

COMPLETE GUIDE TO MEASURING MOISTURE IN RESTORATION



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WHEN ACCURACY IS THE POINT.™

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Every now and again, moisture can become an issue for the integrity of a building. This problem affects not only homeowners, but it is something that insurance adjusters, restoration companies, home inspectors, IAQ Specialists (Indoor Air Quality), and even intrepid DIY enthusiasts will all eventually have to deal with.

How do all of these various individuals deal with and monitor moisture in a building? The first step is often to find a reliable, high quality moisture meter to help them determine moisture content in different parts of the building.

Restoration Companies

For restoration companies, moisture is a constant concern. After a flood, a restoration company will be called in by the owner of the building to make repairs and prevent the damage from getting worse.

Part of preventing future damage is to make certain that there is no excess moisture within the structure. When they want to make certain that there are no more pockets of moisture trapped within the floors or walls of a building, restoration experts use moisture meters for such verifications. By doing so, they are able to document the overall moisture levels in the building and accurately assess the risk of further damage.



With this information, restoration companies are able to better predict the overall costs of their work, and to prioritize the removal of unsalvageable sections of the structure's materials before they can become mold colonies.

Not all restoration companies handle the “build-out,” or actual replacement of damaged items in a building such as drywall and water-damaged subfloor materials. Many restoration companies specialize in the “dry-out process”, or the actual removal of excess moisture from a home. If you are looking to contract the services of a restoration company, it is a good idea to check on exactly what services they offer in addition to the certifications that they hold.

Speaking of certifications, many restoration companies have elected to earn optional certifications from organizations such as the IICRC ([Institute of Inspection Cleaning and Restoration Certification](#)) to demonstrate their expertise in handling moisture problems in buildings to consumers.

Moisture meters and the dry-out services offered by restoration companies go hand in hand.

You would be hard-pressed to find a water damage and restoration expert who did not use at least one or two moisture meters for their work. These experts know the risks that are posed by

abnormally high moisture in structures, from walls and wall cavities, warped, damaged wooden beams and floors to the growth of mold, restoration experts are well aware of the risks posed by excess moisture.

Because they know the risks of hidden moisture, restoration experts will always be sure to carry moisture meters with them onto the jobsite. They use these devices to take measurements of moisture in the building before, during, and after the drying process to track the level of moisture in different areas of the building and to locate potential problem spots.

With the information that they glean from a series of moisture measurements taken over the course of a job, a restoration expert can accurately assess their progress in restoring a home to normal levels of moisture.

Mold Remediation/IAQ

Whenever you have excessive moisture in an unseen, dark corner of a building, you have a risk of mold. While regular cleanup and water-removal efforts can do wonders to reduce the occurrence of mold, not all moisture pockets are visible to the naked eye right away.

Sometimes, moisture gathers deep inside a concrete slab or behind a wall. By the time that the moisture penetrates the surface, there may already be mold growing underneath the surface where prying eyes cannot see.



Even if a surface is dried later, if mold spores have taken hold, they may survive and persist after the initial clean-up. By using a moisture meter after drying a given material or surface, you can ensure that you know and greatly reduce the risk for mold developing in a given spot. For anyone concerned about the potential for mold growth in drywall or basements, a moisture meter is an invaluable tool for tracking down “at risk” areas of the home and gathering critical information for the repair.

IAQ specialists are intimately familiar with the respiratory risks associated with mold growth, which is why they use moisture meters and hygrometers to help them track mold risk in a building.

Building Inspectors

For anyone considering the purchase of a property, whether it is a private residence, an office, or a store, a moisture meter can be a useful tool for acquiring important information.

For those buying a new home, it is important to have a thorough inspection done of the home before you sign the purchase agreement. Excessive moisture in the basement or the insulation



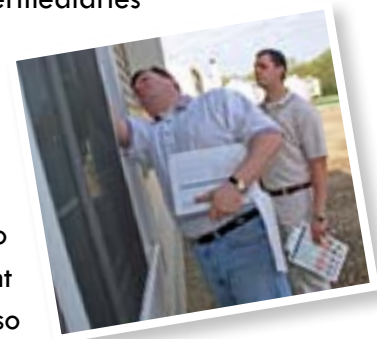
can pose a severe health risk, as it may cause mold to grow. A mold infestation is the last thing a property owner wants to have to deal with, especially given that mold spores can cause fatal health complications for some people, as well as ruin property value.

