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Bulletin

# Laser Scanning

## INTRODUCTION

Contractors have to produce plans for numerous reasons, such as for review, permits and construction, just to name a few. More often than not, if your building was constructed in the latter part of the 20th century, you may have PDF's or possibly CAD plans that you could use. But, what if you do not have existing plans or CAD files on which to base your plans? What if you are required to produce a Building Information Model (BIM) in a retrofit situation where no electronic plans exist? What if you need to measure pipes or ductwork that are 10 feet or more high and there is no ladder? You can use the tried and true method with a tape measure and paper and hope you can reach all the necessary areas. You could use a digital measuring device, but you may need help depending on the size of the space. However, if another person is not available to help, laser scanning may be an option.

## LASER SCANNING – WHAT IT IS AND WHAT IT IS NOT

Generally, laser scanning is defined as a controlled steering of laser beams followed by a distance measurement at every pointing direction. In essence, the instrument emits a laser multiple times per second and associates a point on everything it contacts. At the end of the scan, depending on the accuracy you choose, you may have a few thousand points to a few million points per scan.

There are two types of scanners that a mechanical contractor may use: time of flight and phase-based.

**Time of flight scanners** offer better accuracy for long range scanning (over 50 feet)

**Phased-based scanners** offer better accuracy for shorter range scanning (under 50 feet).

More often, phase-based scanning will work best for mechanical contractors.

A scanner is not an x-ray machine or a CT scanner. It cannot see through walls or ceilings. To see above the ceiling, you will need to remove the tiles. It works on the WYSIWYG (what you see is what you get) principle. Currently, scanners will not produce much more than the points on objects it scans. You will still need to model what you want from the points that you collect. It is a very rapidly ever- changing technology that has limitless potential in the future.

## ACCURACY

Most of the manufacturers will offer accuracy to within 1/8 inch to 1/4 inch. In most cases, this accuracy is usually sufficient. Depending on the settings you choose and the objects that you're scanning, your accuracy may be better.

## CONDUCTING THE SCAN

Running the scanner is the easy part. Once the scanner is set up and ready to go, usually all that remains is to just push a button. The key is in the settings used for the scan and target placement. Each manufacturer will have recommended settings that you will need to follow. Targets are not necessary, but are usually recommended.

## REGISTRATION/"STITCHING"

Once scanning is complete, you need to register or "stitch" the scans together. The scanning manufacturer most likely will have its own proprietary software for the registration. Depending on your scan and the number of set ups and targets used, the software may register it automatically with minimal user input. You will need to learn the software to be able to work with the features that the software offers. This is one step most users do not consider when they get involved with scanning.

## POINT CLOUDS

Once registration is complete, you can place your cloud in your desired software of choice for modeling/drafting.

Most software manufacturers have their own point cloud editing software. There are also third-party software vendors that have add-on's for purchase that work with most modeling software.

## SCANNING USES

Laser scanning is typically used for surveying existing conditions to assist in documenting existing features. It could also be used for construction verification purposes. Key control points should be established to have common reference points for use in orienting your scans. Piping verification, stub up locations, ductwork locations, conduit locations, drains, and equipment can all be scanned and placed against the construction model to verify that components have been placed correctly. Laser scanning can also be used to aid in completing as-built plans once construction is complete.

## PURCHASE VS. RENTAL

Scanners are produced by a multitude of manufacturers for a wide range of prices ($40,000 to $200,000), depending on what type of scanner you need. However, some companies may choose to rent the scanner on an as-needed basis. That option, however, can be quite tricky and very time consuming. The rental company will usually rent the equipment on a daily, weekly, or monthly basis. Prices vary by area. Be careful to check the availability of the registration software and who will be doing the registration. Some companies may choose to purchase the registration software, thereby avoiding the software rental issue. And, rental companies may offer to extend use of the software for a fee as well.

## CONCLUSION

Laser scanning has been used in the civil engineering community for several years. Just recently, the technology has been used in the MEP construction industry. It has its benefits and uses, but it is not ideal in every situation. Laser scanning can be a very powerful tool for any mechanical contractor's tool box.