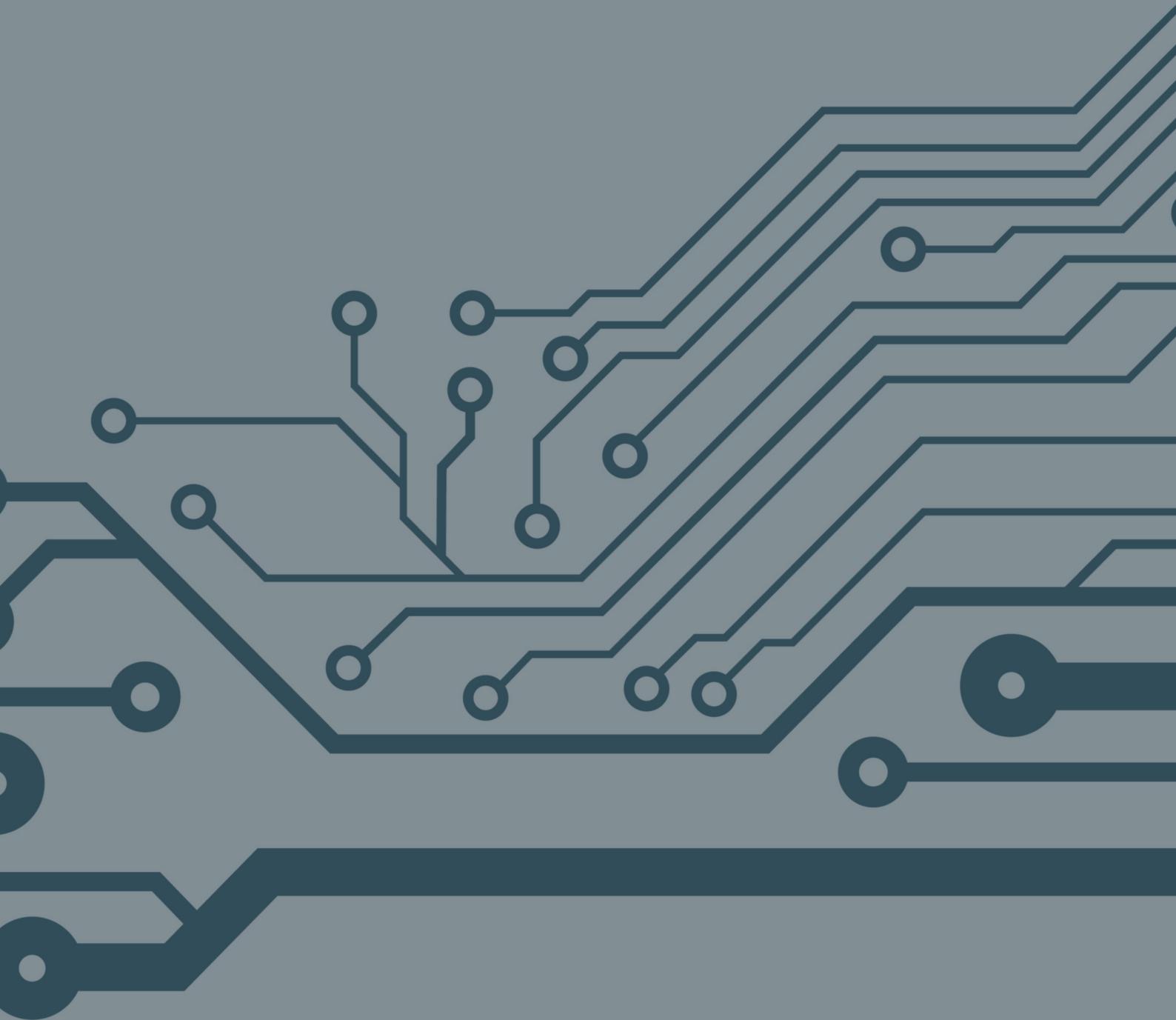


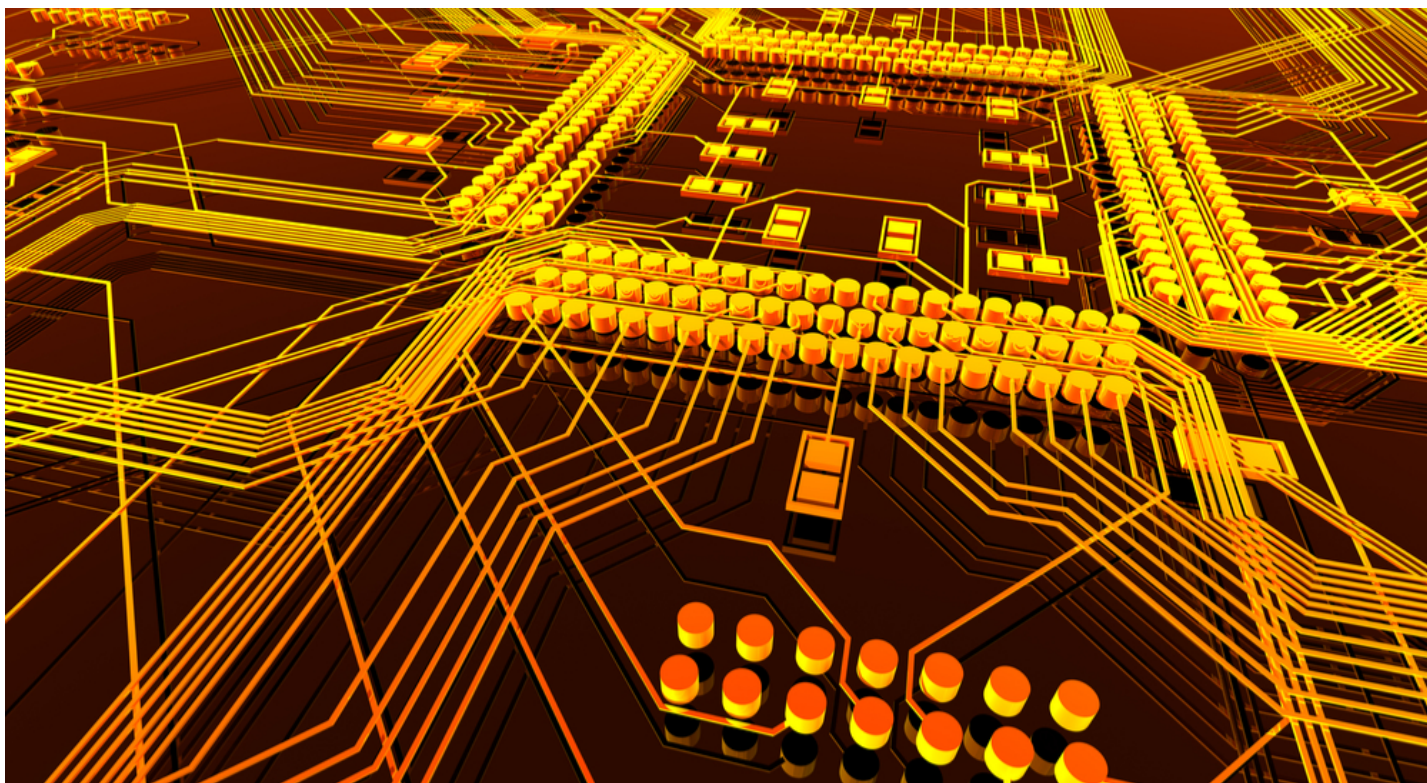
***Altium***<sup>®</sup>

# Auto-Interactive Routing



# AUTO-INTERACTIVE ROUTING

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## AUTO-INTERACTIVE ROUTING

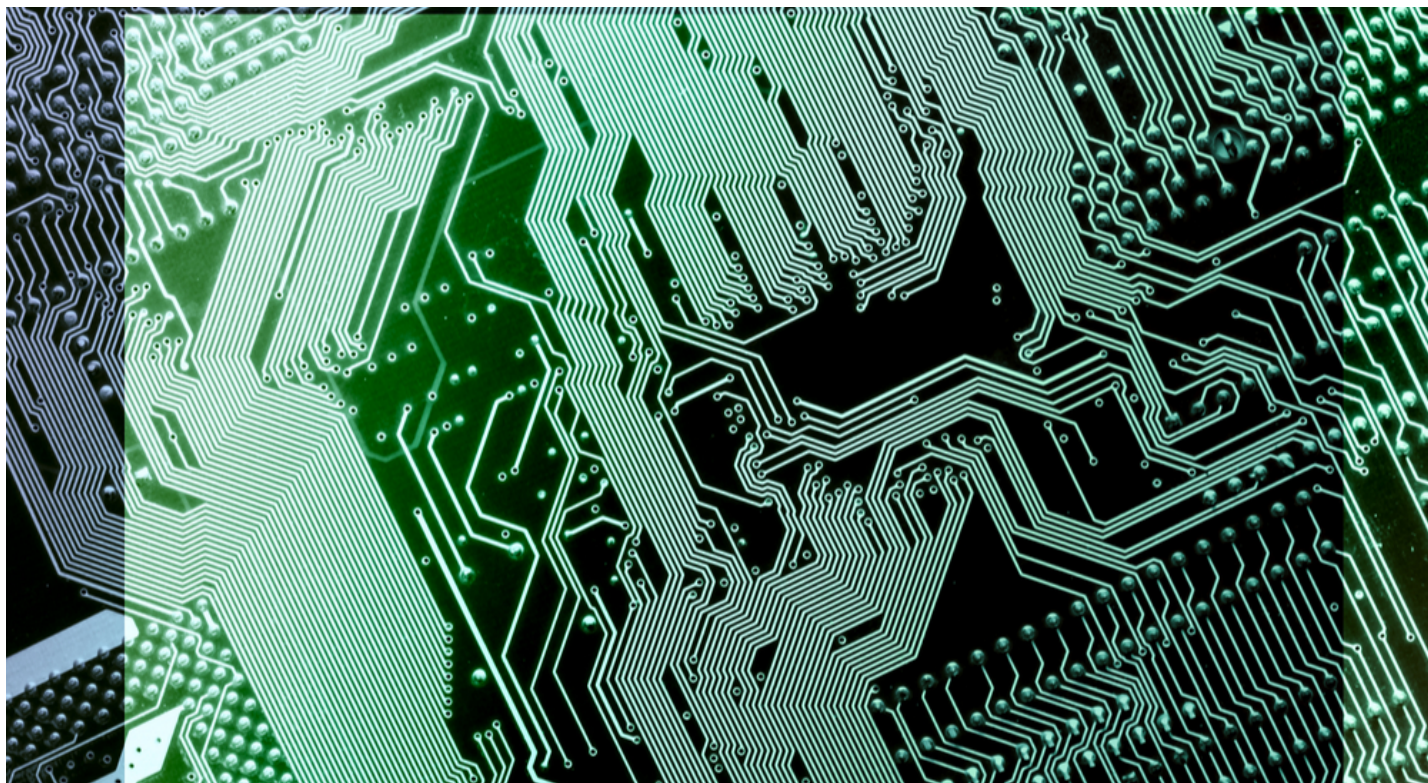
In the past, many PCB designers would shy away from using autorouters in their designs due to their penchant for difficult setups and questionable results. This led to many of us opting for manual hand routing to avoid the trouble and cleanup we'd come to know. However, recent developments in auto-routing technology have flipped the script, allowing for a lot of saved time and effort in your design process. While some of the more critical aspects of your design will still require manual routing, the ability to set the design rules the autorouter will use for your traces will save you the headache.

Not 100% convinced? Join us as we discuss a variety of topics to help you decide if auto-interactive routing is for you, including:

- [Hand Routing vs Using an Automated Router: Why Auto-Interactive Routing Is the Ideal PCB Design Solution](#)
- [Why PCB Design Auto-Interactive Routing is Not a PCB Autorouter](#)
- [Why An Auto-Interactive Router Routes Cleaner Traces than an Auto Router](#)
- [The PCB Routing that Benefits the Most from Interactive PCB Auto Routing](#)
- [The Top Reasons Why PCB Design Software With Auto Routing Can Save You Time](#)
- [Intelligent Routing Features In PCB Design Software Let You Work Smarter, Not Harder](#)



# HAND ROUTING VS USING AN AUTOMATED ROUTER: WHY AUTO-INTERACTIVE ROUTING IS THE IDEAL PCB DESIGN SOLUTION



I have been designing printed circuit boards for a long time. Like most experienced PCB designers, I have my reservations about autorouters. Autorouters have a reputation for being difficult to set up and run, taking a long time to work, and giving questionable results. Often you would put your board into the router in the evening only to find the next morning that the results were not worth saving. I knew designers who would spend hours and hours “cleaning up” the routing that the autorouter had created. Often their cleanup wasn’t done to correct circuitry problems, they just couldn’t stand how it looked. Traces that would circle around the edge of the board, instead of going down a layer for the easy connection, were just one of the problems that those early routers would produce.

