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ADVANTECH MARS-3100R

FULLY RUGGED TABLET PC WITH DUAL PANEL INPUT

By Conrad H. Blickenstorfer, May 2008

The MARS-3100R is a rugged industrial tablet computer made by Advantech, an experienced Taiwanese embedded and industrial computing conglomerate that is making rapid advances in the US market. Founded in 1983, Advantech provides web-based technology, computing platforms and customization services in three business groups (embedded & industrial computing, eServices & applied computing, and industrial automation). Advantech has almost 3,500 employees, and operates a sales, marketing and support network in 18 countries. The company sells directly or works with third parties to provide complete computing solutions for various industries. These include medical computing, vehicle mounts, panels, rugged handhelds, and the rugged industrial Tablet PC shown here.

Small Tablet, Big Screen

Over the past two or three years, the tablet computer market has become increasingly competitive, with several reputable vendors offering good products. It is not easy to shoe-horn most, or all, of the functionality of a modern computer into a heavily ruggedized tablet with a footprint no larger than a sheet of paper. Making such tablet almost always becomes an optimization effort with manufacturers trying to balance features and performance while retaining a competitive edge in one way or another.

A look at the picture of the MARS-3100R should tell you what approach Advantech took and what their primary selling point is. The



tablet itself is quite compact, measuring just 11.8 x 8.85 inches and being under an inch and a half thick. It also weighs less than five pounds, less than most small notebooks. However, and that is a big selling point, the screen is large. Not huge as in those giant panoramic notebooks so prevalent today, but larger than those of much of the competition. The 3100R's display measures 10.4 inches diagonally. And it sports full XGA resolution—1024 x 768 pixels. The extra size and resolution can be invaluable in many applications. Mapping, GIS, logistics and anything that requires browsing benefits from a larger display and higher resolution.

A second selling point is that the 3100R is,

for this class of computers, a powerful machine. There will always be tradeoffs between performance and battery life, and especially so when a mobile computer must remain small and light enough to be carried around all day. Advantech's approach was to offer two models in the MARS-3100 platform, one that emphasizes performance and the other long battery life. The 3100R represents the performance side. It comes with a 1.2GHz Intel Core Duo U2500 processor. While the U2500 is still an ultra-low volt processor designed for economy rather than all-out speed, it is about as fast as it gets in this class of fanless and totally sealed computers.

Dual Panel Input

There was a time when tablet computer users had to choose between touch screens and electromagnetic digitizers. Both have their strengths and weaknesses, and having both in one unit is highly desirable. Advantech equipped the MARS-3100R with both a resistive touch screen as well as a Wacom electromagnetic digitizer. Both can be used at the same time.

The question that instantly comes to mind is whether they interfere with one another. For example, will the pressure from one's palm compete with the signal from the pen? It doesn't. Advantech designed the two digitizers such that the touch panel ignores input whenever the electromagnetic digitizer senses the proximity of the pen.

Dual Panel Input

Speed is totally relative in computers. It depends on many factors. Different operating systems and systems configurations can have a greater impact on perceived performance than processors. Windows Vista, for example, can seem slow to users even when it runs on very fast processors. We installed Passmark Software's PerformanceTest 6.1 on the 3100R to objectively measure performance.

Passmark's benchmark suite runs about 30 tests covering CPU, 2D graphics, 3D graphics, memory, and disk and then computes scores for each category and an overall PassMark score. For comparison, we're also showing the numbers of an older Tablet PC with a 1.5GHz Pentium M processor. The Pentium M was the mobile processor of choice for several years. The results are shown in the table below.

You can see that even with a slower clock speed and more economical operation, the R3100 smokes the last generation setup by a good margin. In fact, these numbers are close to the top in this class of machine. The only discernible weakness in the R3100's performance was in the disk tests where our tester's 5400rpm 40GB Ultra ATA Seagate was not quite as fast as some of the higher capacity SATA drives we've benchmarked. Still, this is a very respectable result, and the 3100R feels quite quick in every day use as well.

Design and Construction

The Advantech MARS-3100R is a handsome machine that combines excellent industrial design with good ergonomics. The overall design and construction of the body are rock-solid. The outer housing of the tablet consists of a front and a rear half, both made of a magnesium-alloy, that are held together and sealed by eight screws. The top and bottom have a hard gray plastic cap with a rubberized surface. They provide extra protection (and a nice design touch!) and also include pushbutton controls and indicator lights.

