M0065690-01 (en-us)
January 2018

Operation and Maintenance Manual

Cat® Detect Proximity Awareness for MineStar Onboard Version 4

PA4 1-UP (Machine Control & Guidance Products)

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards, including human factors that can affect safety. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you verify that you are authorized to perform this work, and have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alert “WARNING” label is shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

A non-exhaustive list of operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Cat dealers have the most current information available.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Cat replacement parts.

Failure to follow this warning may lead to premature failures, product damage, personal injury or death.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

Table of Contents

Foreword

Literature Information

This manual should be read carefully before using this product for the first time and before performing maintenance. This manual should be stored in the product literature holder or in the product literature storage area. Immediately replace this manual if lost, damaged, or unreadable. This manual may contain safety information, operation instructions, transportation information, lubrication information, and maintenance information. Some photographs or illustrations in this publication show details or attachments that can be different from your product. Guards and covers might have been removed for illustrative purposes. Continuing improvement and advancement of product design might have caused changes to your product, which are not included in this publication. Whenever a question arises regarding your product, or this publication, consult your dealer for the latest available information.

Safety

The safety section, if present, lists basic safety precautions. In addition, this section identifies the text and locations of safety messages used on the product. Read and understand the basic precautions listed in the safety section before operating or performing lubrication, maintenance, and repair on this product.

Operation

The operation section, if present, is a reference for the new operator and a refresher for the experienced operator. This section includes a discussion of gauges, switches, controls, attachment controls, transportation, and towing information (if applicable). Photographs and illustrations guide the operator through correct procedures of checking, starting, operating, and stopping the product. Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the product and its capabilities.

Product Information

The product information section, if present, may provide specification data, product intended use, product identification plate locations, and certification information.

Maintenance

The maintenance section, if present, is a guide to equipment care. Proper maintenance and repair are essential to keep the equipment and systems operating correctly. As the owner, you are responsible for the performance of the required maintenance listed in the Owner Manual, Operation and Maintenance Manual, and Service Manual. The Maintenance Interval Schedule lists the items to be maintained at a specific service interval. Items without specific intervals are listed under the "When Required" service interval. The Maintenance Interval Schedule lists the page number for the step-by-step instructions required to accomplish the scheduled maintenance. Use the Maintenance Interval Schedule as an index or "one safe source" for all maintenance procedures.

Maintenance Intervals

Use the service hour meter to determine servicing intervals. Calendar intervals shown (daily, weekly, monthly, etc.) can be used instead of service hour meter intervals if they provide more convenient servicing schedules and approximate the indicated service hour meter reading. Recommended service should always be performed at the interval that occurs first. Under extremely severe, dusty, or wet operating conditions, more frequent lubrication than is specified in the maintenance intervals chart might be necessary. Perform service on items at multiples of the original requirement. For example, at every 500 service hours or 3 months, also service those items listed under every 250 service hours or monthly and every 10 service hours or daily.

Product Capacity

Additional attachments or modifications may exceed product design capacity, which can adversely affect product performance characteristics, safety, reliability, and applicable certifications. Contact your dealer for further information.

Safety Section

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Safety

SMCS Code: 1400

Safety Messages

⚠ WARNING

Do not operate or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance manuals. Failure to follow the instructions or heed the warnings could result in injury or death. Contact your authorized dealer for replacement manuals. Proper care is your responsibility.

Operation

- Ensure that you have read and understood the machine Operation and Maintenance Manual.
- Ensure that the screen is clean and adjusted properly.
- During system start-up, ensure that the audible alarm is heard during the display self-test.
- Prior to operating the machine, ensure that the brightness of the display is properly adjusted. Ensure that the brightness is adjusted after changes in conditions for ambient light.
- Check the display for system information warnings, if warnings are present, contact your supervisor.

PL671 Radio Regulatory Compliance

FCC Notice to Users

Changes or modifications not expressly approved by Caterpillar could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada Notice to Users

This device complies with CAN ICES-3 (A)/NMB-3(A)

Operation is subject to the following two conditions:
• This device may not cause interference
• This device must accept any interference, including interference that may cause undesired operation of the device.

Radio Frequency Exposure Notice to Users

To comply with the FCC and Industry Canada rules regarding Radio Frequency exposure, the PL671 V2x device must be installed in such a manner that, during normal operation, a person is not closer than 20 cm from the device.

Product Information Section

General Information

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General Information

SMCS Code: 7348; 7490

Intended Use

NOTICE
Use of this system does not replace basic safety precautions and procedures for operating a machine. Refer to the Operation and Maintenance Manual of the machine for additional information.

Cat ® Detect Proximity Awareness uses a combination of hardware and software, both onboard (machine) and off board (infrastructure and office) to provide information to the machine operator. The machine sends GPS position to other machines over DSRC using V2x modules and to the office (server) over a wireless radio network. The V2x modules and the office then process all the messages from the individual machines within coverage. The V2x modules then share near real-time positions with the display and the office broadcast the messages out over the wireless radio network for machines that have shutdown or that are equipped with WiFi only Proximity Awareness. The display processes the messages and calculates machines of interest based on the position of your machines and the machines around you.

The Proximity Awareness onboard system uses locations from a Global Positioning System (GPS), to enhance operator awareness of other equipment with a proximity awareness system installed and configured boundaries surrounding the machine.

Detect helps increase operator awareness of machine surroundings. Detect includes a range of capabilities designed to assist the operator, including blind spot and proximity detection of fixed and mobile equipment.

The system is highly configurable during setup and the on-board alarming behavior may differ from what is specified in this manual. Refer with your site supervisor for site-specific alarming behaviors.

Detect Basics

Definitions

GPS: – Global Navigation System (United States Department of Defense (DoD) NAVSTAR)

GLONASS: – Global Navigation Satellite System (Russia)

GNSS: – Global Navigation Satellite Systems (generic naming used to describe the use of more than one positioning system)

BSM – Basic Safety Message is a standard format message that allows machines to share positioning information.

DSRC – Dedicated Short Range Communications is the communications protocol used to pass Basic Safety Messages.

GPS/GNSS Availability

⚠ WARNING

Due to the nature of wireless communications and government controlled navigation systems, satellite timing signals may be lost, inaccurate, or of poor signal strength. The availability of satellite-based positioning signals is beyond the control of both, the user and Caterpillar. Diagnostics to detect low accuracy or the loss of signal provide warnings to the operator. Failure to follow the instructions or heed the warnings could result in injury or death.

Detect Proximity Awareness consists of several key elements that make up the complete system. At the heart of the Proximity Awareness system are the GNSS satellite constellations. Both GPS (United States) and GLONASS (Russia) are owned and operated by the defense departments of the countries that placed the satellites in orbit. While these government agencies recognize the great dependence the private sector has for these systems, an important message is, that for national security reasons, and at any time, the government can shut off, move/reallocate to a different slot, or alter the timing signals provided by these satellites. These government activities are out of the user and Caterpillar control and would have an adverse effect on the system to report accurate locations of the equipment. The onboard system incorporates diagnostics to detect low accuracy and/or no corrections to warn the operator of this condition.

Elements of the Proximity Awareness System

The following list defines elements of the Proximity Awareness system:

- GPS/GNSS (Space element)
- Reference station (Ground element)
- Onboard Site Awareness system (User element)
- Wireless network, onboard, and infrastructure (Two-way data communications)

- Office application (receives machine locations and broadcasts to all)

Another key element embedded within the user element is the geographic local coordinate system calibration file. This file is a conversion file on the GNSS satellite receiver that is created by the mine site. The file calibrates the latitude, longitude, and elevation calculated by the satellite receiver into the mine site local coordinate system (northing, easting, and elevation). The accuracy of the indicated position in the plan view window of the Proximity Awareness system depends on the accuracy of the conversion file and measure-up of the machine during installation. Ensure that the GNSS reference point that is on the machine is placed over known site calibration point. Verify that the Proximity Awareness indicated that position matches the known mine site calibration point prior to placing the machine in service.

Object Detection System (If Installed)

If your machine is equipped with the Object Detect System, refer to the applicable system Operation and Maintenance Manual for further information.

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System Components

SMCS Code: 7348; 7490

The Detect onboard system consists of the following components:

Required:

- Touchscreen monitor display
- V2x module
- GPS antenna
- Wireless radio (customer supplied)

Optional:

- Interface module
- Ethernet switch
- Medium precision satellite receiver

Reference: Refer to Special Instruction, M0077913, “Installation Procedure for theCat ®Detect Proximity Awareness System - PL671” for the installation requirements.

