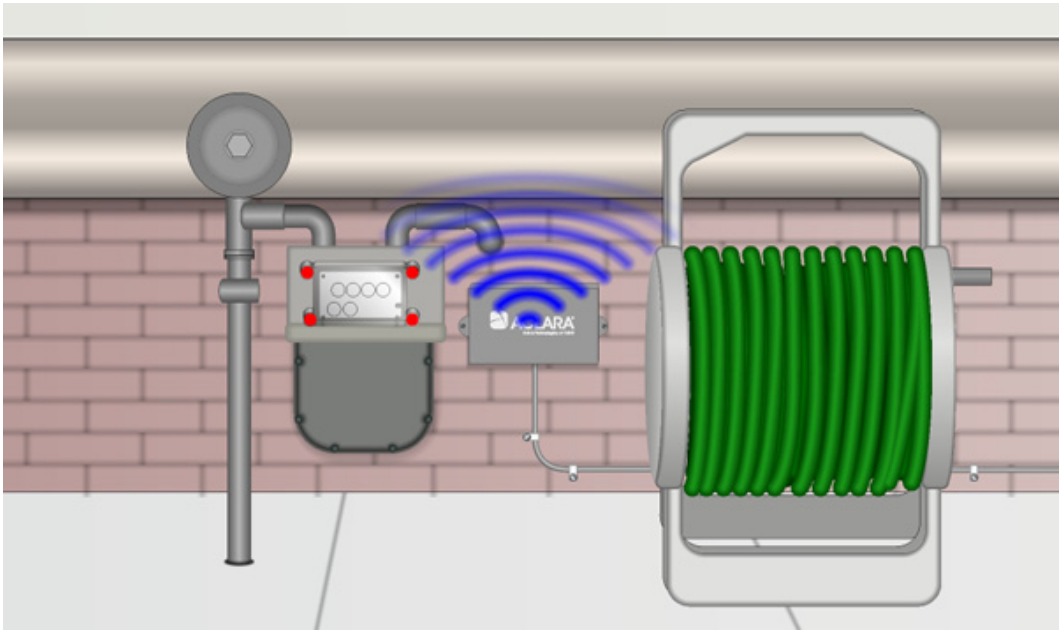
In this example, the RF signal is reflected off of the iron fence and absorbed by the exterior wall of the home.



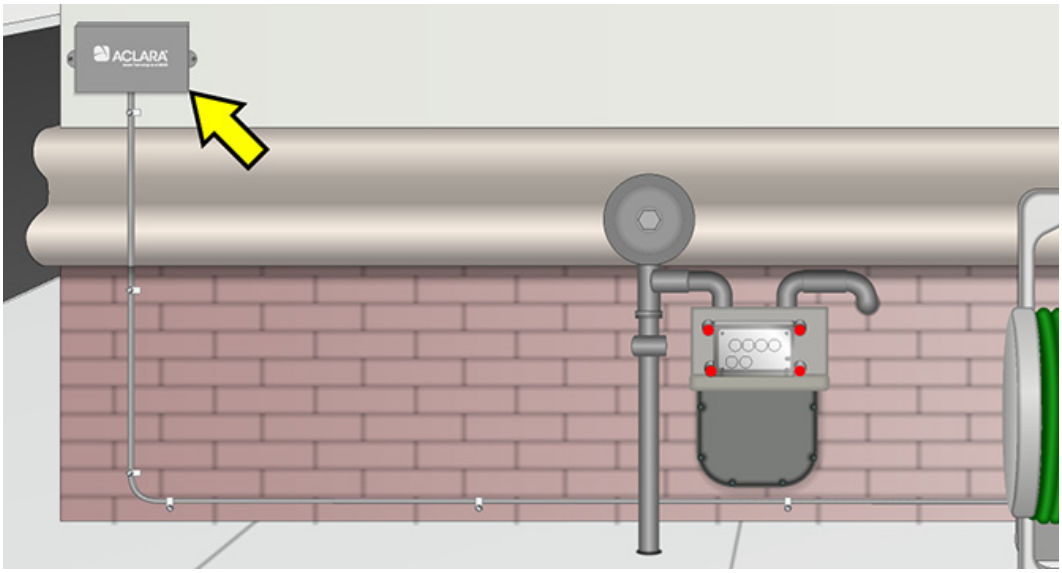
Simply raising the MTU above the fence and moving it to the end of the home (B) will drastically reduce the amount of RF energy reflected by the fence and improve system communication. The ideal location for the MTU, however, is on the front of the home (A).