As a result, it is not unusual for PCB designers to avoid using automation and to stick with manual hand-routing instead. However, there is a whole new world of opportunity out there with today’s auto-interactive routing technology that you may not even be aware of. Let’s look at some of the reasons why designers opt for hand routing and then balance them with some of the benefits that today’s auto-interactive routing technology can give you.

# AUTO-INTERACTIVE ROUTING

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## THAT'S THE WAY I'VE ALWAYS DONE IT

Let's face it, we are all creatures of habit to a certain degree. I myself have often pushed back on using newer board design tool technologies because I had MY way of doing it and was resistant to change. That attitude, though, has only made me late to the PCB design party. The following examples are instances where designers often prefer to manually route their board.

**Short connecting traces:** I usually route short connecting traces from pin to pin by hand. Let's face it, hand routing is cathartic. You can turn your brain off and just click-stroke-click-stroke-click-stroke all afternoon. I'll admit it, there have been several times where I've spent a lot of time hand-routing in these short little connections so that I can later say to anyone who would ask that I have been busy working. Yes, it was busy work but it was gratifying to know for certain each connection was 100% accurate.

**Complex circuits:** Then there are the more complex areas of the board to route, which can be very fulfilling to route. Visualizing the routing in your head as you go, and making it all happen on the screen is not only fulfilling, it's a lot of fun.

But all of this hand routing takes **time**, and that time could be spent on other aspects of your design or to help you get ahead. Here's how the benefits of auto-interactive routing can help you to save time in your design.



*Auto-interactive routing - a great change from the same old way.*

## AUTO-INTERACTIVE ROUTING, ALL THE BENEFITS WITHOUT COMPROMISING THE FUN

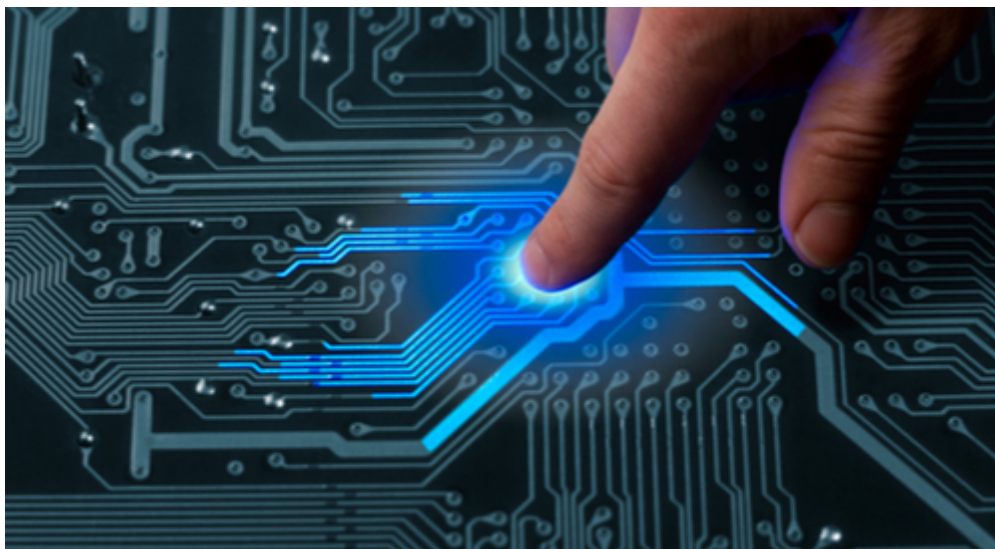
One of the big perks of auto-interactive routing is that it will route traces using the design rules that you currently have set up. This saves you time, especially compared to previous experiences when "prepare your design for the autorouter" was as tedious as it was futile. With an auto-interactive router you tell it where to go, along the guide path you would take. It will route in the same manner that you would have.

## AUTO-INTERACTIVE ROUTING

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With those short point-to-point connections, you can select the nets and engage the auto-interactive router. The auto-interactive router will give you manual routing results without you spending the time to actually manually route the traces.

For more complex routing, you have the option to select the nets and then draw in a path that you want the routes to take. The auto-interactive router will use the layers that you've enabled to route the nets from pin to pin. You will still be directing the routing, but the auto-interactive router will be doing the heavy lifting of putting all the traces in for you.



*Put the power of an auto-interactive router to work for you.*

## PUTTING AUTO-INTERACTIVE ROUTERS TO WORK FOR YOU

Auto-interactive routers are not the solution for every situation. You will still want to exert more manual control over your critical routing, and sometimes you will want to override the decisions that the auto-interactive routing provides. You are still the designer and it ultimately falls on you to make sure that the design is correct.

Auto-interactive routing, however, can save you a lot of time and effort in manually routing a lot of your traces. If you've been avoiding auto-interactive routers because you don't trust the technology or you don't want to give up that portion of the job, break the habit and give them a try. You probably will end up finding that they are a design aid that you really can't live without.

Altium's [ActiveRoute](#) can give you these auto-interactive benefits. Haven't heard of it before? It's a [PCB tool](#) featured in both Altium Designer 17 and [Altium Designer 18](#). Get excited.

Would you like to find out more about auto-interactive routing? [Talk to an expert at Altium.](#)



# WHY PCB DESIGN AUTO-INTERACTIVE ROUTING IS NOT A PCB AUTOROUTER



*Editorial credit: Santiparp Wattanaporn / Shutterstock.com*

A while back I was given the gift of a flight in an AT-6, a WWII era airplane used for training fighter pilots. There couldn't have been a better gift for an aviation enthusiast, and I spent the next 5 months eagerly anticipating it. Finally, the day arrived and I couldn't have been happier as we took off into the wild blue yonder. Then the pilot demonstrated an aileron roll, and my Top Gun expectations were crushed as I spent the rest of the flight with an airsick bag held up to my face. I was so disappointed to find out that I didn't have the stomach for high-speed acrobatics.

I felt the same kind of disappointment the first time I used an autorouter on a PCB design. I expected that the autorouter was going to route my design with the same proficiency that I would. Unfortunately, when I got my design back from the router it looked terrible. Even though the autorouter had completed the routing, it was going to take hours or days doing manual clean-up to get it presentable.

Recently, however, auto-interactive routing technology has made it possible to take the power of automatic routing and put it into the hands of the designer. Auto-interactive routing is different from autorouting and is in many ways superior to it. Before we get to the benefits of auto-interactive routing, let's look at the basic differences between an autorouter and an auto-interactive router.

