
Windows CE
JORNADA
COMPAQ
Aero
epoc
Word
Sheet
Data
Agenda
Sketch
System

One in the hand

From techno toy to the joy of mobile computing, the PDA is now a business portable *par excellence*. We put 14 through their paces, and check out developments in software and functionality.

Twelve months ago, a PDA was an expensive toy. Few had connectivity for email or web access, and no systems manager wanted to deal with yet another device on the network. What a difference a year makes; these devices are now essential business tools out on the road.

When buying mobile computing power, the question everyone asks is whether they want a notebook or a PDA. But why put up with a notebook's pitiful battery life when you can have a PDA with almost all the functions you require of a notebook when out of the office, including note-taking and email? And, of course, the battery life of a PDA is many times that of a notebook.

Perhaps the most important development in the last year has been the updating of Windows CE: its familiar interface makes it an attractive proposition for new users. First aimed solely at handhelds, Windows CE was ported to palmtop devices some time ago and is now gaining ground in the PC arena where users welcome the familiar start button and Control Panel. However, Psion and 3Com are still strong and the latter has just produced new models to keep the Windows CE producers on their toes. We've looked at all the options to find the perfect Personal Digital Assistant.

Contents

• *Tested and reviewed by Ian Robson*

Ratings

★★★★★ **Highly recommended**
★★★★ **Great buy**
★★★ **Good buy**
★★ **Shop around**
★ **Not recommended**

Choosing the right PDA

Getting organised is essential for anyone. Meetings, calls and things to do have to be scheduled, and telephone numbers and addresses stored for easy access. Many users want to take their desktop applications, notably a word processor, spreadsheet and email package, on the road with them without the weight and low battery life of a notebook. Paper no longer meets many users' requirements, with the PC being the place to store data, so for any PDA synchronisation with a PC is essential.

When looking for a PDA, the first decision you need to make is, which kind do you need? There are two main types: those with keyboards, and pen-based models with touch-sensitive screens. Although we're seeing more PDAs with good keyboards (that is, with keys large enough to touch-type and with enough travel to feel comfortable), most are still pen-based. And handwriting recognition has come a long way, with developers converging on common scripts to be adopted on more devices [*see page 186*].

Operating systems for these compact devices have to work within inherent limitations — namely, low memory and low power. Psion was the first to crack the problem with Epoc, compact enough to fit on a small ROM chip and scaleable to suit the device.

◂COMPAQ AERO 2100★★★★

Microsoft's initial attempts at scaling down Windows proved fruitless, so new code was built from scratch to produce Windows CE. We cover these operating systems (OS) in more detail in this feature, and in our group test [*this issue, page 154*]. Application support for these devices varies enormously, and we have covered this when discussing each device.

◂HEWLETT-PACKARD JORNADA 820 ★★★★★

The PalmPilot, now produced by 3Com, was the first palmtop and 3Com has licensed its OS to IBM, which uses it in its WorkPad. 3Com is also rumoured to be about to license the OS to other hardware manufacturers. Since Microsoft released Palm CE, a cut-down version of Windows CE, several manufacturers have produced machines around this OS. Most offer the same functionality: along with your personal agenda will be at least a basic calculator and a contact manager, and with a modem, the option to receive and send email is becoming increasingly popular. The Palms from 3Com also come with an impressive array of software written specifically for this platform.

The key to the palmtop's success has perhaps been recognising its own limitations. Without a keyboard it cannot act as a mini notebook; as a result, it is less demanding on its modest processors, which in turn gives long battery life — in some models as much as three months. Compared to the average of three hours on a notebook, this is very impressive.

Handheld PCs — that is, the Psions and the Windows CE machines — are a curious breed that attempt to bridge the gap between palmtops and sub-notebooks. Smaller and lighter than a notebook, they offer much longer battery life, with most lasting a whole day — long enough to do some serious work and then top it up overnight at a mains socket. They also have the convenience of a keyboard, although some keyboards are so small, they make note-taking difficult. However, the handhelds don't support all the applications you can run on your desktop, although they do come with pocket versions of desktop applications such as spreadsheets, databases, word processors, presentation packages and web browsing.

Some companies now combine voice and data telephone services in a single device, using cellular or other wireless technologies to communicate with the handheld. Given this functionality, these devices are priced accordingly, sometimes costing almost twice that of palmtops.

Because of their small size, battery constraints and a need for robustness, most PDAs don't include hard disk drives but instead store the operating system and basic applications in RAM, or ROM in the case of the Psions, which can be as little as 2Mb. In some instances this can be expanded with additional RAM cards, or CompactFlash cards which can increase memory capacities to as much as 48Mb, with 128Mb cards imminent.

IBM has provided micro-drive solutions utilising the CompactFlash slots, with initial capacities as much as 340Mb. Some handheld PCs also have PC Card slots for external drive use, modems, data cards for mobile phones, or more memory.

Windows CE devices

As most PC owners use Windows 9x, it's no surprise that Windows CE, with a similar look-and-feel to 9x, has quickly gained a firm foothold in the handheld market. After failing to strip-down the full version of Windows, Microsoft had to build a new operating system from scratch that would fit in the limited space available.

Microsoft also had to produce pocket editions of its suite of office applications, for the same reason. The new Word and Excel have just enough functionality for the requisite note-taking or number crunching.

