

AccuGrade®

Grade Control
System for
Track-Type Tractors

CAT®



AccuGrade® Systems

for Track-Type
Tractors

AccuGrade Laser,
AccuGrade GPS

Machine Compatibility

Machine Model

D3G, D4G, D5G, D5N, D6K,
D6N, D6R II, D6R III,
D7R II, D8T, D9T

AccuGrade® Grade Control System for Track-Type Tractors

AccuGrade® Grade Control Systems simplify grading, improve accuracy, increase productivity, minimize material use and lower operating costs.

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 systems and controls to optimize performance and reliability. **pg. 4**

AccuGrade® Laser

The Laser System leverages laser technology to create an accurate grade elevation reference over the work area. The system features automated blade adjustments for elevation control with tight tolerances and built-in elevation/grade display indicators for manual control. **pg. 6**

AccuGrade® GPS

The GPS System uses Global Positioning System satellites to determine precise blade positioning. The system features fully automated blade adjustments for automatic elevation control, and vertical and horizontal guidance light bars for manual control. **pg. 8**

Fine grade and doze the plan with greater accuracy and control using AccuGrade technology solutions for track-type tractors. System flexibility allows the systems to be easily interchanged to meet a wide range of application and site-specific grade requirements.

- *AccuGrade Laser – 2D elevation control*
- *AccuGrade GPS – 3D elevation control*



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. 10**



AccuGrade® Attachment Ready Option (ARO) Machine

Integrates the AccuGrade system into the machine systems and controls to optimize performance and reliability.



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

- Hydraulic control systems are integrated into the machine hydraulics for maximum performance and dependability.
- AccuGrade controls are integrated into the machine controls and levers for reliable operation and precise control.
- 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.
- Safety interlock feature is built in for added protection during automated operation.

AccuGrade for Track-Type Tractors.

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 and hydraulic systems to create an automated blade control system that allows operators to grade with increased accuracy.

The system uses machine-mounted sensors to calculate precise blade slope and elevation information.

The integrated electrohydraulic valve control module uses the information received from the sensors to automatically adjust the blade to maintain grade.

Automated blade control allows operators to improve efficiency and productivity by achieving grade faster and in fewer passes than ever before, reducing the need for traditional survey stakes or grade checkers.

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. Common connectors provide a flexible system, fully upgradeable from two to three dimensional control, on one or both sides of the blade. Moving the add-on systems from one machine to another is easy. 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 finish grading with tight tolerances. Field-proven and versatile, the two-dimensional grade control systems are ideal for fine grading of sites with flat surfaces, single slopes



and dual slopes, such as building pads and parking lots. The three-dimensional systems are ideal for complex 3D designs, such as golf courses and roads with superelevations.

AccuGrade System Technologies.

- AccuGrade Laser – single or dual 2D elevation control
- AccuGrade GPS – single or dual 3D elevation control

AccuGrade[®] Laser

A laser transmitter creates a grade elevation reference plane over the work area to maintain precise grade control.



Operation. AccuGrade Laser is designed for precise grade control using a laser transmitter and receiver.

A laser transmitter is set up on the work site and creates a constant grade reference over the work area. A digital laser receiver is mounted on the machine and captures the laser signal as the machine moves across the work site.

The system captures information and calculates the blade adjustments necessary to achieve grade. The system makes automatic elevation adjustments typically performed by the operator and provides automatic blade control. The operator simply steers the machine. The system also calculates cut/fill requirements for manual blade control.

Single Laser System. The single laser system provides automated blade adjustments to the center of the blade for automatic elevation control.

Dual Laser System. When two laser receivers are used, the system provides automatic elevation and slope control to both sides of the blade.

Laser Transmitter. A laser transmitter is mounted on a tripod so the laser beam can rotate unobstructed above the machine. The laser transmits a plane of light above the work area, which allows several machines to work effectively in any direction using one laser transmitter.

Laser Receiver. An all-new digital laser receiver is mounted on an electric mast above the cutting edge and is used to detect the laser beam. The receiver picks up the position relative to finish grade and measures height deviation from the on-grade location to the laser beam strike. The receiver sends blade position information back to the system to calculate necessary adjustments.