The image below illustrates how the hose reel, the meter, and the wall ledge all shadow the RF signal.



Raising the MTU above the ledge and moving it to the edge of the building eliminates the shadowing effect of the meter, ledge, and hose reel.



Summary

- Mount the MTU as high as possible. The MTU *must* be mounted at or above grade (ground level).
- Mount the MTU with the Aclara logo facing the installer.
- Mount the MTU at least six inches away from any metal objects, including pipes, conduit, and downspouts.
- Mount the MTU so that the top is at least one inch below the siding overlap.
- When mounting multiple MTUs in the same location, leave at least 4 inches between the MTUs if mounting side by side, and at least 3 inches between MTUs if mounting one above another.
- *Do not* mount the MTU so that it is transmitting towards a nearby building or fence.
- *Do not* mount the MTU directly under AC power or telecommunications wires.

Interior

MTUs installed inside of a building should be mounted on an exterior wall that is not immediately facing a neighboring building. As with exterior installations, the MTU should be mounted perpendicular to the ground with the Aclara logo facing the installer.

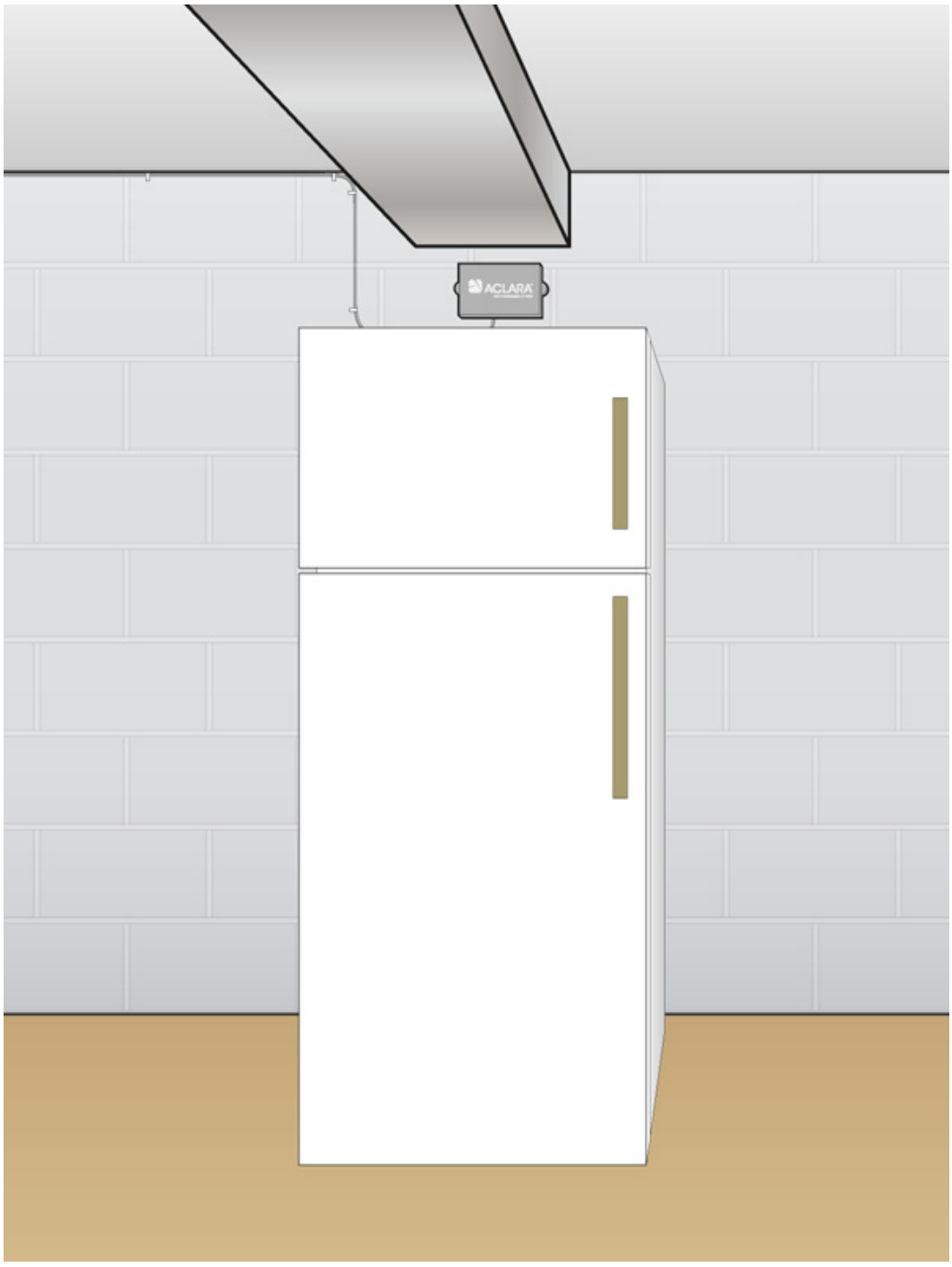
TIP Use a cellular phone's signal strength indicator to gauge the amount of signal interference within a building. Check the signal prior to entering the building, and then again at the proposed mounting location. A drastic drop in cellular signal reception may indicate potential problems with MTU transmission.