With a moisture meter, a building inspector can reveal whether or not there is a significant risk of mold growth or structural damage from moisture in the building. With such knowledge, property buyers can be confident in their purchase, even if the building has experienced flood damage in the past. Reports from an inspector concerning the moisture content of a disaster-restored structure can make or break a sale, so it is important that the inspector has access to reliable, sturdy, and easy to use tools.

Insurance Adjusters

The role of an insurance adjuster is to provide a thorough and accurate assessment of property damage as it relates to an insurance claim. These individuals work as intermediaries between the claimant and the insurance company. The adjuster receives the claimant's report of the property that has been damaged, and then he or she will investigate the claim.

The role of the adjuster is a critical one, as they are the ones that the insurance company will listen to when determining what dollar value to assign to the damage and how much to pay to the claimant. In recent years, the amount of water damage-related claims has gone up, so insurance companies are more leery than ever of paying out for water damage in an effort to reduce costs.



As mentioned before, the insurance adjuster will also check the claimant's documented costs to the date of the inspection. This will allow the adjuster to review any bills that the claimant has paid to restoration and water removal professionals up to the time of the inspection so that they can be included in the claim.

Restoration contractors can help the claimants by recording the moisture measurements of a building so that the claimant can supply this important documentation to the adjuster in order to help substantiate the claim. Meters such as the [Navigator Pro](#) can store readings and create reports quickly and easily.

The more information that the claimant can give to an insurance adjuster about the extent of the damage, the better off they'll be when the time comes for the insurance company to approve the claim.

Do it Yourselfers

Every year, people try to save money on restoration costs by skipping the process of hiring restoration professionals. Instead, these individuals try to handle the tear-out and dry-out processes themselves.

For many “minor” spills (those only involving a few gallons of water at most), this can be fine as long as the spill is cleaned up quickly and occurs well away from walls or other places where the moisture from the spill can reach a gap and seep into the subfloor.



However, whenever there is a major amount of moisture damage, it is critically important that a professional restoration service is brought in to manage the dry-out process. Without the help of a trained and experienced expert, someone who engages in DIY moisture removal may miss pockets of moisture in the building, leading to:

Damaged building infrastructure- moisture can seep into structural materials behind the walls and under the floor, causing damage. With proper dry-out and moisture remediation, much of this damage can be mitigated or even avoided.

Warped flooring- when moisture seeps into subfloor materials, it can cause wooden boards to shift, bend, and cup. This creates an uneven floor, and poses a safety risk to the building’s occupants.

Mold growth- left unchecked, moisture trapped in a building can promote the growth of mold, particularly in cool, dark places such as basements and in-between walls. As any IAQ Specialist can tell you, mold spores in the air pose a serious respiratory risk to children and people with respiratory conditions such as asthma.

As a general rule of thumb, if the damage to your building is severe enough to warrant an insurance claim, then you should not attempt to handle the restoration process on your own. Damage that occurs as a result of DIY restoration efforts is typically not covered by insurance, and restoration work can be hazardous for those who have not been trained for the risks associated with working with dirty water, mold, and water-damaged structures.

Types of Meters

In most cases, contractors and other professionals who are looking to take moisture measurements will use one of two different types of moisture meters. The two primary types of moisture meter are pin meters and pinless meters. However, there are other kinds of meters used by restoration experts as well.

Pin Moisture Meters

These moisture meters are among the most commonly used devices on the market today. As early as the 1940's, with the introduction of Delmhorst's own ram-type electrode with two insulated pins, pin meters have been a staple of moisture measurement. With a pin-type meter, restoration specialists are able to get a precise reading of the moisture content of an object, including:

- The location of pockets of high moisture in a material.
- The average moisture content of the object.
- The full range of the object's moisture content.



How They Work

These devices operate on the principle of electrical resistance. For their basic operation, the user of a pin-type meter pushes two pins into the object to be measured until they reach the desired depth.

Once the pins are in at the desired depth, the user activates the meter, causing one pin to generate an electrical current. The other pin acts as a receiver, measuring the amount of resistance there is to the electrical current. This measurement is then displayed as a value on the reader.

