Honeywell

Five Things to Consider When Using Tablet Computers in Forklift Applications

Why Tablets and Purpose Built Forklift-Mounted Computers Are Not Interchangeable

Executive Summary

Tablet computing is one of the fastest-growing electronics categories. Many businesses are exploring new tablet uses, including evaluation trials for forklift and vehicle applications in distribution centers.

A large screen and a Windows® operating system can make a tablet seem similar to popular forklift-mounted terminals, plus some DCs are curious about removing tablets for use on the floor. Nonetheless, tablets are not drop-in equivalents to purpose-built forklift computers: They have a number of major differences.

If you are considering tablets for forklift use, it is important to know the tradeoffs. This white paper reviews some of these, presenting five key issues to consider when assessing tablets for forklift operators:

1. Is the design and mounting appropriate for a warehouse or DC environment?
2. How will the tablet be powered?
3. Is the tablet compatible with data collection equipment (scanners, printers, RFID), legacy warehouse management system (WMS), fleet management solutions and other critical enterprise systems?
4. How will tablets impact user processes and productivity?
5. How much will tablets really cost?

This white paper is for readers interested in automating warehouses and industrial environments, and focuses specifically on enterprise-grade tablets. Consumer tablets such as the Apple iPad® lack the ruggedness and features that a forklift requires, and are not addressed here.

Mounting & Survivability Considerations

A key distinction between tablets and purpose-built forklift-mounted computers is how they withstand vibration. This difference isn't visible to the naked eye, but its effects can be seen over the device lifespan. Computers mounted to forklifts experience substantial vibration, which can wear down internal components if the mounting doesn't properly protect the computer. Shock and vibration resistance are core requirements for all vehicle-mounted computers, but simply meeting a ruggedness standard and having an available mount are not enough to ensure reliable performance.

The shock resistance, IP ratings and other certifications published on computer spec sheets indicate how the device performed in laboratory testing but do not necessarily predict how it will perform when mounted to a forklift. For example, one of the most-used measures of ruggedness today is MIL-STD, a series of military standards that indicate the compliant device has successfully resisted shock and vibration in testing. MIL-STD 810G is a standard for composite wheeled vehicles, and several manufacturers of forklift-mounted and other industrial computers test their products to this standard.

While MIL-STD 810G is a standard, it allows for inconsistent testing methods, and the conditions tested differ from those found in typical forklift operations. The graphic below highlights these differences. The dotted line indicates the vibration profile used in testing to certify compliance with the MIL-STD 810G standard. The solid line represents the vibration measured during forklift testing. (Intermec by Honeywell designs, manufactures, and tests its products to a "real world" vibration testing profile, developed through long-term observation of typical forklift use and abuse.) Note that in most situations, forklift-mounted computers are exposed to stronger vibration than is required for compliance with the MIL-STD 810G standard. Therefore, a standard-compliant product may not be adequately rugged for long-term use on a forklift.

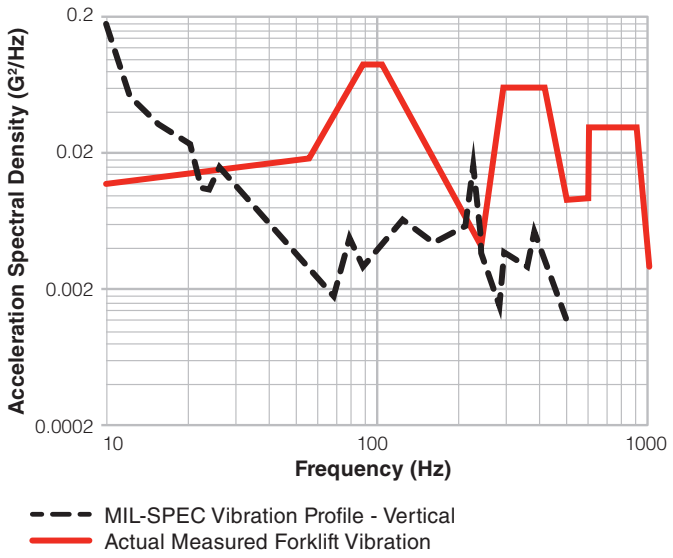

Figure 1: Comparison of Vibration Profiles for MIL-STD Compliance and Forklift Operations