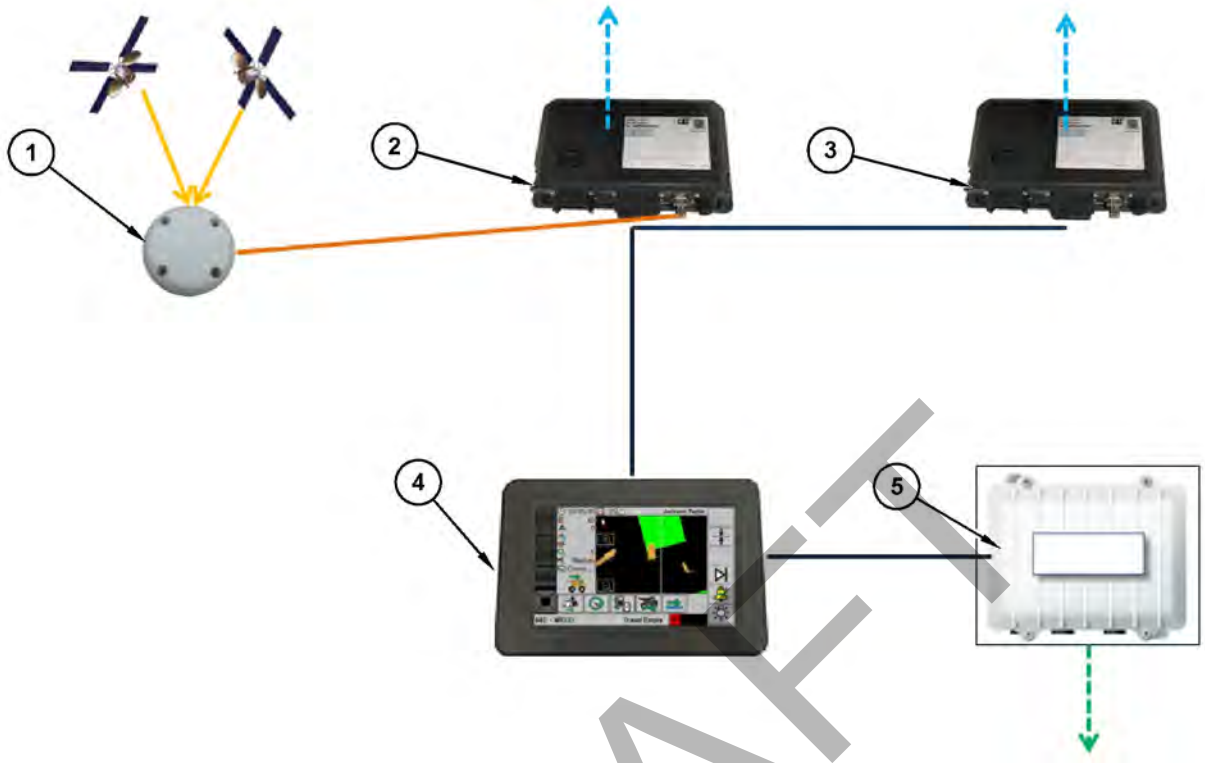

Illustration 1 g06212749

Stand-alone Proximity Awareness system

(1) GPS antenna
(2) Primary PL671 radio
(3) Secondary PL671 radio
(4) GS407 monitor display
(5) Third-party wireless radio

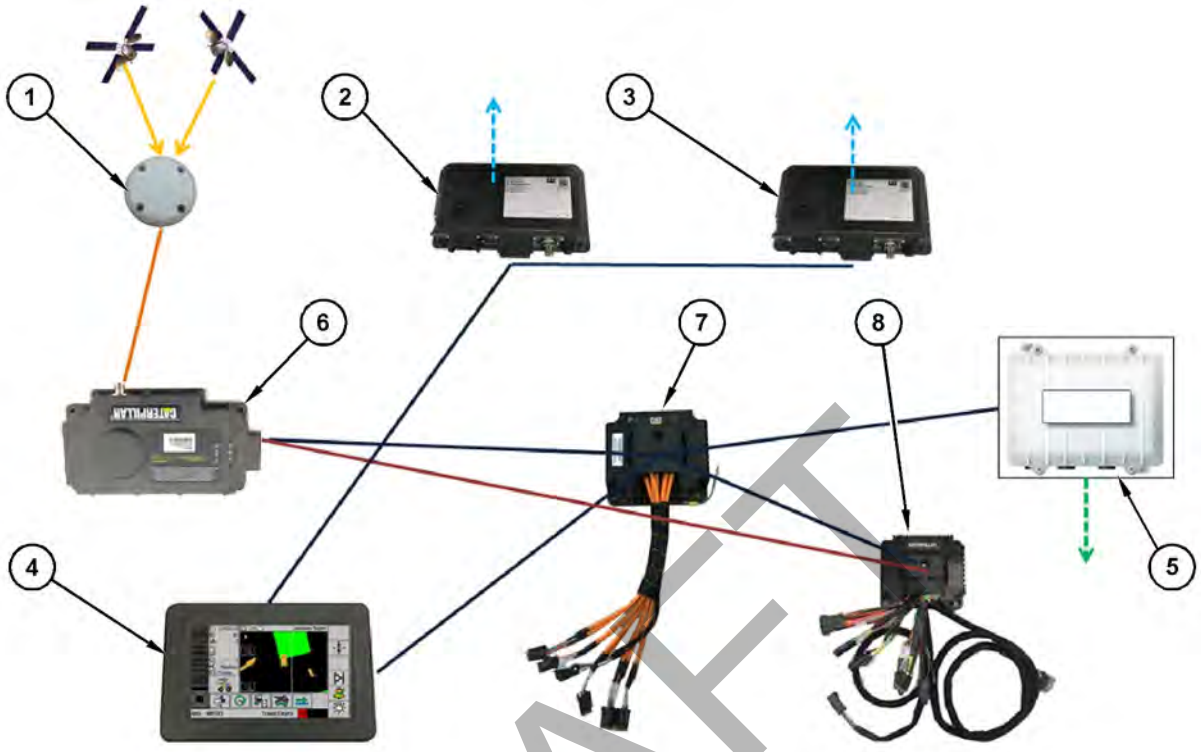

Illustration 2 g06212780

Integrated with Fleet

(1) GPS antenna
(2) Primary PL671 radio
(3) Secondary PL671 radio
(4) GS407 monitor display
(5) Third-party wireless radio
(6) MS352 satellite receiver
(7) Ethernet switch
(8) Health Interface Module (HIM)

Touchscreen Monitor Display

The monitor display (4) provides the only operator interface to control the system. The monitor display provides the following functions:

- Displays the position of the machine and other machines and configured areas in the plan view of the mine site
- Displays the status of system and diagnostic screens
- Generates visible and audible alarms based on proximity of machines and avoidance zones to machine

V2x Module

The V2x module is the systems main communication module. The V2x module performs the following functions:

- Processes GPS positions
- Sends and received Basic Safety Messages

GPS Antenna

The GPS (1) antenna receives signals from the GPS satellites and provides them to the V2x module.

Wireless Radio (Customer Supplied)

The wireless radio (5), supplied by the customer, provides network connectivity between the onboard and office systems.

Optional Items

The following list depicts items that can be integrated when used with Cat MineStar Fleet Onboard Systems:

Interface Module (Optional)

The interface module (8) performs the following function:

- Provides directional gear information from the machine to the monitor display

Ethernet Switch (Optional)

Supplied by the customer, the onboard Ethernet switch (7), provides network onboard between the Detect and Fleet systems.

Medium Precision Satellite Receiver (Optional)

Medium precision MS352 GPS satellite receivers (6) can be configured to provide positions to the V2x module.

Operation Section

Before Operation

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Before Operation

SMCS Code: 7348; 7490

⚠ WARNING

The Proximity Awareness system is highly configurable. Depending on site configuration settings within Detect Office, certain visual and/or audible alerts may not function for a particular event. Work with your supervisor to understand the alert behavior prior to using the system. Failure to follow the instructions or heed the warnings could result in injury or death.

Perform the following tasks prior to operating the machine:

- Understand the functionality of all the views on the monitor display.
- Adjust the screen brightness for optimal viewing in the current conditions.
- Position the display to provide clear visibility of the screen from the operator seat.
- Ensure that the display is clean.

⚠ WARNING

Improper operation of an access platform could result in injury or death. Operators must carry out their duties properly and follow all instructions and guidelines given for the machine and access platform.

Power ON/OFF

Power is supplied to the system when the operator turns the machine keyswitch to the ON position. During the power-up process, the monitor and the V2x module will perform a self-test. During the self-test, the monitor display will ensure that all the components are communicating. System status icons will be displayed if GPS or communication issues are present. The V2x module will illuminate LEDs to indicate what processes are functioning.

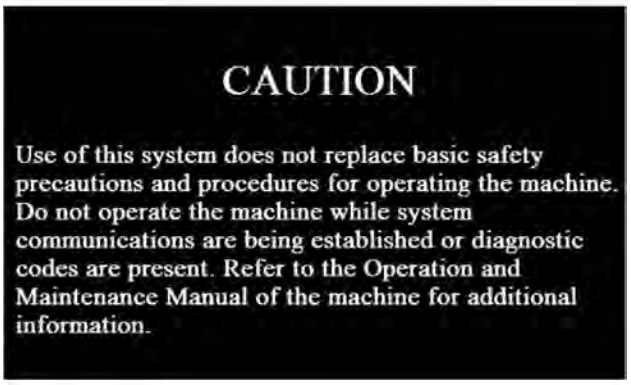

Illustration 3 g03863938

"Caution" screen

After turning the keyswitch on, the "CAT" startup screen will appear while the application launches. The disclaimer splash screen and "caution" will appear. When the self-test is completed, the following actions occur:

- The operator logon window appears (as required).
- The plan view becomes active.

If a portion of the application fails or a system fault is detected, one or more of the following icons will be present:

No GPS – This icon displays when there is no GPS communication.

No communication to office – This icon displays when broadband radio communication to the office is unavailable in WiFi mode or when BSMs are unavailable in V2x Mode.

V2x Fault, High Priority – All Machine to Machine communication functions with the V2x module are stopped.

V2x Fault, Low Priority – Some Machine to Machine communication functions with the V2x module are stopped.

If the self-test fails, contact your site technology support or Cat technical communicator.

If a fault is present, contact your site technology support or Caterpillar dealer.

PL671 Indicator Lights

The PL671 is a V2x module used on CaT Detect systems. The module contains 4 LED indicator lights that indicate the following scenarios:

Green LED

The purpose of the green LED is to indicate when the radio is powered ON or OFF.

Green LED OFF – Indicates that the radio is not powered.

Green LED ON – Indicates that the radio is powered properly and is ON.