The most common use for these meters is in measuring moisture in wood. Wood is a natural insulator, meaning that it does not conduct electricity well. Because water is an excellent conductor, the less resistance that there is in a piece of wood, the more water there is. However, not all wood is created equally.

For a pin measurement to be accurate, it needs to be calibrated to the specific species of wood being tested first. Oak, for example, will give a different reading from Douglas fir or redwood, even if the overall moisture content is the same. Properly calibrated, however, these meters are incredibly reliable.

These meters can also be used for materials other than wood, such as drywall, and just like testing for different species of wood, you will have to set the meter to the material you are testing.

Pinless Moisture Meters

When you either cannot penetrate a surface, or do not want to leave unsightly puncture holes that could prove to be an eyesore later, pinless moisture meters are often your best bet for getting a fast, reliable measurement of the moisture content of an object.

How They Work

When a pinless moisture meter is pressed up against a flat surface to be measured, it sends an electromagnetic wave into the material being measured. The meter then interprets the fluctuations in this electromagnetic wave to create a reading of the moisture content of the object.

The benefits of pinless meters include:

- The ability to scan large areas very quickly.
- They don't leave pin holes.
- Relatively simple to use.
- Can be used on surfaces that are too tough for pins.

There are a few known issues when using pinless meters:

- They require a flat, smooth surface in order to generate an accurate, reliable reading.
- The material being measured must be thick enough to take the signal, or you may end up getting a reading for the space behind the material.
- Surface moisture can skew the reading results.
- Limited scanning depth means deep pockets of moisture may not be detected when testing subfloors or other thick material.

Because of these issues, pinless meters are not ideal for loosely-packed material or material that is unusually thin. They can be the ideal meter for use on most types of wood, marble, and tile. Pinless meters are also useful for taking a preliminary reading on concrete to see if further testing is needed to satisfy ASTM standards.

Thermo-Hygrometers

A thermo-hygrometer measures the ambient conditions of a room as opposed to the moisture of a specific part of the structure. It is important to take measurements outside the structure, in an unaffected area, at the output of a dehumidifier, and in each room that has been affected by water damage. These readings give restoration contractors important information such as temperature, relative humidity, (RH), Dew point, and Grains Per Pound (GPP).



By looking at the overall ambient conditions, the contractor has a better picture of how quickly the room(s) can dry. Evaluating moisture readings taken from the moisture meter and ambient conditions taken from a thermo-hygrometer give the contractor important tools to determine if drying equipment needs to be added, modified or removed from the job.

When using and caring for a thermo-hygrometer, there are several things to keep in mind:

Temperature- As the temperature in an area increases or decreases, the RH reading of a thermo-hygrometer will be affected as well. The higher the humidity, the larger the difference in the RH reading will be at different temperatures. For example, if the RH in a room is 80 percent at 50 °C (122 °F), then an increase of 1 °C (1.8 °F) would alter the RH reading by nearly 4 percent.



Sensor Tolerance- This is the amount of variance that is “built-in” to any given hygrometer. If you put two identical hygrometers with a sensor tolerance of +/-3% RH in the same room right next to each other, and the RH of the room is 65%, then one might read as low as 62% RH while the other reads as high as 68% RH. This degree of error is allowable if other differences such as temperature have been accounted for. To get the most accurate readings, a sensor with a minimal sensor tolerance (+/-2% or less) is desirable.

Calibration- As an RH sensor is repeatedly exposed to chemicals and moisture, contaminant particles may end up being deposited on the sensor material. Over time, this causes inaccuracies in the reading, creating a “drift” in the values represented by the meter. In extreme cases of contaminant exposure, damage may occur to the sensor or the PC board of the hygrometer. Given the varying speeds at which different contaminants can cause a meter to fall out of calibration, it is difficult to give a definitive answer as to how long a meter will remain within tolerance. Sooner or later, all RH sensors will need to be replaced.

Operating and Storage Conditions- To keep a sensor operating at peak efficiency longer, it is important to maintain proper conditions. This generally means avoiding extreme temperatures, chemicals, and handling the unit with care while it is in use.

Delmhorst instruments are calibrated using nationally recognized standards and practices, and is traceable through the NIST (National Institute of Standards and Technology) and checked against a chilled mirror hygrometer.