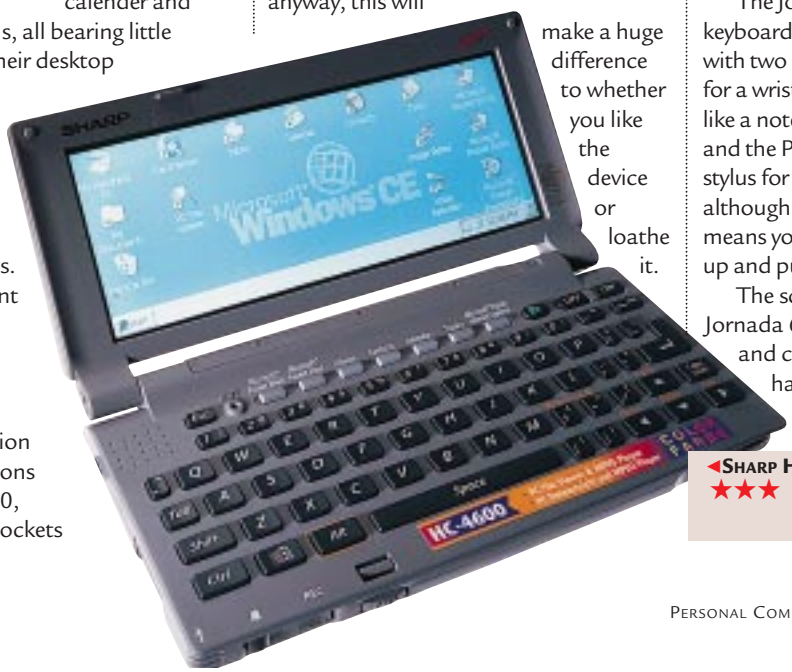
▲LG Phenom Express ★★★★

Pocket Outlook has been split into separate contact manager, calender and email applications, all bearing little resemblance to their desktop equivalents. Customisation functions have been removed however, leaving you with fixed fields and formats. Pocket PowerPoint Player shows presentations created on a PC. As Windows CE Professional Edition supports resolutions of up to 800 x 600, PDAs with VGA sockets can be plugged straight into a projector for presentations made to a group. Finally, Internet Explorer has just about all you could ask for in a handheld web browser. Microsoft still had room to throw in a calculator, world clock, Solitaire, and the ever-useful digital recording facility.

The new breed of colour-screen, keyboard-driven PDAs are not far off notebooks in their functionality, only much smaller, lighter, and with longer battery life, making them attractive alternatives for users on the move. But compared to Palms, increased functionality leads to increased power consumption, weight, cost and computing power. For example, where we're seeing complete handheld functionality in the Palm III's 16MHz processor and 2Mb RAM, Windows CE PCs seemingly require 75MHz processors and at least twice the memory.

Handheld Windows CE devices

A keyboard may be a huge advantage when inputting data, but in terms of quality and size, they vary greatly. As keyboards are highly subjective items anyway, this will make a huge difference to whether you like the device or loathe it.



◀Sharp HC-4600 ★★★

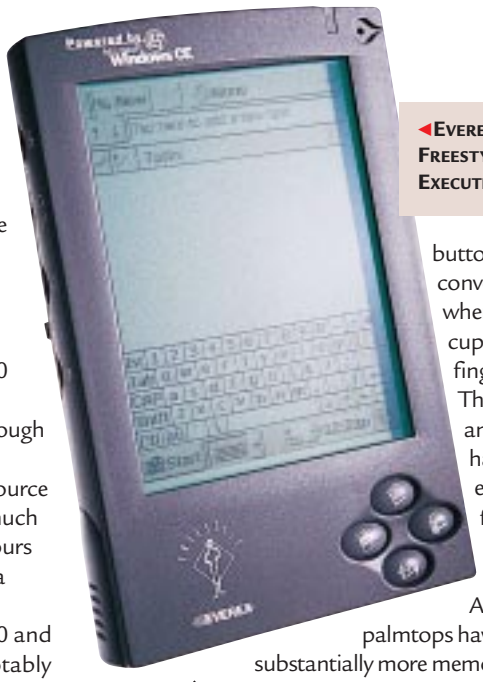
▲Hewlett-Packard Jornada 680 ★★★★

To test manufacturers' claims, we measured the size as a percentage of an average desktop keyboard through a diagonal from the centre of the Q key to the centre of the question mark key [*see features table, page 189*]. The Sharp HC-4600 fared poorly in both size and quality of keys, and we wouldn't consider this machine for lengthy note-taking.

Both the LG Phenom Express and HP's Jornada 820 have near full-size keyboards adequate for touch-typists; the smaller Phenom has firm, flip-down supports at the bottom and rear to raise it for tilting to a comfortable typing angle. The Jornada 680's slightly smaller keyboard, however, is still only suited to thumb typing. In fact, in many ways it's similar to the Psion 5 in much of its design, although it improves upon some of the latter's more dated features, most obviously introducing a colour screen.

The Jornada 820's slightly larger keyboard is complemented by a glidepad with two mouse buttons. There's room for a wrist rest either side and it's the most like a notebook to use. The Jornada 680 and the Phenom Express both include a stylus for their touch-sensitive screens, although the Jornada 820's glidepad means you don't have to constantly pick up and put down a pen as you work.

The screens of the Sharp HC-4600, Jornada 680 and LG Phenom are bright and clear, although the Jornada 820 has a larger screen with a resolution of 640 x 480, compared to 640 x 240 in the others, and was sharper and clearer.



◄Everex Freestyle Executive ★★★

Battery life for typical usage is pitiful compared with that of the Psions, although the battery does support increased functionality, colour and hardware features. However, the Jornada 820's typical 10 hours battery life, while low, should see you through the day until you find yourself near a power source for recharging, and is much better than the three hours you could expect from a notebook.

The Sharp HC-4600 and the Jornada 680 are notably smaller devices but suffer from having no parallel or VGA ports. Additional ports increase the functionality of the 820 and the Phenom for very little extra cost, a situation made even less excusable when you consider that the Sharp is the only one without a built-in modem.

Palmtop Windows CE devices

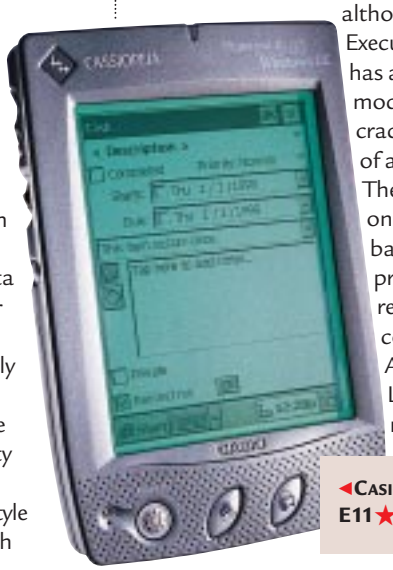
In comparision to the handheld devices, the Windows CE palmtops suffer from small screen sizes, no keyboard, and fewer platform-specific applications. Although most still have monochrome 240 x 320 resolution screens, there are colour variations that are easier and more pleasant to work with but do nothing for your battery life.