Thin, elegant black rubber bumpers fit over the gray plastic in all four corners for yet more protection. They can be replaced in case of a nasty bump that leaves them scratched or marked. What impresses here is that Advantech totally integrated them into the overall design of the machine as opposed to simply use generic bumpers.

The left and right side of the aluminum-alloy clamshell halves have cutouts into which fit two ergonomic black plastic inserts. These provide protection from side impacts, and also cover all the peripheral ports. The peripheral seals/covers are neatly integrated into the lower part of the protective cladding on each side. The protective plugs are attached to the unit via rubber hinges and cannot get lost. They require a firm push to sit and seal nice and tight.

There's only a small ridge to open them. This means there isn't much of a chance for them being opened by mistake. But opening one of the plugs requires a rather firm push with a thumbnail.

Anytime you have a door or cover that protects more than one port, whatever you don't use is exposed. For that purpose Advantech delivers the MARS with small rubber plugs for each and every jack



and port. That definitely provides extra protection. With all rubber plugs in place, there is definitely extra protection. Problem is that they are separate pieces and very easy to lose. So if you need them, keep them in a safe place when they are not on the computer.

In the picture to the right you can see the garage for the Wacom-style pen. The garage has two rubber inserts so that the stylus snaps into place. This solution takes less space and provides more protection to the inside of the computer than an internal garage. The perforated cover below the pen garage would lead one to believe the presence of a fan. However, the MARS-3100R does not use a fan. There is nothing underneath the cover but cooling fins, and no opening into the inside of the computer whatsoever.

The battery (bottom left of the unit) is integrated into the design of the housing, so it is its own cover. In order to minimize the area potentially exposed to water or dust, Advantech completely sealed the battery by placing it inside its own housing, and then sealed the area where the battery contacts are with a separate o-ring gasket. The battery is very securely held in place by two large screws that can be operated by coins, a flatblade screwdriver or even your fingernails (if you don't mind the risk of them braking). This design potentially allows for a larger and more powerful battery at the cost of it protruding a quarter of an inch or so. I don't think Advantech currently offers such a battery.

The compartment above the battery contains the hard disk. In our review unit that was a 2.5-inch 5400RPM 40GB Seagate EE25 Series with random seek times of 12.5 milliseconds and random write times of 14.5 milliseconds. The disk is simply but effectively protected by a lightweight subframe that has foam rubber and neoprene cushioning. The metal cover is held down by six screws, has additional foam rubber shock absorption, and a rubber o-ring gasket for sealing. If you replace the hard disk, make sure none of the foam rubber gets caught under the o-ring seal.



PERFORMANCE	MARS-3100R (U2500)	1.5GHz Pentium M	Increase (%)
CPU Mark	608.2	322.9	88.4%
2D Graphics Mark	170.2	162.8	4.5%
Memory Mark	237.5	208.1	14.1%
Disk Mark	200.6	138.6	44.7%
3D Graphics Mark	101.4	36.7	176.3%
Overall PassMark	281.9	179.6	56.9%

Wireless and Expansion

Integrated wireless communication is standard in almost all current computers, and the MARS-3100R is no different. It comes with a 802.11a/b/g Mini-PCI module that can either be controlled by the standard Windows Zero Configuration utility or via a substantially more comprehensive and well-documented utility from Ralink. RaUI is a tool for advanced users who want to have precise control over their

wireless setup. The statistics section of RaUI can be used to detect network problems. A special WMM panel controls wireless multi-media. Another one handles WPC (Wi-Fi Protected Setup) configurations.

If you want to stay with the standard Microsoft setup, Ralink can still provide a variety of monitoring functions without interfering with the Windows Zero configuration or profiles.



Bluetooth Version 2.0 with EDR (Enhanced Data Rate) is optionally available, as is GSM/GPRS/EDGE Wide Area Network radio that can be integrated in what Advantech calls the SmartBay. Our review unit did not have the WAN function that includes a SIM slot located on the right side of the unit. Whatever options you specify will be supported with the required internal antennas. No need for external ones.

In terms of expansion cards, the standard unit doesn't have any that are externally accessible. That is not an unreasonable design decision for a rugged device as external card slots are notoriously difficult to seal. Advantech does, however, offer an optional SIM card interface.

Connectivity

As far as ports go, the standard MARS-3100R is fairly well equipped, especially for a unit with this high degree of sealing.

Along the left side there are three protective plugs, here shown closed. One covers the power jack; one a standard analog video-out port; and a larger one audio in and out, a USB 2.0 port and an RJ45 jack for landline LAN.

Along the right side are two protective



plugs. One covers a standard DB-9 RS232 connector and a second USB port. This is also where an optionally available SIM slot goes.