When mounting an MTU inside, it is important to note anything on the outside of the wall that may cause interference, such as aluminum siding, or AC units.

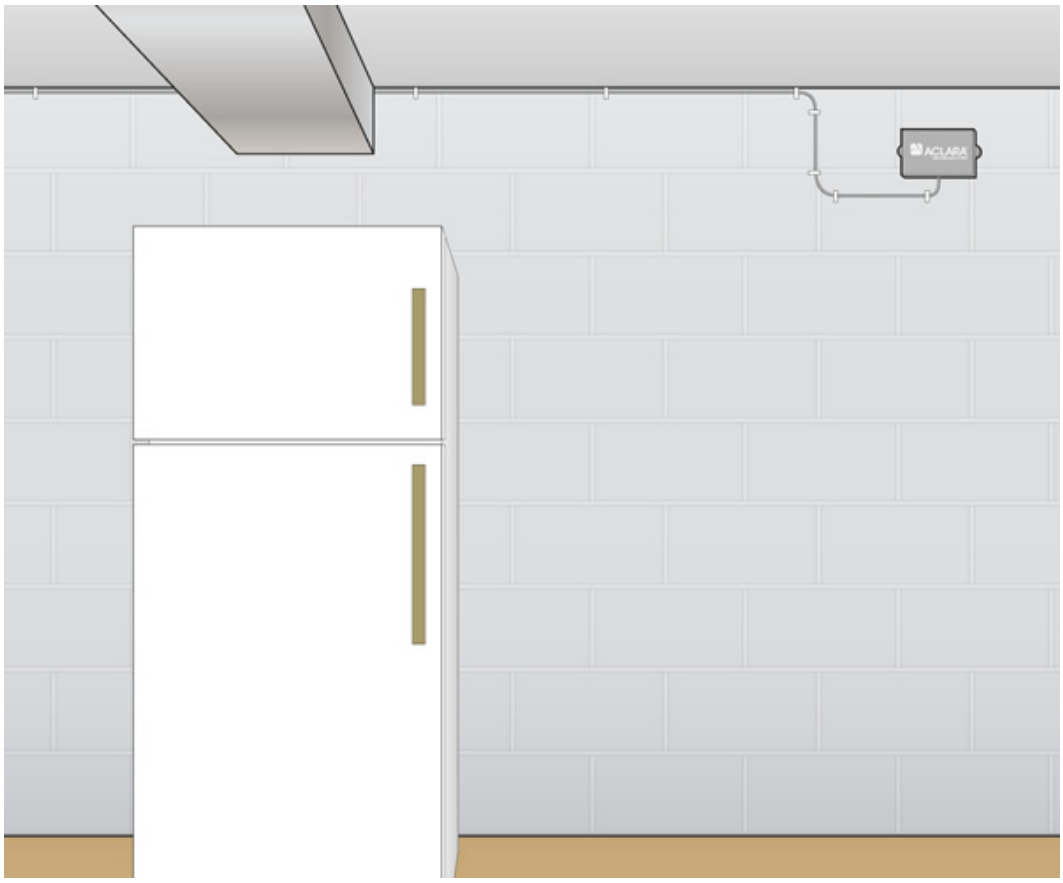
The following illustration shows an incorrect MTU installation. The MTU is mounted to the ceiling, facing the floor, and surrounded by copper and iron pipes. In this case, the RF signal is not only directed towards the floor, but heavily shadowed by the pipes.