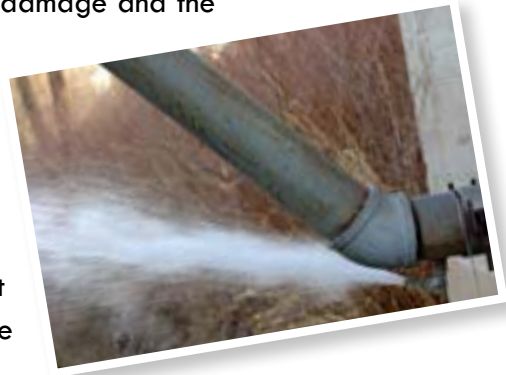
In-field calibration checks can be performed by testing the meter against a second reference sensor or by using a saturated salt solution. Learn more about *Relative Humidity Sensor Behavior and Care* in our [whitepaper](#).

The Main Causes of Water Damage

From catastrophic category 5 hurricanes to the mundane, everyday “leaky pipe,” there exist many different ways for your home to be put at risk for water damage and the lingering aftereffects of high moisture content. Here, we provide a breakdown of the different kinds of flood damage that can threaten a building.

Burst/Leaky Pipes

One of the most common causes of water damage in any building is a simple lack of maintenance for the pipes that provide the critical service of pulling fresh water to where you need it and carrying away the wastewater.



One good idea for preventing this kind of damage to a building is to carry out a basic inspection of your structure’s pipes once or twice each year, preferably sometime in late fall, before the onset of winter weather. The sudden temperature drops that occur in winter can flash-freeze water in your pipes, causing breaks as the freezing water expands inside the pipe. If you have the time and resources, insulate the pipes in your building to prevent them from freezing. Also make sure to engage the shut-off valves leading to outdoor faucets.

Most interior plumbing pipes and water lines are designed to last for a long time, but it is often a good idea to give them regular inspections. If you notice discoloration on the pipes, or a loose connection, you can save yourself a lot of time and trouble by fixing it early. By spotting and fixing such problems early, you can prevent the creation of a mold colony in your building.

Once you have fixed your leaky pipe, you can use a moisture meter to check if the surrounding area has been oversaturated with moisture.

Clogged/Overflowing Sinks, Toilets, and More

Other than leaking pipes, another common indoor plumbing problem is the infamous backed-up toilet or sink.

In many ways, these issues are both better and worse than leaky pipes. The good thing about backed-up pipes is that people are usually able to spot the problem right away and begin trying to fix the problem quickly, before the water has a chance to soak for too long. The bad news is that, especially in the case of toilet spills, the water spilling onto the floor is “dirty” water. This water contains contaminants that feed bacteria, which can prove to be a toxic health hazard.



Even after the water has been removed, there is the risk that the bacteria will continue to breed if the moisture has been absorbed by the flooring or drywall. For this reason, it is very important to know if the moisture from the overflow has been totally removed.

Heavy Rainfall

While most buildings are typically built to withstand normal weather conditions, including the occasional bit of rain, a building that is exposed to heavy amounts of rain for a prolonged period of time can become damaged by water.

If a property does not have sufficient drainage, and is then subjected to heavy rainfall, water could end up pooling against the sides of the building's foundation. This water can be absorbed by the foundation, or even find its way into gaps in the structure between the foundation and the walls. This can cause moderate flooding in the structure where it might not be immediately noticeable.



Whenever a building is exposed to unusually long periods of rainfall, it is important to check its exterior walls and foundation for signs of moisture damage or pools of water along the edges of the building.

Floods

A natural flood can cause enormous damage to a building. Not only does a flood, even a "minor" one, bring a massive amount of moisture into the structure, but that water is often filled with other contaminants.

Dirt, debris, plant and animal matter, bacteria, and even harsh chemicals can all be carried in by flood water. This makes flooding one of the most dangerous forms of damage to a structure because these contaminants can cause damage much more rapidly than a regular tap water spill.

The combination of massive amounts of water and heavy contamination can make floods one of the most severe threats to the integrity of a building.



Floods can be caused by several things, including unseasonably heavy rainfall, hurricanes, and other natural events.

Hurricanes

Every year, cities in coastal areas have to contend with the threat of hurricanes. These super-sized natural disasters pose numerous threats to the integrity of a home, office, or any other kind of structure.