Green LED Blinking – The green LED will blink when a fault has been detected that will prevent the application firmware from running. If the green LED is blinking, contact your Caterpillar dealer.

Orange LED - GPS

The purpose of the orange LED is to indicate whether a GPS fix has been made.

Orange LED OFF – The orange LED will be OFF when a GPS antenna is not found by the radio.

Orange LED ON – The GPS antenna is working properly, and can see enough GPS satellites to determine a good location fix.

Orange LED Blinking – The orange LED will have a constant blinking status when the GPS antenna is working properly, however not enough GPS satellites are viewable to get a good GPS location fix. If a blinking orange LED persists, contact your Caterpillar dealer.

Yellow LED - DSRC Communications

The purpose of the yellow LED is to indicate that a connection to the communication network, through DSCR, is being attempted. This action does not indicate that there is an appropriate signal, only that the hardware is working properly, and is capable of making a connection given that a signal is present.

Yellow LED OFF – Indicates no DSRC communications available.

Yellow LED Blinking – Indicates that there is a DSRC fault and the device is unable to launch communications.

Blue LED - Ethernet

The purpose of the blue LED is to determine when Ethernet connections are present.

Illustration 4 g03738018

Blue LED OFF – Indicates no Ethernet link established.

Blue LED Blinking – The blue LED will blink to indicate Ethernet activity.

Blue LED ON – The blue LED will turn ON when the module has established an Ethernet link. Refer to Illustration 4 .

Operation

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Display Navigation

SMCS Code: 7348; 7490

Illustration 5 g06012813

Display

Arrow button (1) – The arrow button is used to perform the following functions:

- Highlight a selection (up/down)
- Manually adjust brightness level after the brightness button is depressed (right/ left)

OK button (2) – The “OK” button is used to select items that are highlighted.

Tab button (3) – The tab button is used to change the active screen between the plan view and the camera view.

Brightness button – The brightness button is used to adjust the screen brightness. The screen will toggle between two settings. Press the button once to set the screen to the brightest mode, press the button again to set the screen to dimmest mode. Pressing and holding the brightness button for 3 seconds will cause the brightness adjustment window to appear.

Alarm acknowledge button (5) – The alarm acknowledge button is used for acknowledging alarms. Press the button once to acknowledge the alarm. If a new alarm occurs, the new alarm must be acknowledged again. Also, the alarm acknowledge can be used to mute the alarm until the next power cycle or when the button is held again for 10 seconds. When the alarm is muted, all alarms will still be displayed but not be audible. The mute feature depends upon site configuration.

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Main Screen

SMCS Code: 7348; 7490

The main screen allows the operator to monitor the operation of the system. The operator can perform the following tasks in the main screen:

- Monitor the system state for Global Positioning System (GPS) and wireless communications conditions
- View system information
- Monitor position of other machines
- Access toolbar buttons

The main screen is divided into seven areas. The following seven items make up the main screen:

- System information window
- Plan window
- Status window
- Status bar
- Tool access window
- Toolbar button

Note: Depending on how the site has configured the onboard display, the screen may look different.

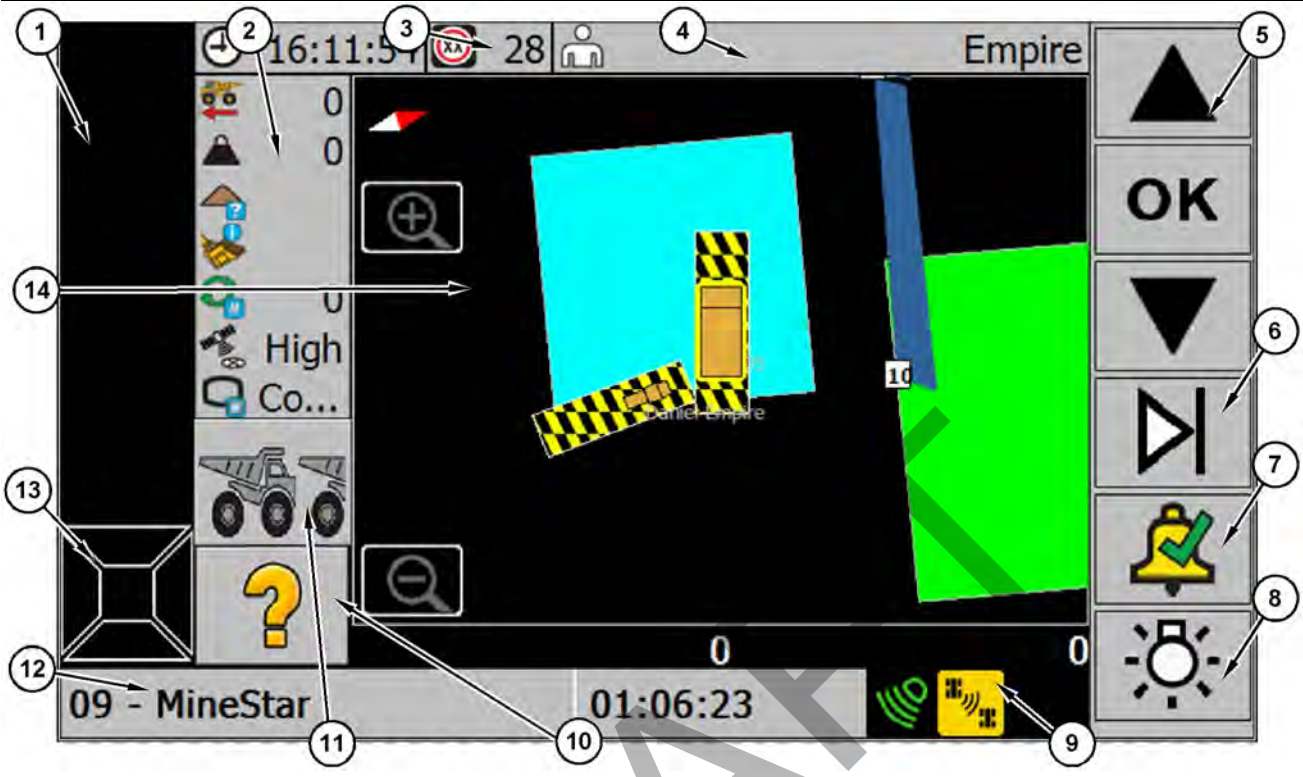

Illustration 6 g06213236

(1) Object Detection Proximity Bar
(2) System Information
(3) Speed Limit
(4) Operator Name
(5) Soft Button Panel including Up and Down Arrows, and OK buttons
(6) Soft Panel Next Screen button
(7) Soft Panel Alarm Acknowledge button
(8) Soft Panel Brightness button
(9) System Status and Warning
(10) Tool Bar Button Menu
(11) Truck State
(12) Status Window
(13) Object Detection Quadrant Detection
(14) Map View

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System Information Windows

SMCS Code: 7348; 7490

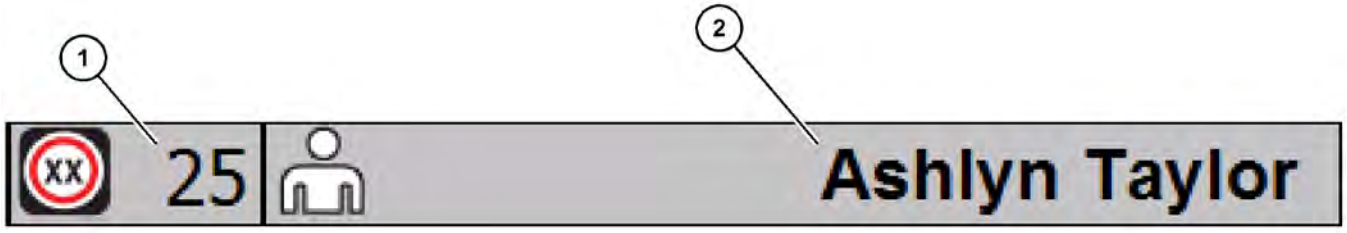

Illustration 7 g06012976

System information window

(1) Speed limit
(2) Name of operator currently logged in

A system information window displays information to the machine operator. A dedicated system information window is configured to display the time. An extra dedicated system information window is configured to display the current speed limit. The system information window that is at the top left of the screen can be configured to display several types of system information data in a single window. This system information displays one item at a time. Touching the system information window scrolls to the next configured system information item.

Several types of system information data can be combined in the system information window. The following system information data can display:

- Time
- Global Positioning System (GPS) accuracy
- Speed limit (KM/H or MPH)
- Operator name

Note: Depending upon site configuration, different items may be available in the status information window.

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Status Window

SMCS Code: 7348; 7490

The status window continuously displays critical system and proximity information. Status icons provide status information to the operator for the following system components:

- Global Positioning System (GPS)
- Radio
- Alarm
- Zones
- Speed limit violation

The status bar will also display information about GPS proximity detection.

GPS Status Icons

Low Priority – “Low GPS” icon displays when the GPS accuracy is low.

No GPS – “No GPS” icon displays when there is no GPS communication.

Radio Status Icon

No communication to office – “No communication to office” icon displays when broadband radio communication to the office is unavailable.

Alarm Status Icon

Alarm muted – “Alarm muted” icon displays when the alarm has been muted by the operator.

Proximity Critical Icons

Low priority – “Low Priority” icon displays when a machine equipped with proximity awareness is in the path or avoidance area of the machine or a machine around your machine. The low priority icon will display when the avoidance or path area of one machine has entered the avoidance or path area of another machine. This information is calculated based on GPS positions and the defined dimensions of your machine in the office.