Those who sorely miss their keyboard could tap away at the on-screen virtual keyboard, but many might try the new breed of handwriting recognition utilities. The Cassiopeia E11, Compaq Aero 2100 and the Everex Freestyles (Manager and Executive) all bundle Jot, which lets you write simplified characters in a specific area of the screen. This is an accurate method of input and one which will, after a relatively quick learning cycle, let you input data as fast as if you were one-finger typing. The Philips Nino uses smARTwriter, which ambitiously attempts true handwriting recognition, but its success rate depends entirely on the legibility of your own script.

Both the Nino and the Freestyle complement the stylus input with buttons placed conveniently where your cupped hand's fingers fall. The Cassiopeia and the Aero have an extremely functional scrolling wheel. All four palmtops have substantially more memory than 3Com's Palms, with the Freestyle Executive doubling the standard with a stonking 16Mb. All can increase this with CompactFlash card expansion, in addition to the Aero's internal module expansion, so you won't be left feeling strapped for space after installing one of the many extra software titles available.

None of these models have screens to rival those of the 3Com Palms. The best of the bunch is the Freestyle, although that still lacks clarity. The colour screen on the Aero very quickly looses its initial appeal, suffering from poorly contrasted colours that even the highest of the three illumination settings couldn't remedy.

On battery life, the Cassiopeia wins. It has almost twice the juice of the others, although the Nino and the Aero do have the advantage of being recharged whenever the unit is docked. A recharging cradle is bundled with the Manager version of the Everex Freestyle, although the Executive version has a built-in modem in its cradle instead of a recharger. The Aero has one of the lowest battery lives, probably as a result of its colour display. As it uses a Lithium-Ion rechargeable battery pack, simply replacing the AA batteries, as with the others, isn't an option.



◄Casio Cassiopeia E11 ★★★★

All four devices reviewed have simple one-touch recording facilities although, with the exception of the Aero, playback without headphones was almost inaudible.

The integration between Microsoft's desktop operating systems and Windows CE is seemless, requiring just the installation of the Windows CE desktop interface application on your PC. Most palmtops use a docking cradle for synchronisation, which is generally plugged into your PC's serial port. You can also use this cradle to install new applications on your PDA. The Phenom Express and the HP Jornada 820, being a little beefier, have their own docking hardware built in, so only a cable is required for complete synchronisation.

►Philips Nino 300 ★★★

Microsoft's Windows CE may have its limitations and disadvantages, but on this occasion the manufacturers have overcome these to come up with some innovative touches. The company has approached the PDA market with a wider view of things to come, and as such has possibly placed limitations on future development. However, Microsoft has left the door open for the next generation of information technology, with Windows CE possibly able to control a wide variety of networked consumer electronic devices.

The Psion range

Psion launched the first handheld computer in 1984. With 15 years' experience behind it, the company has produced the most successful keyboard-based PDAs so far.

From the outset, Psion always felt a keyboard was necessary, although the earliest versions had little more than rubberised calculator buttons. However, the company hasn't shied away from touch-screen functionality and the Series 5 provides the best of both worlds.

Psion's acclaimed Epoc operating system was designed specifically to provide a high level of processing power while preserving battery life. It has been adopted by three leading phone makers — Ericsson, Nokia and Motorola — for the Symbian project, embracing the technologies of both wireless application protocols and Bluetooth, a developing radio technology for enabling communication between mobile phones and PCs and eventually between all consumer electronics.

The Psion Series 3mx is the latest member of the Series 3 family. Externally enhanced, it features an IrDA port, a slightly larger screen and a nicer finish. It's beefier than its predecessors, with its 16-bit NEC V30MX chip running at a feisty 27.6MHz. The increased speed takes applications to a new level with almost instant recalculations and searches, although the memory quota is stuck at a lowly 2Mb. You can, of course, always upgrade the memory using the two proprietary slots.

In common with the older Series 3 models, and to its detriment, the 3mx has no stylus or touch-sensitive screen. You have to input via the keyboard, which, due to the unit's small size, means thumb typing. A row of icons placed neatly over the clamshell join provide shortcuts to your applications, and there are plenty of applications available: at its launch, the 3mx had over 3,000 extra titles. An optional PC connectivity pack costing £49.95 consists of a serial cable and the desktop synchronisation software, PsiWin.

The Psion Series 5 is a very different machine. It took PDAs to a whole new level when it introduced the first keyboard on which you could quite happily touch-type. It has far more functionality than the 3mx and it will take you longer to learn how to use it, although usability is still a key to its overall success. The bundled applications include a fully featured word processor, a customisable database, a limited spreadsheet and a sketchpad. The applications are subtly different from Windows CE's pocket office suite but you'll be surprised at how well written the Psion's applications are. They also run very fast even on the paltry 18MHz processor, thanks to the tightly coded Epoc platform.

▲ **Psion Series 3mx** ★★★

Innovative design features such as the spring-loaded stylus storage and the forward-sliding keyboard, which gives a sturdier base when typing, do add to your overall appreciation. There's even a digital voice recorder with external controls for access when the unit is closed.

Connectivity and PC synchronisation, previously a cause for complaint, is tackled by the same desktop utility in both models, PsiWin. This is now in version 2.2 and improvements include the ability to back up your data via applications such as Lotus Organiser, Microsoft Outlook and, most recently, Lotus Notes, using InSync Pro. The physical connection to the PC is via the serial port. A Psion icon appears on your Windows desktop and can be opened and explored by dragging and dropping to and from the PC, which automatically invokes the requisite file conversions.

Display quality is one area where we have seen much improvement in many of the monochrome models, but both Psions are in need of an overhaul in this area. Reading the screen can be a strain in dimly lit conditions, and the backlight reduces the viewing angle to almost face-on for recognising detailed characters.