## AUTO-INTERACTIVE ROUTING

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### AUTO-INTERACTIVE ROUTERS AND PCB AUTOROUTERS, WHAT'S THE DIFFERENCE?

They may sound similar, but in actuality autorouters and auto-interactive routers are as different as night and day. Both are route engines, of course, but the autorouter tries to do the thinking for you whereas the auto-interactive router lets you be in charge.

Autorouters have been around for a long time as stand-alone applications. Even though they now interface with PCB layout software, auto-routers still need their own design rules in order to operate. These rules can be setup manually or imported from the layout software. When engaged, the autorouter attempts to complete routes for all enabled nets in the design. It runs these routes through a series of passes with preset conditions for different routing strategies. When it is finished, the designer imports the autorouted trace information back into the layout application to replace the existing routing. The amount of usable trace routing that the autorouter produces is totally dependant on the setup of the designer, however, the results may not look the way you expected them to.

By contrast, the success of the auto-interactive router does not depend on any extra set-ups made by the designer. Instead, since the auto-interactive router is integral to the layout application, it uses the **existing design rules**. These are the rules that you have already employed for standard manual routing. The commands for an auto-interactive router are also easily accessible from the existing routing menus of the layout tools. The designer simply selects a net or group of nets for the auto-interactive router to work on and then engages the router. Auto-interactive routers give the user control over the routing as if they were manually routing the board but with the speed of automated routing.



*Setting up an auto-router can be very complex.*

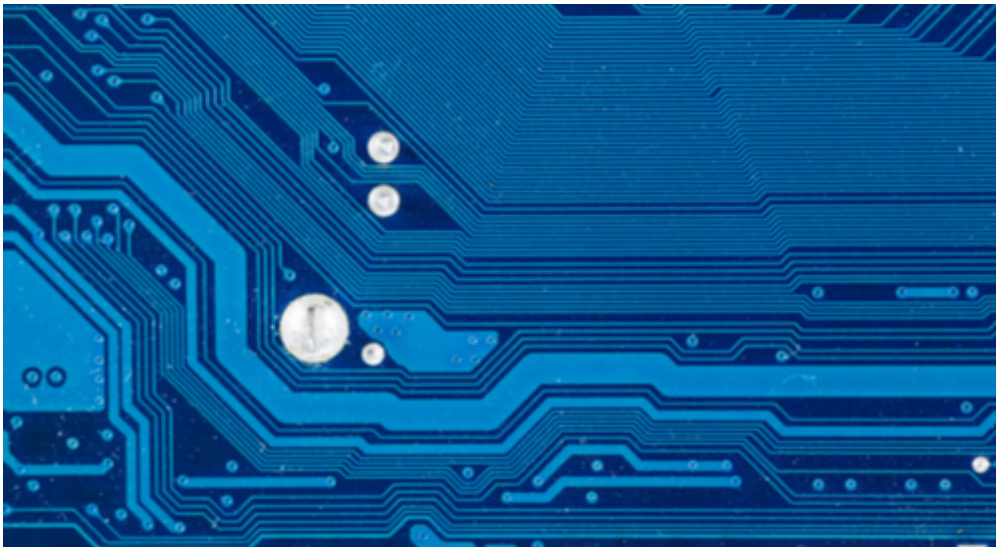
## AUTO-INTERACTIVE ROUTING

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### WHY AUTO-INTERACTIVE ROUTING IS NOT AUTOROUTING

An autorouter requires a lot of setup to work correctly. Since it is going to do all of the routing for you, you must train it to route the way you want it to. In order to train the autorouter, you need to load it with design rules and routing strategies. Although design rules, like net classes and topology constraints, can be imported from the layout software, they may still need to be fine-tuned for peak performance in the autorouter. However, the real challenge is in setting up the different auto-routing strategies. These strategies determine how a trace is to be routed and how many attempts should be made before giving up on it. They will also include wrong way routing distances and how many routing cleanup attempts that you want the autorouter to make. Setting up autorouting strategies is difficult and takes experience to understand how the autorouter will work in different circumstances.

On the other hand, the auto-interactive router gives you the ability to direct the path of the routing without the cumbersome strategy setup steps. Since the auto-interactive router is only going to route the nets that you have selected—instead of the entire design—it doesn't need the strategies that an autorouter does. Once you select the net or group of nets to be routed, you can engage the auto-interactive router. Here, you have the option to either allow the router to choose its own route path or to follow a path that you manually draw for it as a template. Drawing the template for the route path yourself allows you to direct where the routing will take place while the auto-interactive router does the actual heavy lifting of putting the traces in.



*Auto-interactive routing can give you uniform routing patterns like these.*

### AUTO-INTERACTIVE ROUTING DOES NOT MEAN YOUR DESIGN HAS BEEN AUTOROUTED

Using an auto-interactive router will not produce the kinds of problems that come from using an autorouter. An autorouted board can create a lot of undesirable results. You may see traces with annoying little jogs, corners, and stubs, as well as traces that have wandered all over the board. This happens because the autorouter rips up and retries trace routing in its efforts to complete all



## AUTO-INTERACTIVE ROUTING

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routes. The autorouter is also attempting to route the entire board. To accomplish this its focus is on completing those routes instead of creating uniform routing patterns. As a result, bus routing and other routing patterns may be broken up into areas of messy individual trace routing.

The focus of an auto-interactive router is very different. The auto-interactive router will only route the nets that you have selected for routing instead of trying to route the entire board. By only focusing on the selected nets, the auto-interactive router will route traces in tight uniform routing patterns. You also have the ability to specify the path that the selected group of traces will follow. This is a big difference from an autorouter where the routing decisions are made by the router and not the designer.

Auto-interactive routing gives you the precision of manual routing with the power of an autorouter.

Altium's [ActiveRoute](#) can give you these auto-interactive benefits. Would you like to find out more about the PCB design routing solutions that Altium offers its users? [Talk to an expert at Altium.](#)

# WHY AN AUTO-INTERACTIVE ROUTER ROUTES CLEANER TRACES THAN AN AUTO ROUTER



When I was a boy, my room was always a mess. Since I thought I knew where everything was, there was no reason to clean it. Finally, after a lot of pressure from my parents and my peers, I capitulated and cleaned up the room. The difference was amazing. It was so much easier to get around now that I had a clear path.

The same can be said about PCB trace routing from an auto router. Auto routers are known for producing disorganized routes that are unaesthetic. Boards with these characteristics can make further design work difficult and appear to be carelessly designed. This undesirable routing usually falls into one or more of the following three categories:

- 1) Broken up bus routing.
- 2) Long and meandering traces.
- 3) Traces with undesirable corners and stubs.