High priority – “High Proximity” icon displays when a machine equipped with proximity awareness path, avoidance, or body area is in the body area of your machine or your machines path, avoidance, or body area of another machine. This information is calculated based on GPS positions and the defined dimensions of your machine in the office.

V2x Module Icons

High Priority – High Priority icon displays when all machine to machine communication functions with the V2x module are stopped.

Low Priority – Low Priority icon displays when some machine to machine communication functions with the V2x module are stopped.

Miscellaneous Icons

Speed limit violation – “Speed limit violation” icon displays when the machine exceeds the speed limit set for the class of machine being operated. Also, if the machine exceeds a speed limit for a zone that the machine is located in, the speed limit icon will display.

Avoidance zone – “Avoidance zone” icon displays when the machine enters an avoidance zone.

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Plan Map Window

SMCS Code: 7348; 7490

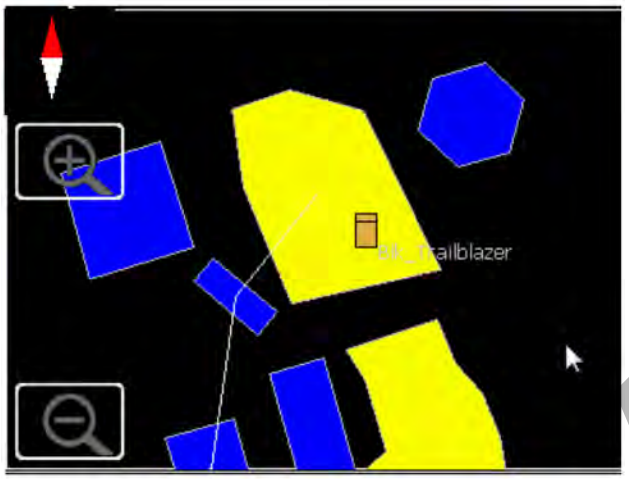

Illustration 8 g02614938

Plan view window

The plan window is the main operating screen in Detect onboard. The plan window displays the following information:

- Position of your machine
- Position of other machines
- Zones
- Reference points

Position of Your Machine

The position of your machine is displayed within the plan view window. Your machine is shown as the icon in the center of the screen.

Illustration 9 g03142117

The name of the machine is displayed next to the icon. Refer to Illustration 9 .

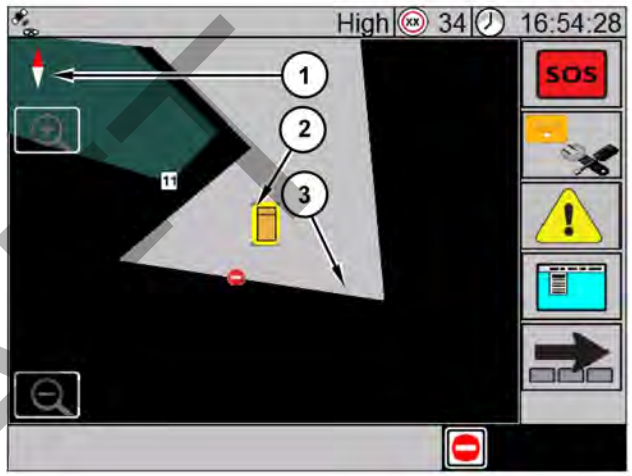

Illustration 10 g03417508

(1) Compass
(2) Machine icon
(3) Zone

The compass (1) is located in the top left corner of the plan map. The red portion of the compass indicates which direction is north. In Illustration 11 , the machine is facing North.

The operators machine is always centered on the screen with the front of the machine (2) facing the top of the display. This location matches the physical orientation of the machine.

The map rotates around the machine during movement to ensure physical and displayed left, right, front, and rear always match. For example, zones that are displayed on the right are physically located to the right (3).

Note: The machine icon will always display near the center of the map. The icon does not move or change directions. The machine icon will always appear to travel towards the top of the display, even when the machine is traveling in reverse. The movement of the machine on the map is shown by the map display changing machine instead of machine in the background, moving behind the icon of your machine.

Zoom Level

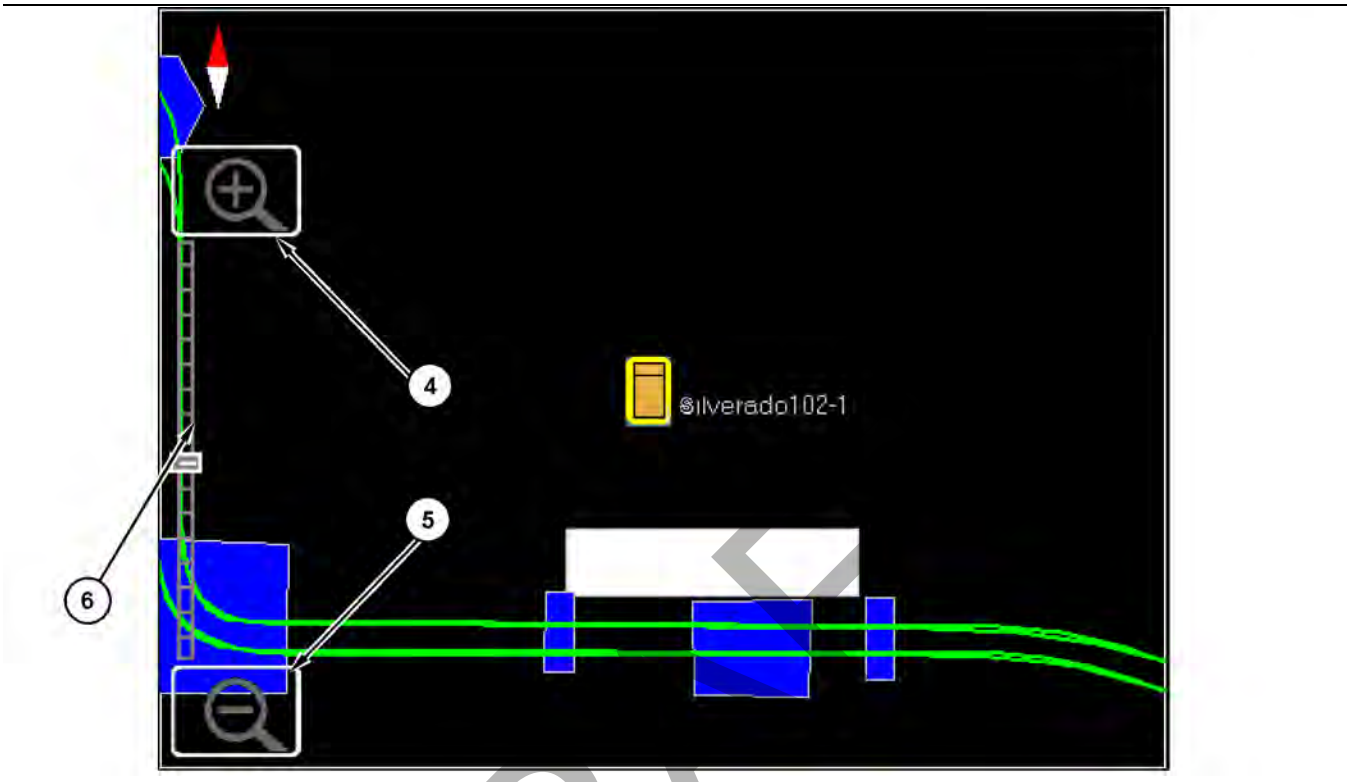

Illustration 11 g03142318

Zoomed out level

(4) Zoom in button (5) Zoom out button (6) Sliding scale

The operator can adjust the zoom level by pressing the zoom in (4) and zoom out (5) buttons on the plan screen.

The sliding scale (6) in between the zoom buttons indicates the current level of zoom. After the operator has set the zoom level, the scale will disappear until the zoom button is pressed again.

All machine icons are displayed to scale both with other machines and their physical environment such as zones and other machines.

Position of Other Machines

The position of other machines is displayed within the plan view window. Your machine is shown as the icon in the center of the screen.

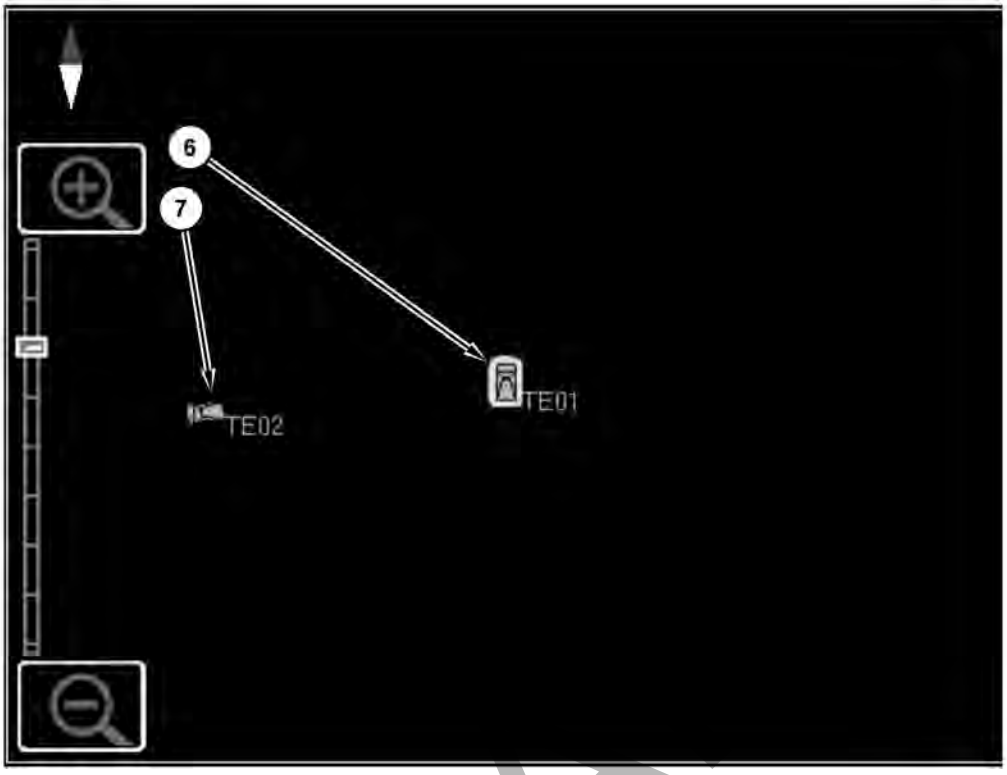

Illustration 12 g03142338

(6) Your machine (7) Other machine

Based on the operator-selected zoom Level, the machines are displayed in the plan view at the appropriate location and size dimensions. In addition, the statuses of the other machines are also displayed as on overlay of the machine icon.