Not only does a hurricane carry heavy rainfall into a large region, the high winds can carry ocean water deep inland and cause damage to the roof and windows of a building, creating a path in for moisture and debris. Even a structure that has been built for high winds and then reinforced could potentially become damaged during a severe storm if it lasts for long enough.

No building is one hundred percent proof against the forces of nature.

After any major weather event, it is important to inspect your building for signs of damage caused by the storm. In the case of hurricanes and floods, using moisture meters to get an accurate reading of the moisture trapped within the walls, floors, and other integral structures is critical to having a thorough picture of the threats to your building.



Where to Use a Moisture Meter and Which One is the Best for Each Situation

Flooring

Floors are the part of any building's interior that are most often exposed to moisture in everyday situations. Your floors are subjected to innumerable accidental spills, and leaking water follows the path of least resistance, which usually means it will collect on the floor.

Because the floors of a building tend to be exposed to so much moisture absorption during any major flooding event, it is important to know what kinds of moisture meters will give you the best results when checking for moisture in each.



Carpets

The padding under the carpet is highly susceptible to retaining moisture, so it is important to be able to estimate the moisture content of a carpet. Even if the dark, discolored patches have disappeared from the carpet, using a pin meter can help you find out if there is residual moisture collected in a carpet after your latest drying attempts.

In addition to the carpet itself, you should also check the subfloor for excess moisture as well to make sure that there is no more risk of moisture damage or mold growth in the structure. The subfloor can be tested with either a pin-type meter or a pinless meter, depending on the material and smoothness of the subfloor.

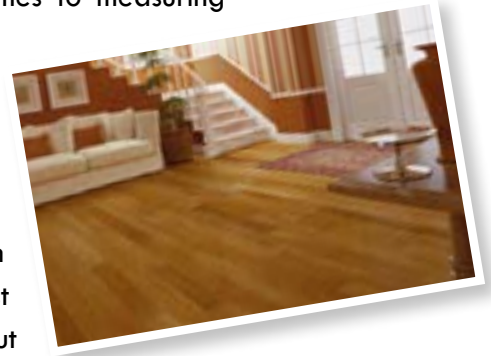


You will want to check the moisture levels of the floor immediately after you have extracted standing or excess water from the affected room, and every few hours afterwards as the room continues to dry. This way, you can gauge the effectiveness of your efforts to dry the room. If the moisture in the carpet and subfloor does not decrease over time, it may be a sign that there is a continuous source of moisture infiltrating the room, or that your current moisture removal strategy needs to be reexamined.

Most professionals find a “dry” spot of the carpet to test, possibly in an unaffected room, to establish a baseline for what is considered dry and what is unusually wet for that building.

Wood Floors

The great thing about wood floors is that many moisture meters are designed to be used on such surfaces, meaning you have a range of options when it comes to measuring moisture in wood. Much like when you measure moisture in carpeting during a disaster clean-up, you should measure the moisture in a wood floor immediately after you are finished with the initial removal of excess moisture, and repeat this measurement every few hours as the room continues to dry. For rapid moisture measurement in a large area of your wooden floor and/or subfloor, a pinless moisture meter is often your best option for measuring the entire area of the floor quickly without creating unsightly pin holes.



A professional restorer could use either a pinless meter or a pin meter in measuring wood floors, depending on their own preferences and what they are looking for. Pinless meters are great for locating the general locations of moisture pockets quickly, while pin meters with hammer-type electrodes can give a more accurate indication of the depth at which moisture occurs.

Laminate

Many people might assume that laminate floors are impervious to the effects of moisture. However, although the surface of laminate is incredibly resistant to moisture intrusion, if moisture gets under the laminate it can cause damage to the material bonding the laminate to the subfloor, or to the subfloor itself.

In many cases, if the laminate is damaged, there will be signs of peeling or bubbling. You should check the moisture levels of the laminate soon after the initial moisture clean-up is finished, and re-check it over the course of the next few days.



A smooth laminate floor can be checked easily with a pinless meter.

Tile

Another example of a flooring material that most people assume to be impervious to water damage is tile. However, not all tile is created equally. In order from least to most resistant, tiles are classified as non-vitreous, semi-vitreous, vitreous, or impervious. Non-vitreous tiles readily absorb moisture, while impervious tiles are almost immune to water (taking in less than 0.5% of their weight in water when submerged).



