



3D GPS+ INDICATE

**EXCAVATOR
SYSTEM**

3DMC GPS+ Excavator Indicate System

Topcon's 3DMC GPS+ Excavator Indicate System is an elevation control system, utilizing GPS+ positioning technology. Results at centimeter level can be achieved by putting the digital design in the computer in the cabin, creating a stakeless jobsite.

Benefits



Reducing surveying costs

By directly controlling, based on the digital design, the contractor can significantly reduce surveying related costs. Surveying stake out work can be reduced to an absolute minimum, and especially the various re-staking and checking phases during a project are eliminated.

Increase productivity

In addition, productivity will be, depending on the application, increased. The operator knows where the grade is, anytime, anywhere! No more need to wait for a surveyor to re-stake or check; all data is available in the cabin! You get to finished level fast!

Applications

Excavating complex landfills? Excavating steep slopes or water reservoirs for road construction? Or just a ditch somewhere? These are all done with the same ease and speed! By using a digital design and comparing this with the actual position, every application can be done, with the same ease and speed, whether it's complex or not!

Improve material usage

Having the design model in the cab, the operator will start to excavate correctly from the beginning. Serious reduction of rework, ensuring that you only excavate what really has to be excavated!

Increase Quality

Topcon's 3DMC does not only drive your direct costs down, it also increases the quality and safeguarding of your product. With less human interactions, no more grade checkers, 3DMC offers the 'missing link' in automation from the survey and design phases of a project to stake out and daily execution. It significantly reduces your chances of mistakes during the entire process!

System features

GPS+GLONASS

Not enough GPS satellite availability caused by steep slopes, nearby trees and buildings or any other obstruction will result in poor or no GPS positions. This means inaccurate work or even downtime!

When using Topcon's GPS+GLONASS, the additional availability of a few GLONASS satellites can make the difference between working, or not!

Two GPS+ antennas

To solve the problem of the excavators' direction, two GPS+ antennas are used to calculate a so-called heading. This is the most advanced and sophisticated way. By using this method, the correct excavator heading is always available, in every position! No more rotating around to determine the machines direction on every new position!

360°-triple axes-gravity sensors

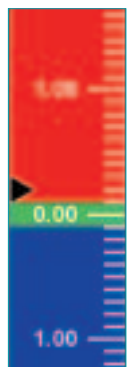
360°-triple axes-gravity sensors make it possible to use one sensor for multiple axes-movements. Opening and closing of the bucket as well as the buckets cross slope are measured using one sensor. The 360°-triple axes-gravity sensor is also used to measure the angle between boom, stick and other elements. The sensors can be mounted on every position of the specific element. Making it a simple and easy to mount system!

Can bus technology

Using the integrated can bus technology; adding or swapping sensors is no problem. The system automatically detects sensors and adjustments can be done for each sensor separately. Adjusting a sensor for smoothness, reaction time or sensitivity is easily done just by tapping the screen. Easy to handle, easy to control!

Multiple machines and survey, one format

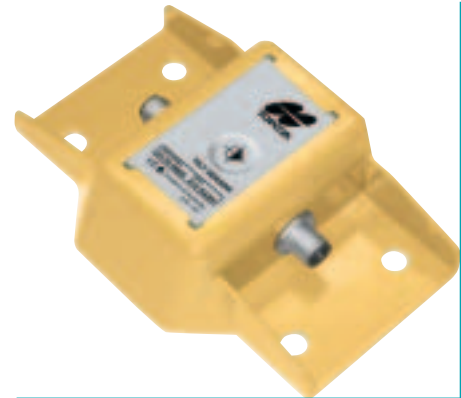
On the jobsite, the same software is running on different construction machines. Excavators, dozers, motor graders and even survey crew, all work with the same user-friendly software; Topcon's 3DMC! Creating a seamless job flow!



Basic principle

The GPS+ receivers on the machine calculate multiple times per second the actual position and heading of the excavator. By knowing the lengths of boom and stick and accurately measuring the angle from these elements to the gravity center of our earth, the system knows exactly the bucket-position of the excavator.

The accurate measuring of the angles from boom, stick and bucket are done with the latest, state of the art, 360°-triple axes-gravity sensors. These are possible to mount free on every position and are linked with each other using can bus technology. The operator can adjust these sensors for his application, to achieve smoothness, faster reaction time and the right sensitivity to work in the most comfortable way. Easy to install, easy to calibrate and easy use for every application!



The actual bucket-position is continuously compared to the digital design and displayed on the screen in front of the operator. Besides the graphical display, comparison values and grade indicator lights are shown to the operator.



During operation, the digital design can be displayed in several forms and colors. Besides a plan view of a DTM or alignment model, cross sections or profile views can be displayed, with easy to use zoom functions. Elevation and cross slope keys continuously display actual values versus achieved ones. Offsets to certain breaklines can be displayed if required.

The satellite status key continuously shows the current accuracy based on the actual satellite geometry and conditions as well as sky plots of the actual satellite positions. Besides the real time information, estimated GPS accuracies provide the operator with useful information on an hourly scale from day to day.

Other functions of the software include cut/fill display, terrain survey via the Topo function, radio-channel change, sensor calibration and on-board storage of multiple DTM's and projects. 'On the fly', the operator can change the cut/fill offsets, allowing Indicate Control above or below the Design Surface.