The MTU should be mounted to the wall and away from the metal pipes, as shown below.

Mount the MTU at least 5-10 feet away from large metal objects like furnaces, duct work, refrigerators, and cabinets. In the example below, the MTU is mounted between the HVAC duct and the refrigerator. Both of these large metal objects will interfere with the RF signal.



Moving the MTU several feet away from the duct and the refrigerator will eliminate the interference and increase system performance considerably.

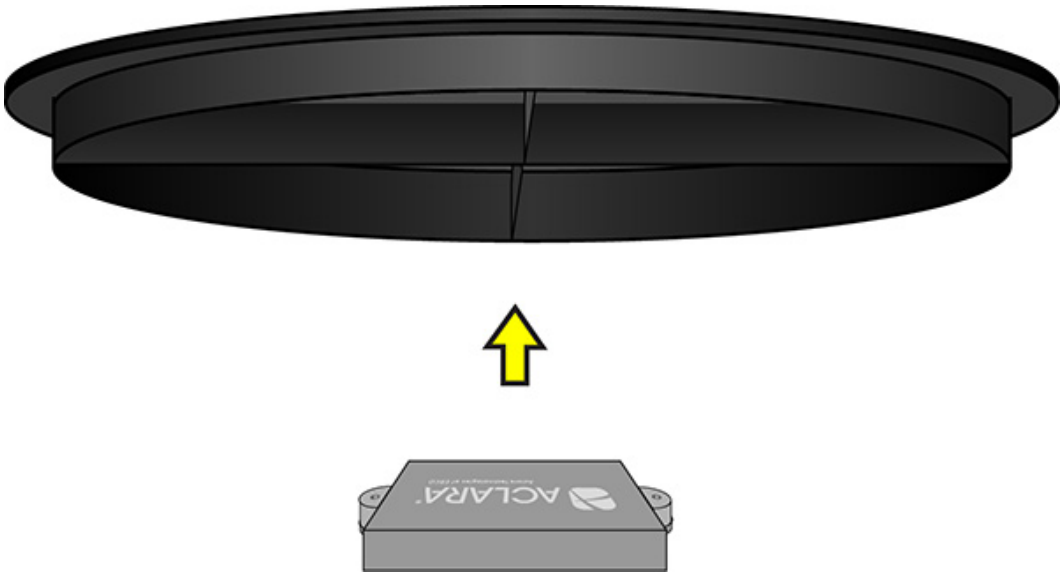


Summary

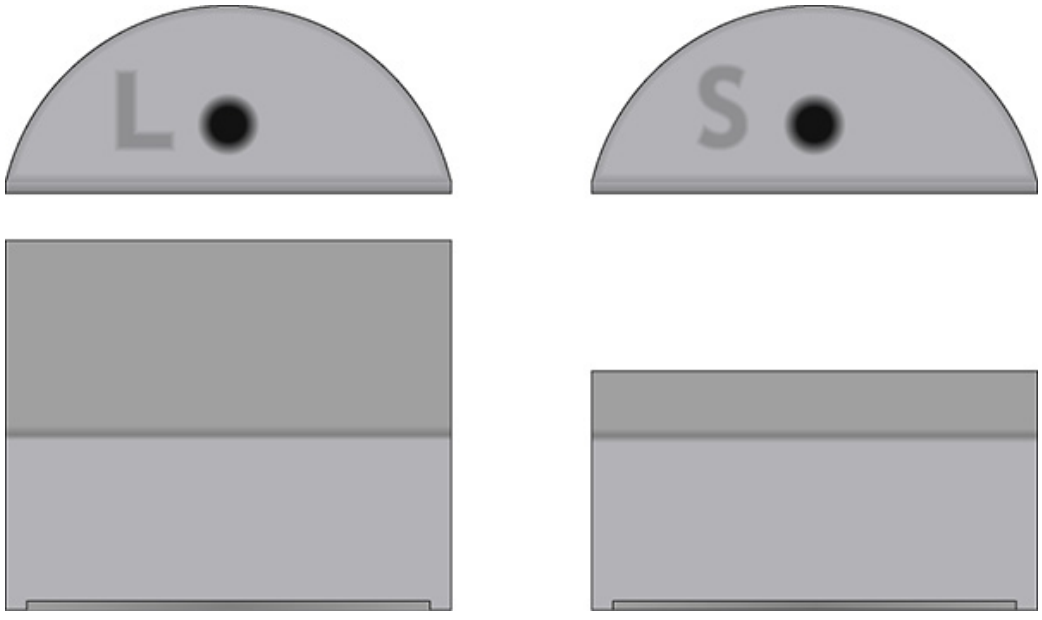
- Mount the MTU as high as possible near an exterior wall. The MTU *must* be mounted at or above grade (ground level).
- Mount the MTU perpendicular to the ground with the Aclara logo facing the installer.
- Mount the MTU at least six inches away from pipes and conduit.
- Mount the MTU so that the top is several inches below the ceiling.
- Mount the MTU at least five feet away from any large metal objects. (e.g. refrigerators, HVAC ducts, furnaces, and hot water heaters)
- *Do not* mount the MTU in a basement with a metal ceiling.
- *Do not* mount the MTU directly under AC power wires, circuit breaker panels, or telecommunications wires.

