

Guidance for all

A novel wireless machine guidance system provides all the benefits of a hard-wired set-up, but with considerably less complexity and at a much lower cost. It's also specifically designed for self-installation and is easily transferred between machines. Mick Roberts reports.

The DigPilot machine control system uses wireless technology, which means it's not only simple to install, but this also makes it easy to switch between excavators and even backhoes. As well as spreading the investment across the whole fleet, this clever portable system means contractors need only to take the system to the work, rather than having to pay to transport a suitably equipped machine to the job.

"In the UK the biggest potential market for machine control is excavators," says Gary Escott, a director of importer OnGrade. "And first of all owners and operators need to forget everything they have heard about existing systems. For a start it's not really machine 'control' – in common with other excavator systems DigPilot provides on-screen 'guidance'. It doesn't automate digging, but it does make the work much safer, easier and far more accurate. The system is designed to enhance the operator's own skill and reduce his dependence on people like grade checkers."

In the past this could be achieved only with hard-wired or 'integral' systems. But these have three big disadvantages: firstly, they are very expensive – costing thousands of pounds per machine. Secondly, the wiring is vulnerable to damage and if one wire breaks the system stops working and usually requires an external engineer to fix it. But the third point is that, until now, wired systems by their very nature have to go with the

machine – you cannot easily transfer them. DigPilot is designed to be quickly installed, fitted and, importantly, also removed.

"This also improves security, because at the end of the day it takes just a couple of minutes to unclip the sensors, remove the terminal and put them all in the carrying case. The operator can then take the system away with him and store it safely off site," he explains.

This is also why the DigPilot set-up arrives in its own robust, plastic carry case – about the same size as a large briefcase. It costs from about £5850 and inside owners will find not only everything to run the system, but all the necessary fittings to install it yourself as well – even the right sized drill bits, spirit level and a tape measure are included. Opening the lid of the case you will find it contains the DigPilot PC touchscreen display including wireless co-ordinator, a sensor charger, brackets and sensors and comprehensive manuals.

For a 360-degree excavator the kit includes four position sensors that contain high capacity rechargeable batteries that will last for a minimum of two weeks on a full charge. They use the latest solid-state inclinometers to detect position and angles of the machine base, boom, arm and bucket. One of the sensors is also equipped with a laser detector window.

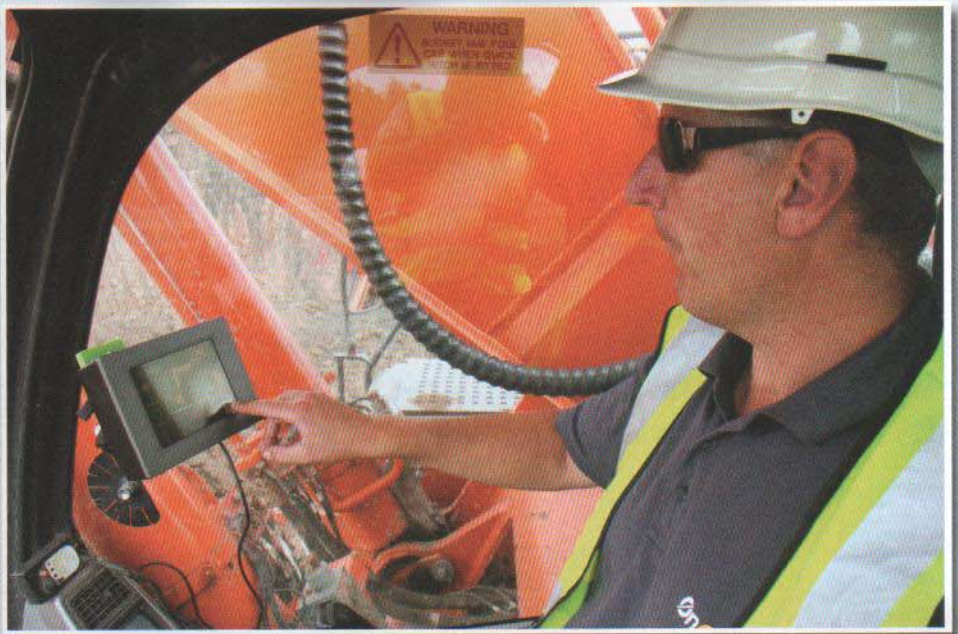
As well as monitoring the arm angle it also provides the means for accurate referencing to a known working height from a standard rotating laser level, although the system can also reference to an on-site benchmark if required. The pitch/roll and compass sensor is mounted at the rear of the machine on a special 500cm mast and is also used to measure upper-structure slew.

Installation is a very simple process that requires no special skills or tools and with a little common sense can be achieved in less than two hours. Although **EARTHMOVERS** didn't actually fit the system, from reading the very comprehensive Setup Manual, it appears to be a quite straightforward process, well within the capabilities of any competent mechanic. It's also worth noting the 54-page manual is very easy to follow and understand, written in plain English with clear illustrations explaining in great detail how to fit each component.