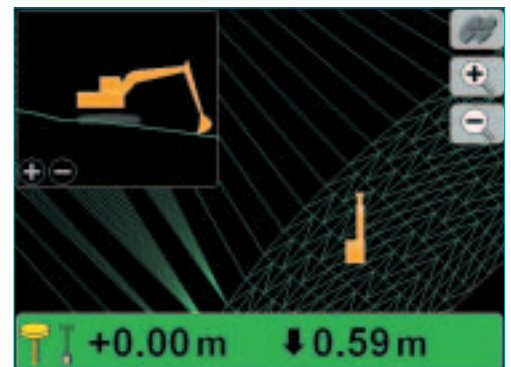
Same reference for multiple machines and survey

When using satellite control in real time, centimeter accuracies can be achieved. A base station is set over a known point and corrections are calculated and transmitted via radio to machinery or survey crew in real time. The base station can be located several kilometers away, so no line-of-site is needed. Multiple machines and survey crews can use the same correction signal simultaneously.

Same software for multiple machines and survey

All construction machinery using Topcon 3D Machine Control Systems are interfaced with the same software; 3DMC. Excavators, dozers, motor graders and even survey crew, all work with the same user-friendly software. Whether it is in the operators' cabin or on surveyors' field-computer, creating a seamless job flow!

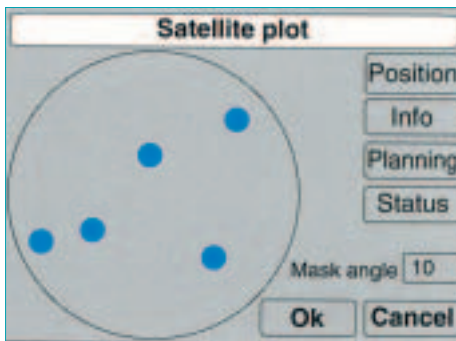
Each project needs to be defined once, the digital design needs to be prepared once and all machines and survey crews work with the same set up, just a matter of copying. Easy to manage, everybody speak the same 'language'.



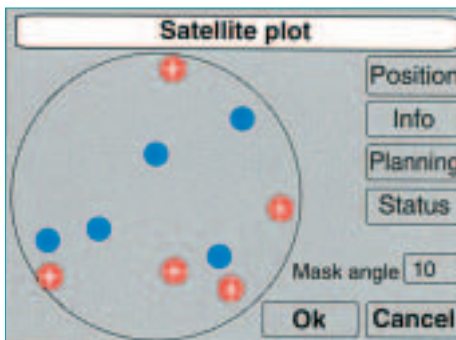
The Topcon GPS+ Concept

Global Positioning System

The United States of America's department of Defense designed the Global Positioning system, GPS. A network of satellites travelling fixed paths around the earth, providing a continuous positioning reference for its users. For real time, moving applications, two GPS receivers are required to achieve the accuracy demanded in our construction industry. One receiver set up over a known reference point, and one moving on the machine. The receiver set up over the reference point ('base station') continuously provides correction signals to the moving receiver via a radio link. In this way, the accuracy of the positions determined by the moving receiver is increased from meter to centimeter level.

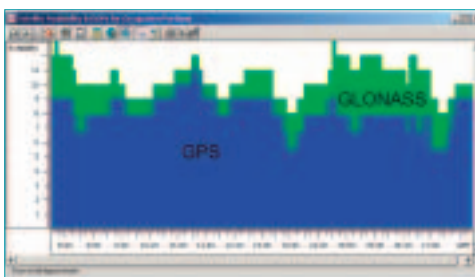


GPS only



GPS+: GPS+GLONASS

These two images are from Topcon's System Five 3D control display as of 14:00 on Friday, May 23 at Erfurt Germany.



Topcon GPS+GLONASS

Topcon's GPS+ solutions are being recognized as state of the art, because of their unique characteristics. Although GPS+ technology today is well accepted, the difference in this industry is made when it comes to initialization (start up) times, quality of position calculated (accuracy) and additional functionality to separate and filter true GPS+ signals and noise created by atmosphere or for instance the machine.

Topcon's GPS+ solutions do not only use GPS satellites, but also offer to use the Russian based GLONASS satellites in addition. This means more satellites and in many applications this will translate into quicker initialization times when starting up, and eliminate down time when satellite signals could be lost due to obstructions (trees, buildings, bridges, etc.).

GLONASS is a Russian satellite network already available for years. Recently this network has been updated with new satellites and more launches are planned for the near future. This makes GLONASS a full satellite network! Currently 11 satellites are in orbit and at the end of 2005 there are 18 planned in total. Added these to the American GPS network, the network is increased with almost twice as many satellites.

Especially, in these situations where not enough GPS satellites are available; for instance obstruction caused by steep slopes or trees! GPS only solutions can become impossible. The additional availability of a few GLONASS satellites can make the difference between working, or not!

In addition, Topcon's GPS+GLONASS solutions use advanced calculation and noise reduction techniques to provide the most accurate positions via their advanced multi path reduction, co-op tracking and in-band-interference jamming.

Example of satellite availability plot.
Glonass offers an average of approx. 30% more satellites!



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Item number: 5510241
Language: English
Printed: 03-2005

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Certificatie No. NL 04/0091QA
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