Machine Status Indicators

NOTICE
Use of this system does not replace basic safety precautions and procedures for operating a machine. Refer to the Operation and Maintenance Manual of the machine for additional information.

⚠ WARNING

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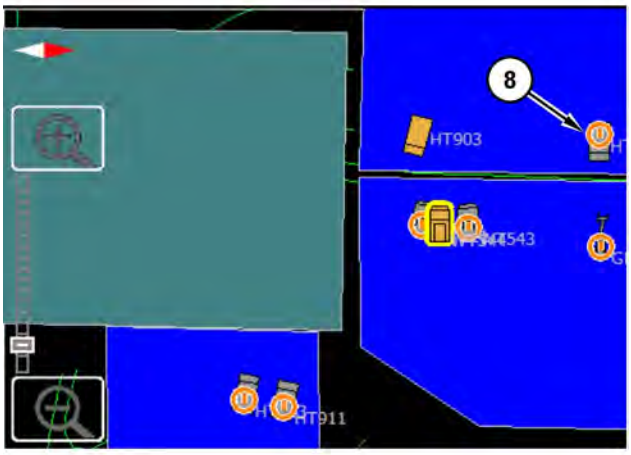

Illustration 13 g03416717

Example of powered off icon

(8) Powered off machine

Powered Off – This icon overlay indicates that the machine has been shutdown. This location is the last known good position reported to the office prior to the shutdown. Since the machine indicates that it is shutdown and has not reestablished communications to report a startup, then the last known position is likely the current position of the machine.

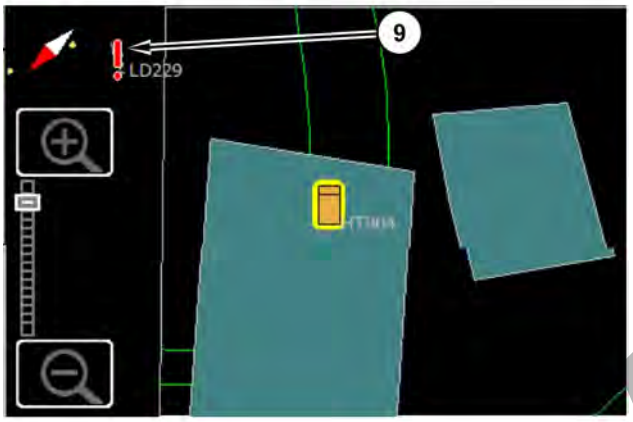

Illustration 14 g03416721

Example of out of communication icon

(9) Out of communication machine

Out of Communication – This icon is only used for Detect machines in WiFi only mode and will not be used for V2x Mode machines. This icon overlay indicates that the machine has low GPS quality and/or has lost communication with the office. The current location on the screen is the last known good position reported to the office. The machine position on the display may not reflect the actual current position of the machine or machines.

Machine Types

The following list indicates the machine icon with the associated machine type:

Articulated Truck, Haul Truck, or Underground Truck

Cable Shovel

Compactor

Dragline

Drill

Fuel Truck or Water Truck

Grader

Hydraulic Shovel or Track Excavator

Light Vehicle

Scraper

Soil Compactor, Underground Loader, or Wheel Loader

Track Dozer or Track Loader

Wheel Dozer

Wheel Excavator

Wheel Loader

Other Machine with Heading

Other without Heading

Zone Polygons

WARNING

The proximity awareness feature does not replace basic safe operating procedures identified in the machine Operator and Maintenance Manual. Machines equipped with proximity awareness that are turned off and/or have lost radio communication, will not report current position of machine. Be aware of your surroundings before moving. Failure to follow the instructions or heed the warnings could result in serious injury or death.

NOTICE

Zones can be configured as any color. Note which type of zone you are approaching before you enter the zone.

Zones are used to define specific areas on the mine site. The zone polygons display on the plan view screen to the operator. The operator may encounter the following types of zones:

- Avoidance zones
- Speed limit zones
- Hazard zones

Avoidance Zone

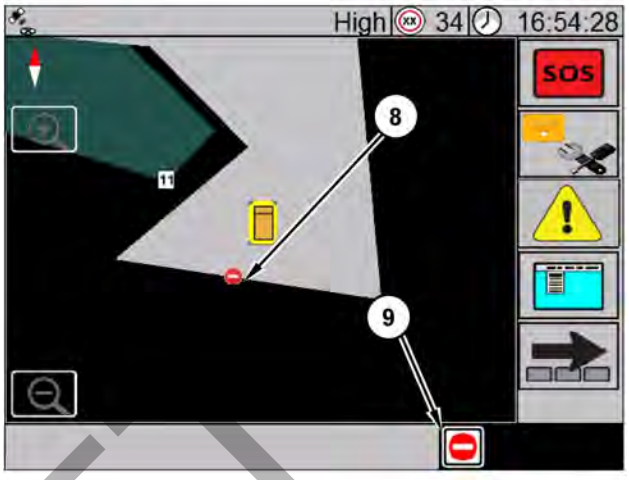

Illustration 15 g03140116

Avoidance zone

(8) Avoidance zone symbol
(9) Icon indicating machine has entered avoidance zone

Avoidance zones (8) are areas on the mine site that are restricted to the machine. An icon (9) will appear indicating that the machine has entered an avoidance area. Also, a “do not enter” notification message may display to the operator and a constant audible tone will sound. These alerts will continue until the machine leaves the avoidance zone.

Speed Limit Zones

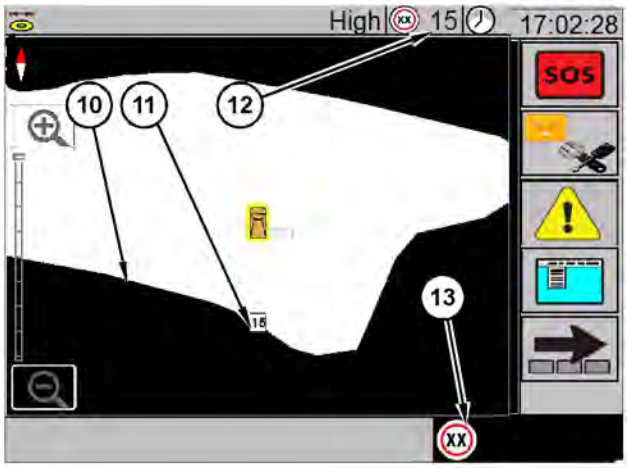

Illustration 16 g03140165

Speed limit zones

(10) Speed limit zone
(11) Speed limit of the zone
(12) Current speed limit
(13) Speed limit violation icon

Speed limit zones are areas on the mine site where the speed limit changes from the set global speed limit. The current speed limit indicator (12) will update indicating the new speed limit of that zone to the operator.

Note: If the global speed limit for your class of machine is lower than that of the zone, the speed limit will not change.

If the machine exceeds the set speed limit, a single beep audible tone may sound and a visual speed limit violation icon (13) will be displayed until one of the following scenarios occur:

- The machine speed drops below the speed limit
- The machine exits the speed zone and enters an area with a higher speed limit which is not being exceeded

Hazard Zones

Hazard zones are areas on the mine site that the operator needs to be aware of. These areas include but are not limited too, material spillage, damage to haul roads, and disabled machines. A “do not enter” notification and message may be displayed to the operator and a constant audible tone may sound. These alerts will continue until the machine leaves the hazard zone.

Entering and Exiting Zones

The operator may be notified upon entry and exit of zones. The following notifications occur:

- An audible alarm may sound depending upon site configuration.
- A popup text message may appear depending upon site configuration.

⚠ WARNING

The site may not be configured to display visual or audible warnings. Be aware of the site configuration settings before operating a machine. Consult your site operations manager. Failure to be aware of the site configuration settings could result in serious injury or death.

Illustration 17 g03057276

Example message

Refer to Illustration 13 for an example of a message that would appear upon entry of a zone.

i07060246

Tool Button Display

SMCS Code: 7348; 7490

Illustration 18 g03064342

Tool buttons

The tool button display expands vertical and buttons stack. The tool button display would allow for four buttons. A dedicated button at the bottom is available to scroll to other tool buttons.

The following functions are accessible from the tool bar windows:

- Operator login
- Send a mayday
- Mark hazards
- Diagnostics
- More buttons
- Delays
- Zone lock
- Data record

Illustration 19 g03410764

Operator login – This toolbar button is used to change the operator.

Illustration 20 g03106256

Send mayday – This toolbar button is used to send a mayday to the office.

⚠ WARNING

The mayday feature is for non-critical situations where the operator requires assistance from office personnel. Due to the nature of wireless communications, the mayday message is not ensured to reach the office in a timely manner. Failure to follow the instructions or heed the warnings could result in injury or death. Proper care is your responsibility. Use other methods of communication for safety critical situations.

