

## *Machine Control for Graders*



# Grading done efficiently and with precision

The basic upgradable Machine Control System by Leica Geosystems controls the blade automatically. It assures smooth grading results and enormous material savings. Even manpower requirements are drastically reduced.

## Your advantage

Leica Geosystems Machine Control System for Graders meets all demands. It combines the strengths of MOBA's basic GS-496 Control System with the advantages of a 3D high-end Control System.

### Higher precision

- Precise, remotely copying of reference heights by the MOBA Sonic-Ski.
- Smoothly graded surfaces.
- Material is graded to mm precision, enabling total cost control.
- Increases overall precision.

### Time savings

- Slope checks are not required while grading.
- Fewer work-steps are required.
- Grade more material within less time.

### Cost advantages

- Only the driver is required for grading (3D solution).
- No surveying costs for stake outs, guide wires and check measurements (3D solution).
- Material requirements can be precisely calculated and controlled.
- Reduced construction time as daily efficiency is improved.

### Flexibility

- Can be used in just about any topography.
- Easy interchange between basic and 3D-Guidance Systems.
- Interchangeable laser, ultra sonic, 3D total stations and GPS sensors.
- Easy to down or upgrade.
- Can be used with almost all machine types.

### Reliability

- All components mounted on the outside of the machine are robust and completely molded on.
- The machine computer meets the highest quality standards (EN550022 [FCC151] class B).
- CAN connection optimizes data-flow to all sensors by digital transfer.

### Easy to operate

- Almost every function can be performed from the same control panel.
- Clear display of all required information for the driver.
- Automatic height and slope control relieves the driver.

## Applications for the basic Control System (slope, laser, ultra sonic)

- Streets and paths.
- Parking lots and flat hall floors or floors with an even slope.
- Areas with fixed points or fixed lines, such as trenches or road edges.



**Control panel**  
The machine's current status at a glance.



**Rotation compensator**  
Exact data of the default rotation provides optimal slope compensation.



**Multisticks**  
Enables hands-on control of the system with the hydraulic control levels.



**Slope sensor**  
Determines the current position of the blade for precise slope control.



**Sonic-Ski height sensor**  
Using 6 resonators makes it the most precise remotely controlled ultra sonic sensor.



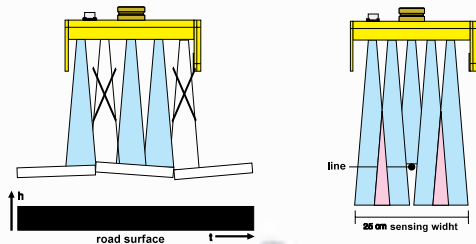
**Laser receiver LS-250**  
High precision linear laser scanner without electric mast or mast control.



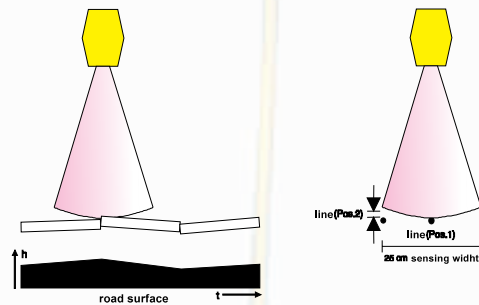
# ... with automatic ultra sonic scanning

## Applications for ultra sonic control

- Exact copying of reference heights by the MOBA Sonic Ski.
- Smoothly graded surfaces.
- Material is graded to mm precision enabling total cost control.
- Increases overall precision.



Fade out errors



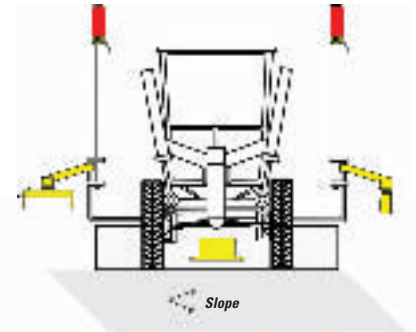
Copy all errors

## Easy cable connections via CAN-BUS

The CAN (Control Area Network) enables a single cable type to be used for all sensor connections. They all use the same plug layout with the same pin assignments.