The vehicle mount can mitigate the vibration and shock experienced by the computer, but to ensure protection, the mount needs to be designed for the computer and the vehicle. Forklifts have different vibration profiles than vehicles that are driven on the road, such as police cars and delivery trucks. Mounts designed for these vehicles and adapted for forklifts may not provide adequate protection. There is a difference between simply fitting a computer to a forklift and truly protecting it from shock and vibration. When considering tablets for forklifts, verify that a proper mount is available (and whether there will be an added cost), and ask for test results like those shown above.

There is another mounting consideration if tablets are intended to be frequently removed from the forklift and used for operations on the floor. If these work processes are envisioned, make sure the tablet can be removed and replaced conveniently and without undue risk of damage to the connectors over the long-term.

Power Considerations

Forklift-mounted computers are run from the vehicle's power supply, a DC battery. Tablets typically run from their own battery. Therefore a DC-to-DC power converter is required to use a tablet on a forklift. Running the tablet on its own battery power is not an option because typical warehouse transaction volumes (including scanning and wireless communication) would require batteries to be recharged multiple times each shift. While DC power conversion is not an unsolvable challenge, it does add time, cost and complexity to the installation.

Tablet computers can be forklift powered by installing a DC converter box between the device and the battery. The converter box requires one cable from the forklift battery, and a second cable to transmit the converted power to the tablet. The purchase price and future maintenance costs of these additional components should be considered in the total cost of the tablet implementation.

The next challenge is to effectively mount the converter and place the cables. This typically is not an issue with purpose-built forklift computers, which run on DC power and whose cables may be run through the vehicle mounting to reduce exposure and the risk of damage. When a DC-to-DC converter is needed, the box and its cables must be strategically placed so they do not interfere with forklift operation or inconvenience the operator, and are not exposed to moving parts and potential damage. Loose cables represent a safety hazard and reliability risk because they can snag or break. The converter and cables represent new potential points of failure, and working through the installation issues adds to implementation time.

Power management solutions often cannot be leveraged across the enterprise fleet because different forklift models are often used at different locations, or even within the same location. For example, electric forklifts are typically only used for indoor operations. These vehicles are powered by large batteries that range from 36V to 72V, depending on the model. These batteries need to be recharged at the end of the shift, which often involves removing the battery from the vehicle and replacing it with a charged battery. During the changeover, the forklift-mounted computer has no battery to draw from, so it will shut down and data and settings could be lost unless the computer has an uninterruptible power supply to keep sessions active.

Diesel-powered forklifts do not require battery recharging (the battery is powered by the alternator), but pose other power-management challenges. The computer continues to draw a small charge from the forklift battery even when the computer and vehicle are turned off. Over a weekend, this draw can be enough to drain the battery to the point that the vehicle cannot start when work resumes on Monday morning. This problem is prevented by building a charge guard into the computer, which is a differentiating feature between computers built to be used on forklifts and those that are adapted to the task. Additionally, diesel forklifts have 12V to 24V batteries, whose output can drop to less than 6V when the vehicle is started. This drop in power output can cause the connected computer to shut down unless the device has power management features designed for this usage environment. A sudden computer shutdown may result in data and transactions being lost, and will definitely result in lost time and productivity during the reboot.

Cold storage operations create additional power demand and usability challenges. Computers used in cold-storage environments require an internal heater and a heated display to prevent frost and condensation from making the screen unreadable when the forklift transitions in and out of cold storage areas. These features are not available for tablets, because they require more power than a tablet battery can provide.