The top of the unit does not have any ports. Instead, that's where you find the main on/off button as well as the wireless on/off button. They are push button areas that are part of the protective upper endcap and thus inherently sealed. There are also four indicator lights. To the left one that shows whether wireless is on, and to the right a battery of three: power, hard disk activity, and battery status. The lights are built into the forward edge so that they are visible both from top and from the front.

The bottom has a docking connector with its own protective rubber seal. A second cutout next to it is factory-sealed and may provide access to additional factory-installed options. Here's how it looks:

A number of hardware buttons are integrated into the protective cladding on the right side. There is a standard 4-way navigation diamond with a small enter button in the center. Above it are the "security" key that brings up the Windows Task Manager and a screen rotation button that quickly rotates counterclockwise in 90 degree increments. Below the navigational diamond are three function keys. F1 brings up the on-screen keyboard; F2 the Advantech Central Manager.

Advantech Central Manager

Lacking an integrated keyboard, Tablet PC slates rely on good software for optimal operation. Ideally, a user should be able to perform all configuration, maintenance, and operation tasks with the tap of a finger or pen. To help make that possible, Advantech ships the MARS-3100R with its ACM (Advantech Central Manager) application. As you can see on the right, it is a handy tabbed utility that allows instant access to all the important system and configuration areas. ACM is configured to launch by pushing the F3 function key.

The "Touch" function lets you quickly calibrate both the touch screen interface and the digitizer, and also configure pen tablet ad mouse properties. "Communication" shows which interfaces are active, and what their IP address, subnet mask and gateway is. That can come in very handy. "Audio" lets you quickly set speaker and microphone levels without having to fumble

with the Windows controls. "Display" let you rotate, set brightness, and get quick access to the Windows Display Properties control panel. "Hotkey" allows instant programming of



ADVANTECH MARS-3100R

- Type:** Rugged pen tablet
- Chassis:** Magnesium alloy housing
- Processor:** 1.2 GHz Intel Core Duo U2500
- OS:** Windows XP Professional
- Memory:** 512MB expandable to 1GB DDR2
- Display:** 10.4" XGA 1024 x 768 pixel TFT; Sunlight Readable option available
- Digitizer:** Dual panel input: Wacom active plus passive resistive touch screen
- Keyboard:** Optional external USB
- Storage:** 5400RPM Ultra ATA 40 or 60 GB shockmounted hard disk
- Size:** 11.8" x 8.85" x 1.43"
- Ruggedness:** IP54 sealing, -4 to 140 F operating temperature, 3-foot drop, MIL-STD tested (vibration, safety, humidity, thermal shock, water/dust, mechanical shock, altitude)
- Weight:** 4.6 pounds incl. battery
- Power:** 40 WHr Lithium-Ion; hot-swappable battery option
- Communication:** 802.11a/b/g Mini-PCI, Bluetooth V2.0/EDR; optional: GSM/GPRS/EVDO/EDGE/CDMA, SIRF III GPS
- Interface:** RJ45 LAN, 2 USB 2.0, video, audio/mic, 9-pin RS-232, optional: fingerprint scanner, 1.3MP CMOS camera,
- Price:** Inquire
- Contact:**

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the hotkeys. You'll appreciate that if you encounter repetitive tasks in the field. "Power" gives a quick overview of the current battery situation and also provides one click access to the Windows Power Options Properties Panel.

Things like the ACM utility may be just small extras, but they can make a big difference in how easy it is to configure and operate a computer. Quite obviously, Advantech thought this through.

Operating System

Interestingly, our review unit came with Windows XP Professional and not the Tablet PC Edition. There are some pen-specific functions and utilities. The Pen Tablet Properties control panel lets you configure the pen. You can determine how to issue a right click, and how soft or firm the electronic eraser at the top of the pen should feel. However, as a longtime pen computing enthusiast I missed the significant additional functionality of the Tablet PC Edition. Once you get used to electronic ink in Microsoft Journal and numerous utilities and applications, it becomes part of the tablet experience. Likewise, while not everyone uses handwriting recognition, I miss it on a tablet when it is not there. There is a perfectly functional on-screen keyboard, but I prefer the more powerful one that comes with the Tablet PC Edition. So my vote would be to install the Windows XP Tablet PC Edition.

Camera and Fingerprint Scanner

Our early production model did not have them, but Advantech offers two interesting options.

A fingerprint scanner module located below the function keys on the right side of the unit (see picture to the right) provides additional access security in conjunction with several levels of password protection.

