

Cat[®] Command for Dozing



Command for Dozing Features

- Operation using an over-the-shoulder console or comfortable ergonomic operator station.
- Enables continued, safe operation when conditions become unsafe for operators to be on the machine.
- Removes operator from machine, reducing exposure to dust, noise and vibration.
- Direct integration with machine electronics provides quick response, access to all operational features, and notifications of critical machine health parameters.
- Fingertip controls and functional icons common with the machine provide a familiar environment to reduce operator onboarding.
- Optional avoidance zone feature (Cat Terrain required) provides visual and audible warning if the operator approaches identified area.



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Cat® MineStar™ is the industry's broadest suite of integrated mine operations and mobile equipment management technologies configurable to suit your operation's needs.

Command enables you to implement remote control, semi-autonomous or fully autonomous mining equipment systems — offering unprecedented improvements in operator safety, equipment availability and site productivity.

Command for dozing enables remote control of Cat D8T (serial prefix FMC only), D10T, D11T and D11T CD large track-type tractors. Protecting the most valuable asset on a site, the operator, Command for dozing reduces the risk of injury by allowing safe operation of the machine in potentially hazardous environments.



Command for Dozing

Remote control technology to keep your operators safe

Keeping operators safe and out of harm's way is a top priority for you and Caterpillar. Avoiding potentially hazardous areas of a mine such as highwalls, stockpiles, falling debris and steep slopes helps you achieve this goal. Command for dozing removes operators from these hazardous environments to a safer location with less risk and often greater comfort.

Command for dozing utilizes wireless technology and on-board electronic systems to allow the machine to be controlled without an operator in the cab. This is ideal for mining and industrial applications including stockpile feeding and highwall operations. Command for dozing gives operators the ability to effectively operate the machine from outside the cab while maintaining visibility to critical machine health information.

The machine is controlled one of two ways:

- Operator console: lightweight, over-the-shoulder unit with similar machine functions as the cab
- Operator Station: seat, joysticks and display that mimic the machine cab layout and feel while providing enhanced comfort

Both units enable effective, line-of-sight and non-line-of-sight control* and are ergonomically designed to minimize operator fatigue while controlling the machine at a safe distance from potentially hazardous working conditions.

Caterpillar's electronics integration enables the activation of several enhanced features to ensure that the operator remains in control of the machine at all times. For example, a machine

shutdown will be activated when a loss of communication between the console and machine is detected, or if the operator console is tipped too far, which may indicate that the operator has fallen. Breaching an avoidance zone will result in the stopping of machine movement. Any stopping of the machine results in the application of the parking brake and the implementation of a lockout.

** Optional camera system required*

Applications:

- Vehicle recovery
- Stockpile management
- Aggressive ripping
- Clearing unstable benches
- Cleaning under highwalls
- Hazardous environment
- Poor air quality
- Inclement weather
- Repetitive applications
- Remote locations
- Operator fatigue
- Pushing to a shovel
- Push to edge

Features and Benefits

Enhancing operator safety and comfort

Command for dozing provides a number of safety benefits for the operator as well as your mining operation. Familiar control icons enable operators to switch between standard in-cab machine operation and remote control with little training or orientation. Integration of this technology system into the machine electronics enables reduced latency and quick response to commands from the remote operator, keeping your operators productive and efficient.

Enhanced Operator Safety

- Reduces operator safety risks in the event of a high wall collapse, machine roll-over or fall.
- Enables continued use of machine without putting operators at risk
- Decreases potential for injury from slips, trips and falls when climbing on and off machine.
- Removes operator exposure to full body vibration

Machine Protection

Multiple, redundant features built-in to stop all motion of machine should one of these events occur:

- One of three stop switches is pressed.
- Loss of wireless communications.
- Detection of a severe fault where continued operation will result in damage to the machine.
- Operator console is tilted too far from normal operating position
- Operator presence detection on the operator station.
- Machine enters an avoidance zone.

Efficient Operations

- Command for dozing is the only remote control solution that integrates directly with Cat machine electronic control systems. This integration saves installation time and speeds machine response time compared to aftermarket systems.
- Simple installation procedures provide step by step instructions to quickly and efficiently implement the system with minimal machine downtime. By utilizing the machine's existing hydraulic valves and electronic harnessing, reliability is greatly increased over non-integrated systems.