◀ **Psion Series 5** ★★★★

3Com Palms

Handheld computing received a welcome boost when Palm Computing introduced its Pilot 1000 and Pilot 5000 organisers in 1996. Following two changes in ownership — Palm was bought first by US Robotics in 1995 and then subsumed into 3Com in June 1997 on that company's merger with US Robotics — the Palm products have become formidable players in the handheld computing arena. The range has a staggering 65 percent of the market.

The proprietary PalmOS is currently only licensed to IBM, which uses it in its WorkPads, although 3Com may license the OS to other manufacturers in light of the threat posed by Windows CE, notably in its Palm incarnation. 3Com boasts a large number of developers creating and adapting software for the PalmOS platform, while 3Com's acquisition of Smartcode Technologies in February should result in more support for the OS.

In conjunction with TDK, 3Com has released GlobalPulse 1.0, a cellular-phone interface that enables Palm organisers to use supported GSM telephones as wireless modems for direct internet access and remote synchronisation with the user's desktop software.

Although the new Palm V's anodised aluminium is certainly sleek by design, with recessed buttons and a removable embossed leather front cover, the real eye-opening features are within. Running on a single Lithium-Ion battery, recharging commences as soon as the device is slipped into the bundled data synchronisation cradle. The Palm IIIx runs on two AAA batteries. Both the Palm V and the Palm IIIx have improved upon their displays, with better contrast and clarity.

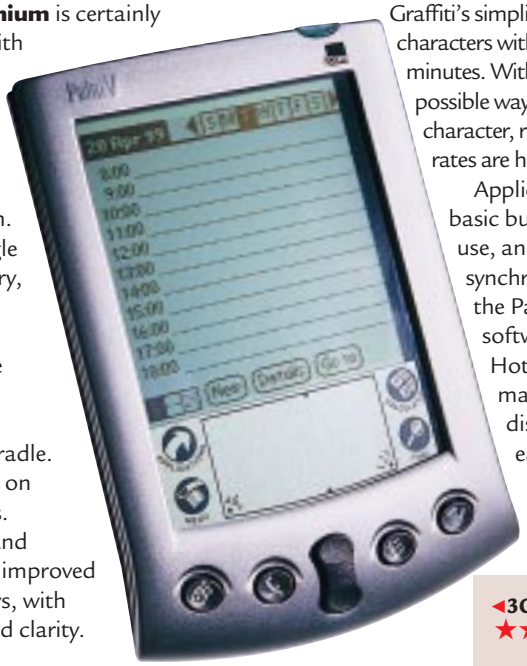
The Palm V sticks with the same amount of memory as the Palm III — just 2Mb. The Palm IIIx doubles this quota to 4Mb, effectively offering storage of up to 12,000 addresses with an internal expansion slot for the addition of peripherals, such as more memory or a pager when one becomes available. With the right application, the Palm IIIx can be used as a formidable information device, able to store large amounts of data and with software support from Oracle, Remedy and SAP R/3.

On a smaller scale, both products have built-in email compatibility for Microsoft Exchange, Outlook and Outlook Express, Lotus cc:Mail and Qualcomm Eudora Pro. Third-party software provides even more connectivity to POP3 internet mail clients and Lotus Notes.

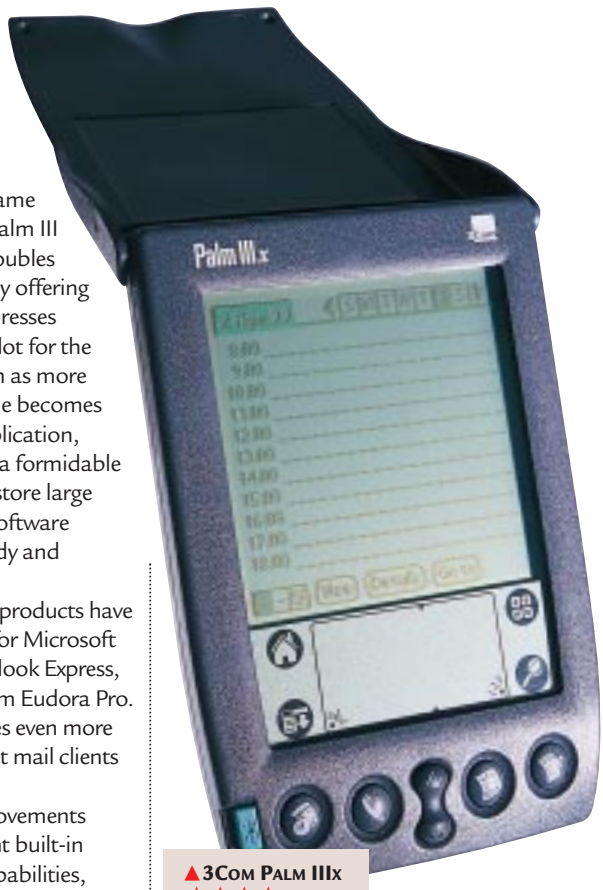
For business users, improvements to the Palm OS have brought built-in network synchronisation capabilities, so logging on to the server should no longer be a problem.

Popular features in the Palm III have been included in both the IIIx and the V: sharing information between Palms using infra-red, and flash memory for easy upgrading of the OS. There's no keyboard, so you'll have to make do with the stylus and 3Com's proprietary handwriting recognition system, Graffiti. You can pick up the basics of Graffiti's simplified characters within about 20 minutes. With only one possible way to draw each character, recognition rates are high.

Applications are basic but easy to use, and instant synchronisation via the Palm Desktop software and HotSync cradle make these disadvantages easier to bear.



◀3Com Palm V
★★★★★



▲3Com Palm IIIx
★★★★

The Windows CE keyboard-based handhelds offer a familiar interface and applications, but all the palmtop varieties, both Windows CE and PalmOS based, are less intuitive to use. The operating system is the most important feature of any mobile device and the PalmOS won't limit you in terms of functionality or applications.

