AccuGrade®

Grade Control System for Hydraulic Excavators

AccuGrade® Systems for Hydraulic Excavators	AccuGrade GPS
Machine Compatibility	
Machine Model	320D, 324D, 325D, 330D, 345C, 365C, 385C

AccuGrade® Grade Control System for Hydraulic Excavators

AccuGrade® Grade Control System simplifies digging, improves accuracy, increases productivity, minimizes material usage, and lowers operating costs.

Features and Benefits

✔ AccuGrade delivers a wide range of customer benefits designed to increase operator efficiency and productivity, improve accuracy, reduce material costs, reduce surveying and labor costs, and lower overall operating costs. **pg. 4**

AccuGrade® Attachment Ready Option (ARO) Machine

✔ The AccuGrade ARO machine simplifies system installation and reduces machine downtime. The AccuGrade system is designed and integrated into the machine system to optimize performance and reliability. **pg. 5**

AccuGrade® GPS

✔ The GPS System uses Global Positioning System (GPS) satellites to allow for precise digging and slope control. An indicate only display and light bars help guide the operator to achieve high accuracy bucket positioning. **pg. 6**

Excavate with greater accuracy and control using AccuGrade technology solutions for hydraulic excavators. In-cab guidance features allow operators to quickly excavate trenches, slopes and complex designs without traditional survey stakes.

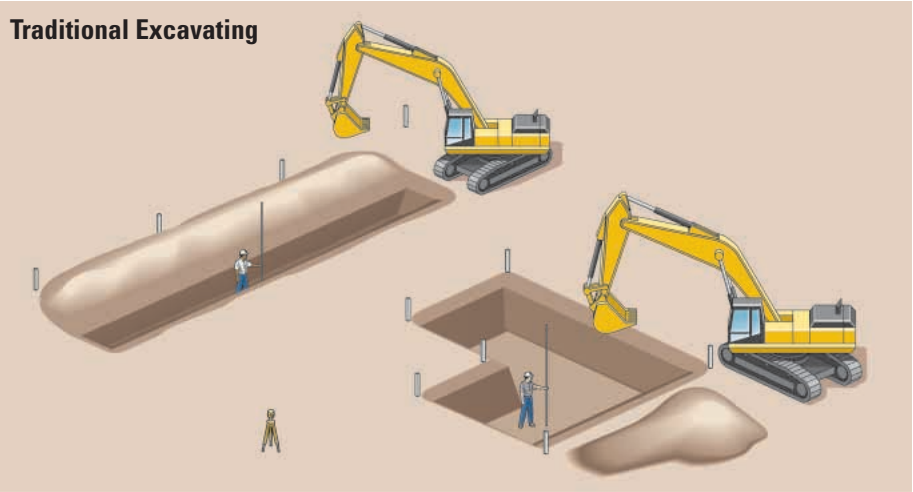
AccuGrade Office Software

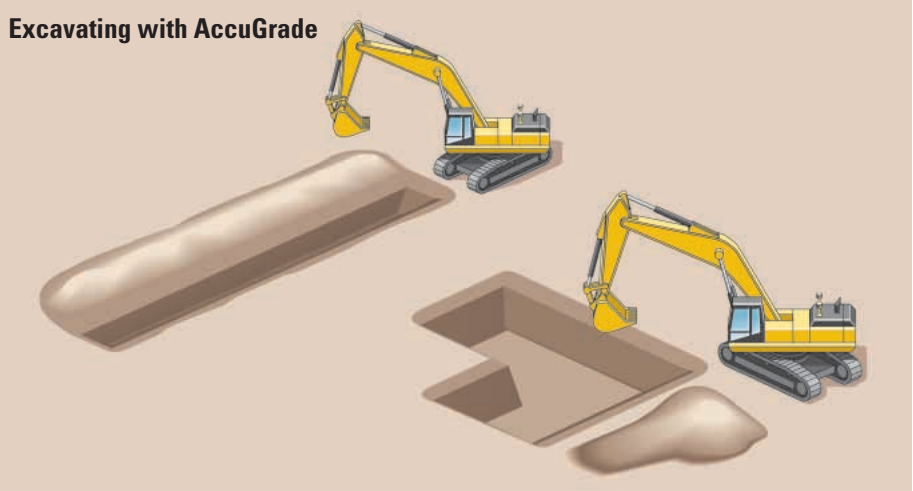
✔ AccuGrade Office software manages and converts engineering and survey data for use in the machine. It is the interface between the machine system, site managers and design engineers. **pg. 8**

