

Crawler Dozers

Product Information

Liebherr Operator Assistance
Systems and Machine Control



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Liebherr Operator Assistance Systems and Machine Control



In the face of the constantly increasing pressures on time and costs, construction machines have to meet the highest demands, both in terms of speed and precision in operation, in order to win through. For this very reason, automatic machine control and operator assistance systems are being used ever more extensively to increase the productivity of operator and machine.

These make use of digitised planning data to automatically control the machine equipment when removing or laying down material. With the assistance of the latest technology, it is possible to produce complex surface areas and exact grading both quickly and precisely.

Because of their innovative drive systems, Liebherr crawler dozers are ideally suited to the application of automatic controls. The hydrostatic drive ensures smooth propulsion, free from gear changes and jerky movements. Optimum grading properties are ensured due to the long running gear and the perfect match of front equipment to the operating hydraulics and the base machine. The low centre of gravity enables safe operation even on steep slopes and steeply inclined terrain.

Advantages of Liebherr Operator Assistance Systems

- There is a significant reduction in the use of pegs and guide wires as well as personnel costs.
- Lost time due to measurement checks or the extra effort of rework is eliminated.
- The resultant fewer machine passes mean less wear and tear and less fuel consumption.
- More precise material application means lower usage of materials.
- Machine operating efficiency increases and projects are completed faster.

A range of control technologies are used depending on the type of application. To significantly simplify installation for the operator, Liebherr offers a range of Ready Kits. These ensure that the control system can be set up on the dozer at a later date without intervention in the internal systems of the machine.

Liebherr also offers a factory fitted, roof mounted 3D grading system from Topcon.

Construction Site Management



Increasingly, complex construction site management systems are being applied more frequently to construction projects. Amongst other benefits, these enable direct communication between construction machinery, site surveyors and the planning office.

This allows changes to planning data to be directly transferred to the dozer and site progress reports can be transmitted from the machine to the site management office.

This allows precise monitoring of the course of the project and online storage of relevant construction site information to be simultaneously realised. Remote maintenance of the control system can be frequently made using direct online access to the control unit.

The objective here is to further increase the efficiency of the project procedures, while at the same time improving the utilisation of construction machinery through faster communication channels.

Automation Solutions for Operator Assistance Systems and Machine Control

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Liebherr

- 1D: Free Grade
- 2D: Definition Grade
- 3D: 3D Grade (Topcon)

Trimble

TRIMBLE ReadyKit

- 2D: Laser control
- 3D: GPS control
- 3D: Total Station control

TOPCON

TOPCON ReadyKit

- 2D: Laser control
- 3D: GPS control
- 3D: Total Station control

Leica

LEICA ReadyKit

- 2D: Laser control
- 3D: GPS control
- 3D: Total Station control

To establish with certainty that an existing control system can be installed on a new machine with a Ready Kit, it is recommended that you consult the corresponding control system manufacturer.