For years, PCB designers have been dealing with these routing problems when they needed an auto router's speed. Auto-interactive is a lesser-known routing alternative that will save you time without the trace routing problems that come with auto routers.

# AUTO-INTERACTIVE ROUTING

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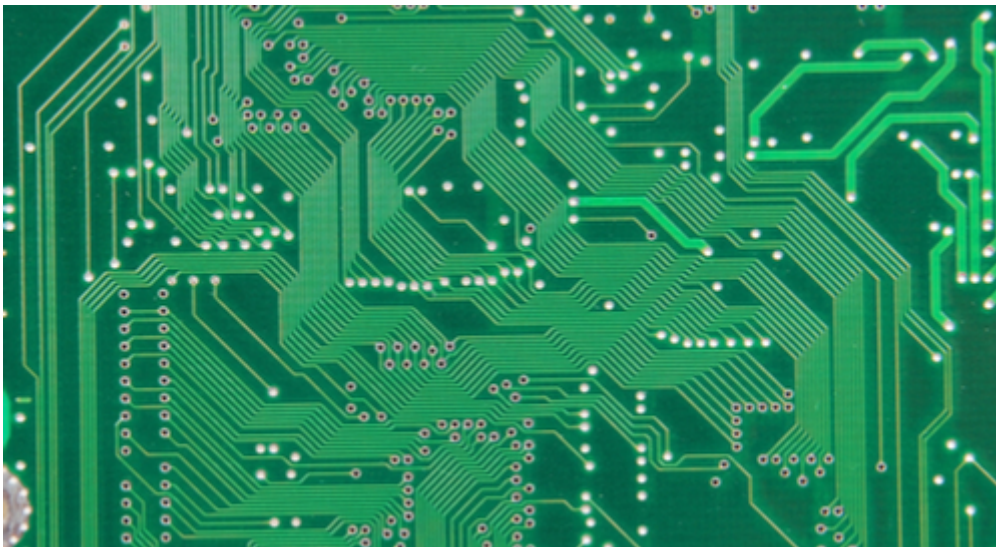
## UNIFORM BUS ROUTING

An auto router can create a lot of problems when routing your PCB. The first and most obvious of these problems is broken up bus routing.

Bus routing is the uniform routing pattern of a group of alike nets. For example, the 8 nets of a data bus (D0-D7), should be routed together as tightly as possible. This will preserve the signal characteristics of the data bus by matching their trace lengths and topologies.

An auto router considers each net in the bus individually instead of routing the bus as a group. In order to route each net, the auto router may push and shove the other routes in the bus out of the way. By the time it is finished, the auto router may have completely broken up the uniformity of the buses.

Alternatively, an **auto-interactive router** operates on the nets that you have selected instead of all of the nets in the design. It will also adhere to the net and net class design rules that you have set up for width, clearances, layers, and topologies. This will result in bus routing that produces clean and precise patterns. Furthermore, unlike an auto router which makes its own directional decisions, auto-interactive routing lets you specify the path that the bus routing should take.



*Clean uniform routing patterns.*

## SHORT DIRECT TRACES

While we've discussed what can go wrong with auto routing buses, they aren't the only traces that get broken up by auto routers. The next problem in auto routed boards are traces that are too long and wander all over the board.

When an auto router is completing a net, it will take any path that it can in order to accomplish that goal. The auto router is designed

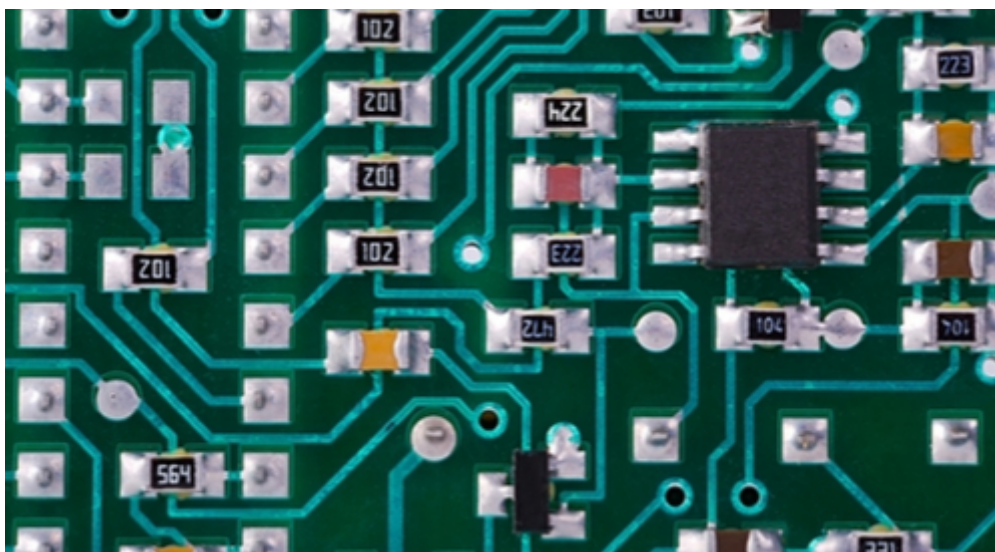


## AUTO-INTERACTIVE ROUTING

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so that if it runs into an obstacle, it will take the path of least resistance to work its way around, even if that means going in the wrong direction. It is not uncommon to see an auto routed trace span multiple board layers and travel for very long distances in order to connect a simple net.

On the other hand, an auto-interactive router will only **route the nets that you have selected**. It will route the selected nets from their starting point to their finishing point without considering every other net in the design as an auto router would. This keeps the routed traces as short as possible without wandering. Additionally, if you specify the path that the auto-interactive router is to follow, the routed traces will stay within the confines of that path.



*Short direct traces are the goal.*

## UNDESIRABLE ARTIFACTS FROM TRACE ROUTING

Another problem that you might encounter is small undesirable artifacts in the traces. Although they are not as obvious as broken bus routing or long wandering traces, they can give you just as big of a headache.

Auto routers often put undesirable routing artifacts, like jogs, corners, and stubs, into its traces. This happens because the auto router is ripping up trace segments and then re-routing them in order to connect all nets in the design. In its efforts these little problems get left behind. These artifacts can be more than minor annoyances since trace stubs can end up acting as antennas and cause **signal integrity problems** with the design.

An auto-interactive router avoids this problem because it is not ripping up traces to do its work. Instead, it will route the selected nets in a single pass using the shortest path possible. Once the selected nets are routed, the auto-interactive router is finished with them and won't try to re-route them. This prevents it from creating the undesirable trace routing artifacts that an auto router does.