✔ *New Feature*

Features and Benefits

The AccuGrade® system is easy to use and delivers a wide range of customer benefits.





Increases Productivity and Efficiency.

- Increases productivity
- Reduces guesswork and costly rework by moving dirt right the first time
- Reduces survey costs up to 90%
- Increases material utilization
- Reduces operating costs
- Extends the work day

Worksite Safety.

- Reduces the need for ground personnel (survey stakers and checkers) on the worksite, in the vicinity of working equipment.

Assists with Labor Shortage.

- Reduces labor requirements and costs
- Customers can get the job done more quickly and efficiently
- Reduces need for staking and checking
- Empowers operator and improves operator confidence by delivering excavation information to the cab

Improves Employee Satisfaction and Retention.

- In-cab display brings elevation control to the cab
- Empowers operator with real-time results
- Real-time feedback on progress increases job satisfaction, eliminates guesswork and reduces operator stress
- Improves operator skills and takes performance to the next level
- Investing in the latest technology leads to a sense of value and trust in the operator

Increases Equipment Versatility.

- Provides consistency and accuracy, turning your production machine into a precision digging machine

Integrated into Cat® Machines.

- Proven, optimized on-board electronic system
- Components designed into machine to maximize reliability
- Integration into cab increases ease of use
- Cat Dealer Network provides unmatched service and support

Customer Support. The AccuGrade suite of products is just one example of the Caterpillar commitment to raising the bar in the industry by making customers' work more productive and profitable. Your Cat® Dealer is ready to assist you with matching machine systems to the application and offering responsive, knowledgeable support.

AccuGrade® Attachment Ready Option (ARO) Machine

The AccuGrade ARO machine integrates the AccuGrade system into the machine system to optimize performance, reliability and productivity.

AccuGrade for Hydraulic Excavators. Caterpillar is helping customers revolutionize the way they move material with new technology solutions for earthmoving machines. Solutions that provide greater accuracy, higher productivity, lower operating costs, and more profitability.

The AccuGrade System is designed and integrated into the machine to create a control system that allows operators to excavate with complete accuracy.

The system uses two GPS receivers mounted on the rear of the machine, one pitch sensor and three angle sensors, mounted on the boom, stick and bucket to calculate precise bucket positioning.

An in-cab display shows the operator real-time 3D bucket positioning relative to the design plan. The system uses information from the sensors to calculate and display precise cut/fill information. Light bars visually guide the operator by indicating adjustments to bucket tip elevation and left/right bucket tip positioning. Immediate feedback eliminates overcutting or undercutting and helps the operator achieve complex designs and precise slope and depth control in fewer cycles.

AccuGrade Attachment Ready Option (ARO) Machine. The factory AccuGrade ARO machine makes system installation and setup quick and easy and optimizes performance and reliability.

- Wiring harnesses and cables are routed during assembly for improved wear protection and better reliability.
- System is designed to withstand vibration for long life in rugged working environments.

Plug and Play Capability. The system uses a Controller Area Network (CAN) designed for plug-and-play capability. This allows components to be quickly and easily added or removed. Simply mount the components, connect, calibrate, and the system is ready to operate.

Applications. The AccuGrade system is designed for a wide range of construction earthwork applications, from bulk earth moving with high production rates to excavating with tight tolerances. The three-dimensional system is ideal for digging trenches, finishing slopes, and complex 3D designs, such as retention ponds, slopes and mass excavation. With the optional tilt-bucket upgrade, operators receive bucket position information when digging to a sloped plane perpendicular to the boom's axis.