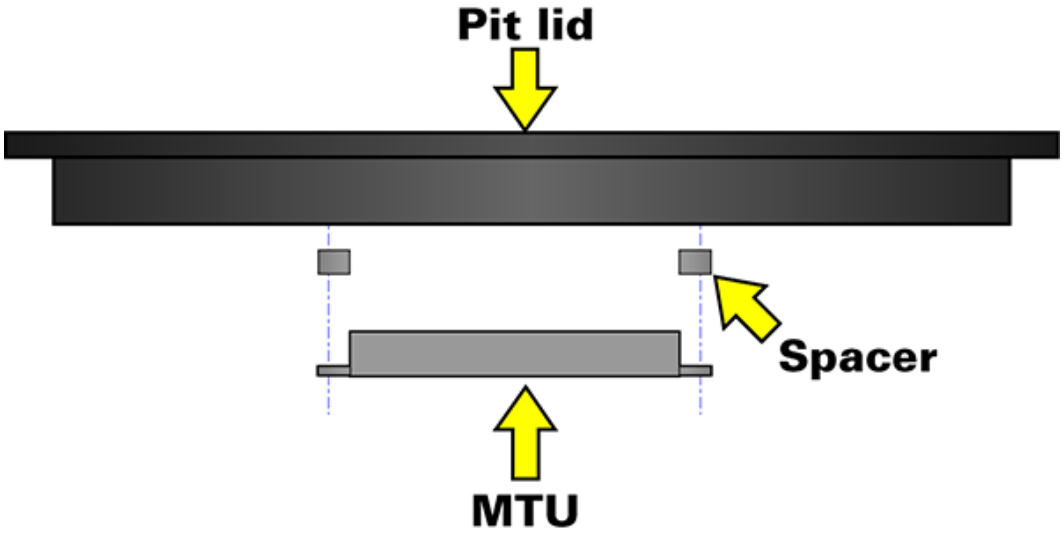
Pit

MTUs connected to meters located in meter pits may be mounted to approved, non-metallic pit lids. The MTUs should be mounted with the Aclara logo facing the pit lid, as shown in the following image.



Pit lids that are ribbed on the underside require short spacers, while meter pit lids that are smooth on the underside require long spacers. Short spacers are marked with an S, and long spacers are marked with an L. Always use the appropriate spacers when mounting an MTU to a meter pit lid.





MTU to pit lid mounting procedures vary according to pit lid model. Please refer to the appropriate pit lid installation instructions for specific mounting procedures.

Summary

- Mount the MTU to approved, non-metallic meter pit lids only.
- Mount the MTU with the label facing the pit lid.
- Use the appropriate spacers for the type of meter pit lid.

WIRING

All wiring must be consistent with the wiring provided with the MTU and adhere to local and national codes.

Cable Insulation

Most MTUs are shipped with black cable insulation. Dual port MTUs, however will have two cables: one with black insulation and one with gray insulation. The black inulated cable is for port 1, and the gray insulated cable is for port 2.

Wire Length

MTUs are provided with a standard wire length of 12 feet. If necessary, additional wire may be used to extend the range between the meter and the MTU up to 500 feet. (Some meters require shorter wire lengths. Please refer to the meter manufacturer's documentation for exact limitations.) Always use cable of with 22 AWG solid copper wire, preferably with similar insulation coloring when extending the wiring.

Wire Routing

All wiring should be secured every 18 inches and before and after every change in direction. Wiring routed along wood or drywall should be secured with 9/16" rounded-crown staples. Wiring routed along masonry walls should be secured using appropriate wire clips. The MTU cable should be allowed to move slightly within the staples or wire clips.