A full 360 degrees of laser detection range allows the receiver to pick up the laser signal from any direction on the work site while the machine is working.

Electric Mast. An electronically adjustable, telescopic mast is used for mounting the laser receiver above the blade's cutting edge. The mast is powered by an electric motor, which allows the operator to raise and lower the mast from inside the cab to precisely position the receiver above the cab for unobstructed laser reception.



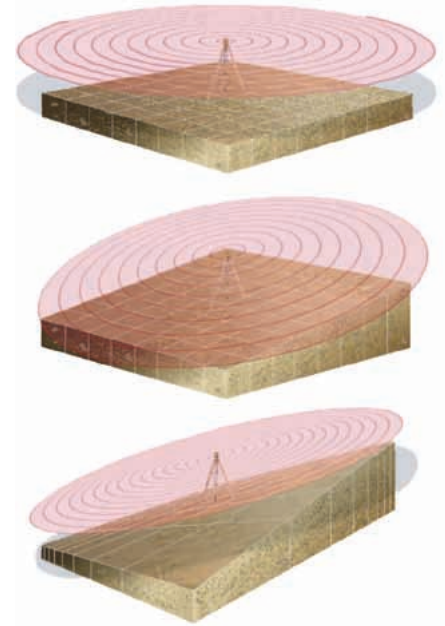
Controls. System controls are integrated into the machine controls and levers for easy access and control. Push button operation allows the operator to easily switch from manual mode to automatic mode.



Automatic/Manual Mode Button. Allows the operator to toggle between automatic and manual mode.

- In automatic mode, the system automatically controls blade elevation adjustments.
- In manual mode, the operator manually controls the blade while using cut/fill information on the in-cab display and grade indicators to guide blade movements.

Remote Offset Switch. Allows the operator to set elevation offsets at a preset distance from the design plan to optimize cutting depth in various soil conditions or accommodate sub base fill requirements.



Applications.

- Flat Planes
- Single Slopes
- Dual Slopes
- Building Pads
- Parking Lots
- Sports Fields
- Indoor Applications



In-Cab 2D Display. The CB420 or all-new CD610 in-cab displays with easy-to-read grade indicators and elevation display delivers all system information to the cab for easy viewing by the operator. Simple controls offer easy setup, operation and access to system menus, allowing the operator to focus on productivity. Grade indicators provide vertical guidance to the operator and indicate which direction to move the blade to achieve grade. The monitor numerically displays cut/fill requirements for manual control. Refer to technical specification pages for compatibility chart.

AccuGrade® GPS

Global Positioning System satellites provide precise location information for elevation control with centimeter-level accuracy.



Operation. AccuGrade GPS uses advanced Global Positioning System (GPS) technology to deliver precise blade 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 blade positioning with centimeter-level accuracy.

AccuGrade GPS computes the positioning information on the machine, compares the position of the blade relative to the design plan and delivers that information to the operator via an in-cab display. Information, such as blade elevation, necessary cut/fill to achieve grade, visual indication of the blade's position on the design surface and a graphical view of the design plan with machine location.

AccuGrade GPS puts all the information the operator needs to complete the job in the cab, resulting in a greater level of control. Vertical and horizontal guidance tools visually guide the operator to the desired grade.

Automated features allow the hydraulic system to automatically control blade adjustments to move the blade to grade. The operator simply uses the light bars to guide the machine for consistent, accurate grades and slopes, resulting in higher productivity with less fatigue.

Single GPS System with Blade Slope.

The single GPS system with blade slope provides 3D grade control across the full width of the blade. The system uses a 3D position from the GPS receiver in combination with information from the blade angle sensor to automatically control blade elevation and blade slope.

Dual GPS System. The dual GPS system provides 3D grade control across the full width of the blade. Dual GPS receivers allow the system to automatically control blade elevation.



GPS Receivers – MS980C. The receivers are mounted on masts above the cutting edge. GPS satellite signals are received by the GPS receivers to generate a 3D position. This information, in conjunction with machine dimension information, is used to determine the precise horizontal and vertical position of the blade in real-time.

GPS Receivers – MS990C. The all-new 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 also able to use satellites in 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.