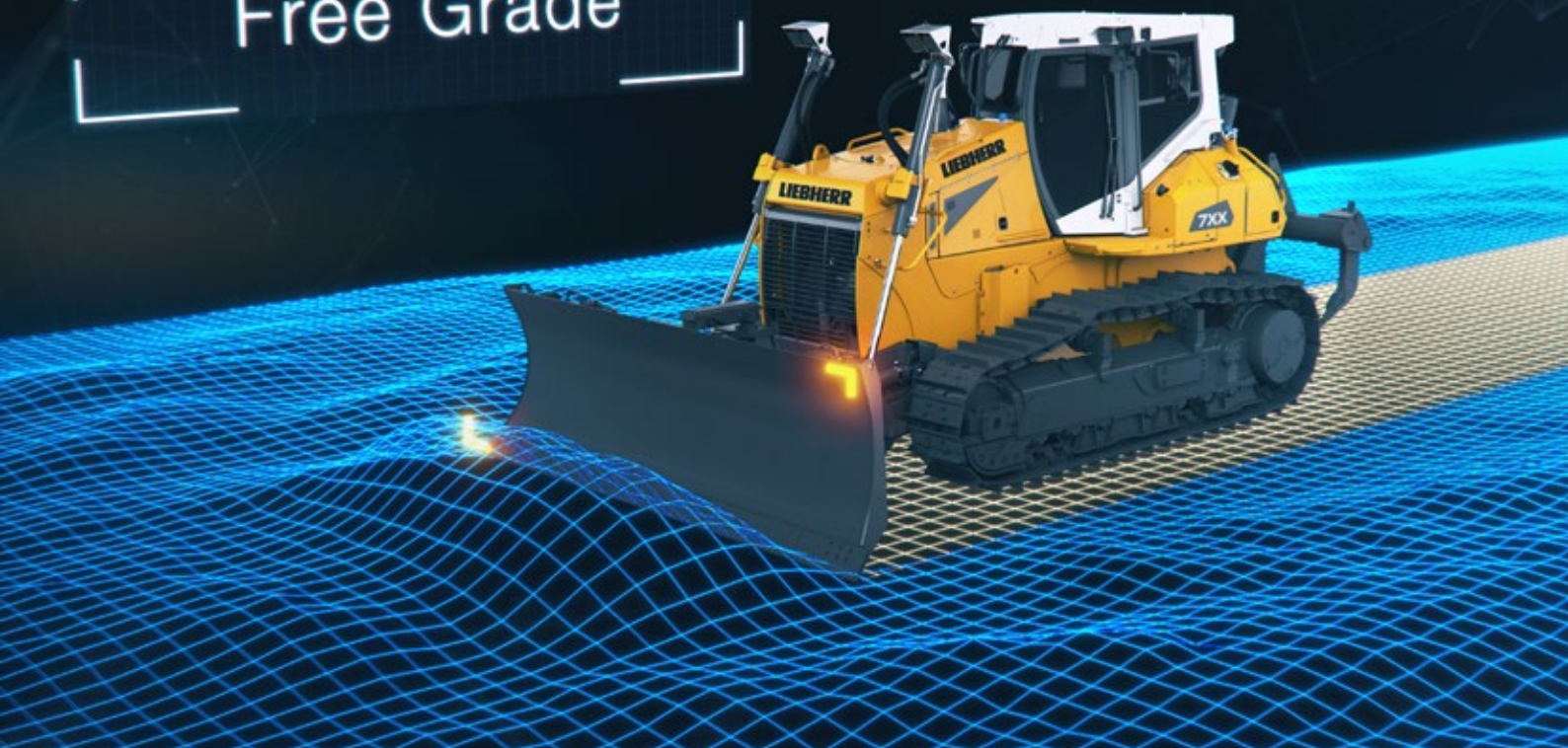
Liebherr Operator Assistance Systems



The intuitive 9-inch Touch Display

- A summary of the key machine parameters
- A wide range of driver-specific settings:
 - Responsiveness of work hydraulics
 - Responsiveness of drive hydraulics
 - Eco mode, automatic speed reduction and engine shutdown
- Operating platform of Liebherr Operator Assistance Systems:
 - Liebherr Indicate: 3D real-time position display
 - Free Grade: Active fine grading support
 - Definition Grade: Creating defined 2D surfaces