- One replacement cable is enough to cover all cable requirements of a job.
- Damage to plugs due to wrong connections can be ruled out.

The CAN-BUS enabled control panel keeps the driver informed about the system.



## Multiple ultra sonic scans

The Sonic Ski is a height sensor and uses five ultra sonic sensors. A sixth sensor serves as temperature compensation. Of the five individual and simultaneous ground scans, the three with the least deviation from the initial adjustment are used to calculate a mean. In this way inaccuracies or obstructions can directly be eliminated from the mean calculation.

While scanning ropes the Sonic-Ski always uses the resonator closest to the rope for the measurement.

The measurements are therefore within an accuracy of  $\pm 2 \text{ mm}$  over the entire scan width of 25 cm.



***... with automatic laser control***



### ***Proportional laser receiver LS-250***

The LS-250 laser receiver is a linear sensor for height measurements that works with the known rotation lasers such as red light emitters (Helium, Neon) and infrared emitters.

Unlike conventional multi-channel receivers that only have a few sections within each receiving range, the LS-250 evaluates every single receiver cell. It is possible to freely select and shift the receiving sections. Every deviation is recorded with an accuracy of 1 mm making proportional control according to the deviations possible. Electronic masts and mast control are no longer required.

### ***Dual slope laser***

Dual slope lasers are best suited to control a grader with the proportional receiver LS-250.

Robust self-levelling rotation lasers like the LB-4 or the Javelin have a large working range and steep slopes (up to  $\pm 10\%$  respectively  $\pm 20\%$ ) can be entered for both axis (Javelin-s up to  $\pm 50\%$ ).

In addition, they have selectable, high rotation speed for perfect control of graders.





## *... with the automatic 3D total station*

### **Applications for 3D Control**

- Large projects with frequently changing slopes.
- Projects with complex designs such as windings, elevations, clothoids...
- Projects with large earth moving requirements.



### **Leica Geosystems uses precise automatic Total Stations to control Graders.**

Depending on accuracy requirements, all TCA, TCRA models of the TPS 1100 series, as well as TCA1800 of the TPS1000 series can be used. The Total Station communicates via radio to the robust computer on the machine and measures the exact 3D position of the prism on the machine. Combined with the measured data collected by the slope sensors, the position and orientation of the machine is constantly updated. By comparing the project data saved in the machine computer, the design correction for height and slope are calculated and transferred to the blade controller.

### **The high degree of system utility is reflected in the following characteristics:**

- Can be used in just about any topography.
- Easy interchange between basic and 3D Control Systems.
- Interchangeable laser, ultra sonic, 3D total stations and GPS sensors.
- Easy to down or upgrade.
- Can be used with almost all machine types.





## ... by 3D TPS position measurements



The Leica Machine Control System for Graders meets all requirements. It combines the strengths of the basic GS 496 Control System by MOBA with the advantages of high-end 3D Control.

With **Automatic Target Recognition (ATR)** and intelligent search routines the Total Stations quickly and reliably find the target on the machine. The target is a simple prism without any additional electronics.

The Leica 3D solution with automatic Total Station and LMGS-G software, makes the very precise Machine Control System for Graders possible.

**System accuracy** of  $\pm 5$  mm in height and  $\pm 10$  mm in position is attainable. A homogeneous grading job is the result. Straight forward or difficult street designs can be graded according to the projected parameters.

### *Mast slope sensor*

The Leica 3D Control software combined with the mast slope sensor permits the driver to adjust the blade angle to suit the job at hand.



The software automatically recognizes the direction of travel of the machine eliminating the need for making a manual switchover. With half of the blade grading can be done beyond the edge of the project. The data model is a simple ASCII file that any CAD program can generate. The project data of the entire project only has to be transferred to the machine computer once.



## *... using 3D GPS position measurements*

The GPS System 500 can be used instead of the total station. The position of the GPS antenna on the mast is determined and the GPS measurements are processed in the machine computer. The type of data is different when compared with the Total Station, but the processing is the same. This enables the easy interchange between GPS and TPS sensors.