Broken up bus routing, wandering traces, and undesirable trace routing artifacts are three of the problems that designers will

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eventually have to deal with when auto routing a PCB. These problems can be eliminated by using an auto-interactive router instead. Auto-interactive routing will give you the precision you need without the problems that a traditional auto router can cause.

PCB design software, like Altium Designer 18, is full of powerful design resources to help you with your PCB designs. One major resource is an enhanced version of Altium's *ActiveRoute*, which will give you the auto-interactive routing benefits that we've talked about. Would you like to find out more about the PCB design routing solutions that Altium offers its users? [Talk to an expert at Altium.](#)

# THE PCB ROUTING THAT BENEFITS THE MOST FROM INTERACTIVE PCB AUTO ROUTING



Years ago I helped to re-roof a house, and the first task was to remove the old shingles. Pulling up shingles one at a time, I was very proud of my efforts until a professional roofer came over to me shaking his head. Using a scoop shovel like a snow plow, he removed a couple a hundred shingles in less time than it took me to pull up five by hand. I learned up on the roof that day to always look for better ways to get the job done.

When routing a PCB design, we also want a more efficient way to get the job done. You as a designer are probably aware of how much time it takes to manually get the cleanest route possible. You're probably also aware of Auto routers, which will do the job faster, but often with **undesirable routing results**. Now, like how the shovel was a better way to remove shingles, we have a better way to route using an auto-interactive router.

For those of you who aren't familiar with the term auto-interactive router, this is a **relatively new routing technology**. It is designed to give you trace routing that has the look and precision of manual routing but at approximately **one connection per second**. Auto-interactive routing is not a batch auto router and is not designed to route your entire board. Instead, it is interactive PCB auto routing where you have the control and the router does the work.

While auto-interactive routing can generally speed up your process, there are areas of circuitry that benefit from it. Particularly, single or multiple nets that need to be connected in a specific order without changing layers. More specifically this can be, point-to-point



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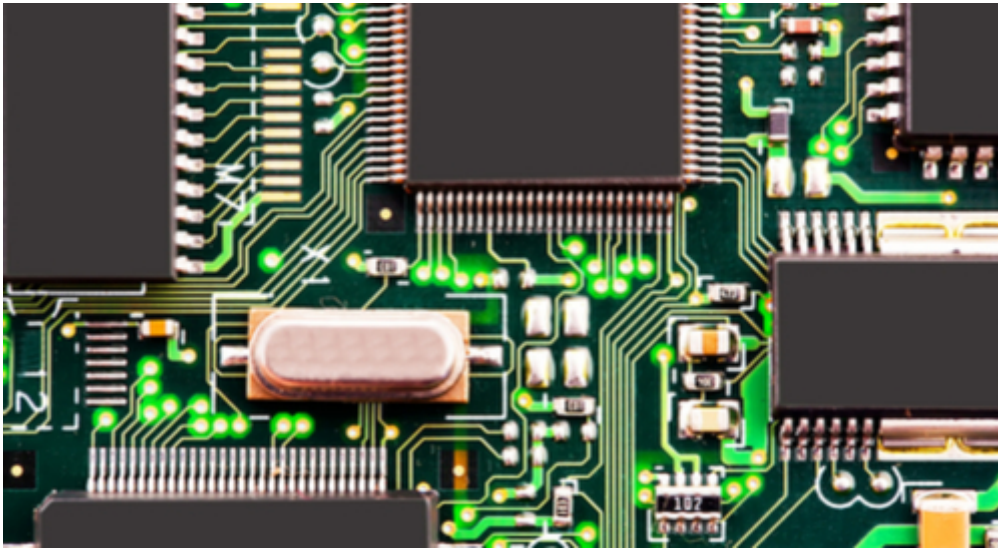
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routing, BGA breakout routing, and bus routing.

### POINT-TO-POINT TRACE ROUTING

As you know, PCBs have many point-to-point connections. These can be short nets that connect component pins in tight circuitry groups, via escape patterns from SMT pads or nets that run the length of the board. These are not difficult to manually route, but they take time. An auto router will route them very fast, but you may be left with undesirable routing on the rest of the board. You could restrict the auto routing to just the short connections, but that requires additional setup time before you can use the auto router.

An auto-interactive router is incredibly fast when routing these same nets. You will simply select the nets that you want to route and then **engage the router**. Using the design rules that you have already established in the database, the auto-interactive router will use the shortest possible path to route the traces. It will also do this without the cumbersome setups that an auto router requires.



*An auto-interactive router works well to connect short point-to-point connections.*

### BGA TRACE ROUTING

Before manually routing traces out of a BGA, you'll need to take the time to figure out the best connection order of the nets. This ordering is important so that the designer can route the traces in the most efficient patterns possible to connect the BGAs. Efficient routing patterns not only leave open space on the board for additional routing but will reduce or eliminate the need for vias. Vias take up space that you may need for other routing, and they can introduce undesirable signal characteristics. Using an auto router for BGA routing may actually increase your via count as it typically does not choose the best connection order of the nets.

This is where using an auto-interactive router can be handy. It can quickly order the BGA connections for you. It will evaluate your

## AUTO-INTERACTIVE ROUTING

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selected nets in order to evenly distribute the traces on the board layers that you have enabled for routing. The auto-interactive router will then route the traces to connect the BGAs together in clean and precise routing patterns without using vias. These clean routing patterns will give you the additional board space that you will need for trace tuning or other routing edits later on.



*Bus routing is another strength of an auto-interactive router.*

## BUS TRACE ROUTING

Often times buses are manually routed to create a clean routing pattern. If the bus is not routed in a clean pattern, it could **cause problems with the signal characteristics of the bus**. The downside is that manually routing a clean bus pattern takes a lot of time. Buses can have a lot of nets in them, and some boards may have several different buses as well. For example, double data rate (DDR) circuitry is an example of multiple bus routing with high net counts.

An auto-interactive router will route the nets of a bus for you, but it will do it under your control. First, you will select the nets of the bus that you want to route. Next you will draw a path on the board that you want the bus routing to follow. This path is a template that specifies the direction and width of the bus to the router. The auto-interactive router will then follow the path to route the traces all while obeying the design rules at the same time. The router does this work very quickly, and the results are a very clean bus routing pattern.

Just as the shovel was a much better way to remove shingles, an auto-interactive router is a much better way to route your PCB design. Knowing the best ways to use this router will be the key to your success, and we've talked about three of those ways. Point-to-point, BGA, and buses are all areas of routing that an auto-interactive router can help you to do a better job.