Free Grade



Free Grade – Blade Stabilisation

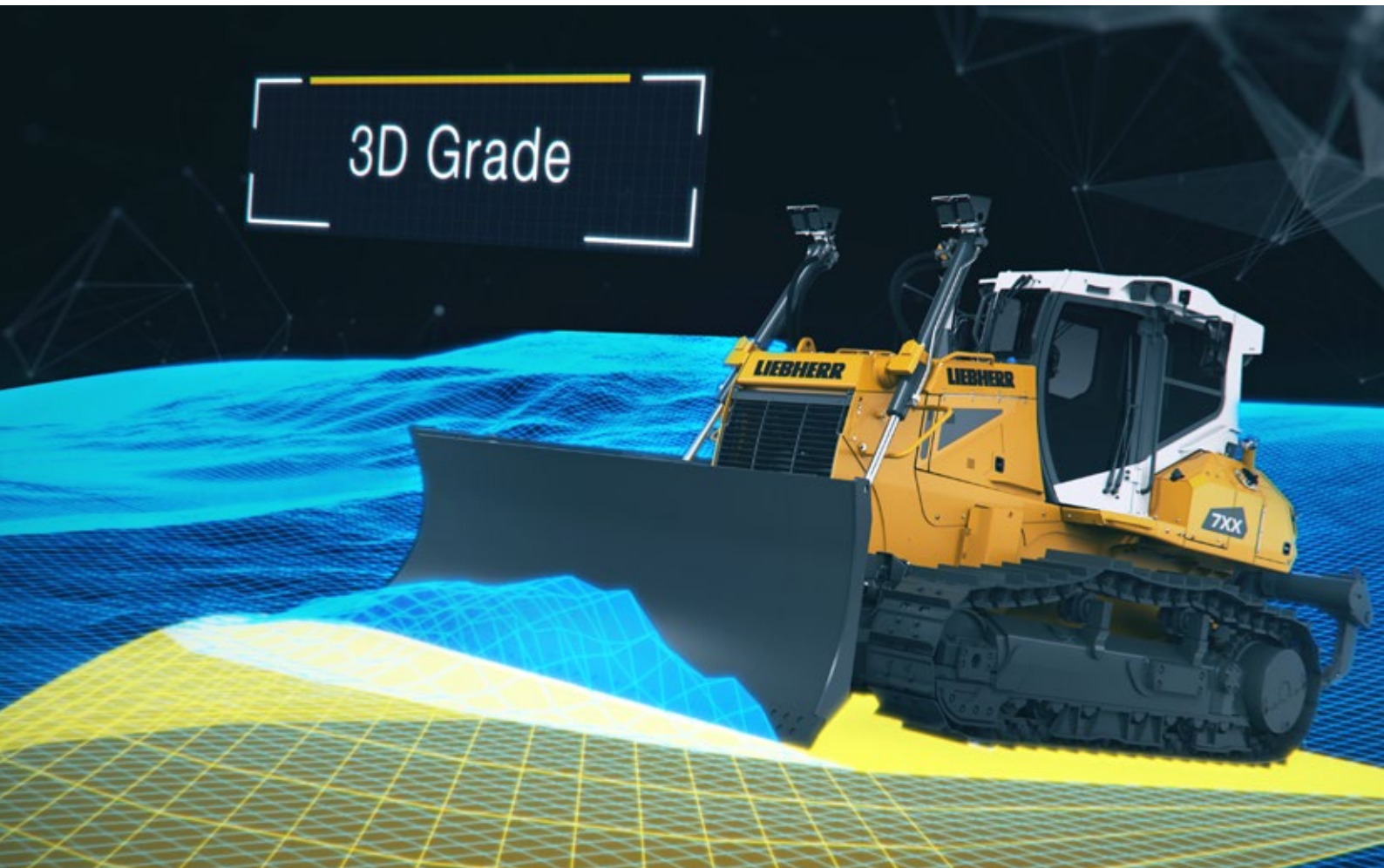
- Creation of a formation level: flat surfaces, ramps, dams
- Active blade stabilisation (longitudinal/transverse inclination) when grading
- Increased productivity with simultaneous time saving
- Improved quality with less experienced operators, less stress for experienced operators
- Greater safety on the construction site as more attention is given to what is going on around the machine

Liebherr Operator Assistance Systems



Definition Grade – Blade Inclination Control

- Basic modelling of 2D surfaces
- Automatic/active position control of the blade to a specified target inclination
- Operation without additional equipment, e.g. GNSS receiver, base station, etc.
- Operation independent of local conditions, satellite reception, Internet, etc.
- Savings on costs (no additional equipment/hardware necessary)
- Increased productivity with simultaneous time saving
- Improved quality with less experienced operators, less stress for experienced operators
- Greater safety on the construction site as more attention is given to what is going on around the machine



3D Grade – Factory Fitted, Roof Mounted Grading System (Topcon)

- Modelling of complex 3D site models
- Automated 6-way blade control
- Exact positioning of the blade relative to a target profile (site model) Theft protection, no mounting or dismantling of mast, available factory fitted, smart/intelligent
- Full integration into Construction Site 4.0

3D Grade – Factory Fitted, Roof Mounted Grading System (Topcon)

MC-i4 Communication Unit

- This interchangeable module houses a radio modem, a cellular modem and the Long-Link™ module.

MC-X1 Control Computer

- This future-proof, compact and robust unit was specifically developed for machine control. This also took into account future add-ons.





