



Machining

Lights-Out Manufacturing: 5 Essential Elements You Need to Automate Your Factory

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“Lights-out” manufacturing uses industry 4.0 technology to automate your operations so they run without human labor. It allows companies to keep machines running after hours and despite talent shortages. Here are five factors that will help make lights-out manufacturing work for you.

Over the past several months, manufacturing companies have faced supply chain disruptions, facility shutdowns and limited staff availability because of the COVID-19 pandemic.

As a result, automation solutions such as robotics and software controls have grown more appealing. The promise of lights-out manufacturing has also grown, and it could be a significant factor in helping companies operate at full capacity.

Automated factories that use lights-out manufacturing are fully automated and require no intervention from humans. It means that instead of letting machines and tools sit idle, a shop’s management can run them during evenings and weekends, when employees are at home or when workers are unavailable.

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There are caveats. There has to be enough work for the machines and equipment to justify the investment. Not all parts being made are suitable for unsupervised machining—though most are with the right approach and execution.

Yet even with those constraints, the more you know about how to automate factories, the more potential output there is to help the bottom line. Here are five essential elements needed to make lights-out manufacturing a reality.

1. The Right Part Mix

You might think that lights-out manufacturing is only possible for shops producing relatively simple, loosely tolerated parts by the thousands, preferably of aluminum or other free machining material.

Not so. Plenty of shops have turned out the lights on close-tolerance, highly complex titanium and Inconel components—even in one-off quantities.

The recipe for success in these environments isn't based so much on what metal you're cutting or the tolerances you're holding. It's more about the steps you take to conquer the variables of machining.

If the process is stable and predictable, most parts are candidates for some level of automation if the following are intact:

- Chip-control mechanics
- Tool life management
- In-process metrology

A family of parts or a frequently repeated part is an excellent place to start on any lights-out initiative.

2. The Right Machine Features and Tools

Any CNC machine tool can be automated, although it is decidedly easier with certain equipment types.

For example, lathes come standard with hydraulic workholding, a prerequisite for any automation. Many are also equipped with chip conveyors and high-pressure coolant systems that help ensure wayward chips won't cause a problem during the night.

Bolt on a magazine-style bar feeder and an in-process probing system to keep an eye on things, and chances are good that you can keep the machine running unattended for an extra shift or two.

Using a vertical machining center requires more effort. You'll need:

- A robot to load and unload parts
- A conveyor to move raw material in and machined parts out
- An automated vise or pallet system
- An effective way to get chips out of the work area

Horizontal machining centers are the most automation-friendly of all. An HMC eliminates many VMC shortcomings, especially when equipped with a pallet pool or linear pallet system.

Whatever the machine type or brand, however, it should have the spindle power needed to remove metal effectively, be accurate enough to meet part tolerances without babysitting and be extremely dependable.

Newer machines are also equipped with Ethernet-based networking capability. They also often come with advanced sensors that make it easier to monitor machining conditions and analyze events that may have occurred during the night.

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3. Automation-Friendly Tooling and Workholding

A machine should have plenty of extra tool stations and some sort of tool life management function to maximize its lights-out capabilities.

This makes it easy for CNC machine programmers to call up replacement cutting tools at predetermined intervals or when the probing system indicates a tool has worn. This is less of a concern when cutting materials such as mild steel or aluminum, but it becomes increasingly important with stainless steel and superalloys.

“Going lights-out is an all-encompassing journey. It maximizes available machining hours and a shop’s potential.”

This presents another strong argument for an HMC: Most machine builders provide options for massive tool magazines and centralized tool storage systems. A multitasking lathe with tool-changing capabilities is a much better choice for lights-out work than a basic turret lathe.

What’s the right tooling? It’s somewhat irrelevant from an automation perspective, although investing in dual-contact Capto, HSK, KM or equivalent *toolholder* systems is always a good idea for shops that value machine uptime and efficiency.

Other tooling types that matter for lights-out manufacturing include: quick-change zero-point-style clamping, quick-change jaws and fixtures, and hydraulic or pneumatic vises. All of these tooling areas will increase shop floor flexibility and reduce machine downtime.

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4. Remote Monitoring, Software and Machinists on Call

Spindle or turret-mounted probing is critical for broken tool detection, workpiece placement validation and in-process measurement. These systems are now standard on many machine tools.

Gone are the days of complex macro programs. Today’s monitoring systems and software are much easier to use than they once were.

Probing is a necessary component of any lights-out machining strategy, but shops should also have some level of remote monitoring capabilities. This might be something as simple as a notification from the CNC to the cellphone of the on-call machinist for the week about a machine going down.

You may also mount cameras inside each machine and monitor it through the company’s virtual private network.

It’s worth noting that a lights-out approach still requires some human intervention, such as when a machine stops unexpectedly or a tool fails. The last thing any shop wants is a complete work stoppage that affects daytime production. The goal is to avoid downtime, after all.

5. An Investment of Time and Capital

Lights-out manufacturing requires an effort in process development and validation, setup and management of the probing routines, tool life management, robots and grippers, and remote monitoring systems.

On top of all that, the machine tools themselves must be kept in excellent working order. Give special attention to routine machine and tool maintenance, coolant management and shop floor organization so that late-night surprises are kept to a minimum.

Going lights-out is an all-encompassing journey. It maximizes available machining hours and a shop’s potential.

Are you working with lights-out manufacturing? What challenges have you faced? Share your thoughts in the comments below.