The first part of the installation process involves fitting metal brackets on to the machine. These are the only parts that stay permanently attached,

Axminster Excavators is using a DigPilot system on its Doosan DX480 on a project at a disused railway siding at Taunton.



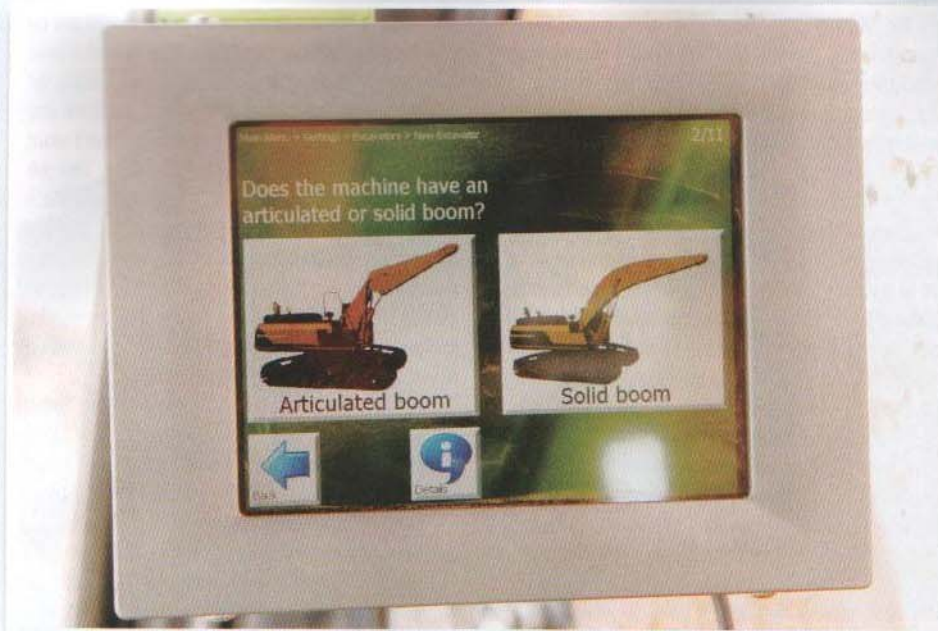


because they contain spring-loaded catches, which hold the sensors in place. The control terminal is mounted on to a cab window by a substantial suction mount in a convenient position for the operator. It takes its power from the cigarette lighter in the cab.

As the sensors snap into position, a big benefit of the wireless system also clicks clearly into place, "Security is one obvious benefit. But this ease of removal means, from an operational point of view,

***Main Picture, Above Left and Left:
One of the advantages of the DigPilot
system is that it takes only a few
minutes to remove all the
components, which then can easily
be fitted to another excavator.***





Centre and Left: The DigPilot's control terminal uses simple on-screen prompts and questions to help install, set up and use the system.

it's so simple to transfer the system from one machine to another. Clearly another advantage is the system is fitted only when it is needed and can be removed when the machine is working, as excavators often do, in more harsh applications such as demolition, using hammers or uprooting trees etc," adds Mr Escott.

Additional brackets to mount the sensors to other machines cost about £65 each. Once these are fitted, like the originals, they stay with the machine, allowing the quick and easy fitting of the

DigPilot to up to 20 different excavators – of any make or model.

"Provided the machine is equipped with the mounting brackets, all the operator has to do is carry the DigPilot case to the job, fit the system and then start digging. This is why we say 'the system goes where the work is, not the machine'. This alone will save thousands in transport time and costs," he adds.

For each individual machine, however, the system needs to be calibrated. Again this is a one-off procedure, detailed in the manual. This involves taking about 12 measurements and inputting these into the memory for the set-up, and performing four simple calibration steps – all easily achieved by following the intuitive on-screen instructions.

Once this has been done all the operator needs to do is call up a list on the DigPilot in-cab terminal – and select the machine's name or number that was inputted during installation. The terminal also stores the dimensions of up to 20 different buckets and attachments, which the operator simply selects in the same way as the machine.

"As well as a business being able to share one or more DigPilot systems across its fleet, another option could be to install the mounting brackets on the machines and then hire in a system. We already have systems with Survey Connection, which hires them out in the same way as it does with, for example, a laser leveller," adds Mr Escott.

SITE VISIT

Sam Voysey, a director of his family's Axminster Excavators, says while he has previously been interested in guidance and control systems, the cost, complexity and limitations of a machine-specific system has always put him off. But, he says, when he saw the DigPilot system he realised this would overcome those drawbacks and, being portable and easily switched between machines, it was much easier to justify the investment.

"I've looked at various systems – including the top notch ones – but even if I could afford them the problem always came back to trying to decide on which single machine to mount the system. Financially and physically it was always going to be a very difficult decision. With a fixed, hard-wired system it meant I would have to choose one machine and then move that from job to job. With the DigPilot I move the guidance system. It now goes with the driver – it's just another part of his tool kit," he says.