- Quick system response enabled through comprehensive machine integration of the electronic and hydraulic systems. Commands from the operator console and station are sent directly to the engine and implement electronics via a remote control module and a dedicated radio, reducing delays.
- Complete control with access to advanced features offered on Cat machines such as Autocarry™, Automatic Ripper Control and Auto Blade Assist. Terrain with Blade Control can be achieved with a VNC connection with the on-board display.
- Operators can easily be trained side-by-side leaving time for more productive work.



Improved Productivity

- Reduces downtime associated with shift changes by eliminating travel to machines.
- Allows production to continue immediately following blasting operations
- Increases likelihood of working steeper slopes to improve efficiencies
- Lessens idle time due to reduced operator fatigue

On-Board Components

Rugged components for harsh mining environments

Command for dozing includes rugged on-board components that are sealed to keep out dust and moisture.

Indicator Lights

The high-intensity blue LED lights indicate when the machine is in remote operation. Green lights indicate the machine is being controlled manually. Yellow lights indicate the machine is approaching an avoidance zone. Red lights can indicate an avoidance stop, emergency stop, A-Stop or shutdown.

Wireless Transceiver

A rugged wireless transceiver is used to communicate between the operator console and the remote control electronics that are located on the machine. The transceiver is located on a bracket near one of the ROPS lights.

Ground Level Service Center

The ground level service center contains a remote/manual switch and an engine shutdown switch, as well as optional ladder and delayed lighting switches. As Cat dozers can come equipped with a drawbar, ripper carriage or counterweight attachment, mounting kits are available to accommodate these different configurations.



Operator Console

Comfortable, rugged, functional



The operator console allows for line-of-sight control from a distance of up to 400 meters with the option of a 900 MHz version or a 2.4 GHz version. The 2.4 GHz console and on-board transceiver utilize frequency hopping spread spectrum technology to virtually eliminate interference from other wireless devices using the 2.4 GHz frequency bands. Proprietary algorithms secure the communications between the on-board wireless receiver and the console, preventing communications from unauthorized devices.

The operator console has been ergonomically designed to enable an operator to work an entire shift comfortably. The console only weighs 3.6 kg (8.0 lb) with battery and is suspended on the operator by adjustable nylon straps or “J-Hook” style over-the-shoulder support. Controls have been laid out to allow the use of heavy gloves. At the end of the day, cleanup is easy, as the console is sealed to enable cleaning with low pressure water spray.

Full functionality of the dozer is available through the operator console. Basic machine functions such as start-up/shutdown, blade control, gear selection, steering and ripper control — among others — are easily accessed through the ergonomic layout of the console controls all of which are protected from impact by the aluminum roll bar. Advanced options such as Auto Blade Assist, AutoRip and Autocarry (if machine-equipped) are also accessible from the console.

Critical machine and system status information is also delivered to the operator through the intuitive layout of the console. LED indicator lights and display show the operator the gear selection, temperatures, operational mode, faults, system status and low battery warning.



Operator Station



With a comfortable seat and familiar controls, the operator station enables ergonomic control within line of sight of the machine. It builds on the features and functionality of the operator console with an added level of comfort for working longer durations.

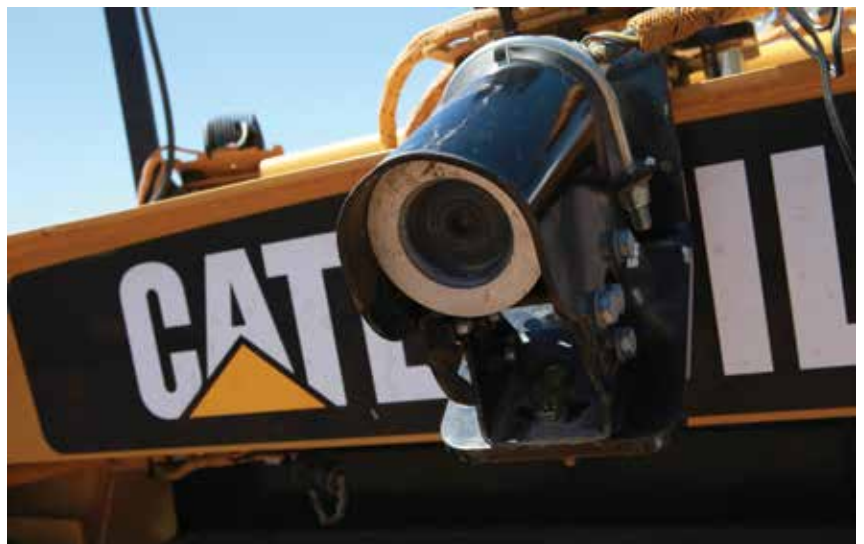
The station can be utilized within any type of enclosure, permanent or fixed, within viewing distance of the machine. One operator station can be assigned to multiple Command-equipped machines and can control an individual machine by performing a simple switch function on the station display. This saves costs by allowing one station to be purchased and utilized for multiple machines or moved to different working locations as the needs of the mine change.