3Com's tight, power-conscious coding has resulted in battery lives of around two months for the Palm IIIx and typically one month for the Palm V, if you forget to charge it in the docking cradle. With demanding processors and substantial memory in the Windows CE devices, you will typically only get 25 hours' usage before you have to top up.

3Com's Palm VII organiser, codenamed Razor, which was not available at the time of going to press, will feature a colour screen in a unit only a third of an inch thick. It will be able to download cut-down versions of web pages onto the handheld's screen using web clipping and wireless internet access.

As a result of this new technology, 3Com is certain that people will expect e-commerce facilities, so is currently developing Palms with credit-card slots.

Mobile communication

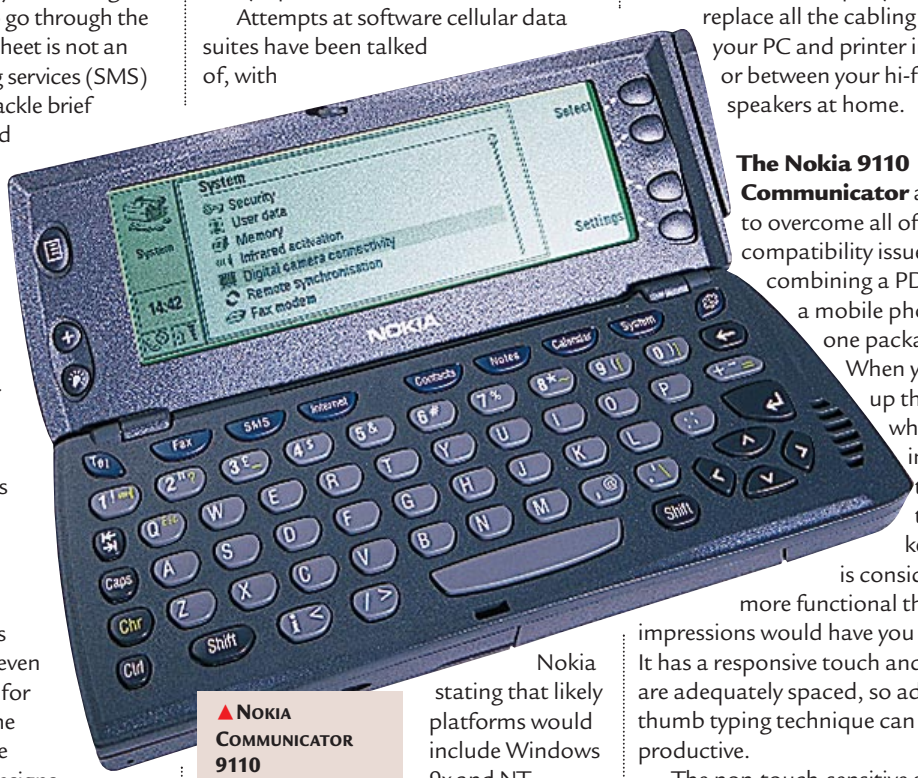
The busy executive needs facts and figures at their fingertips, no matter where they are: calling someone at the office to go through the finer details of a spreadsheet is not an option. Short messaging services (SMS) on mobile phones can tackle brief messages, but if you need more information passed down to you when you're away from a phone socket, you'll need a mobile phone connected to a PDA via a cable. It sounds so simple, but there's a vast amount of incompatibility that's the bain of both the PC and telecommunications industries.

Each mobile-phone manufacturer has made cable connections proprietary, with some even having a different cable for each of their phones. The reasons for this could be differing voltages and designs to suit particular models, but it's also evidently a nice little money-spinner providing exclusive accessories for each model of phone. Some manufacturers keep the pin specifications as closely guarded secrets, giving rise to some hit-and-miss engineering attempts at third-party cable manufacturing.

At the other end, connecting your phone cable to your PDA isn't any more straightforward. Type II PCMCIA Data Card solutions may seem the most appropriate, but you'll have to check which GSM-ready cards have compatible connections.

The electronics built into these cards is little more than a bridge for transferring digital data, nothing like that required by modems which have to convert digital to analogue and vice versa. There have been some attempts at putting the required electronics directly into the mobile phone, but this still leaves the problem of proprietary cables and makes the phone more expensive to build. Even smart cables have been produced which either contain all the required electronics, or support electronics built into the phone, the PDA or both. However, once again, these are proprietary solutions and are costly options.

Attempts at software cellular data suites have been talked of, with Nokia stating that likely platforms would include Windows 9x and NT but, strangely, not CE. Even Psion proposed this as a connectivity solution, but as yet nothing has materialised. These do imply cost reductions, but as with PDAs offering built-in modems, the issue of physical connection has still to be addressed.



▲ **Nokia Communicator 9110**
★★★

The idea of IrDA posed exciting possibilities, but issues of line-of-sight and reliable, fast transfers stumped any development in this area. This is where the possibilities of Bluetooth technology really can be implemented effectively. Bluetooth is a wireless technology jointly developed by Intel, IBM, Ericsson, Toshiba and Nokia, with Psion hopping on board later. It's envisaged as a means of replacing all the connecting cables between mobile phones, PCs and peripherals, although the idea has been extended to include possibly all electronic consumables likely to sit within the 10m range. As it's based on shortwave radio, it's ideally suited to both office and home use, allowing easy networking of all your electronic devices. So, for example, you could replace all the cabling between your PC and printer in the office, or between your hi-fi and speakers at home.