The **MC500 sensor** with its robust, vibration-resistant casing is mounted on the machine and used as the rover station. A SR530 is set-up as the reference station. Only with the reference station is the high degree of precision possible, as the position of the rover station (on the machine) is always calculated relative to the known position of the reference station.



A single reference station is enough to cover a construction site of 10 x 10 kms and to guide any desired number of machines with that reference signal.

## *Decades of experience*

The close cooperation with the control systems manufacturer **MOBA**, has put decades of experience at Leica's disposal. **MOBA technologies** are cutting-edge.

The CAN bus system for data transfer has become the standard it has been for years in the automobile manufacturing industry.

MOBA's ultra sonic sensor (Sonic Ski) and the laser receiver LS-250 have unique features that enormously increase grading precision. "Cross coupling" enables parallel changes in height and slope control, considerably speeding up blade control.

The **system accuracy** is within the accuracy range of GPS systems, meaning that  $\pm 30$  mm in position and height is attainable. One time system set-up permits around-the-clock operations. GPS is well suited to prepare construction sites and for large earth moving requirements.

The extremely robust **machine computer** with touch screen is ideally suited for harsh construction site conditions. It is resistant to dust, humidity, splash-water (IP65) and is highly immune to vibrations. All components inside, even the processor are soldered in place, not just plugged in and coated with a protective layer of lacquer.



Leica Geosystems as survey specialists provides the required instruments for 3D upgrades.

Total Stations and GPS for Machine Control applications are standard products that can be used for all typical surveying jobs. The Leica system makes it possible to interchange the sensors depending on application. The sensors only have to be plugged-in and the CAN bus system initiates them.



# We are always at your disposal

- We offer support with project planning and system installation.
- We offer total solutions.
- We offer solutions to your specifications.
- We offer worldwide service.

**Beside Machine Control Systems for Graders, Leica Geosystems offers solutions for other automatic construction machines such as Slip-form Pavers, Trimmers, Pavers and Bulldozers.**



**Construction laser-** our lasers are always built to meet the demands of construction sites, no matter what they are used for: the construction of high-rise buildings, for digging trenches, for machine guidance or interior construction.



**Automatic levels** – professional optical levels are built for the construction site. They are quickly set-up, very precise and top every comparison of price to performance ratios.



**Leading in GPS and TPS technology** – used worldwide in projects that demand the highest standards, designed for various applications and to be easy-to-use. We developed the first reflectorless total stations in 1998 and our experience with GPS dates back to 1967. We hold several patents and were first at introducing many new technologies to the industry.



**Software and accessories** – integrated software solutions and a complete series of tripods, staffs, our patented 360° prisms, batteries, chargers, everything you need to extract the best performance from your instrument.



**Hand-held Laser Distance Meter** - Simple and handy tool to determine distances, areas and volumes quickly and accurately, indoors and outdoors.



**DIGI System** - The location system provides a fast and safe solution for tracing buried utility services.

**CAUTION**  
LASER RADIATION – DO NOT  
STARE INTO BEAM  
620-690nm/0.95mW max.  
CLASS II LASER PRODUCT

**MOBA**  
Controls

**Distancer and ATR:**

Laser class 1 in accordance  
with IEC 60825-1 and EN 60825-1  
Laser class I in accordance  
with FDA 21 CFR Ch. I § 1040

**Laser plummet:**

Laser class 2 in accordance  
with IEC 60825-1 and EN 60825-1  
Laser class II in accordance  
with FDA 21 CFR Ch. I § 1040

**Electronic guide light:**

Laser class 1 in accordance  
with IEC 60825-1 and EN 60825-1

The machine control system  
for graders was developed  
with the assistance of MOBA  
Mobilautomation GmbH.

Your dealer:



**Total Quality Management -  
Our commitment to total  
customer satisfaction**

Ask your local Leica  
Geosystems agent for  
more information about  
our TQM program.

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