Routing is part of the PCB design process that Altium can help you to do a better job with. Altium Designer 18 is **PCB design software** with powerful resources, including auto-interactive routing with **ActiveRoute**. Would you like to find out more about how ActiveRoute will be able to help you to route your next PCB design? **Talk to an expert at Altium.**

# THE TOP REASONS WHY PCB DESIGN SOFTWARE WITH AUTO ROUTING CAN SAVE YOU TIME



I've been designing printed circuit boards long enough that my family has sadly grown accustomed to me spending more time at work than at home. With a design on deadline, everyone knows that I'm going to be working late nights at the office. I knew that I had to find a way to shorten my design time in order to relieve the stress and spend more time with my family.

A few weeks back it was Halloween and as usual, I had another deadline to hit. This time though, my design was ahead of schedule and I made it home early to everyone's delight. We trick-or-treated, played games, laughed and had a great time together. Not only was I a hero to my family, but that night I slept more soundly than I have in a long time. Being ahead of schedule helped us all, and I owe a debt of gratitude to something that I have traditionally avoided - the auto router.

I know all the arguments against using an auto router because I've been using them for years. These days though, I'm singing a new tune. Auto routers have evolved and are much more useful now than they used to be. Instead of producing a board full of confusing and unusable routing, today's auto routers are refined for specific needs. Once you learn how to best use these routers, you will be amazed at how they can help you. The world of PCB design software with auto routing has changed, and you owe it to yourself to take a fresh look at it.



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## AUTO ROUTERS: OUT OF THE BLACK BOX AND INTO YOUR PCB DESIGN SOFTWARE

A lot of us have thought of auto routing as some kind of secretive black box technology that we had no control over. In the past we have sent our designs to the mysterious router, only to be disappointed by the results when it came back. Often we discovered that the router had produced a mess of undesirable routing that would take us hours to manually clean up. Problems like these have caused many designers (including yours truly) to lose confidence in using an auto router.



### Black-box testing

*Auto routing a PCB used to be a black box mystery.*

Today it's a different story though, as auto routers are vastly improved over what they used to be. Many of them are embedded with your PCB design software instead of being a third party black box application. This allows you to use the design rules that you already have set up, and it eliminates the need to interface with another application. Today's auto routers also function in different modes so that you can target specific areas of your design to work on. Here are a couple of examples:

**Point-to-point auto routing:** You can use the auto router to connect simple point-to-point nets. You select the nets that you want to route, and the router will automatically route the traces according to your design rules.

**Batch auto routing:** Similar to the older "black box" auto routers that we remember, these modern batch routers are much more configurable. Since they are usually contained within your PCB design software, they use the design rules that you've already set up giving you much better control.

# AUTO-INTERACTIVE ROUTING

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## HOW PCB DESIGN SOFTWARE WITH AUTO ROUTING CAN HELP YOU

When my peers first encouraged me to look again into auto routing, I initially resisted. Eventually, though my need for help forced me to reconsider, and I gave auto routing another look. What I found surprised me, and I'm betting that you will be surprised too. Here are some of the types of routing that I have discovered where an auto router has really helped me:

1. **Short or long point-to-point nets.** These nets used to take a long time to route manually. Now, whether they are short nets from pin to pin or long nets that cross the entire board, the router puts them in much faster than I ever could.
2. **Non-critical miscellaneous routing.** At the end of a design when I have a bunch of non-critical nets left to route, the batch router is a great tool to have at my disposal.
3. **Routing cleanup.** The auto routers also have a lot of trace routing cleanup routines built into them. These greatly reduce the amount of time that I used to spend doing a manual cleanup.

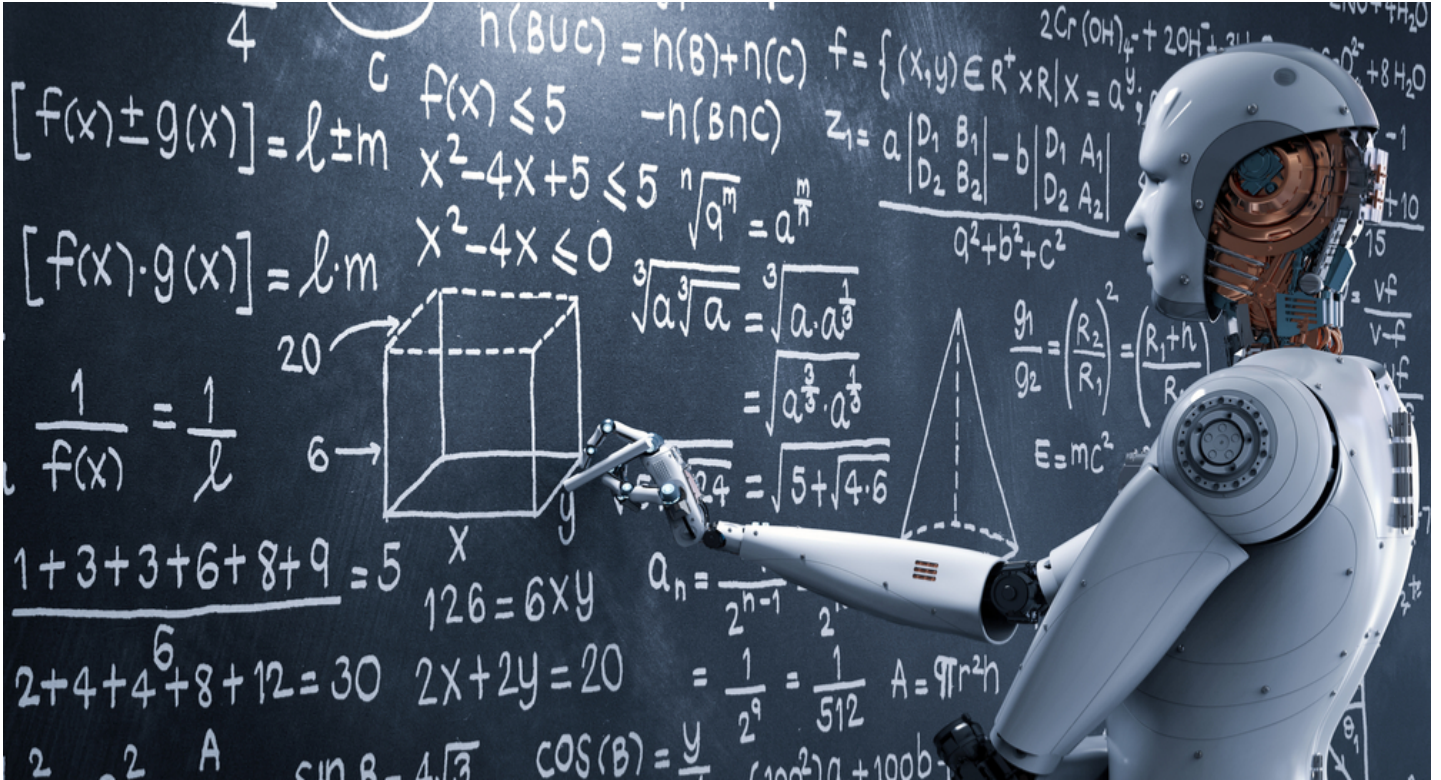
I am finishing my designs more quickly these days because of auto routing. This has helped me to spend less time at the office and more time at home. I'm also sleeping like a rock now because I don't worry nearly as much about how I'm going to finish my design on schedule.