The issue of physical connection has still to be addressed

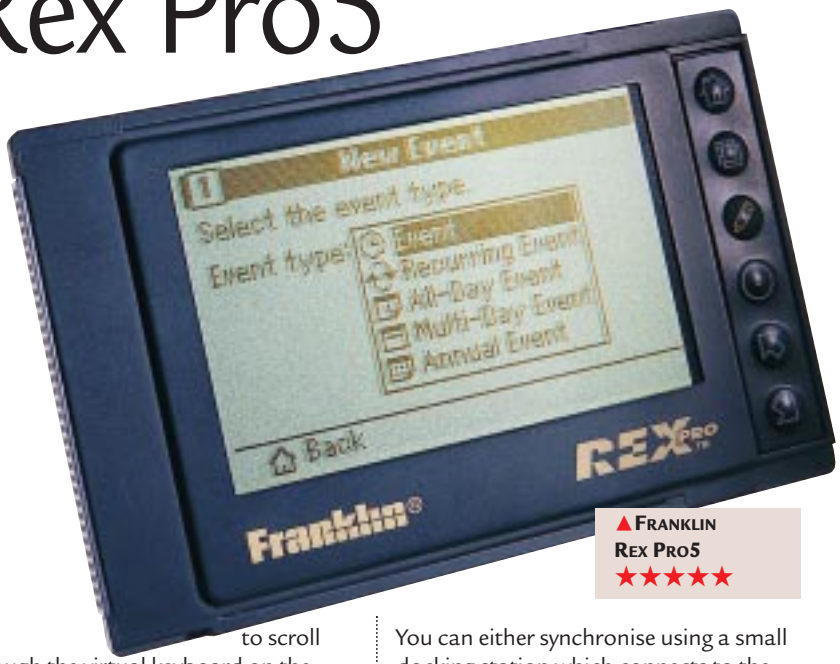
The Nokia 9110 Communicator attempts to overcome all of the compatibility issues by combining a PDA and a mobile phone in one package. When you flip up the lid, which incorporates the phone, the keyboard is considerably more functional than first impressions would have you believe. It has a responsive touch and the keys are adequately spaced, so adopting a thumb typing technique can be productive.

The non-touch-sensitive screen is reasonably clear and for dimly lit conditions there is now a backlight; an improvement over the previous model, although not bright enough to help you negotiate those awkward keys.

There's a contact manager, email, notepad, internet browser and fax, and third-party applications offer some interesting features such as simple spreadsheets that contain short message system (SMS) links for live updating of the contained information. PC synchronisation is through a proprietary cable connection to the PC's serial port, and you can synchronise data with Outlook Express and Organiser 97.

As a self-contained package for limited PDA functionality and mobile connectivity, the Communicator 9110 is an indicator of what's around the corner. But it will very quickly be surpassed by the next generation of web-enabled handhelds which will seamlessly combine the full functions of PDAs and phones.

Franklin Rex Pro5



▲ FRANKLIN REX PRO5 ★★★★★

If you don't want to settle for either a palmtop or a handheld, there's another solution. If all you're looking for is a Personal Information Manager (PIM) with the capacity for holding up to 6,000 items including names, addresses, phone numbers, appointments, notes, memos and to-do items, but in the smallest possible form factor, then you can't go far wrong with the credit-card sized, or rather Type II PC Card sized, Rex Pro5.

The Rex Pro5 improves upon its predecessor, the Rex, with enhanced capacity and the ability to input data while the unit is out of its cradle. When you first power-up the Rex you'll be faced with six relatively large icons, each clearly representing one of the information areas. The two navigation buttons take you to the data in the various areas. You have little control over how the information is organised, so navigation is easy.

Data is usually downloaded from the PC. There's a limited input function on the card, but you're best advised to consider this as a last resort. You'll have to scroll through the virtual keyboard on the screen using the navigation buttons, find the character you're looking for, and enter it — a time-consuming activity. Franklin has also included a mini paper notepad in the leather wallet for keeping important entries until you can enter the data into your PC and then synchronise.

... you'll be left marvelling at the genius that is the Rex Pro5

Starfish TrueSync is used for synchronisation with the PC. You can either synchronise using a small docking station which connects to the serial port of your PC, or you can plug it straight into a Type II slot in a notebook. Either way, synchronisation is extremely smooth. On both the PC and the card you'll see the synchronisation progress bar, and the card will beep to tell you that all the data has passed over successfully. Alternatively, it will warn you of any items it has had to forshorten.

And with a half-year battery life, you'll be left marvelling at the genius that is the Rex Pro5.

Handwriting recognition

Truly effective handwriting recognition would make handhelds as powerful as desktops for routine office tasks. But how can we expect machines to read our scrawl when we often cannot read it ourselves, especially when it's written in a hurry? The problem recalls the old joke about the man who, when asked the way to town, replied: 'Well, if I were going there, I wouldn't start from here.'

Our handwriting evolved to suit human cognition, which can usually cope with its ambiguities. Even so, a '5' and an 'S', an 'l' and an 'I', an 'O' and a '0', are barely distinguishable out of context. Yet with the aid of the simplest software, it would be easy to design a script that provides the absolute precision of a keyboard. The script would need fewer symbols than the alphabet because the meaning of each can change with how you write it: an upstroke and a downstroke look much the same to us, but to a computer they are chalk and cheese. The horizontal, vertical, and diagonal (forward and back) strokes alone can represent eight letters; qualifiers, such as an underlying dot to mark a capital, extend the possibilities.

Designing a usable script involves more than simply assigning meaning to gesture, however. A far harder and subtler task is that of ensuring that the script flows easily from the hand.

The new script would take a lot of learning, but so does a keyboard, and the effort would certainly be worthwhile: we spend years perfecting our handwriting, and communicating with machines is becoming just as important.

Machine recognition of traditional handwriting will always be fallible. We need an unambiguous script, and my hunch is that sooner or later we'll adopt one. It may come as an industry initiative; more likely, it will be bundled with devices as a curiosity and spread until its use is expected of the literate.

Like ASCII, or Morse code, it will complement rather than replace handwriting. And it won't stop with the alphabet: I'd make a bet now that our children will communicate with machines through a mix of speech and shorthand.