Illustration 21 g03416726

Mark hazard – This toolbar button is used to mark a hazard.

Illustration 22 g03142760

More buttons – This toolbar button is used to cycle through the toolbars on the display.

Note: Additional toolbar buttons are available as part of the Cat MineStar Fleet system. Consult the Fleet Operator Maintenance Manual (OMM) for details on these buttons.

i07073355

Visual Proximity Alarming

SMCS Code: 7348; 7490

Fundamentals

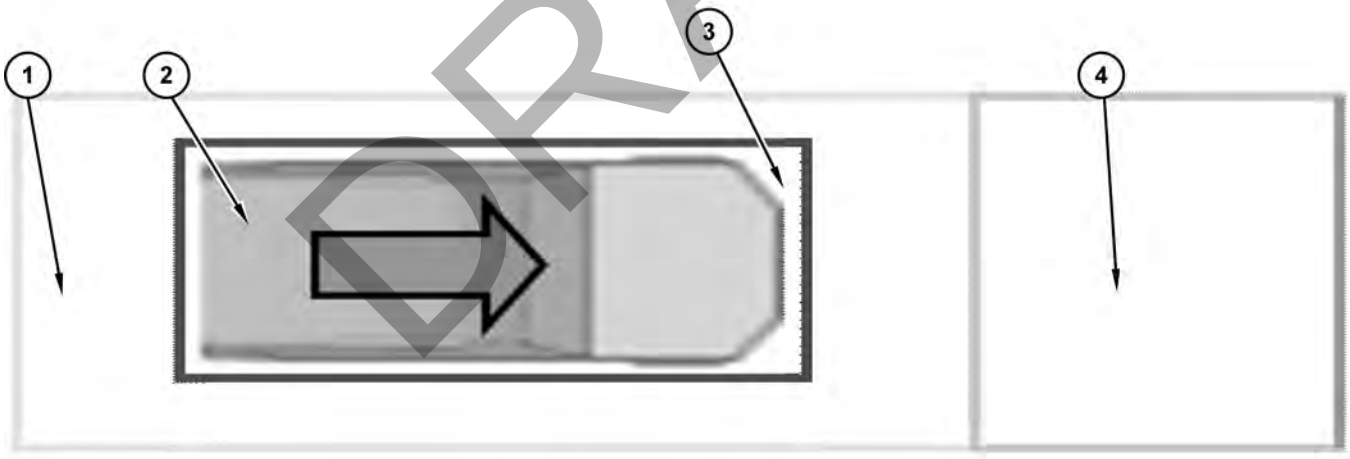

Illustration 23 g03320138

(1) Avoidance area
(2) Machine body area
(3) Stop zone
(4) Projected path

Proximity alarming is based on the following:

- Machine speed
- Machine position
- Machine heading
- Machine dimensions and avoidance areas defined in office software

The avoidance area (1) is a fixed area around the machine, is configured in the office at the machine class level, and does not change based on the heading or the speed of the machine. The area does scale as the GPS accuracy decreases. For example, if the GPS accuracy is 1 m (3.28 ft) and the zone is configured as 2 m (6.56 ft), then the total avoidance zone around the machine would be 3 m (9.84 ft).

Note: The dimensions of the machines and the avoidance areas of the machine are defined in the office software.

The projected path (4) is added onto the avoidance area (1) at the (front or rear) of the machine to determine potential collisions. The total projected path is a mathematical calculation tied to the speed and direction of the machine and is defined in the office software. The projected path will increase as the speed of the machine increases and decrease in the direction of travel as the speed of the machine decreases.

Alarms are based on priority. For example, if a machine is equipped with Object Detection and an object is detected by the Object Detection sensors, that alarm would have higher priority then a GPS-based proximity alarm.

Table 1

Priority Alarms				
		Other Machine		
		Path	Avoidance	Body
Your Machine	Path	Low	Low	High
	Avoidance	Low	Low	High
	Body	High	High	Critical

Refer to Table 1 for priority of the alarms.

Low Priority Proximity Alarm

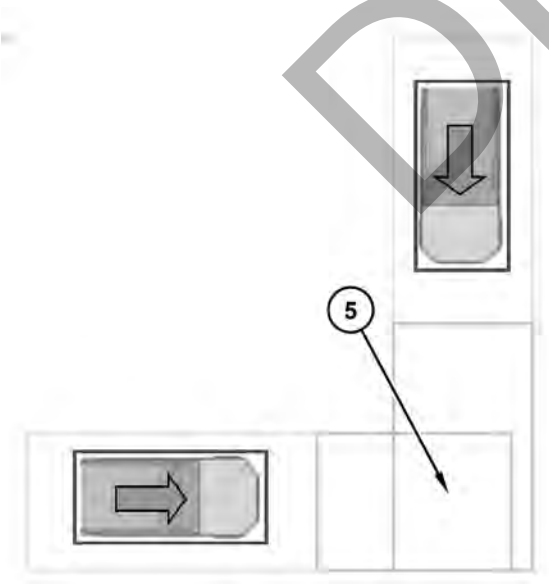

Illustration 24 g03061398

(5) Projected path

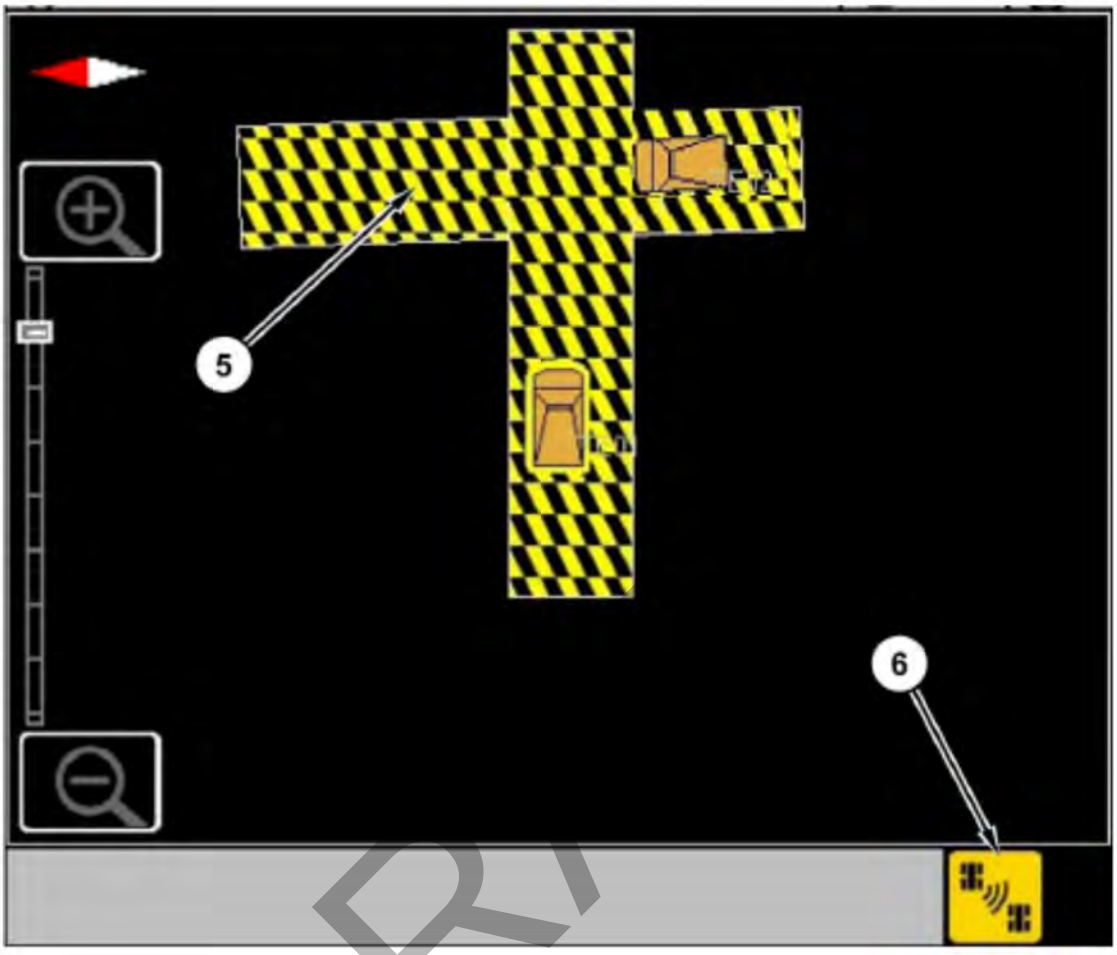

Illustration 25 g06012988

(5) Projected path (6) Machine proximity low alert icon

⚠ WARNING

When the proximity awareness audible alarm is sounded, identify the other machine and the location of the other machine before you move your machine. Failure to identify the location of the other machine prior to moving your machine can result in product damage, personal injury, or death.

The low priority proximity alarm is generated when any of the following occur:

- Projected Path on Projected Path
- Project Path on Avoidance Zone

The projected path (5) appears on the plan view and a proximity alarm icon (6) appears in the bottom right corner. During caution, the icon is solid. Depending on configuration, an audible alarm tone is sounded. Refer to M0065690, Audible Alarms section for additional audible alarming details. Refer to Illustration 24 and Illustration 25 for an example of a low priority proximity alarm.