Compatibility Considerations

Forklift-mounted computers must not only be fit for the physical environment, but for the distinct industrial IT environment. Forklift drivers use their computers to access WMS and other specialized applications; enter data through bar code scanning, voice and RFID; often use terminal emulation to access proprietary systems that were developed long ago; and have special device management and wireless communications needs. Support for these requirements must be considered before any computer changeover.

Peripheral support is a key consideration. Tablets are designed for touchscreen input. Purpose-built forklift-mounted computers also typically support touch, but bar code readers are the most widely used input devices on forklifts and keyboards are also common. Therefore, to preserve well-established and productive work processes, tablets would need to support bar code scanners and all the other input devices (e.g. keyboards, voice, RFID) that are currently in use.

Supporting various input devices means having adequate interface ports and being able to recognize and process the incoming data stream. Computers designed for forklift have native support for bar code input, and increasingly, for RFID and voice too. Tablets and other devices may need to have software drivers installed and additional configuration to support these input technologies. Connectivity is another consideration. Ensure that the tablet has the serial connection or other interface ports needed to support desired peripherals (or can provide Bluetooth® connectivity). As with DC converter boxes, peripherals should mount securely and cables should be placed to minimize the risk of tangling or snagging.

New computers are not always compatible with legacy applications. This situation frequently arises in warehouse and industrial operations, where terminal emulation is often used to give Windows-based wireless computers access to proprietary applications and inventory data held in old mainframe systems. Enterprise tablets tend to run on the latest Windows operating system, so users of non-

Windows applications will need to determine if terminal emulation is available, and if not, how much software development will be required to access systems from the new computers. There are also potential complications for Windows-to-Windows computer transitions due to the range of Windows operating systems available in the market. There are important differences between embedded Windows operating systems (e.g. Windows CE) and PC versions (e.g. Windows 7) that can impact application performance. While these issues are not unique to equipment changeovers involving tablet computers, they need to be assessed in any evaluation or trial.

Finally, deploying tablets or any other new computer for forklift drivers should not require the enterprise to compromise on its wireless security, device management standards, and interface protocols. For example, the CAN-BUS protocol is utilized by several leading forklift fleet management applications. These solutions typically require an external "black box" fleet management controller with a separate wireless host connection. A new trend in purpose-built forklift computers is to build in native support for CAN-BUS, which allows the forklift computer to integrate all of the functions of data collection, WMS, and fleet management into a single device. Native CAN-BUS support simplifies deployments, integration and wireless security management by eliminating the need to administer duplicate connections and the need to install external "black box" controllers. Tablet computers may not support CAN-BUS, and those that do will require system administrators to configure both the computer and vehicle monitoring device. Determine whether the new devices are compatible with security policies and protocols and any legacy mobile device management software. If incompatibilities exist, determine what upgrades and additional software will be needed.

User Considerations

Getting the most return on investment in forklifts and the most productivity in forklift-based work processes requires maximizing the time the operator spends in the vehicle. Forklifts are expensive assets and their operators are among the highest-skilled and highest-paid workers in the warehouse. Therefore, it is important that forklift operators' computers enhance their productivity rather than inhibit it.

Forklift-mounted terminals are optimized for workers who perform most of their activity in the vehicle, while tablets have been designed for workers that carry devices and work on foot, either at the store, factory or warehouse floor or in a field service situation. Warehouse managers should carefully consider if it will be worthwhile to have their forklift assets sitting idle while operators detach the terminals to count inventory or perform other tasks on the floor, and must consider if this is the best use of skilled drivers' time. If forklift operators will regularly perform tasks while off the vehicle, tablets are not likely the best form factor to support them because they do not enable convenient, one-hand bar code scanning. Better options include voice terminals that allow hands-free data entry, and small handheld computers with integrated bar code readers.

Tablets are generating interest among warehouse managers who want their workers to perform a mix of vehicle-based and floor-based activity, such as remaining in the forklift for picking and putaway while also leaving the vehicle to conduct inventory cycle counts. Tablets can be a viable solution for the hybrid environment, but it is important to determine whether this need stems from the desire to streamline work processes, or results from a desire to update equipment and introduce tablet computers. Industrial tablet computers have been available since the 1980s—long before the iPad—but have never been widely used in warehouse operations because better suited handheld and vehicle-mounted computer options have been available.