CLIVE AKASS

Table of features

Manufacturer	3Com	3Com	Compaq	Casio	Everex
Model	**Palm IIIx**	**Palm V**	**Aero 2100**	**Cassiopeia E11**	**Freestyle Executive**
Price inc VAT (ex VAT)	£279.99 (£238)	£349.99 (£298)	£350.15 (£298)	£299 (£255.31)	£298.45 (£254)
Telephone	0800 731 1064	0800 731 1064	0845 270 4000	0181 450 9131	01252 331441
Web Address	www.palm.com	www.palm.com	www.compaq.co.uk	www.casio.com	www.freestyle.everex.com
Form Factor	Palmtop PC	Palmtop PC	Palmtop PC	Palmtop PC	Palmtop PC
Size (w x d x h) / Weight	80x120x15mm / 150g	78x115x11mm / 100g	85x134x20mm / 260g	83x124x19mm / 184.3g	81x18x122mm / 150g
Operating System	Palm OS 3.1	Palm OS 3.1	Windows CE 2.2 (PalmCE)	Windows CE 2.1 (PalmCE)	Windows CE 2.1 (PalmCE)
RAM	4Mb	2Mb	8Mb	8Mb	16Mb
Display Size / Resolution	57x77mm / 160x160	57x78mm / 160x160	61x82mm / 240x320	60x80mm / 240x320	60x80mm / 240x320
Colour/Monochrome	Monochrome	Monochrome	256 colours	Monochrome	Monochrome
Memory Expansion	Internal memory module	None	Int mem mod, CompactFlash	CompactFlash	CompactFlash
Modem/IrDA/Micr/Par/Ser/VGA	x/✓/x/x/x/x	x/✓/x/x/x/x	x/✓/✓/x/x/x	x/✓/✓/x/x/x	On cradle/✓/✓/x/x/x
Claimed Battery Life	2 months	1 month	6-8 hours	25 hours	8 hours
Input Method	Touch-screen	Touch-screen	Touch-screen	Touch-screen	Touch-screen
Added Extras	Docking cradle	Dock cradle, rech battery	Docking cradle	Docking cradle	Docking cradle
Software Applications	Ag, CM, EM, N, Ex, Cal, G	Ag, CM, EM, N, Ex, Cal, G	Ag, CM, EM, HR, DR	Ag, CM, EM, HR, DR	Ag, CM, EM, HR, DR, G, F, DIV

Table of features

Manufacturer	Franklin	HP	HP	LG	Nokia
Model	**Rex Pro 5**	**Jornada 680**	**Jornada 820**	**Phenom Express**	**Communicator 9110**
Price inc VAT (ex VAT)	£169.99 (£144.67)	£599 (£509.79)	£799 (£680)	£600 (£510.64)	£349.99 (£297.86) w connect
Telephone	0800 328 5618	0990 474747	0990 474747	01753 500 400	0990 003110
Web Address	www.franklin.com	www.hp.com	www.hp.com	www.lgphenom.com	www.nokia.com
Form Factor	Credit Card Organiser	Handheld PC	Handheld PC	Handheld PC	Mobile phone, Handheld PC
Size (w x d x h) / Weight	85x54x4mm / 30g	189x95x32mm / 520g	245x178x32mm / 1150g	136x150x25.4mm / 820g	156x56x27mm / 253g
Operating System	TrueSync	Windows CE 2.2	Windows CE 2.2	Windows CE 2.11	GEOS 3.0
RAM	512Kb	16Mb	16Mb	16Mb	8Mb
Display Size / Resolution	55x34mm / 160x98	150x55mm / 640x240	169x127mm / 640x480	194x75mm / 640x240	112x35mm / 200x640
Colour/Monochrome	Monochrome	256 colours	256 colours	256 colours	Monochrome
Memory Expansion	None	Type II card, CompactFlash	Type II card, CompactFlash	Type II PC Card	Multimedia Card
Modem/IrDA/Micr/Par/Ser/VGA	x/x/x/x/x/x	✓/✓/✓/x/x/x	✓/✓/✓/x/✓/✓	✓/✓/✓/✓/✓/✓	✓/✓/✓/x/x/x
Claimed Battery Life	6 months	7 hrs	10 hrs	11 hrs	6 hrs (170 hrs standby)
Input Method	One key or PC Sync	68% size kebd, touch-screen	94% size keybd, glidepad	88% size keybd, touch-screen	60% size keyboard
Added Extras	Docking station	RJ11 cable / PC serial link	RJ11 cable / PC serial link	RJ11 cable / PC serial link	PC serial link
Software Applications	Ag, CM, N	MS Pocket Office, EM, G, F, Fin	MS Pocket Office, EM, G, F, Fin	MS Pocket Office, EM, G, F, Fin	CM, EM, N, F, ComM, B

Table of features

Manufacturer	Philips	Psion	Psion	Sharp
Model	**Nino 300**	**Series 3mx**	**Series 5**	**HC-4600**
Price inc VAT (ex VAT)	£299.99 (£255.31)	£199.95 (£170.17)	£369.95 (£314.85)	£599 (£509.79)
Telephone	0171 744 0095	0990 143050	0990 143050	0800 262958
Web Address	www.nino.philips.com	www.psion.com	www.psion.com	www.sharp.co.uk
Form Factor	Palmtop PC	Handheld PC	Handheld PC	Handheld PC
Size (w x d x h) / Weight	85x135x20mm / 220g	165x85x22mm / 275g	170x90x23mm / 354g	186x95x29.6mm / 490g
Operating System	Windows CE 2.1 (PalmCE)	SIBO	Epoc	Windows CE 2.11
RAM	8Mb	2Mb	8Mb	16Mb
Display Size / Resolution	60x79mm / 240x320	127x44mm / 480x160	134x50mm / 640x240	155x60mm / 640x240
Colour/Monochrome	Monochrome	Monochrome	Monochrome	256 colours
Memory Expansion	CompactFlash	2x proprietary slots	CompactFlash	Type II PC Card
Modem/IrDA/Micr/Par/Ser/VGA	x/✓/✓/x/x/x	x/✓/✓/x/✓/x	x/✓/✓/x/✓/x	x/✓/✓/x/✓/x
Claimed Battery Life	10 hrs	1 month	35 hrs	6 hrs
Input Method	Touch-screen	59% size keyboard	75% size keybd, touch-screen	73% size keybd, touch screen
Added Extras	Dock cradle, rech batt			Docking cradle
Software Applications	Ag, CM, EM, HR, DR	AG, EM, B, WP, Sp, DB	AG, EM, B, WP, Sp, DB	MS Pocket Office, EM, G, F, M