High Priority Proximity Alarm

The high priority proximity alarm is generated when any of the following occur:

- Avoidance Zone on Body Area

- Projected Path on Body Area

Critical Proximity Alarm

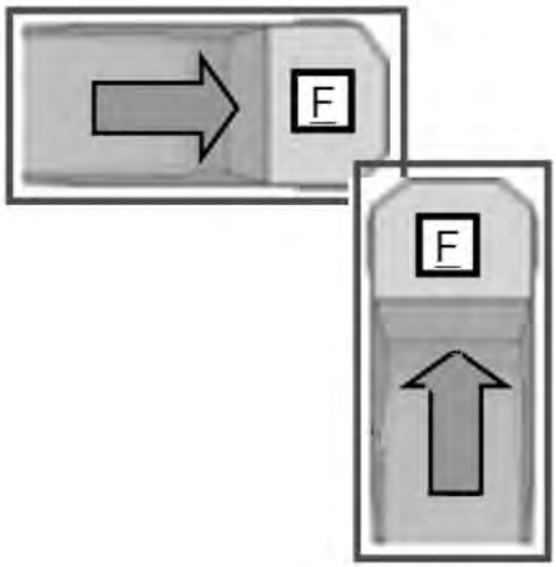

Illustration 26 g03061444

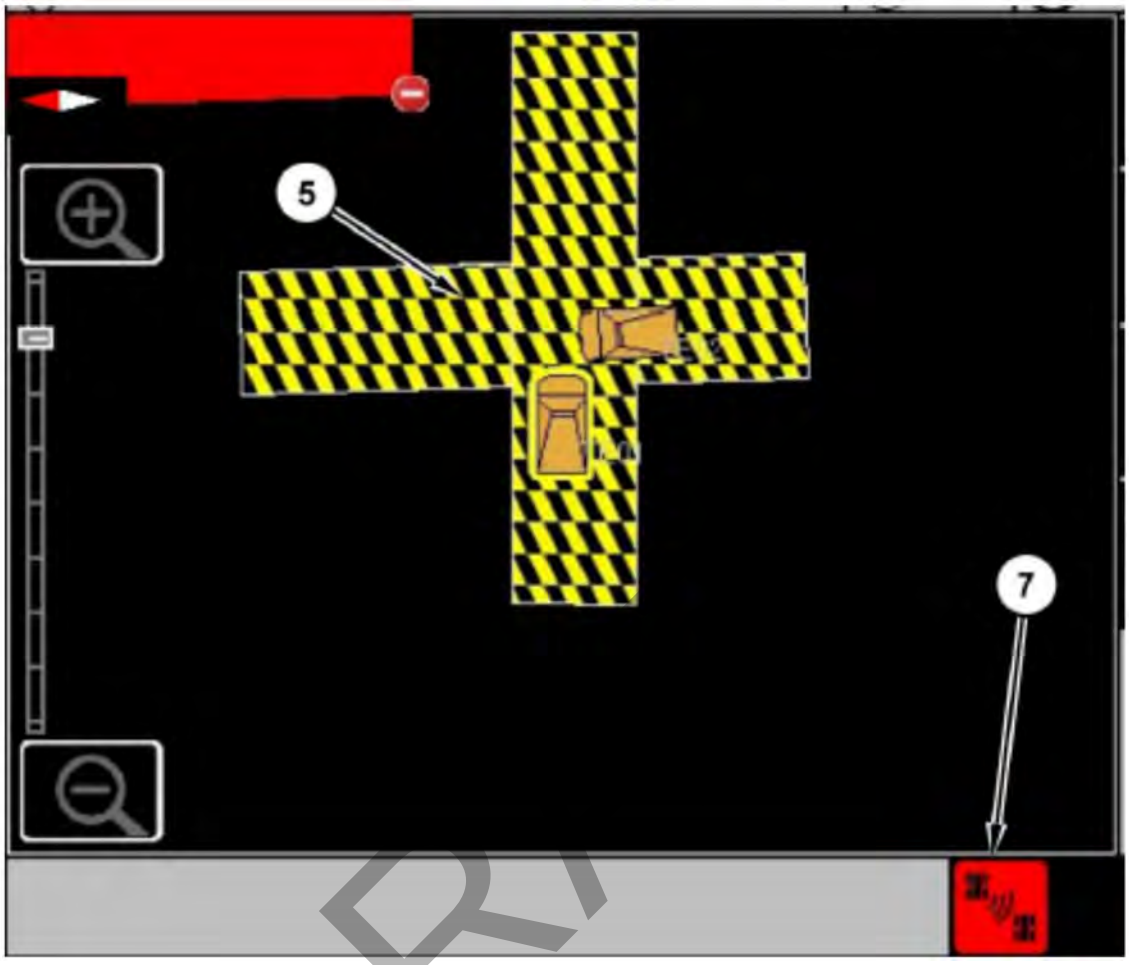

Illustration 27 g06012994

Critical Zone

(5) Projected path (7) Stop zone alert icon

A critical proximity alarm is generated when any of the following activities occur:

- Body on body area

The projected path (5) appears and a proximity alarm icon (7) appears in the bottom right corner. During the incident, the icon flashes, and an audible alarm tone is sounded. Refer to M0065690, Audible Alarms section for additional audible alarming details. Refer to Illustration 26 and Illustration 27 for an example of a critical proximity alarm.

⚠ WARNING

When the proximity awareness audible alarm is sounded, identify the other machine and the location of the other machine before you move your machine. Failure to identify the location of the other machine prior to moving your machine can result in product damage, personal injury, or death.

Unknown Machines

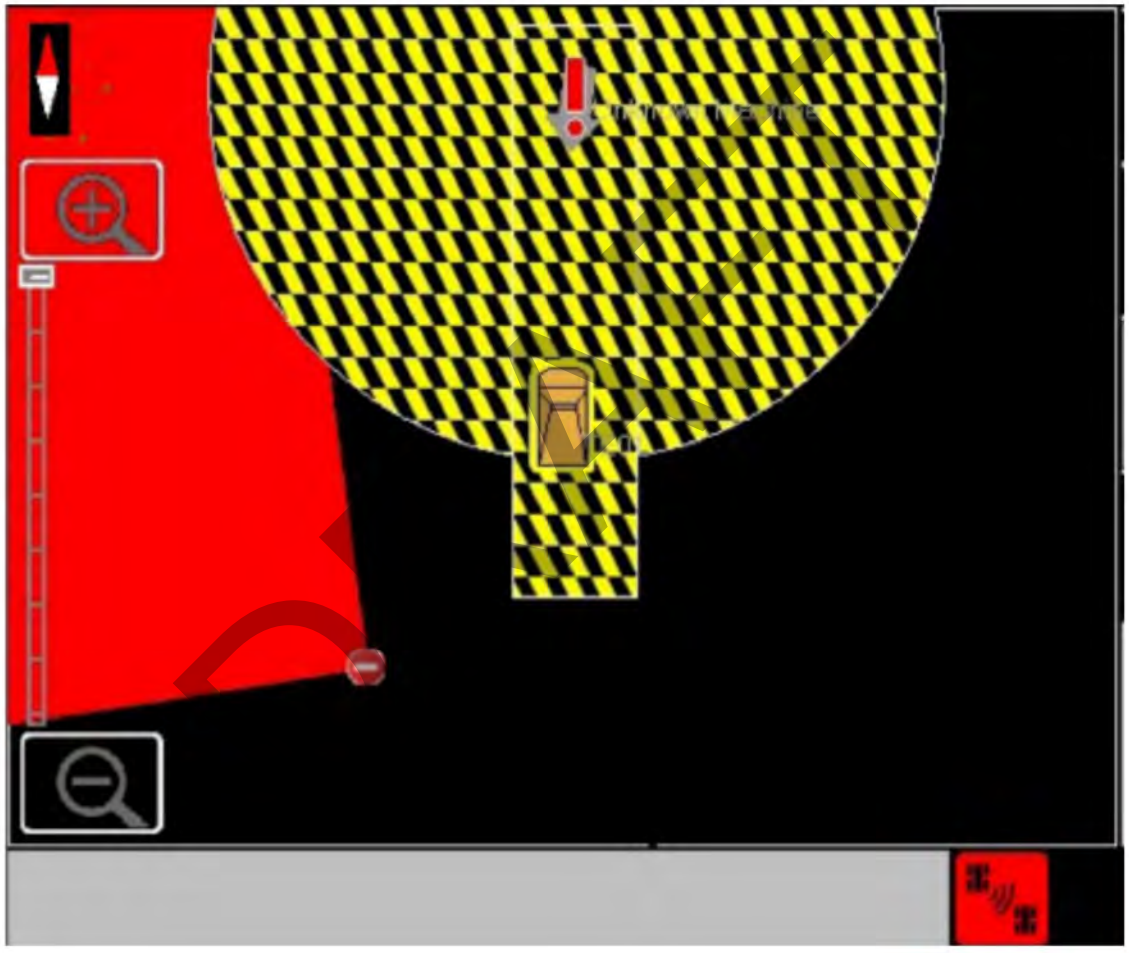

Illustration 28 g06013037

Unknown Machine

Unknown machines are treated as a rotational machine and have a default body area and avoidance area that is defined in the configuration file. These machines are represented as an arrow on the display. Illustration 28 shows an unknown machine type and the default body area and avoidance area. The same rules apply regarding alarming for machines that are unknown.

i07071219

Audible Alarms

SMCS Code: 7348; 7490

Proximity Alarming Filters

The system can be configured to exclude Proximity Awareness alarms except for the body on body alarm. These filters are used generally with loading tools so that normal operating procedures do not produce nuisance alarming. Check with your supervisor regarding the site-specific configuration.

Alarm Types

The Proximity Awareness System sounds audible alarms for different types of events.

⚠ WARNING

The Proximity Awareness system is highly configurable. Depending on site configuration settings within Detect Office, certain visual and/or audible alerts may not function for a particular event. Work with your supervisor to understand the alert behavior prior to using the system. Failure to follow the instructions or heed the warnings could result in injury or death.

