

## A White Paper from Datalogic Mobile

### Introduction

Ergonomics is the science of designing equipment, tasks and work spaces to fit more naturally with the capabilities of the workforce. Making tools, equipment and the workplace more ergonomic can both improve productivity and avoid worker fatigue, discomfort and injury.

In the world of rugged hand-held computers, ergonomic design has become increasingly important over the past decade as these devices are used by a rapidly growing pool of employees throughout a larger percentage of the work day.

When rugged mobile computers were first introduced in the 1970s and 1980s, the devices were bulky, boxy and heavy. However, these early models were used for just a few hours a day for receiving and shipping operations during high-intensity periods of peak activity. Today, workers have found that mobile computers play an integral role in their work processes over the length of the entire shift.

In a distribution center, mobile computers are constantly in use for receiving, put away and shipping operations. In field service and delivery operations, end users must be able to easily carry and utilize mobile computers in unpredictable conditions, often while moving or operating other equipment or carrying large parcels. For end users to be able to handle these devices for long periods of time, they have to be lightweight, easy to use, and designed to fit comfortably in a person's hand.



*Early mobile computer designs lacked ergonomics*

Devices that are too heavy, that are improperly balanced, or that have poor display visibility can negatively impact a company's mobile operations in two significant ways. First, devices that are awkward to use or that have a design that makes it difficult for users to rapidly key-enter numeric information or scan a bar code can be a drag on productivity.

Second, mobile devices that are too heavy or that aren't properly balanced can lead to repetitive strain injuries (RSIs), one of the fast growing categories of workplace related injuries. These types of injuries can lead to increased use of sick leave by injured employees, higher healthcare costs, and higher workman's compensation claims.

### The Elements of Ergonomic Design

A number of factors can impact the ergonomic suitability of a mobile computer. When evaluating a mobile device, it is important to examine the combined impact of these design elements on usability, and to ensure that device is well suited to the application and the operating environment.

**Weight:** The weight of a device is one of the single biggest factors that influence a mobile computer's ergonomic performance. A number of design elements influence how heavy a mobile

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computer will be; generally, anything that makes the device lighter will involve a trade off between weight, ruggedization and functionality.

Mobile computers can weigh anywhere as little as eight to ten ounces to in excess of two pounds, depending on the device. The more rugged a device, the heavier it is likely to be. While computer components are becoming smaller and lighter in general, ruggedization for extremely harsh environments will always lead to increased weight. However, a heavy device can still provide ergonomic benefits if it is properly designed and balanced.



*Modern mobile computer designs incorporate ergonomics*

Extended capacity batteries can also add a significant amount of both weight and overall bulk to a mobile computer—generally speaking, the longer the life of the battery, the heavier it will be. If your application requires an extended capacity battery, be on the watch for solutions that simply require you to attach a power unit somewhere on an existing computer. These batteries not only increase the weight and size of the device, but can also throw it off balance. Find a computer that has been designed from the ground up to accommodate a larger battery while maintaining its ergonomic attributes.

**Balance:** The balance of a mobile computer refers to how the device feels while it is in the hand of the end user. The computer's center of gravity should generally fall in the center of the user's palm or slightly behind the center, which provides the best control over the device. If the computer is too "nose heavy" it will flex the user's hand forward, putting undue strain on the top of the wrist.

Balance considerations will vary depending on the form factor of the device. But both pistol-grip scanners (typically used in warehouse or retail applications) and hand-held devices (like those used in field sales or service solutions) should be designed so that the bulk of the weight falls near the middle of the device for maximum comfort.

**Shape:** Although many manufacturers still produce very boxy computers, nothing about the human hand is shaped like a square. By contouring these devices to the hand, they are easier to balance and control during use. Datalogic, for instance, has designed its mobile computers to be contoured to the human hand. If a mobile computer fits more comfortably in the user's hand, they can use it more efficiently and comfortably.

**Switch Activation Force:** When end users press a button or pull a trigger on a mobile computer, they should receive some sort of tactile feedback that they have successfully completed their operation; sometimes this comes in the form of a definitive "click," or a point where they can easily tell they've hit the bottom of the trigger or button's action and a connection has been made. If the buttons are too "stiff," then users may have to over-exert themselves to press a key; if they are too loose, it's difficult for users to tell if they've made a successful entry.

Buttons and switches need to be easy to press, but still provide clear feedback without wearing out the user's fingers during a full shift that may include thousands of scans or key entries per day.

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**Display:** Even if a device is properly weighted and balanced, it will be nearly useless if end users can't read the device display.

There are a number of options available on most mobile computers, including color and black and white screens, backlighting options, and a variety of sizes. The key is to find a display type that will be easily read in your environment—mobile computers that are primarily used indoors have different display requirements than those that might be used in bright sunlight, for instance. Different display types will also have different power management requirements, which could impact battery performance.