GR-i3F GNSS Receivers

- These fully integrated GNSS receivers capture signals from multiple satellite systems in order to enable precise positioning of the dozer at any one time.

GX-55 Intuitive Display

- This robust display features a light and compact aluminium housing with integrated LED light bars, a graphical user interface and a fast processor

Ts-i4 IMU Sensors

- The IMU sensors on the base machine and the blade deliver data at high speed so that the blade remains on target even at maximum speed.

Ready Kits for Liebherr Dozers



Which control goes with which dozer?

As a basic principal, it is possible to install 2D and 3D machine control systems from all well-known manufacturers on Liebherr crawler dozers of all sizes.

Ready Kits for Liebherr Crawler Dozers

Liebherr offers factory fitted Ready Kits for controls from a variety of manufacturers. These include all preparatory work on the machine that is necessary for mounting of an automatic control at a later date. This applies to electrical and hydraulic components as well as all brackets and plug connections.

With a factory fitted, pre-installed Ready Kit, mounting machine controls in the field is greatly simplified and potential sources of error are eliminated. The corresponding control components, such as masts, inclination sensor, display or control unit, GPS antenna, receiver prism or data radio, can be simply mounted or plugged in. As these kits, in each case, support all of the systems from a single manufacturer that are listed on page 3, subsequent upgrading of a dozer, for example from 2D to 3D, can be carried out at any time

Ready Kit Components



The machine is fully wired internally, including plug connections and power supply.



Mast mounting brackets and support brackets for the transverse tilt sensor.



Remote data transmission module (not included in all kits).



Connection cable and radio data unit mounting option on the cabin for operation with GPS / GNSS or Total station.



Mounting socket and connections for the control unit (monitor) in the cabin. For ergonomic operation, the automatic switch is usually integrated in the joystick.

Representative photos: Component design vary for the various kits.

2D Laser Controls

Operation

The rotating laser spins at high speed, creating a reference surface from laser light. This surface can be horizontal or inclined, but is always in one plane (two-dimensional).

The laser receivers are mounted on masts on the dozer blade. They receive the emitted laser beam and therefore determine the current height difference of the blade relative to the reference height. For applications with lower accuracy requirements, it is sufficient to use a single laser receiver, which only determines the height of the blade (single laser).

It is normal, however, to have 2 masts, or a mast and a tilt sensor installed. As a result, the blade position can be detected relative to both height and inclination (dual operation). The control unit with integrated display is located in the cabin within sight and reach of the operator. It processes the signals from the laser receivers and transverse tilt sensor and

continuously regulates the height and tilt of the blade through the operating hydraulics. The operator only needs to drive the dozer in automatic mode, while the machine control automatically guides the blade. As a result, a grade is created parallel to the laser surface.

Applications

- Producing horizontal or inclined grades to a high level of accuracy
- Suitable for small to medium-sized construction sites.
- Application for landscaping sports fields, constructing roads and car parks and constructing industrial and commercial facilities and halls, etc.

Components



On site

- Rotary laser



On the grading blade

- 1 or 2 laser receivers
- Optional: Transverse tilt sensor



In the cabin

- Control unit

Images illustrate Trimble control components.

Useful information

- There must be visual contact between the rotating laser and the dozer.
- A simple and comparatively inexpensive system, but unable to create 3D contours.
- With a single rotating laser, multiple machines can work on the same grading level.

3D GPS / GNSS Control

Operation

The antennae that are mounted on masts on the blade or cabin roof receive signals from several GPS or GLONASS satellites and thus determine the position of the blade. A base station is necessary to achieve the required accuracy. Its position is precisely measured and calibrated when the construction site is set up; it continuously sends correction signals to the machine via radio.

Companies are also increasingly using correction data from regional providers, which can be called up via GSM (or GPRS) or the Internet. One or two GNSS antennae can be used. In dual mode operation, the orientation of the blade is also taken into account. This eliminates deviations caused by the swing of a 6-way blade.

Surveying data of the desired site profile are available in standardised formats. These are transferred to the control unit and shown graphically to the driver on the display.