However, much like laminate, even impervious tiles can suffer water damage during a flood, as the subfloor and even the adhesive and grout holding the tiles in place soak up water. So even if your

tile is impervious, it is important to measure the moisture of your flooring to know if the tile flooring is at risk of damage from excess moisture.

Walls

Walls are not exempt from moisture damage, especially along their bases near the floor. After a major flood or other moisture-related event compromises a home, testing the walls is critical to being able to identify your mold and moisture damage risk.



Drywall

For most drywall, moisture exposure to any significant degree results in immediately noticeable damage. Sometimes, however, drywall can appear to hold up even as rot sets in.

To make certain that the drywall is in good condition and free of mold, it is important to check the moisture content of the drywall to know whether it is dry or it is at risk.

There is a specialized type of drywall, called greenboard, which is specially-treated to resist moisture intrusion. However, there is a limit to how much direct moisture greenboard can resist before it begins to exhibit signs of damage just like regular drywall.

For finding moisture damage before visible signs start to show through the paper or paint covering the wall, a pinless moisture meter can be very useful. Measurements should be taken immediately after your initial moisture cleanup, and every few hours afterward to monitor moisture related risks.

[Delmhorst's BD-2100](#) and [Techcheck Plus](#) meters are designed with drywall in mind. These meters are calibrated for drywall and give an actual %MC measurement in drywall. This makes it easy for you to determine whether or not the drywall is at risk of falling apart or growing mold.

If moisture in a patch of drywall persists despite your efforts to dry out the area, you may want to check the area behind the wall for leaking water lines or wet insulation.

Insulation

Not just an issue in attics, insulation is also located in the spaces in between your walls. Insulation can soak up vast amounts of moisture, and the space behind your wall is an ideal environment for the growth of mold when moisture is added to the dark, cool space.

Left unchecked, hidden moisture in the insulation of a building can annihilate the structure's walls from the inside and enable the growth of severe mold infestations such as potentially lethal black mold. This is why IAQ Specialists often focus on the moisture conditions behind a wall as well as in the ventilation system.



As there are many different kinds of insulation on the market (such as wool, fiberglass, and foam), the moisture risks for any given building's insulation can be difficult to predict. If moisture in a wall remains even after extensive removal efforts, contractors may have to open up the walls in order to test the moisture content of the insulation.

For loosely-packed insulation such as fiberglass, a pin meter with extended-length probes can be the ideal tool for the job.

Ceiling

It is very important to regularly check your ceiling for moisture intrusion, especially after a major rainstorm or hurricane. In many cases, your first sign of a leaky roof will be discoloration in the roof, or moisture leaking from the top of the wall where it meets the ceiling after heavy rainfall.

To check for moisture in a ceiling, a pin-type meter can be the most reliable way of obtaining a moisture measurement in areas that are suspected to have excess moisture.

For example, after a repair to the roof has been made, a contractor might check the discolored areas of the ceiling with a meter to see if they are still wet, or if they have sufficiently dried out to prevent sagging or mold.



Attic

When a roof is compromised, the attic (if there is one) needs to be checked for moisture. Left unchecked, moisture in the attic can compromise wooden beams or allow mold to grow and spread spores throughout the structure.

Insulation in the attic can be inspected using a pin-type meter with extended-length probes to penetrate to the interior layers of the insulation. This will allow contractors to find out if insulation is at risk of developing mold.

For the wood frame of the attic, either a pin-type meter or a pinless meter can be used to find moisture in the wood. In most cases, a pin meter can give you a more accurate reading of the depth of moisture penetration, while a pinless meter can allow you to scan more wooden beams more quickly.

These measurements should be taken shortly after you have cleared the excess moisture from the attic and repaired the leak in the roof that allowed for the moisture intrusion.



When a building is subjected to excess moisture from any source, it is imperative that you know exactly how much moisture is present in the structure in order to make informed decisions regarding the restoration process. Armed with the knowledge of how much moisture is present in a given material, whether it is a floor, wall, or ceiling, you can know whether that item should be dried out and salvaged, or if it should be torn out and replaced.

Know more about your restoration project with an accurate, reliable moisture meter from Delmhorst today.



Feel free to give us a call or email for answers to your questions about what kind of meter to use for your project, and where to purchase. And remember, we value our customers and look forward to your feedback.

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