Most warehouse managers conclude it is best for them to employ a segmented workforce, with forklift operators performing as many of their tasks as possible from the vehicle and using floor-based workers with ruggedized handheld computers for the rest. Having workers repeatedly get in and out of the forklift to conduct their work builds unproductive time into operations. Managers have their own responsibilities and computer support needs, and tablets may represent a good option for them. The computer each category of workers uses should complement the most-efficient work processes for their tasks; processes should not be designed around the device.

Putting efficiency concerns aside, there are several features and characteristics tablet computers need to have to effectively support forklift operators when used in non-vehicle operations. The ergonomic requirements change when vehicle-mounted computers are detached and carried. Weight isn't usually a concern for forklift computers because they are mounted on the vehicle, but becomes a consideration when the operator has to carry and hold the device while performing activities. Besides being easy to hold and use, the tablet should have conveniently placed interface ports for bar code readers and other peripherals that may be used.

All computers that get carried will eventually (and often repeatedly) get dropped, so a good drop-resistance rating and crack-resistant screen are advantageous. Tablets for use in warehouses, yards, shop floors and other forklift environments should be rated to withstand repeated drops to concrete (some drop-resistance ratings listed on product specification sheets cite test results from drops to carpeted floors). See Intermec by Honeywell's white paper How Ruggedness Reduces TCO for Mobile Computers to learn more about drop resistance and other design features that impact reliability, and affect the total cost of ownership.

Power management is another important consideration. When computers are detached from forklifts they run on their internal battery instead of the vehicle power supply. So, if plans call for hybrid on-vehicle/off-vehicle operations, perform testing to see if the battery life is sufficient to power all non-vehicle operations. The battery life listed on the spec sheet will not answer this question because battery life varies in real-world conditions. Wireless communication, bar code scanners and other peripherals all consume power and can keep the computer from achieving its maximum stated battery life.

Cost Considerations

Another difference between tablets and purpose-built forklift computers is list price. Tablets appear to be a lower-cost option, which is driving interest in the category. When used on forklifts, the list price of a tablet can be significantly different than its initial cost. As previously documented, to use a tablet on a forklift, it may be necessary to purchase the following accessories typically included in the price of a purpose-built forklift computer:

- Vehicle mount
- DC-DC power converter and cables
- Battery chargers and extra or replacement batteries
- Specialized dock with required interface ports (serial, USB, power)

Organizations may also incur software development costs to make the tablet compatible with legacy applications, provide terminal emulation and accept bar code, RFID and voice input. Acquiring and integrating these extras also increases the deployment time and cost. When comparing costs between specific models of computers for forklifts, it is imperative to compare the total cost of ownership, including the cost of peripherals and accessories, the expected failure rates, downtime and device lifecycle, and the time required for installation, maintenance, device management and support.

Conclusion

The exploding popularity of tablet computers means they will likely find a niche in warehouse operations. While these devices may outwardly look similar to traditional forklift-mounted terminals, they should not be thought of as potential drop-in replacements. Organizations that are considering introducing tablets to perform forklift-mounted computer functions need to consider how the fundamental differences between the product categories will impact operations. Without a review of these issues, using tablets on forklifts can cause unexpected installation and integration delays and expenses, and result in excessive maintenance and reduced user productivity. The key to avoiding these problems is finding the product that best matches existing work process.

Intermec by Honeywell has been helping companies automate warehouses and other industrial environments for more than 40 years and has a complete line of indoor and outdoor handheld and vehicle-mounted computers, including forklift-mounted models. Intermec by Honeywell mobile computers have native support for bar code, RFID, voice and other data input; provide Bluetooth, wireless LAN and wireless wide area network communication; run on Windows operating systems; offer terminal emulation; are available at a variety of ruggedness levels and have many other features to meet enterprise user needs.

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