Mast. A rugged steel mast is used for mounting the GPS receiver above the blade's cutting edge for optimum GPS satellite reception.

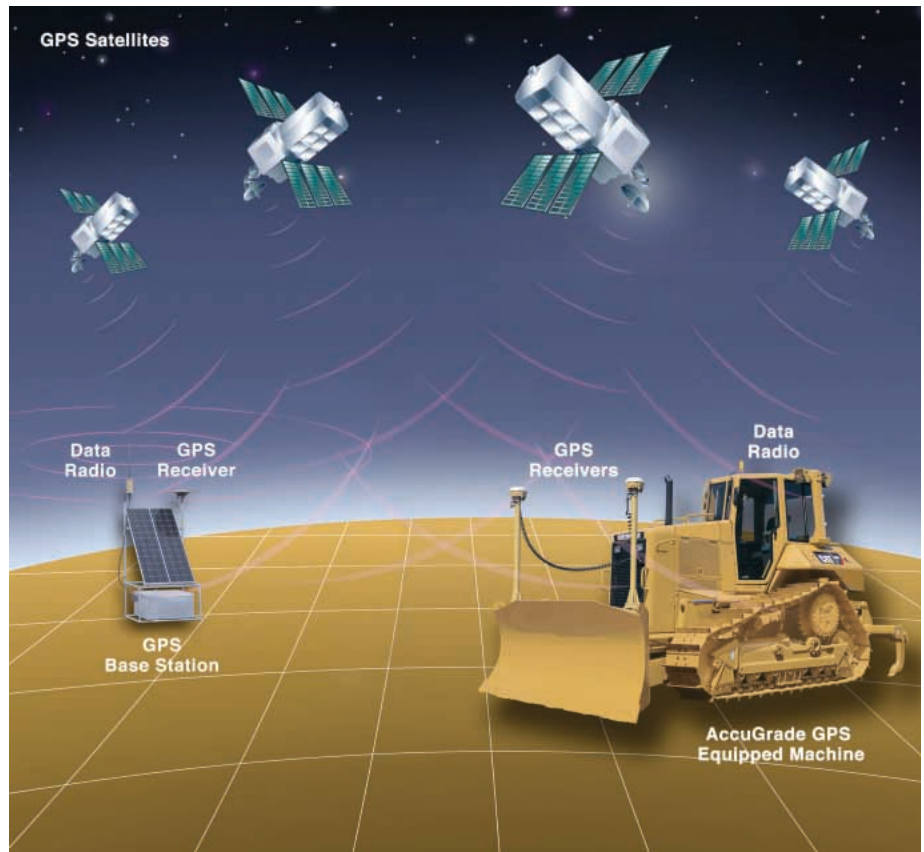
Radio. The communications radio is mounted on the cab of the machine to ensure maximum signal reception. The radio receives real-time Compact Measurement Record (CMR) data from the GPS base station radio for calculating high accuracy GPS positions. Radio broadcast frequencies work in all weather conditions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



In-Cab 3D Display. An all-new display has a 27 percent larger screen, with a processor that is five times faster and improved display buttons. 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, blade 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.

- Two vertical guidance light bars visually indicate where the blade tips are relative to grade.
- The horizontal guidance light bar indicates blade location relative to the selected horizontal alignment.



Controls. System controls are integrated into the machine controls and levers for easy access and control. Push button operation allows the operator to easily switch from manual mode to automatic mode.

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 and 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