Larger displays may be required for applications that require a large number of fields to be filled out, or that are very text-intensive. Smaller displays, on the other hand, can work just as well with a streamlined graphical user interface. Keep in mind that display size also impacts the overall weight of the device.

**Keypad:** The data entry keys on the mobile computer should be easy to read and to use. The size of the keys may vary based on your application needs; for instance, end users that typically use gloves may need larger keys.

More importantly, the keys should be arranged to ensure efficiency. High-use keys should be close to the fingertips to minimize the amount of time between keystrokes. Mirroring common keyboard layouts (i.e., a QWERTY keypad or telephone keypad layout) also helps to reduce the need for end user training and increases data entry speed.



*Green Spot Technology provides visual feedback to users*

**Audio or Visual Feedback:** Mobile computers are often used in noisy industrial environments. For applications where accurate bar code scanning is important, it may be difficult for users to know they have successfully scanned a code. In these instances, the scanner can emit an audible tone to indicate a good scan; in others, the ambient noise level may simply be too high for the tone to be heard, so a visual indicator would be more useful. Datalogic's patented Green Spot technology, for example, uses a separate LED to provide visual confirmation of a successful scan.

When the bar code is scanned and read, a green spot is instantly projected onto the bar code. Green Spot technology is used in applications like healthcare or library settings where silent scanning is preferred.

## Pilot Testing Uncovers Ergonomic Issues

How do industrial mobile computer users determine if a given device "feels" right for their workforce and application? Increasingly, this is accomplished through pilot testing of the devices in a real-world scenario.

For large deployments, companies may test several different devices at a facility for anywhere from 30 to 90 days. The same end users who will ultimately work with the mobile computers during the live deployment are able to run the computer through its paces during an actual shift. By providing

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feedback on usability and device handling, employees contribute valuable input in the device selection process for their employer.

### Ergonomics Pays Off

Selecting a mobile device that is a good ergonomic "fit" with users can pay off in multiple ways.

First, the device will be more efficient to operate, and allow for longer use during a full shift. Devices that are more comfortable to use are also more likely to be accepted by front-line employees. If an end user likes a device, likes the way it handles during operation, they will be much more likely to use it—and to not abuse it out of frustration. Companies that don't consider ergonomics during device selection may find themselves making a costly mistake; it is not uncommon to find cabinets full of abandoned mobile computers that end users simply did not like using.

Just as important, companies can avoid the expense of costly workplace injuries. In a 1993 report, the Occupational Safety and Health Administration (OSHA) found that repetitive strain injuries (RSIs) accounted for one in four lost-time injuries and illnesses reported by employers to the Bureau of Labor Statistics. Carpal tunnel syndrome, which is the most common RSI, results in the highest number of days lost among all work-related injuries—nearly half of these cases result in 31 days or more of work loss, according to the National Center for Health Statistics.

The cost is also high—OSHA estimates that RSIs cost employers between \$15 billion and \$20 billion per year in the United States alone, accounting for one of every three workers' compensation dollars.

By selecting well-designed mobile computers that reduce strain on user's hands, arms and eyes, companies can avoid costly work-related injuries and workers' compensation claims.

### Conclusion

Ergonomic design is an important selection criterion when choosing a mobile computer for enterprise applications. End users are expected to carry and use these hand-held devices for hours at a time, and they play a mission-critical role in obtaining real-time data in industrial, retail and field service environments. By deploying well-designed devices, companies will have happier, healthier workers who can operate with optimal efficiency. By increasing productivity and reducing work-related strain injuries, ergonomically designed mobile computers can provide a significant return on investment and improve the overall work environment.

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### About Datalogic Mobile

Datalogic Mobile is a global manufacturer of mobility solutions for retail applications, assisted shopping, warehouse solutions, and field-force automation.



*Datalogic Mobile has a complete line of rugged mobile computers for retail, warehouse and field force applications.*

Our diverse product range of rugged mobile computers includes pocket-sized computers, pistol grip mobile computers, and industrial PDAs designed to keep workers connected to their enterprise inside or outside the four walls. Our mobile computers use Cisco® Certified CCX radios for maximum levels of: RF security, data throughput, and efficiency. Datalogic Mobile computers use the latest technologies for voice and data communications giving mobile workers on-the-go connectivity.

Datalogic Mobile is the worldwide leader in Assisted Shopping. Over 350 retail stores have implemented Datalogic Shopevolution™ software and the Datalogic Joya™ handheld pod as their assisted shopping solution. Datalogic assisted shopping gives retailers a competitive advantage while reducing their operational costs. Joya makes shopping a multimedia experience that increases consumer loyalty.

Datalogic Mobile has worldwide presence in over 30 countries and over 800 business partners worldwide. A leader in technology, Datalogic has a growing portfolio of over 850 patents, eight research and development centers, and 300 engineers.

See us on the web at [www.mobile.datalogic.com](http://www.mobile.datalogic.com) or call 800-929-7899