AccuGrade® GPS

Global Positioning System satellites provide precise location information for accurate digging control.

Operation. AccuGrade GPS uses advanced Global Positioning System (GPS) technology to deliver precise bucket positioning information to the cab. Using machine-mounted components, an off-board GPS base station and Real Time Kinematic (RTK) positioning, GPS provides the information necessary for the system to accurately determine bucket positioning with high accuracy.

AccuGrade GPS computes the positioning information on the machine, compares the position of the bucket relative to the design plan and delivers that information to the operator via an in-cab display. Information such as: bucket elevation, how much bucket tip is necessary to achieve the appropriate depths, visual indication of the bucket's position on the design surface and a graphical view of the design plan with machine location.

AccuGrade GPS puts the information the operator needs to complete the job in the cab, resulting in a greater level of control. Light bars visually guide the operator to desired depth.

The operator simply uses the light bars to see where to position the bucket for consistent, accurate depths resulting in higher productivity with less fatigue.

Dual GPS System. The dual GPS system provides precise elevation reference and position of the bucket tip.

GPS Receivers – MS990C. The MS990C is the next generation GPS receiver designed as a modular component in the AccuGrade grade control system. Its rugged design includes features to maximize the new modernized GPS signal structure including L2C and L5 tracking capabilities. The MS990C is able to use satellites in both the US satellite constellation and the GLONASS satellite constellation to augment the GPS solution and provide increased availability and up time to the operator. The MS990C includes improved technology that provides faster RTK initialization times, better tracking and accuracy characteristics over a broader range of operating environments.

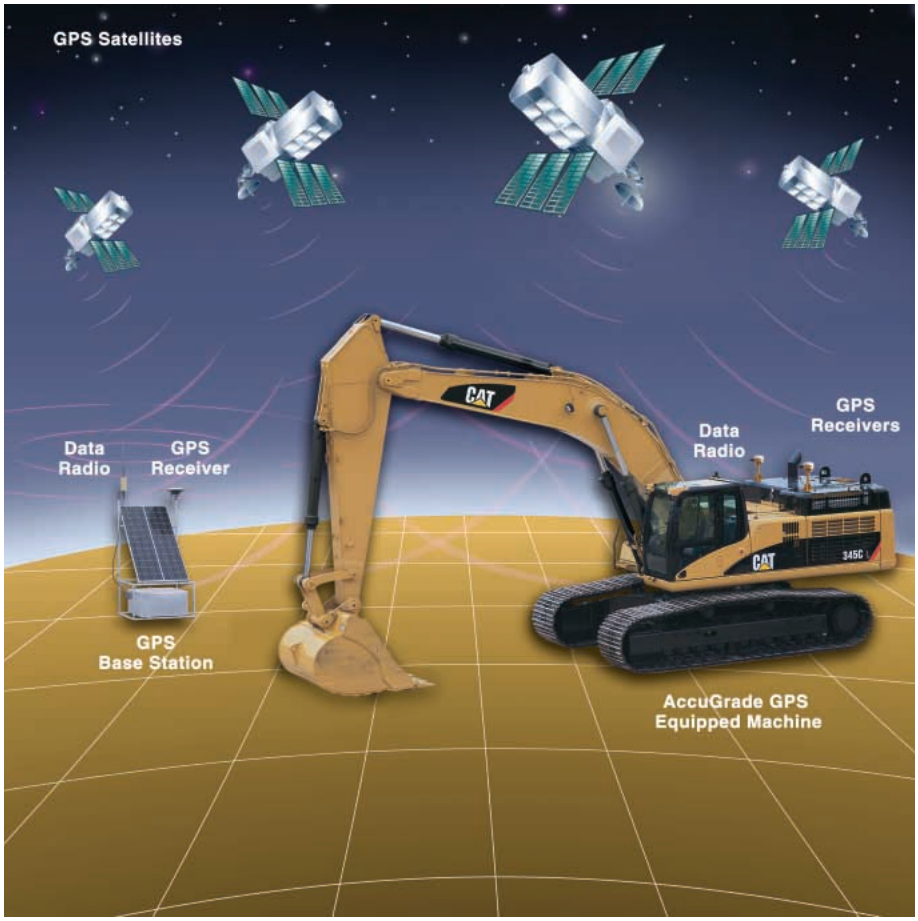
Masts. Rugged steel masts are used for mounting the GPS receivers above the machine for optimum GPS satellite reception.