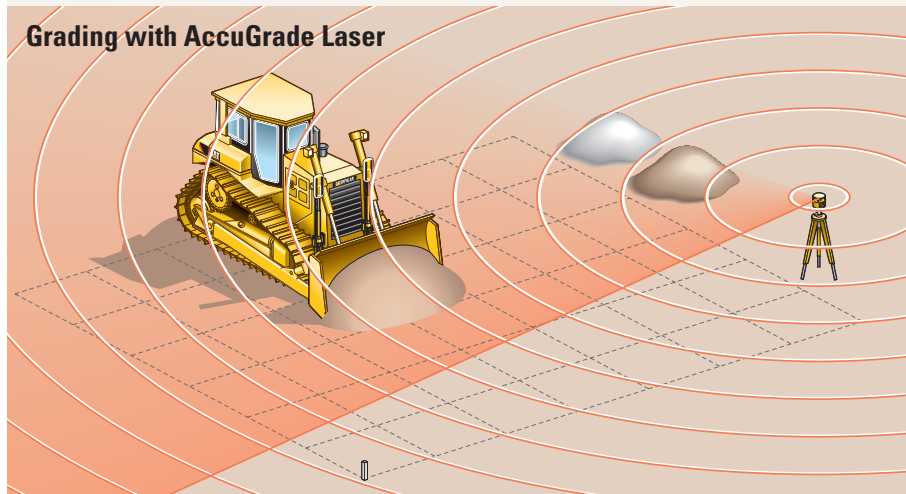
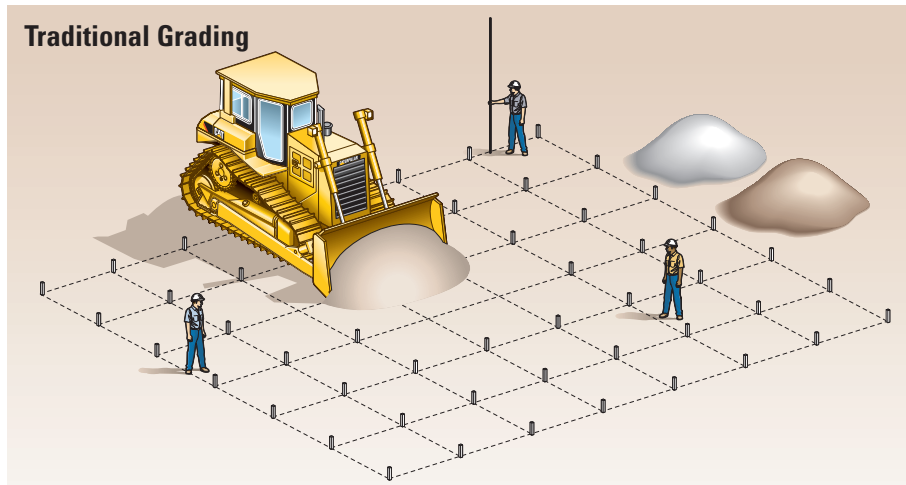
station's known position, is sent to the machine via the communications radio and is used by the machine's GPS receivers to calculate centimeter-level accuracy positioning.

3D Design Software. Flat and sloping planar surface design files can be created on-board the machine. More complex designs require 3D design software.

Office Software. The office software manages and converts engineering survey data for use in machine format. It is the interface between the machine system, site managers and design engineers. Design data is exported from the office software onto a data card for use by the AccuGrade system. AccuGrade Office software is the recommended software for managing and converting design files.

Features and Benefits

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



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 by the operator

Increases Equipment Versatility.

- Plug-and-play connections allow fast, easy conversion from laser to GPS grade control system
- Provides consistency and accuracy, turning your production machine into a fine grading machine

Integrated into Cat® Machines.

- Proven, optimized on-board electronics and hydraulics systems
- Components designed into machine to maximize reliability
- Integration into cab and control levers increases ease of use
- Safety interlock (park brake, system health, idle time)
- Cat® Dealer Network provides unmatched service and support

Customer Support. For more than 25 years, Caterpillar has been providing electronic and electrical components and systems for the earthmoving industry – real-world technology solutions that enhance the value of Cat products, making customers more productive and profitable. Your Cat dealer is ready to assist you with matching machine and grade control systems to the application and obtaining responsible, knowledgeable support.

Increases Productivity and Efficiency.

- Increases productivity by up to 50%
- Reduces guesswork and costly rework by moving dirt right the first time
- Reduces survey costs up to 90%
- Improves material utilization
- Reduces operating costs
- Extends the work day

Assists with Labor Shortage.

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

Worksite Safety.