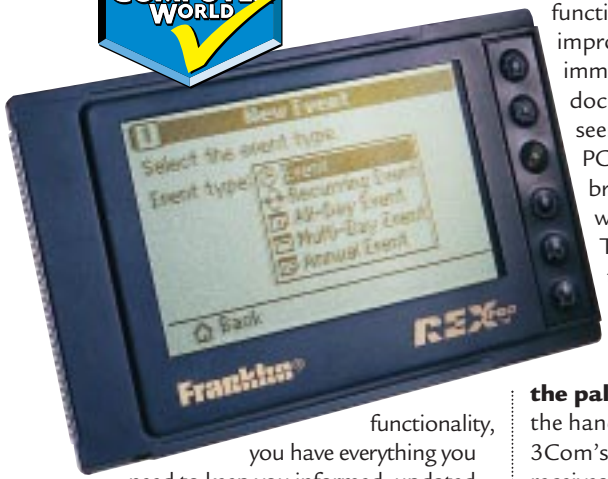
Agenda - Ag, Contact Manager - CM, E-Mail - EM, Notepad - N, Expenses - Ex, Calculator - Cal, Games - G, Handwriting Recognition - HR, Digital Recording - DR. Fax - F, Digital Image Viewer - DIV, Compose Music - ComM, Browser, B, MPEG player - M,

Editor's Choice

As we set out to compare the PDAs, it quickly became apparent that the requirements of the end-user would immediately rule out certain types of devices over others, although it's quite feasible that you'll find all three of the awarded devices in the briefcase of some business people, along with their mobile phone.

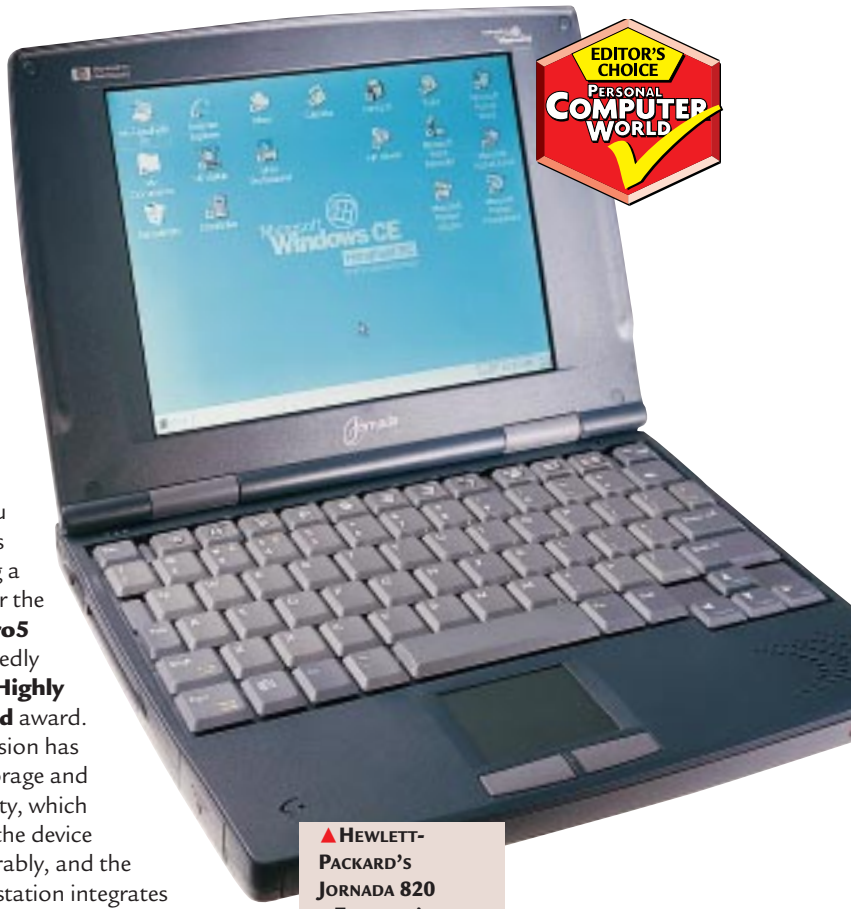
If you want to enter data, then the palmtop varieties would be the first to be discounted in favour of more fully functioned keyboard-based PDAs. However, the palmtops are unobtrusive and fast to access — in other words, perfect for checking a phone number and taking a quick note before making a dash for the next meeting.

The new breed of keyboard-based handhelds are almost sub-sub-notebooks. With their extended battery lives compared to notebooks, but without the weight and bulk, or indeed too much loss in application functionality, you have everything you need to keep you informed, updated and up to speed.



Editor's Choice is the beautifully designed and constructed **Jornada 820** from Hewlett-Packard. The largest of the three handhelds, it's still small and light enough to feel truly portable. It has the devilish cloak of a notebook, with its glidepad and pointer buttons completing the guise, but slips into the flap of a briefcase. The higher screen resolution of 640 x 480 may have contributed to the lower battery life of just 10 hours, which is much lower than that of the Psions but far higher than any notebook.

As an added option for the perfectly formed Jornada you can find some vendors offering Franklin's Rex3 at very tempting prices. However, you may think it's worth paying a little more for the fuller **Rex Pro5** which deservedly receives our **Highly Commended** award. This later version has increased storage and functionality, which improves the device immeasurably, and the docking station integrates seemlessly with your desktop PC to make updating the Rex a breeze. If you use it in conjunction with the Jornada, which has a Type II PC Card slot, you'll be the envy of your clients and colleagues.



▲ HEWLETT-PACKARD'S JORNADA 820
◀ FRANKLIN'S REX PRO5
▼ 3COM'S PALM V

Finally, of the palmtop varieties, the hands-down winner is 3Com's **Palm V**, which also receives our **Highly Commended** award. Although it has limited functionality compared to the keyboard-based handhelds, it's perfect if all you want to do is source data or jot down the odd note or two. Its perfectly formed sheath cloaks a feisty interior that responds to your every command at the blink of an eye.

The Palm V deserves to win awards for its intuitive design and sheer simplicity, extending to its leather cover flap which can be moved from left to right so it doesn't hamper left-handed users.