Radio. The communications radio is mounted on the cab of the machine to ensure maximum signal reception. The radio receives real-time Compact Measurement Record (CMR) data from the GPS base station radio for calculating high-accuracy GPS positions. Radio broadcast frequencies work in all weather conditions. This allows AccuGrade GPS to accurately monitor bucket tip position in fog, dust and at night.

In-Cab 3D Display. The display with keypad allows the operator to interface with the system using push buttons and a color monitor. As the machine operates the operator can view real-time information, such as machine location, bucket position and elevation relative to the design plan. The system uses 3D design files that are stored on a compact flash data card and inserted into a slot next to the keypad. The new display provides improved access to the data card, with a quick-release door and environmentally sealed card slot.

Light Bars. Three light bars are mounted in the machine cab and provide vertical and horizontal guidance to the operator.

- The top vertical light bar provides cut/fill guidance based on elevation of the bucket tip.



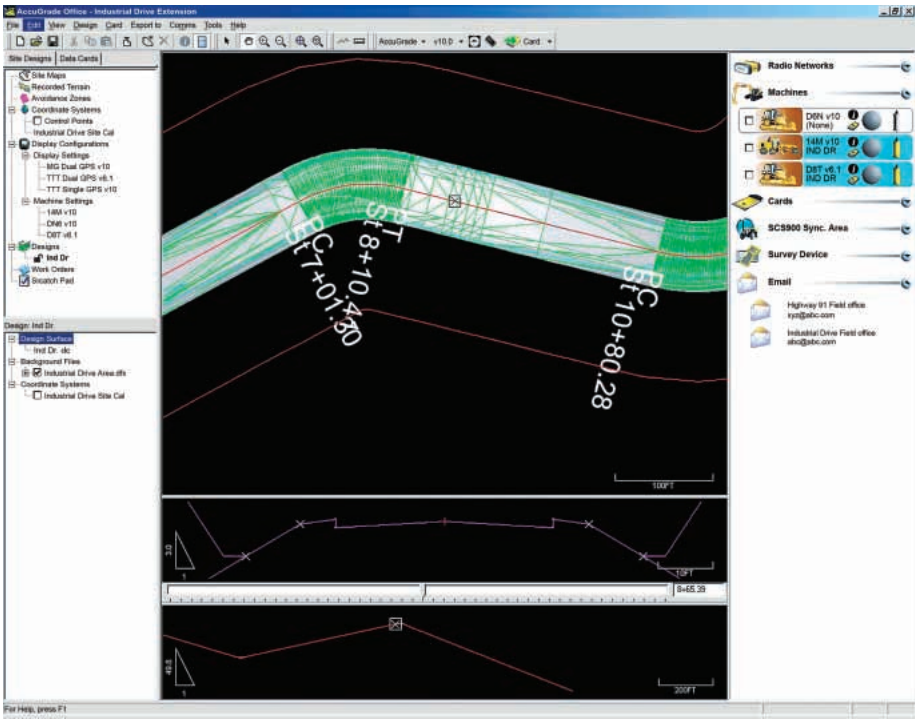
- The horizontal light bar indicates the left or right alignment of the bucket tip relative to the design plan.
- The bottom vertical light bar shows the operator what forward/backward bucket movement is necessary to achieve grade.

GPS Satellites. Positioning information from GPS satellites is received by the GPS base station and the machine mounted GPS receivers. The satellites constantly transmit their positions, identities and times of signal broadcasts.

