

Power Assist Wheelchairs

A Beginner's Guide



THE BASICS

Power assist wheelchairs fall into the broad category of *mobility products*, which encompasses everything from canes to exoskeletons and everything in between. Power assist wheelchair technology has been around since the late 1990s.

Once seen a narrow niche in the mobility products marketplace, experts are coming to realize that *the applications for power assist are far more widespread than originally believed*. As a result user demand is growing for these unique products.

In this Beginner's Guide we provide you with a flavor for power assist wheelchairs and will hopefully leave you with some ideas to consider next time you're considering a new mobility product.

POWER ASSIST WHEELCHAIRS: WHAT THEY ARE



Photo 1 – an exoskeleton, high end mobility

Operates like a manual chair

Power assist wheelchairs operate in essentially the same manner as manual wheelchairs. The only difference is an on/off switch. Once turned on, *the user pushes the hand rims just like a manual wheelchair*.

Dramatically different user experience from a manual chair

Unlike manual wheelchairs, power assist wheelchairs have smart, software-driven motors that respond to user force on the hand rims by providing intuitive assistance. *The motors adaptively help the user accomplish more with less effort*. Not only can power assist users do more, this technology also enables them to do things they otherwise could not do at all.

Many common user benefits

The benefits of power assist wheelchairs are numerous. Below is a brief list of some of the most commonly cited benefits by users:

- Improved ability to navigate hills (up and down)
 - *Extra boost going uphill* dramatically reducing strength required
 - Regenerative braking for *smoothly going downhill* reducing strength required

- Improved ability to navigate uneven surfaces
 - Grass, gravel, dirt, bumpy sidewalks—all become more navigable
- Maintains the look-and-feel of a manual wheelchair
 - Sleek and stylish
 - Can be loaded into the trunk of a car
 - *Smartly concealed design allows user to be the focus*, not the device
- Prevents repetitive stress injuries
 - Whether it's rotator cuffs, sore wrists, or carpal tunnel syndrome—*power assist reduces the torque on joints and muscles* tremendously
- Enables user to go further and stay out longer
 - Users remain active by pushing the wheelchair, but the *boost from the power assist delays fatigue onset*
 - Allows for greater independence



Photo 2 – propel easier on surfaces like this

Numerous different applications

The list of potential applications is also quite lengthy. In short, anyone who is wheelchair bound and has the use of his or her arms is a potential candidate for a power assist wheelchair. A partial list of relevant applications includes:

- Spinal cord injury – paraplegic, quadriplegic
- Illness – multiple sclerosis, muscular dystrophy, spina bifida, ALS, cerebral palsy
- Other medical condition – amputee, stroke
- General physical weakness – elderly, obesity (limited by weight capacity), diabetes

POWER ASSIST WHEELCHAIRS: WHAT THEY'RE NOT

Now let's turn the conversation around and talk about what power assist is not.

Not a Manual Wheelchair

Manual wheelchairs require 100% self-propulsion. Power assist combines self-propulsion with smart motor propulsion.

Not a Power Wheelchair

A power wheelchair is heavy, wide, and joystick operated. Power chairs are heavy in part because the power requirement is high, resulting in a large battery. They are wide because they generally have a more substantial seating system, wider tires, and more electronics to house on the chair. Lastly they are joystick operated meaning that the user operates the chair with minimal physical exertion.

Power assist wheelchairs use electric power as well, but in a more streamlined fashion. They also use push rims instead of a joystick.

Not a Mechanical Advantage Based Gear, Lever, or Row Drive Add-On

Mechanical advantage systems make modifications to a manual chair to increase leverage during self-propulsion. These systems change the way the chair is propelled, but do not ultimately add energy to the propulsion. They also do not help going downhill.

Power assist wheelchairs add energy for propulsion by way of smart motors that work intuitively with the user.

Not a Joystick Power Add-On Unit

These systems are conversion kits that add a motor, battery, and joystick controller to a manual chair. They substitute push rim propulsion with joystick propulsion in the same manner as a power wheelchair. Products using joystick propulsion do not glide like manual wheelchairs.

Power assist wheelchairs maintain the use of hand rim propulsion and the *motors sense the user's input to provide the right amount of assistance and glide.*

Not a Motion Sense Power Add-On Unit

Motion sense power add-on units sense motion and then propel the wheelchair at a constant speed via electric motors. The chair will continue at this speed until the user re-applies force to the hand rims signaling a desire to cease motorized assistance.

Power assist wheelchairs utilize software to process the force applied to the hand rim and translate that force into a specific output. Unlike the motion sense power add-on unit where the response to force is constant, *power assist wheelchairs are smart.*



Photo 3 – a typical power wheelchair

THE TWO CATEGORIES OF POWER ASSIST WHEELCHAIRS

Hopefully at this point you've got a good idea about the product category, so now let's talk about power assist options. Currently the market offers two types of power assist wheelchairs: the add-on unit and the integrated design.

