

5 Ways MEP Contractors Can Survive and Thrive in a BIM-Enabled Build Environment

How Digital Measurement Technology Is Transforming MEP Pros Into Key BIM Players



Few dispute that building information modeling (BIM) is now the de facto basis for nonresidential construction in the U.S.

A recent survey of commercial general contractors (GCs), construction managers and specialty trades reveals 89% of construction professionals use BIM on at least some projects; 47% on at least half their projects.

Many reasons explain the technology's ascendancy over the last 50 years, not the least being that it's a better way to build. A majority of AEC professionals say BIM:

- Reduces rework (76%).
- Improves budget and cost controls (66%).
- Shortens project cycle time (55%).

Even COVID-19 may play a role in the quickening pace of BIM acceptance. The last nine months of 2020 accelerated tech adoption in the construction trades the equivalent of three years, according to the latest annual State of Construction Tech report by JLL. Today there's even talk of a national mandate for the use of BIM technology on all government construction projects.

However, a federal push isn't necessary. Building owners and AEC professionals have already signaled their vote through a growing reliance on BIM software tools such as AutoCAD, Revit, BricksCAD, SketchUp, Navisworks, among many others.

For many in the trades, the decision to go all-in on a BIM-enabled workflow is moving rapidly from a maybe-someday argument to something far more persuasive: **The contract requires it.**



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MEP Contractors

Against this rising digital-first backdrop is an army of specialty contractors in the mechanical, electric and plumbing (MEP) trades. Some determinedly embrace the new normal. Others continue to weigh their cost-benefit options against familiar, albeit fading, analog measurement practices.

Take layout. It's not getting any easier for MEP layout teams to capture distances and angles for hanger, anchor, sleeve, box, pipework, cable trays and other building-service components, especially with today's curved, nonlinear building designs. The demands of prefabricated assemblies also require tolerances that push traditional measuring tools such as the tape measure, string and theodolite to extremes.

The chances of error can be high. Is the theodolite level? The tape measure steady? Is that really the best reference point? Does the string mimic the curve? Even a minor measurement flub can echo downstream in unexpected ways. Small wonder construction budgets and insurance policies typically anticipate measurement errors and omissions.

Playbook Basics

BIM technology is not a cure-all. Rework must always be anticipated at various points in the project life cycle. It's the nature of construction. A growing body of evidence clearly shows BIM technology offers project stakeholders a new order of construction precision and understanding, starting with unprecedented data and visualization collaboration across all trades.

This playbook focuses on MEP delivery and its central place in a BIM ecosystem. We'll explore how MEP contractors respond to the digital workplace. What's their experience? How has it transformed their workflow? What should be considered when evaluating a digital measurement tool?

A Choice of Digital Measurement Tool

BIM construction precision is based on digital measurement. For that, contractors turn to a trio of digital measurement technologies –

- **Robotic Total Station**
- **3D Laser Scanner**
- **Scanning Total Station (Multistation)**

Each presents a particular set of advantages. Here's a brief look at each:

Robotic Total Station

It makes sense to begin the examination with the chief BIM-enabling tool for MEP professionals, the robotic total station (RTS). This tripod-mounted electronic/optical instrument can be found at many work sites. For AEC professionals, especially general contractors on larger projects, its precision and speed in layout applications are nearly mandatory. Also, it's typically more affordable than either a 3D laser scanner or scanning total station and requires just a single operator.

The RTS combines an electronic theodolite with electronic distance measurement. This enables measurement of vertical and horizontal angles along with the distance from the device to an intended point, such as a hanger or anchor location. The word robotic describes the unit's remote-control feature, which allows a single operator to manage the digital layout tool at distances of up to 3827 yards.





3D Laser Scanner

Think of a 3D laser scanner as the macro, measure-it-all counterpart to a sharply narrowcast RTS, offering vastly more data through a rapid dome scan that can capture as-built conditions over large areas. It performs many of measurement functions expected of an RTS with a huge value-added component that frequently makes a powerful business case for its comparatively higher expense. The data-rich point cloud a 3D laser scanner generates represents an information gold mine, offering comprehensive measurement insight beyond the scope of an RTS. Ideal for the inspection of curved shapes and complex geometries that defy other methods.

Scanning Total Station (Multistation)

As the name suggests, this is a hybrid technology, offering the best of both worlds: 3D laser scanning capability wedded with point-to-point RTS precision. This all-in-one device offers a wide range of benefits, including the ability to graphically show the locations in the field to any person. The point cloud generated from a scanning total station is less dense than a dedicated 3D laser scanner and the speed of data capture is slower. However, many contractors find the limited scanning capability presents a more manageable file size, more than sufficient for their applications. Scanning total stations represent a price point between the RTS and 3D laser scanner.



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RYAN HOGGATT
Director of Manufacturing for UMC

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Weeks Saved

The genius of digital measurement technology is its unerring ability to pinpoint layout coordinates directly from the BIM model, taking the all-too-error-prone strings, tape measures and plumb lines off the table. For example, data can be transmitted back to the office to verify precise placement.

With automation, laser-placed precision and single-operator ease come speed. Ryan Hoggatt, director of manufacturing for UMC, a full-service MEP contracting company based in Washington state, knows the before and after well. “We were working on a clean room facility that was modeled for miles and miles of under-floor piping. They initially wanted us to hand draw the detailing because of a schedule issue. That would have taken hundreds of hours. Our operator went out and scanned the floor and brought the data back. We accomplished in less than a week what would have taken at least a month. All in 3D, too. Now the client wants the entire facility scanned.”

Speed and efficiency gains are just part of the story. On-the-fly QA/QC and documentation are also significant considerations. The value of BIM engagement, and more specifically, applying a digital measuring tool to a workflow, can vary across the trades.