Familiar controls reduce training time and change management associated with introducing a new technology system. Side-by-side training allows multiple operators to learn simultaneously, saving time and enriching the overall training experience.

Note: Please contact a Caterpillar dealer for wireless network requirements necessary to support the remote operator station system. The enclosure, PC and touch screen display utilized with the operator station are customer provided.

Non-Line-of-Sight

Command for dozing includes the option of on-board digital cameras and a microphone hardened for use on dozers. This system provides the operator with visuals from the left and right cutting edges, as well as the top/center of the blade and a rear view that includes the ripper. The video and audio from this system is streamed back to the remote operator station to provide additional information directly from the machine.





Semi-Autonomous Dozing

Starting with a Remote Operator Station, a mine site can scale up to Semi-Autonomous Dozing capability with the addition of our on-board planner system and MineStar Office. Command for dozing's semi-autonomous system is only available on the D11T, serial number prefix JEL and AMA.

Semi-Autonomous Dozing allows an operator to sit comfortably and control multiple dozers from a Remote Operator Station while automating the dozer push process. This solution makes next-generation dozing a reality by allowing operation of dozers from a remote location either on the mine site or miles away, and reduces costs by tying multiple machines to a single operator and station.

In addition to the features of the Remote Operator Station, Semi-Autonomous Dozing provides Situational Awareness with 2D Computer Generated Imagery. It also includes a Tactical

Planner System that features real-time terrain mapping through a Global Navigation Satellite System. This system reacts in real time to mapped environmental changes, and is designed to handle operator interventions quickly and smoothly. The step-based approach to Semi-Autonomous Dozing allows customers to introduce technology to the mine when they are ready while leveraging their initial investment.

Auto Blade Assist (ABA), Autocarry and AutoRip Control are all necessary to begin Semi-Autonomous Dozing. The system also requires Terrain with Blade Control to assist with productivity to a design plan.

Note: Please contact a Caterpillar dealer for wireless network requirements necessary to support the semi-autonomous system.



Customer Support

Providing you with unmatched global support

For more than 25 years, Caterpillar has been providing electronic and electrical components and systems for the mining 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 guidance systems to the application and obtaining responsible, knowledgeable support. From sales and implementation to support and service, count on your Cat dealer to provide all of your technology product needs.

Cat Command for Dozing Specifications

Operator Console	900 MHz	2.4 GHz
Frequency Range	905.2 to 908.375 MHz	2.402 to 2.480 GHz
Frequency Management	Audio frequency shift keying narrowband	Frequency hopping spread spectrum
Transmit Power	16 mW	100 mW
Temperature Range	-20° C to 60° C (4° F to 140° F)	
Water and Dust Intrusion	Console is sealed (IP65 MIN)	
Battery	3.7 Volt Lithium Ion	
Battery Ambient Charging Range	0° C to 45° C (32° F to 113° F)	
Battery Storage Temp Range	-20 C to 45 C (4° F to 113° F)	
Battery Duration	> 10 hours	
Weight	3.6 kg (8.00 lb)	

On-board Receiver	900 MHz	2.4 GHz
Frequency Range	905.2 to 908.375 MHz	2.402 to 2.480 GHz
Modulation Type	Audio frequency shift keying narrowband	Frequency hopping spread spectrum
Transmit Power	16 mW	100 mW max
Temperature Range	-40° C to 85° C (-40° F to 185° F)	
Water and Dust Intrusion	Receiver is sealed (IP68)	
Input Voltage	9 to 32 Volts	

Standards Compliance

ISO 15817	Earthmoving Machinery – Safety Requirements for Remote Operator Control
AS/NZS 4240	Remote Controls for Mining Equipment

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

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