GPS Base Station. The GPS base station is located within radio range of the work site. It consists of a GPS receiver, GPS antenna and radio. The horizontal position (latitude, longitude) and the vertical position (height) of the base station are fixed to known reference points. The base station receives information from the GPS satellites. This information, along with the base station's known position is sent to the machine via the communication radio and is used by the machine's GPS receivers to calculate high accuracy positioning.

AccuGrade Office Software

AccuGrade Office software manages and converts engineering survey data for use in the machine as well as imports data from the machine.



AccuGrade® Office Software. AccuGrade Office is a state of the art software that allows the user to import 3D design data, convert data for use on machines equipped with AccuGrade GPS, validate the data and then export data to AccuGrade machines using a compact flash card.

Data Import. Importing data into AccuGrade Office software is the first step in preparing data for use with the on-board machine control and guidance systems. Imported files provide data for the designs, site maps, avoidance zones, display configurations, background data and coordinate systems exported to a grade control system. A number of surface, road, linework and field data/file formats can be imported into AccuGrade Office software.

Create Designs. Although the majority of design data is imported into AccuGrade Office software, the software also provides the capability to create new designs.

Organize Data. Once data has been imported into AccuGrade Office software, it is organized into the following categories:

- Design surfaces
- Background site maps
- Avoidance zones
- Display and machine configuration files
- Coordinate system
- Data Cards

Data Validation. Validating the data is critical for machine control and guidance systems.

Data Export. Once data has been imported, organized, and validated in AccuGrade Office software, the final step is to export the data for use with on-board machine control and guidance systems. Exporting can be done directly to a hard drive or to a compact flash card, e-mailed to selected e-mail addresses, or wirelessly to a machine.

AccuGrade Office Wireless Option. AccuGrade Office Wireless Option for 900 MHz communications radios permits AccuGrade Office software to communicate wirelessly with excavators equipped with the AccuGrade GPS system. AccuGrade Office software supports the following wireless communication features for AccuGrade GPS equipped excavators:

- Export designs from AccuGrade Office software to excavators with wireless communication enabled
- Display machine location in the AccuGrade Office plan view window
- Delete, rename and retrieve files on-board excavators
- Send text message to the machine display
- Retrieve screen snapshot from the display
- Retrieve diagnostic report from machine display

Wireless capability between machines and AccuGrade Office software is enabled through an optional add-on component to the AccuGrade Office software. The component is distributed on a separate CD, installed as an add-on to the base AccuGrade Office software and requires its own licensing and registration. An add-on wireless option key is needed to enable wireless communication on the machine.

AccuGrade® Systems

for Hydraulic Excavators	AccuGrade GPS
Emissions and susceptibility	CE compliant

Machine Compatibility

Machine Model	320D, 324D, 325D, 330D, 345C, 365C, 385C

3D Display – CD700

Display screen	177.8 mm (7 in) QVGA, 480 X 234 pixel, LCD	
Electrical input	9 to 32V DC	
Network connector	39-pin	
Memory drive	Compact flash	
Operating temperature	–20° C to 80° C –4° F to 176° F	
Storage temperature	–40° C to 85° C –40° F to 185° F	
Sealing	IP68, sealed to 34.48 kPa (5 psi)	
Width	230 mm	9.06 in
Height	170 mm	6.69 in
Depth	101 mm	3.98 in
Weight	3 kg	6.61 lb
Language capabilities	Chinese, Danish, Dutch, English (UK & US), Finnish, French, German, Italian, Norwegian, Portuguese, Spanish, Swedish	

GPS Receiver – MS990C

Horizontal accuracy	10 mm	0.39 in
Vertical accuracy	20 mm	0.79 in
Operating range	Up to 10 km (6.2 miles)	
Network connector	16-pin	
Electrical input	9 to 32V DC	
Operating temperature	–40° C to 70° C –40° F to 158° F	
Storage temperature	–50° C to 85° C –67° F to 185° F	
Height	147 mm	5.8 in
Width	232 mm	9.1 in
Depth	251 mm	9.9 in
Weight	3.8 kg	8.3 lb