Here's how several MEP professionals assess their experience.

Full-Service MEP

UMC, Puyallup, Wash.

UMC celebrated its 100th year in business last year, a firm long respected in the Pacific Northwest for its exacting care and quality in mechanical and plumbing services. Hoggatt leads the company's manufacturing unit, primarily focused on prefabricating assemblies for mechanical and plumbing applications, such as spool components. Hoggatt also runs the reality capture group, which the fab shop relies on for 100% accurate parts specs.

UMC is no stranger to 3D modeling. It has been working with 3D applications for more than 25 years. Its decision to invest in a digital measurement tool was born out of necessity. The day of reckoning arrived after completing a grueling boiler room upgrade for Boeing, which required the fabrication of thousands of spools. "I basically said there's got to be a better way than tapes and lasers," he said.

"Being able to scan into a BIM model and then draw the piping knowing it will fit in the field with certainty is huge for our clients," Hoggatt said.



5 BENEFITS: Mechanical MEP and Digital Measurement

- 1 Fabricate must-fit spooling parts with 100% accurate data.
- 2 Capture data in real time and bring it into the BIM model.
- 3 Identify clashes and inconsistencies early in planning.
- 4 Compress project measurement cycle times.
- 5 Differentiate their service as a BIM-friendly player.



5 BENEFITS: Electrical MEP and Digital Measurement

- 1 Produce more accurate and precise electrical designs.
- 2 Complete larger installs faster.
- 3 Eliminate manual work using measuring tape and string lines.
- 4 Catch clashes sooner, and reduce rework from uncoordinated BIM.
- 5 Reduce training time needed for system installs.

Electrical Contractor

Miller Electric, Jacksonville, Fla.

Miller Electric Co. is the nation's largest and oldest electrical contractor, working in all 50 states. Similar to UMC, Miller depends on the fabrication of large off-site modules using the BIM model. Alan Creel, vice president of pre-construction services for Miller, explained: "If we're certain we are designing and installing precisely, then we're able to quickly install much larger coordinated assemblies. We're getting larger with every project."

That growing confidence stems from an RTS. Miller is often the first to install its assemblies on the job site. That puts it at a measurement disadvantage. Many of the reference points one might ordinarily expect, such as HVAC ductwork, aren't installed. That exposure prompted the RTS investment.

For Creel and his team, the effect has been transformative. "We model conduits, hangers, overhead or underground racks and then extract precise XYZ coordinates at attachment and layout points," he said. "We can lay out in an empty field with no need for string lines, tapes or offsetting. It's made a big difference in the way we work. We now train all our union electricians to use the RTS. We think it's essential to our trade."

Plumbing Contractor

The Sack Company, Statesboro, Ga.

The Sack Company is a full-service MEP contracting company that has served the Southeast United States for 76 years. It used modeling and layout technology as needed but hesitated to acquire in-house RTS capability until a recent school construction project. To test the new device, the company used it to double-check what it had previously laid out by string and tape. The RTS identified several errors that were fixed before installation.

“Being able to see things in a 3D environment makes it easier to understand what you are looking at. Rather than going through hundreds of pages of design documents, you turn on a tablet. Using the RTS ties our work together with BIM, which saves us time and money and reduces overall project risks,” said Brandon Spainhour, the company’s BIM/CAD coordinator. “We have one person dedicated to the RTS. No one is taken off a crew to digitally measure.”



5 BENEFITS: Plumbing MEP and Digital Measurement

- 1 More accurate and precise layout models.
- 2 Real-time BIM model access in an IFC format.
- 3 See model issues and inconsistencies in real time.
- 4 Generate valid point data that’s been checked/verified.
- 5 One-person operation for faster technology adoption.



Playbook Strategies

1 Take No Chances

The decision to acquire a digital measurement tool is an important one in the life of any MEP company. One factor to keep in mind is that BIM isn't going away. The pull to upgrade MEP services to clients, especially BIM-savvy GCs, will only become stronger in the coming months. Will reliance on analog measuring become a project disqualifier in a digital-first world? Only time will tell. What is certain is that MEP companies like UMC, Miller Electric and The Sack Company aren't standing still. They understand that aggressive reinvestment in technology has, in part, explained why each has survived and flourished for many decades.

Century-old UMC has the most forward-looking view for adoption of digital measurement tools: It purchased a second RTS. "A good RTS isn't cheap," Hoggatt conceded. "But the writing is on the wall. We've proved time after time how an RTS reduces job costs for our client."

2 Look for Ease of Use

Laser-based measuring devices should be simple to operate. The transfer of data between the field and the office should be streamlined, with no need for multiple imports, exports and data conversions, characteristics found in some technology.

3 Ask About Special Capabilities

The hallmark of an RTS, 3D laser scanner and scanning total station is their ability to bring order and confidence to once-difficult measuring, such as curved walls and parametric geometries. Today's geospatial technology should include built-in routines and automated workflows for a variety of surface layouts and slope lines.

4 Expect Smart Integration

Fast, precise placement of hangers, anchors, conduits, spools and other building services is important. All the more reason to not get boxed in with a proprietary operating system. Ask for an open, agnostic system based on the global data standard IFC format for fast conversion of model data.



Conclusion

MEP contractors' need for placement and fabrication speed and precision makes them logical BIM advocates.

They play a central role in the life of any building project. Their detailing, installation and fabrication tasks must coordinate with the consultant's 3D model, making them especially reliant on BIM methodologies for a successful project delivery.

The MEP contractors' enabling tool — the robotic total station — is crucial for coordinating design changes to the MEP office team in real time from the field. Result: Clashes are resolved faster and more accurately, eliminating costly project delays and rework liability.



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Hexagon's Building Solutions empower companies to effortlessly utilize BIM to improve productivity and reduce costs across the entire life cycle of the building.

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