All changes in wire direction should only be made at right angles. Wiring should run parallel to ceiling joists, when possible. If joists must be crossed, the wiring should cross the joists at right angles.

If wire clearance holes are needed to route wire from the meter to the MTU, use a ¼" drill bit. The installer is responsible for the selection of an appropriate location for any hole to be drilled.

Connections

All connections must be made using silicone gel filled IDCs. Typical splice connectors will require removing approximately 1" of the outer cable jacket.

CAUTION It is important that you do not damage the insulation of the inner conductors when removing the outer jacket.

Aclara recommends you refer to the specific manufacturer for detailed installation instructions. The connectors must be installed according to the manufacturer's instructions.

Please consult the appropriate meter installation instructions for specific MTU wiring instructions.

Interior/Exterior Environment

All wire connections outside the building must be made with UL and RUS listed moisture and solvent resistant connectors. These are silicone gel filled, electrical insulating, IDCs.

Meter Pit Environment

All wire connections that are in a pit environment must be made using the appropriate IDCs with a silicone electrical insulating gel. The connectors must be UL listed as a wire connector system for use with underground conductors and CSA certified as a underground cable splicing kit for 600V direct bury and submersion applications.

APPENDIX

A

RECOMMENDED EQUIPMENT

This appendix provides a detailed list of recommended tools and supplies for specific installation types.

Tools	Indoor	Outdoor	Pit
Hammer	X	X	X
Staple gun	X	X	
Flashlight	X	X	X
Diagonal cutters	X	X	X
Wire stripper	X	X	X
Flat-tip screwdriver	X	X	X
Phillips head screwdriver	X	X	X
Cordless drill/driver with flat and phillips bits	X	X	X
1/4" General purpose/twist drill bit, standard length	X		X
1/4" x 12" General purpose/twist drill bit		X	
Cellular phone	X	X	X
Connector crimping tool	X	X	X
Fine-point permanent marker	X	X	X
Safety glasses	X	X	X
Spare serial adapter batteries (AA)	X	X	X
Known good meter register	X	X	X
Known good MTU	X	X	X

Supplies	Indoor	Outdoor	Pit
Cable ties	X	X	X
9/16" Rounded-crown staples	X		
#6 x 1" Plastic anchors for screws	X	X	
#6 x 1 5/8" Drywall screws	X		
#8 x 1 3/4" Exterior grade screws		X	
RTV silicone sealant	X	X	
Electrical tape	X	X	
3 Conductor, 22 AWG, solid copper wire w/black jacket	X	X	
3 Conductor, 22 AWG, solid copper wire w/gray jacket	X	X	
Gel-filled, insulation displacement connectors (Aclara #043-1913, or equivalent)	X	X	X
Direct burial splice kits (Aclara #043-1912, or equivalent)			X
Short MTU spacers (Aclara #056-8150S)			X
Long MTU spacers (Aclara #056-8150L)			X

APPENDIX

B

CHECKLIST

Use the following checklists to help verify the correct installation of MTUs.

General
Is the MTU mounted securely?
Is it mounted perpendicular to the ground with the Aclara logo facing you?
Is there a minimum of 1 inch clearance above the MTU?
If mounting multiple MTUs side by side, is there at least 4 inches between them?
If mounting multiple MTUs above one another, is there at least 3 inches between them?
Is there minimum of 6 inches of clearance between the MTU and any pipes, conduit, downspouts, etc.?
Is there a minimum of 5 feet of clearance between the MTU and any large metal objects, such as dumpsters, HVAC ducts, or cabinets?
Is there any damage to the wiring (e.g. nicks or cuts)?
Exterior
Is the MTU mounted at least 12 inches above the ground?
Is the MTU mounted so that it is not transmitting directly into a metal fence?
Are wire splices made using silicone electrical gel filled IDCs?
Interior
Is the MTU mounted in a room without a metal ceiling?
Is the MTU mounted near an exterior wall?
If located in a basement, is the MTU mounted as high as possible?
Meter Pit
Is the MTU mounted securely to a non-metallic lid?
Is the MTU mounted with the Aclara logo facing the lid?
Are wire splices made using silicone gel filled electrical insulating IDCs and appropriate direct burial kit?
If necessary, is the MTU mounted with the appropriate spacers?