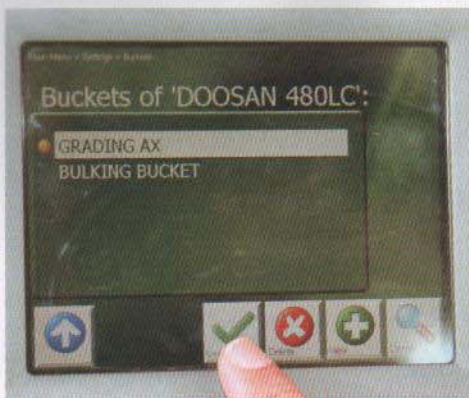
As well as using the equipment to boost efficiency and digging accuracy, Mr Voysey was quick to see the system's potential to not only improve the quality of work and save time, but importantly, also increase safety while cutting costs at the same time.

"I see the biggest benefit is reducing the need to have a banksman constantly checking the line and level. Moving men away from working machinery removes a line out of the risk assessment – I obviously don't want to put my workers in danger, so anything that helps here has to be good for my employees, our company and my customers.

"Safety is a huge issue in this industry. I think that being able to state that we use this system to help improve site safety will also be beneficial when tendering, because the big contractors are also looking to ensure they can demonstrate they are also fulfilling their responsibilities," he adds.

Machine guidance, he says, is also good for business. By reducing the need for a full-time banksman, that employee's time can be employed elsewhere on other work, which further helps recoup the cost of the investment in the technology. This also makes the operation of the excavator more efficient, because the driver is able to self-check his own work and, in some cases, work without batter rails. Again, this provides advantages for customers who can save the time and cost involved in marking out the site.





Mr Voysey also sees the system providing operational benefits, including increasing productivity and working accuracy. By referring to the system, operators not only cut at the right angles, but also do not remove excess material that wastes time and fuel required to reinstate the correct slope or depth.

"From my experience as an operator I think the system provides great peace of mind and saves a lot of hassle. I remember when driving an excavator I would know when I was roughly on the right level and would stop and get a banksman to check it. I would get the thumbs up to continue and then, with no change suddenly find I was 4in too low!

"I used to think how did that happen? It was very frustrating to be given poor feedback simply because I couldn't easily check my own work. This is where I see the system increasing excavator output and saving fuel and time.

Above Left: With the DigPilot wireless machine control system one size fits all and can store data on 20 different excavators and 20 buckets.

Left: The system monitors for a standard rotating laser level beam to determine the actual working height.



A 500cm mast on the upper-structure is for the sensor that measures slew, pitch and roll angles.

"Also, there are times when possibly you are on your own, you simply don't have time to check your work. When digging and loading dump trucks, for example, you can't stop and check because the trucks are always waiting. In the end I don't want me or my customers 'hoping' it is right. The job needs to be right first time, all the time," he adds.

One of the first jobs Mr Voysey put the DigPilot to work on is a project to level land and prepare a site on disused railway sidings adjacent to Taunton station. The job involves re-grading the entire site, installing a road through the middle and putting down pile mats for future development.

A Robotic Total Station has provided the initial set and this is used to set up the laser levelling for the DigPilot to work from. If the system employed the 3D option it could work independently without the laser or any need for staking.

Currently Axminster Excavators is using the 2D system. Although the site is marked out with stakes, Mr Voysey adds, it doesn't actually need this because it takes its own angles from the machine settings in the DigPilot and depth from the laser, calibrated using the referencing procedure (see panel).

"At the moment we are using it on a big excavator – a Doosan 480LC – to improve the grading quality and the speed of the bulk digging," says Mr Voysey. "When the operator switches to the grading bucket he selects this on the screen and changes the system over from the bulk bucket. If he moves the machine he needs to reference this through the laser before starting work again.

"We don't actually need the batter rails here, but they were already set out. That's another area where we can make a saving for the customer. Nevertheless it's still quicker and more efficient with the DigPilot system. It's like taking the batter rails with you," he adds. "This has really filled a vacuum for us because the only alternative was a hard-wired system, which is far too costly and complex for our business."

DigPilot technology

The modular DigPilot system is designed to be upgraded and is available in three levels: 1D provides angle sensors for depth and position; 2D includes a pitch/roll compass to take account of the slew position. Both of these systems can use a standard rotating laser leveller for height and position referencing.

The 3D option provides the facility to use 3D survey models (DTM) and GPS/GNSS positioning, which used in conjunction with a digital terrain map allows the system to work independently without referencing or a laser. It can document the work and import and export data in a variety of formats, including as a LandXML file, which is becoming the industry standard on large construction projects. A standard USB port is used for transferring files.

The system operates in eight different types of work or 'projects': Flat plane, Single slope, Dual slope, Trench, Profile, Channel, Embankment and 'Bucket defined slope'.

When starting out the operator first has to simply switch on the terminal and follow on-screen instructions.