Communications Radio

Operating range	Up to 10 km (6.2 miles)	
Technology	Spread spectrum	
Data rate	High speed	
Operating temperature	–40° C to 70° C –40° F to 158° F	
Storage temperature	–55° C to 70° C –67° F to 158° F	
Humidity	100%	
Height	216 mm	8.5 in
Width	86 mm	3.4 in
Length	260 mm	10.3 in
Weight	0.9 kg	2 lb

Power Control Module

Electrical input	9 to 32V DC	
Load dump protection	ISO 7637 compliant	
Over-current protection	15 amps	
Output	3 circuits, 15-amp	
Operating temperature	–40° C to 71° C –40° F to 160° F	
Storage temperature	–55° C to 85° C –67° F to 185° F	
Humidity	100%	
Sealing	IP68 sealed to 34.48 kPa (5 psi)	
Input connector	8-pin	
Output connector	8-socket	
Height	64 mm	2.5 in
Width	89 mm	3.5 in
Length	213 mm	8.4 in
Weight	1 kg	2.2 lb

Light Bars

Input connector	4-pin	
Operating temperature	–40° C to 85° C –40° F to 185° F	
Storage temperature	–40° C to 100° C –40° F to 212° F	
Sealing	IP68, sealed to 34.48 kPa (5 psi)	
Height	174 mm	7 in
Width	53 mm	2 in
Depth	32 mm	1.2 in
Weight	0.22 kg	5 lb

Angle Sensor

Electrical input	9 to 32V DC	
Operating temperature	–40° C to 85° C –40° F to 185° F	
Storage temperature	–40° C to 100° C –40° F to 212° F	
Network connector	10-pin	
Height	95 mm	3.7 in
Width	95 mm	3.7 in
Depth	70 mm	2.8 in
Weight	0.8 kg	1.8 lb

Pitch Sensor

Working range	±160°	
Network connector	6-pin, bulkhead	
Electrical input	9 to 32V DC	
Reverse voltage protection	to 36V DC	
Load dump protected	ISO 7637 compliant	
Humidity	100%	
Sealing	IP68 sealed to 34.48 kPa (5 psi)	
Operating temperature	–40° C to 85° C –40° F to 185° F	
Storage temperature	–40° C to 100° C –40° F to 212° F	
Length	120 mm	4.7 in
Width	135 mm	5.3 in
Depth	49 mm	1.9 in
Weight	1 kg	2.2 lb

AccuGrade® Systems

ARO Machine

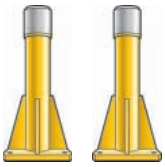
AccuGrade Attachment Ready Option (ARO) Machine

Dual GPS System

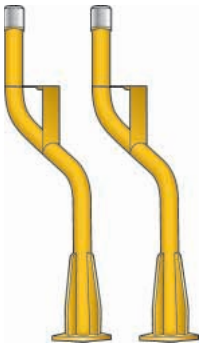
3D Display – CD700

Communications Radio

GPS Receivers



Masts (345C-385C only)



Masts (320D-330D only)

Light Bars

Pitch Sensor

Angle Sensors

Power Module

Tilt Bucket Angle Sensor (Optional)

AccuGrade® System Kits

Standard equipment may vary. Consult your Caterpillar® dealer for details.

AccuGrade Attachment Ready Option (ARO) Machine
- Weldments
- Wiring Harness

3D Kit:
- AccuGrade Dual GPS Kit
  - CD700 Display, Carrying Case
  - GPS Receiver (2), Carrying Case
  - Communications Radio
  - Power Control Module
  - Light Bars (3)
  - Angle Sensor (3)
  - Pitch Sensor
  - Rigid Mast (2)
  - Cable (2)
  - Bracket
  - Wiring Harness
  - Tilt Bucket Angle Sensor (Optional)

AccuGrade® Grade Control System for Hydraulic Excavators

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

Materials and specifications are subject to change without notice.
Featured machines in photos may include additional equipment.
See your Caterpillar dealer for available options.

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