Benefits and limitations of the add-on unit

One benefit of *the add-on unit is that it retrofits to a variety of wheelchairs*. Also, with some technical know-how the add-on unit can be taken on and off.

The limitations of add-on units are that they house the motors in the wheels and in some cases the battery too. This makes the wheels heavy, impacting both ease of disassembly and the chair's ability to glide like a manual wheelchair. Add-on units also widen the chair. The more obvious nature of the add-on unit also detracts from the aesthetic appeal of a manual wheelchair.



Benefits and limitations of the integrated design

The integrated design is more or less what it says it is. A key benefit of this design is that *the power assist components are tucked away underneath the frame*. This means that the weight is located in the chair rather than the wheels, making disassembly for transport simple and the chair's glide similar to that of a manual wheelchair. It also means that the aesthetic appeal is maintained, keeping the power assist concealed from the average passerby.

On the limitations side, the design is indeed integrated. These chairs come with a specific frame designed for the specific system.

SOFTWARE: THE KEY INGREDIENT

As discussed throughout this guide, power assist wheelchairs are smart, which means they are aided by intuitive software. However, they are smart in different (sometimes proprietary) ways and are not all created equal. Here we will outline some of the things to consider when trying out different power assist products.

Force multiplication or distance targeting?

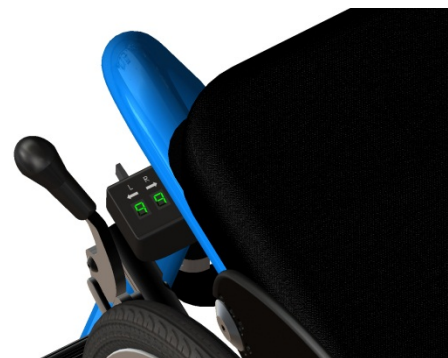
This is a question of how the software algorithm works. Force multiplication takes a unit of force applied to the hand rims and multiplies it, say, three times. This means that operation should be proportionally easier. Uphill and uneven surfaces will remain relatively more difficult than level surfaces, but all will be easier to navigate than before.

Distance targeting takes the force applied to the hand rims and turns it into a desired distance. In this latter case *the system results in the same distance traveled regardless of terrain*. So a push on a hill will result in the same distance as that same push on level ground. Distance targeting comparably reduces user strain on difficult terrain when assistance is most necessary.

Adjustable sensitivity

Power assist wheelchairs always adapt to user inputs driven by either force multiplication or distance targeting. But what about adjusting the level of sensitivity (i.e. the output per unit input)? This can also be done through software. The important features to consider here are:

- Left/Right sensitivity—to adjust for difference in strength side-to-side
- Number of sensitivity levels—level of resolution to tune the system to user
 - This can be especially important for Left/Right sensitivity
- Ease of adjusting sensitivity levels
 - How quick and reliable is adjustment?
 - Can it be adjusted on the chair directly, or is a remote necessary or PC connection required?



Other miscellaneous

Other software related options to think about include the fuel gauge location and resolution, how the system handles downhill situations, and the location and ease of the on/off switch.

CONCLUSION

So there you have it. *Power assist wheelchairs are not just cool technology, they are powerful in the lives of people*. And they continue to grow in popularity.

Users will find differences in the power assist wheelchairs available in the marketplace and should do their homework before picking one manufacturer's product over another. Hopefully this Guide has helped you get started with the process. *The best advice we can offer is to do your own research*. It's all out there. Google is your friend!

About the Company



We're passionate about technology and improving people's lives.

Part of a family-owned group of businesses with a long and proud heritage in precision manufacturing, in Clinton River Medical Products we've taken our collective skills and expertise and applied them to the medical mobility industry.

With a focus on unique niche technologies, our goal is to create intelligent products that dramatically transform the lives of our customers for the better.

Clinton River Medical Products makes the Tailwind Power Assist Wheelchair—available in 2013.

About the Author



Craig Doescher is General Manager and Co-Founder of Clinton River Medical Products, LLC. He has a passion for entrepreneurship driven by a desire to enable people to live better lives. Craig has been involved in other early stage ventures, including Tegu where he established the Company's international supply chain. Prior to Tegu he co-founded Living Way in Cape Town. Craig also has a background in automotive components having spent time with both Robert Bosch LLC and Ralco Industries Inc. He started his career on Wall Street at the Blackstone Group. Craig holds a BBA from the Michigan Ross School of Business and an MBA from the MIT Sloan School of Management.

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