The control unit processes the signals from GPS receivers, tilt sensors and base stations and compares them with the stored default values. It regulates the height and tilt of the blade automatically through the attachment hydraulics. This creates a profile that corresponds to the specified terrain data. In some cases, GNSS systems are combined with laser sensors in order to achieve a particularly high level of height accuracy.

Applications

- Production of large grades and complex three-dimensional surfaces.
- Suitable for medium to very large construction sites.
- Used for road and railway construction, landscaping golf courses, constructing large industrial facilities, earthworks and landfills , etc.

Components



On site

- Base station



On the grading blade

- Optional: Transverse tilt sensor



On the machine

- 1 or 2 GPS antennae
- Data radio



In the cabin

- Control unit

Illustrations show control system components from Topcon

Useful information

- There must be visual contact between the machine and the GNSS satellites.
- Not suitable for working underground, in narrow valleys or in the forest. Visual contact between the machine and the base station is not necessary.
- A base station can operate any number of machines on the construction site (radio connection).

3D control with Total station

Operation

The Total station detects and tracks the receiver, which is mounted on a mast on the dozer blade. Both the distance to the receiver as well as the horizontal and vertical inclination are constantly verified. The Total station is calibrated before commencing work, so that its position is known exactly. This allows the exact position and height of the blade to be continuously determined and the operating hydraulics to be controlled accordingly.

Only a single mast is used at any one time, so a transverse tilt sensor is always required to detect the tilt angle of the blade. As with GPS, the site data is stored in digitised form in the control unit. This position data and the measured transverse tilt are processed and compared with the stored default values so that the blade is always guided on the required site profile.

Applications

- Production of grades and complex three-dimensional surfaces to a high level of accuracy.
- Suitable for small to medium-sized construction sites.
- Application for roadway construction, landscaping of golf courses, site preparation for residential buildings as well as industrial and commercial facilities, and laying down airport taxiways, etc.

Components



On site

- Total station



On the grading blade

- Receiver prism
- Transverse tilt sensor



On the machine

- Data radio



In the cabin

- Control unit

Illustrations show control system components from Leica

Useful information

- There must be visual contact between the machine and the Total station. If this is briefly interrupted, the station automatically adjusts itself, or the operator must manually restart the search after the obstacle has been removed.
- A single Total station is required for each construction machine.
- For use when producing 3D surfaces to a high level of accuracy, or where GPS reception is not possible.

Available as 1D, 2D, 3D versions for each fitment

Available fitment	1D			2D		
	Dual IMUs	Dual IMUs	Single Mast Laser	Dual Mast Laser	Dual Mast Laser	Dual Mast Laser
Free & Definition Grade	✓*	✓*				
3D Grade (Topcon)					✓	
Trimble Earthworks Ready Kit	✓	✓	✓	✓	✓	✓
Leica Ready Kit	✓	✓	✓	✓	✓	✓
Topcon Ready Kit						On request

Available fitment	3D				
	Single Mast GNSS	Dual Mast GNSS	Single Cab GNSS	Dual Cab GNSS	Single TPS / UTS
Free & Definition Grade					
3D Grade (Topcon)				✓*	✓
Trimble Earthworks Ready Kit	✓			✓	✓
Leica Ready Kit	✓	✓		✓	✓
Topcon Ready Kit					On request

*Available factory fitted

The Liebherr Group of Companies



Wide Product Range

The Liebherr Group is one of the largest construction equipment manufacturers in the world. Liebherr's high-value products and services enjoy a high reputation in many other fields. The wide range includes domestic appliances, aerospace and transportation systems, machine tools and maritime cranes.

Exceptional Customer Benefit

Every product line provides a complete range of models in many different versions. With both their technical excellence and acknowledged quality, Liebherr products offer a maximum of customer benefits in practical applications.

State-of-the-art Technology

To provide consistent, top quality products, Liebherr attaches great importance to each product area, its components and core technologies. Important modules and components are developed and manufactured in-house, for instance the entire drive and control technology for construction equipment.

Worldwide and Independent

Hans Liebherr founded the Liebherr family company in 1949. Since then, the family business has steadily grown to a group of more than 130 companies with more than 48,000 employees located on all continents. The corporate headquarters of the Group is Liebherr-International AG in Bulle, Switzerland. The Liebherr family is the sole owner of the company.

www.liebherr.com