- Removes grade stakers and checkers from the worksite and keeps them away from the heavy equipment
- Designs include avoidance zones with audible warnings

AccuGrade Systems

for Track-Type Tractors	AccuGrade Laser, AccuGrade GPS
Emissions and susceptibility	CE compliant

Machine Compatibility

Machine Model	D3G, D4G, D5G, D5N, D6K, D6N, D6R II, D6R III, D7R II, D8T, D9T
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2D Display – CB420

Display screen	128 × 64 pixel, LCD
On-grade indicator	Green
Above/below grade indicator	Amber
Operating temperature	–29° C to 60° C –20° F to 140° F
Storage temperature	–40° C to 80° C –40° F to 176° F
Humidity	100%
Sealing	IP54 sealed
Electrical input	9 to 32V DC
Input connector	6-pin
Network connector	6-pin
Remote connector switch	6-socket
Data connector	9-socket
Length	295 mm 7.7 in
Width	130 mm 5.1 in
Depth	102 mm 4 in
Weight	1.4 kg 3 lb
Language capabilities	Chinese, Dutch, English (UK & US), Finnish, French, German, Italian, Norwegian, Portuguese, Spanish, Swedish

2D Display – CD610

Display screen	320 × 240 pixel, LCD
On-grade indicator	Green
Above/below grade indicator	Amber
Operating temperature	–40° C to 85° C –40° F to 185° F
Storage temperature	–40° C to 85° C –40° F to 185° F
Humidity	100%
Sealing	IP68 sealed to 34.48 kPa (5 psi)
Electrical input	9 to 32V DC
Network connector	70-pin
Length	221 mm 8.7 in
Width	140 mm 5.51 in
Depth	71 mm 2.8 in
Weight	1.59 kg 3.51 lb
Language capabilities	Chinese, Danish, Dutch, English (UK & US), Finnish, French, German, Italian, Norwegian, Portuguese, Spanish, Swedish

Laser Receiver

Detection angle	360°
Detection range	231 mm 9.1 in
Detection accuracy	1.5 mm 0.06 in
Transmitter speed	270 to 1,320 rpm
Grade display	LED grade indicators
Operating temperature	–40° C to 71° C –40° F to 160° F
Storage temperature	–55° C to 85° C –67° F to 185° F
Sealing	IP68 sealed to 34.48 kPa (5 psi)
Electrical input	9 to 32V DC
Network connector	6-pin
Height	292 mm 11.5 in
Width	168 mm 6.6 in
Depth	213 mm 8.4 in
Weight	2.8 kg 6.3 lb

Electric Mast

Position repeatability	±1 mm ±0.04 in
Typical speed	30 mm/sec (1.2 in/sec)
Operation	12 and 24 V
Operating temperature	-29° C to 60° C -20° F to 140° F
Storage temperature	-40° C to 80° C -40° F to 176° F
Humidity	100%
Sealing	IP54 sealed
Electrical input	9 to 32V DC
Network connector	10-pin
Input connector	6-pin
Height retracted	1640 mm 5 ft 5 in
Height extended	2900 mm 9 ft 7 in
Base diameter	240 mm 9.4 in
Weight	25 kg 55 lb

Angle Sensor

Working range	45°
Electrical input	9 to 32V DC
Network connector	6-pin
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
Height	68 mm 2.7 in
Width	93 mm 3.7 in
Length (with connector)	104 mm 4.1 in
Weight	0.8 kg 1.8 lb

3D Display – CD700

Display screen	177.8 mm (7 in) QVGA, 480 × 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 – MS980C

Horizontal accuracy	20 mm 0.78 in
Vertical accuracy	30 mm 1.2 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 160° 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

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

Light Bars

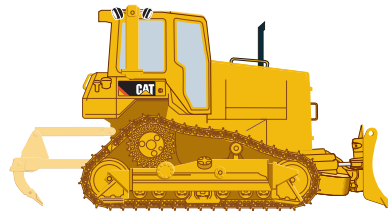
Input connector	4-pin	
Operating temperature	–40° C to 85° C –40° F to 185° F	
Storage temperature	–40° C to 100° C –40° F to 212° F	
Sealing	IP68, sealed to 34.48 kPa (5 psi)	
Height	174 mm	6.9 in
Width	53 mm	2.1 in
Depth	32 mm	1.2 in
Weight	0.22 kg	0.5 lb

Communications Radio

Operating range	Up to 10 km (6.2 miles)	
Technology	Spread spectrum	
Data rate	High speed	
Input Connector	8-pin	
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