The MARS-3100R can also be ordered with an integrated 1.3 megapixel CMOS camera. The camera lens is mounted on the backside of the unit, right below the pen garage. Pointing the lens away from the user means Advantech meant to give the unit camera functionality as opposed to videoconferencing capabilities.



Ruggedness

The Advantech MARS-3100R is a fully rugged machine that's tough enough to hold up to rough handling and demanding environmental conditions. The aluminum-alloy housing with its protective top and bottom and rubber bumpers on all four corners make the unit nearly impervious to coincidental damage.

As for environmental specs, Advantech claims a very wide operating temperature range of -4 to 122 degrees Fahrenheit. It can also survive a three foot drop to concrete and was tested according to the IEC 68-2-32 and MIL-STD-810F, Method 516.5 procedures. Water and dust protection is said to be IP65 equivalent, where the 6 stands for total protection against dust, and the 5 for protection against low pressure water jets from all directions. Advantech claims testing in accordance with MIL-STD-810F, Method 56.4, Procedures 1 and 3.

Operating and storage humidity, thermal shock, vibration, mechanical shock, crash shock, solar radiation, low pressure, and salt fog resistance were all tested according to methods mandated in MIL-STD-810F.

Advantech further lists a variety of standards that the unit meets. Among them are UL 1604 which is a certification document and covers equipment, circuits, or components intended for use in hazardous locations. This basically deals with a unit's safeguarding against causing ignition of specified flammable gas- or vapor-air mixtures. It'd add little to this review to delve into the details of all those standards. If an intended application has specific environmental requirements, I'd just ask Advantech.

Docking, Vehicle Operation and Cradles

Industrial tablet computers like the MARS-3100R are primarily designed to be carried around and used in the field. However, thanks to their small size and lack of a bulky keyboard, many will be used in vehicles. And since they are also full-function computers they will see duty in offices and even homes. This means they'll require a variety of mounting and docking solutions. In a vehicle, the emphasis is on secure, vibration-free mounting, perhaps with a quick-release. In an office environment the machine must be docked so that it comfortably works with a full-size keyboard and a mouse.

The image to the right shows the MARS-3100R secured in a dock. All side-mounted ports remain easily accessible. The dock also adds additional interface connectivity via the docking connector. Ports on the dock face back-



wards to keep cable clutter at a minimum.

Mounting arms use National Products' patented RAM-MOUNT solutions. The unique rubber ball and connector arm system makes for unparalleled flexibility and near total absence of vibration. To change the viewing angle, you loosen the large, grippy control knob, get the unit into the proper position, and tighten it. Mounting plates are all industry standard.

Bottom Line

In summary, the Advantech MARS-3100R is a rugged industrial tablet computer from an experienced Taiwanese embedded and industrial systems company with a worldwide presence. It's small and handy and weighs just five pounds. A 1.2GHz Intel Core Duo U2500 processor provides a good balance between performance and battery life. Despite its good performance, the unit does not require a fan and runs silently. The aluminum-alloy body is very solid and there is extra protection in the form of high-impact plastic and rubber inserts and bumpers. The device is sealed to IP56 specifications and can take a beating.

Among the defining features of the unit is its 10.4-inch display in a class of computers where 8.4-inch screens predominate. Combined with full 1024 x 768 pixel XGA resolution, the MARS-3100R excels in applications that require as much screen real estate as possible. Advantech offers both a standard transmissive display as well as a sunlight-readable display option.

Equally welcome is the dual digitizer setup. A Wacom electromagnetic digitizer is complemented by a resistive touch screen. This way you can use the pen (which does not need batteries) for applications that require precision and cursor tracking, and use the touch screen for programs optimized for finger tapping. Both digitizers are on at the same time.

In terms of connectivity, the MARS-3100R does well for a unit with such a high degree of dust and water protection. You get two USB ports, LAN, serial, video, audio in/out, and a docking connector. A CF slot is optional as are a fingerprint reader, a camera, and a SIM slot for GSM/GPRS/EDGE communication.

Our review unit came with Windows XP, but we'd recommend the Tablet PC Edition in order to take full advantage of the electromagnetic digitizer. We'd also like to see more than 1GB of RAM, larger hard disk options, and rubber plugs attached to the unit so they can't get lost.

While facing formidable competition in the industrial tablet market, the MARS-3100R with its clean design, ruggedness, large screen, and dual digitizer is well equipped to tackle difficult jobs in manufacturing, warehousing, any type of field service, government and law enforcement applications, and more.

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