*PCB design software with auto routing can help your design.*

Could you use some help to shorten your design time? If so, then take another look at auto routing, it's changed a lot over the years. Today's PCB design software with auto routing, like Altium Designer, can help you to get your designs to the finish line sooner. Who knows, you may even end up sleeping better as well. Would you like to find out more about how Altium's auto routing can help you? Talk to an expert at Altium.

# INTELLIGENT ROUTING FEATURES IN PCB DESIGN SOFTWARE LET YOU WORK SMARTER, NOT HARDER



Everybody has those lazy moments, trying to figure out how little one can do while still completing a task. In my first job, I created a software where I can automatically launch my favorite applications through voice command. Later, I found a new level by coding a special program to email reports, close applications, and shut down my computer with one click of a button.

My first PCB designs took place on the early versions of PCB design software. These had the auto-routing capability; however, I didn't know how to use them very well yet. I thought, like with my end-of-the-day app, I could just hit a button, go grab some tea, and have the PCB ready for manufacturing when I came back. Yeah, imagine the disappointment when I come back to a poorly routed PCB that I then have to spend hours reworking. It wasn't very fun.

A decade later, PCB design software has gone through many cycles of revision and improvements. Today's intelligent routing features are much more powerful than their predecessors. But another part to their improving usability is my growing knowledge and experience: PCB software was never meant to replace the skill and insights of a hardware engineer, and so it wasn't built to do that. Instead, PCB design software, when used appropriately, can save hardware engineers precious time to complete their design. Four key tools can help you leverage intelligent routing features in PCB design software without falling into complacency.



# AUTO-INTERACTIVE ROUTING

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## 1. COMPONENT AUTO-PLACER

The component auto-placer is a great tool that arranges all your components systematically. It is tempting to just use the auto-placer on most of your components and start the routing process. Indeed, in a simple design, there may not be any major issue. However, in complex applications, failing to separate components according to their modules may cause **cross-coupling** between noisy components and analog circuits. When cross-coupling occurs, the components end up polluting each other and the system in place, changing an isolated interaction to a more problematic disturbance.

Component placement must take into account several factors, including heat production and sensitivity as well as direction and orientation of signals. While it may be possible to have an auto-placer work with these considerations in mind, it is more important to maintain a compatible relationship with the auto-placer. The auto-placer is best used to complement the **best practice of component placement**.

## 2. AUTO ROUTER

Following my—failed—attempt to have the auto-routing feature take over my job, I've changed my way of using this intelligent routing tool. Now I use the auto-routing tool to save me countless hours of routing an “unroutable” board.



*Route smartly through intelligent problem-solving.*

Unroutable boards often occur when your board is too small to hold the number of required connection. When you're working in this situation, a quick test to save you time is to hit the auto-route and see if it can complete the routing in its first two attempts. If the auto-router fails, then you might need to revise your components or enlarge the PCB size. If you were to attempt this test

## AUTO-INTERACTIVE ROUTING

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manually, you could be wasting valuable time. Worse yet is designing before running the auto-route: in that case, you might spend hours on a PCB design just to find that it is impossible to route given its size.

One of the best tactics for using auto-routing is to apply it alongside manual and interactive routing. Begin by placing the power supply, high-speed communication, and analog signals manually. Then route the differential pairs before completing the remaining signals with the auto-routing tool. Make sure that the auto-route signal does not alter pre-routed important tracks.

### 3. MULTIPLE PAIR AND DIFFERENTIAL PAIR ROUTING

The multiple pair and **differential pair routing** are great tools in maintaining equal copper length and ensuring they are running in parallel. Instead of routing one signal followed by others, it saves you precious time by routing a set of signals simultaneously. As intelligent as it is, however, it is up to you as the designer to ensure that the differential or multiple pairs signal is not routed near other high speed or analog signals. Consider multiple pair and differential pair routing as tools in your toolbox rather than a replacement for your engineering insights.

### 4. DESIGN RULE CHECK

Design rule check (DRC) is probably the best tool that helps engineers to eliminate human errors. It highlights routing errors and zooms into the exact location on the PCB for immediate remedial work. As great as it is, it shouldn't be the cause of complacency in engineers where PCB best practices are concerned. While it may help eliminate mistakes like unconnected nets or clearance constraints violations, a compatibility with both features and experience will allow the engineer to identify issues like **ground loops** or incorrect ground plane placement. Ultimately, the DRC is only as effective as the engineer who configures it.



*Shortcuts only work if you know what you can't do first.*

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Throughout my years designing PCB for various applications, I've put intelligent features in various versions of [CircuitStudio](#) to good use. With the right approach, these features could cut down on your design time without compromising the quality.

Integrating these tools into your workflow can help you work smarter, not harder. Learn more about intelligent routing features by [talking to the experts at Altium](#).

## ADDITIONAL RESOURCES

Thank you for reading our guide on Auto-Interactive Routing. To read more Altium resources, visit the Altium resource center [here](#) or join the discussion at the bottom of each original blog post:

- [Hand Routing vs Using an Automated Router: Why Auto-Interactive Routing Is the Ideal PCB Design Solution](#)
- [Why PCB Design Auto-Interactive Routing is Not a PCB Autorouter](#)
- [Why An Auto-Interactive Router Routes Cleaner Traces than an Auto Router](#)
- [The PCB Routing that Benefits the Most from Interactive PCB Auto Routing](#)
- [The Top Reasons Why PCB Design Software With Auto Routing Can Save You Time](#)
- [Intelligent Routing Features In PCB Design Software Let You Work Smarter, Not Harder](#)