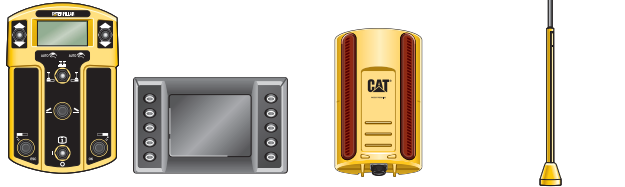
AccuGrade® Systems

ARO Machine



AccuGrade Attachment Ready Option (ARO) Machine

Single Laser System

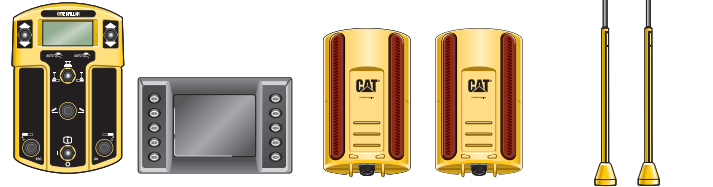


2D Display –
CB420 or CD610
See compatibility table.

Laser Receiver

Electric Mast

Dual Laser System

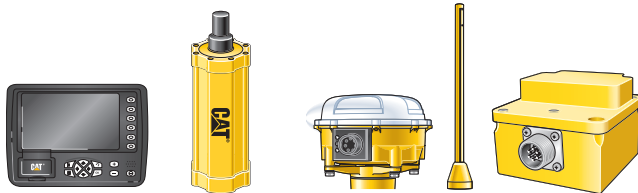


2D Display –
CB420 or CD610
See compatibility table.

Laser Receivers

Electric Masts

Single GPS System with Blade Slope



3D Display –
CD700

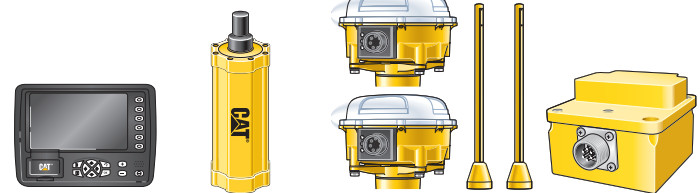
Communications
Radio

GPS
Receiver –
MS980C or
MS990C

Mast

Angle
Sensor

Dual GPS System



3D Display –
CD700

Communications
Radio

GPS
Receivers –
MS980C or
MS990C

Masts

Angle
Sensor
(Optional)

Compatibility Chart

Technology and Display Configurations

Model	Single Laser	Dual Laser	Single GPS with blade slope	Dual GPS
D3G, D4G, D5G	CB420	CB420	CD700	CD700
D5N	CD610	CD610	CD700	CD700
D6K	CD610	CD610	CD700	CD700
D6N	CD610	CD610	CD700	CD700
D6R II, D6R III	CD610	CD610	CD700	CD700
D7R II	CD610	CD610	CD700	CD700
D8T, D9T	—	—	—	CD700

CB420



CD610



CD700



AccuGrade® System Kits

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

AccuGrade® Attachment Ready Option (ARO) Machine

- Weldments
- Wiring Harness
- Hydraulic Valves
- Plumbing
- Electronic Control Module
- Remote Switches

2D Kits:

AccuGrade Laser Kits

Single Laser

- CB420 or CD610 Display
- Laser Receiver, Carrying Case
- Electric Mast
- Shock Mount
- Coiled Cable (2)

Dual Laser

- CB420 or CD610 Display
- Laser Receiver (2), Carrying Case
- Electric Mast (2)
- Shock Mount (2)
- Coiled Cable (4)

3D Kits:

AccuGrade GPS Kit

- Communications Radio

- Single GPS with Blade Slope

 - CD700 Display, Carrying Case

 - GPS Receiver, Carrying Case

 - Rigid Mast

 - Light Bars (3)

 - Coiled Cable (2)

 - Angle Sensor

Dual GPS

- CD700 Display, Carrying Case

- GPS Receiver (2), Carrying Case

- Rigid Mast (2)

- Light Bars (3)

- Coiled Cable (2)

- Angle Sensor and Coiled Cable (Optional)

AccuGrade® Grade Control System for Track-Type Tractors

For more complete information on Cat products, dealer services,
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