Note: Depending upon how the system is configured an audible alarm may not be present for all the scenarios listed below.

Diagnostic Alarms

The following alarms are raised for diagnostics:

- Low GPS
- No GPS
- Loss of wireless communications
- System fault (if equipped with Object Detection)

Low GPS

When GPS drops below the level defined in the configuration file, a single beep may sound depending on the site configuration for 1 second indicating to the operator that the system has a low GPS signal. No action is required by the operator.

No GPS

When GPS signal is lost for more than 5 seconds either due to the environment or equipment failure, the audible alarm may sound depending on the site configuration for 1 second indicating to the operator that the system has lost the GPS signal. The operator should contact the supervisor if the “no GPS” indicator does not disappear from the screen.

Loss of Wireless Communications

When wireless communications with the office are lost for more than 15 seconds either due to the environment or equipment failure, the audible alarm may sound depending on the site configuration for 1 second indicating to the operator that the system has lost wireless. The operator should contact the supervisor if the “no communication to office” status indicator does not disappear from the screen.

Object Detection System Fault (if equipped with Object Detection)

If the Object Detection detects a fault with one of the components within the system, the system will trigger a diagnostic code or an event. The operator should contact the supervisor to resolve the issue. Refer to the applicable Object Detection system for additional information regarding diagnostic codes and events.

Zone Alarms

The following alarms are raised for zones:

- Speed zones
- Entering hazard zones
- Entering avoidance zones

Speed Zones

When the machine is operating in a speed limit zone and exceeds the speed limit of that zone, an audible alarm may sound depending on the site configuration continuously until the machine slows to the speed limit or exits the speed zone and enters an area with a higher speed limit which is not being exceeded.

Entering and Exiting Zones

When the machine enters a hazard zone, an audible alarm may sound depending on the site configuration for 1 second. Once the machine exits the zone, the audible alarm depending on the site configuration may then sound again for 1 second.

Entering Avoidance Zones

When the machine enters an avoidance zone, the system may sound depending on the site configuration an audible alarm until the machine exits this zone.

Proximity Alarms

The following alarms are raised for proximity events:

- Object Detection System (if equipped)
- Proximity Awareness

Object Detection System (if equipped)

The Object Detection system has various alarm levels depending upon the distant of the object to the machine. Refer to Operator and Maintenance Manual, “Proximity Indicator (If Equipped with Object Detection)” for more information regarding the various alarms of the Object Detection system.

Proximity Awareness

The Proximity Awareness system has two distinct alarm types based on the proximity of the object to the machine. Refer to Operator and Maintenance Manual, “Proximity Alarming”for more information regarding the various alarms of the Proximity Awareness system.

Note: Alarms are automatically silenced once the machine is stopped and the gear selector is put into park or neutral. Once the machine is back in gear, the alarms are reactivated. This scenario applies to Object Detection and Proximity Awareness alarming only when installed on a machine utilizing VIMS supporting Cat MineStar system products. Consult your Site MineStar champion for more details.

Table 2

Proximity Awareness Operator Notifications (GPS Based)				
Notification Levels	**Description**	**Conditions**	**Audible Alert**	**Visual Notification**
Low Priority	Signals to the operator control new conditions Prepare to take action if required	Path or avoidance regions of two machines intersect	Low Frequency On Off On Off tone pattern reference PA_Caution.wav on Dealer.Cat.Com	Solid yellow low priority icon
High Priority	Signal to the operator new conditions have escalated Prepare to take action if required	Path or avoidance regions intersect with another machines body region	Medium Frequency OnOffOn Off On Off tone pattern reference PA_Warning.wav on Dealer.Cat.Com	Flashing red high priority icon
Critical	Signal when conditions are in violation of configured regions and require immediate correction	Body regions of two machines intersect	High Frequency OnOffOn Off On Off tone pattern reference PA_Critical.wav on Dealer.Cat.Com	Flashing red high priority icon

(continued)

(Table 2, contd)

Miscellaneous Alerts				
Notification Levels	**Description**	**Conditions**	**Audible Alert**	**Visual Notification**
Fault	Signals when there is a loss of functionality that is not under operator control	Poor GPS signal, loss of communication	Configurable single 0.5 second alarm	Fault icon in the System Status window
Zone entry	Indicates that a configured proximity zone has been entered	Entering or exiting a proximity zone	Configurable single 0.5 second alarm	Configurable pop-up
Speeding	Indicates that the speed limit has been exceded	Exceeding a class or configured zone speed limit	Constant tone	Speed violation icon displayed in the System Status window
Zone Violation	Indicates that a restricted zone has been entered	Entering or exiting a restricted zone	Constant tone	Zone violation icon displayed in the System Status window

Table 2 outlines the details of the various notification levels.

Acknowledging Alarms

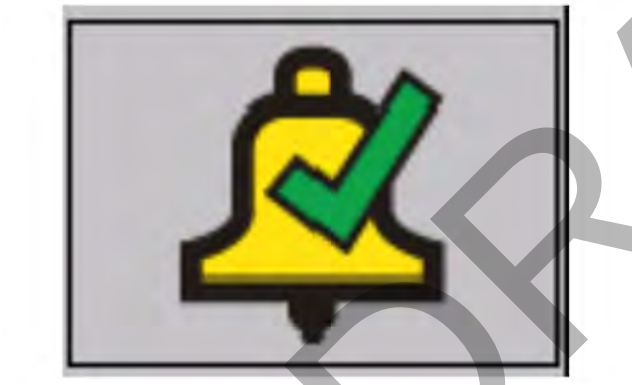

Illustration 29 g06013042

Acknowledge alarm

Depending upon the site configuration, the operator is able to acknowledge audible alarms. Acknowledging alarms silences the current active audible tone during that particular alarm event (for example, a radar object detection). Acknowledgment does not affect new events from generating audible alarms. Press the alarm button to acknowledge the alarm or alternatively, press the alarm acknowledge softkey (optional).

The following alarm types can be acknowledged by the machine operator depending on the site configuration:

- No GPS
- Speed limit violation
- Proximity Awareness events

Muting Alarms

Note: The alarm can be muted permanently based on-site configuration. By default, the alarms are not muted.

Depending upon site configuration, the operator may be able to mute certain audible alarms. Muting the alarms silences the audible tones until the display is power cycled or the operator unmutes the alarms.

The following alarm types can be muted by the machine operator depending upon site configuration:

- Loss of radio communications
- Low GPS
- No GPS
- Interaction with machine that is out of communications
- Speed limit violation
- Proximity Awareness events

To mute the alarms, perform the following procedure:

1. Press and hold the alarm acknowledge button for approximately 3 seconds. The disclaimer dialog will appear. Refer to Illustration 30 .

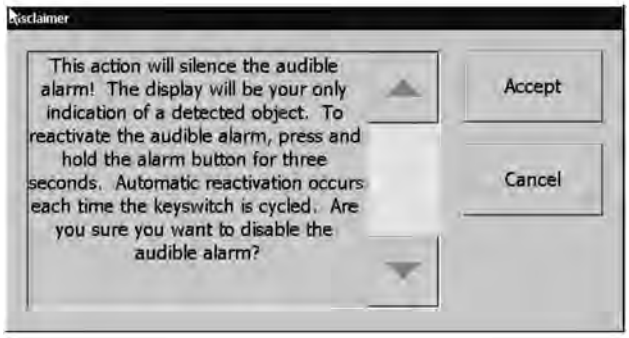

Illustration 30 g03353994
Disclaimer screen

2. Press the “Accept” key to mute the alarms. An icon will appear in the status window indicating that the system is muted.

Illustration 31 g03353997
Muted alarm icon

Note: The ability to mute an alarm type is configured specifically for each alarm type.

3. To unmute the alarm, press the alarm acknowledge button again for 5 seconds or cycle the power to the display.

i06535633

Operator Utilities

SMCS Code: 7348; 7490

Logging In

Change operator – This button may be configured to display on the toolbar of the display. Press this button to log into the system.

To log into the system, perform the following procedure:

1. Press the change operator button on the touchscreen of the display.

One of the following windows will appear:

- “Login Confirmation”
- “Select User Id”

Illustration 32 g02155330
“Login Confirmation” window

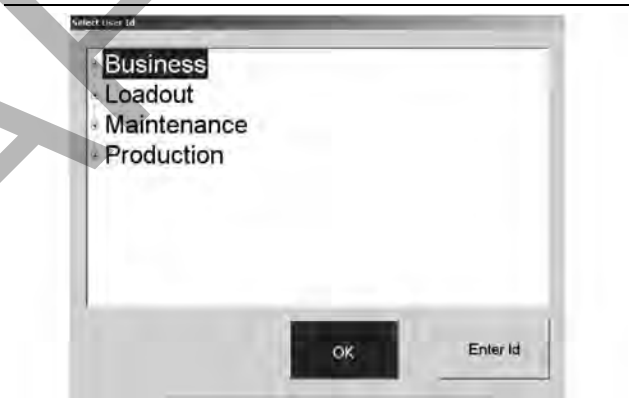

Illustration 33 g02155332
“Select User Id” window

2. If the “Login Confirmation” window appears, confirm the login. If the “Select User Id” window appears, perform the following procedure:

a. Select a user name in the selection tree of the “Select User Id” window. Alternatively, the user may press the “Enter Id” button. If the “Enter Id” button is used, the keypad will display to enter a numerical user ID.

b. Press “OK” once a user is selected from the selection tree or a user entered. The “Login Confirmation” window will display.

c. Select “Yes” to confirm the login. Press “No” to return to the “Select User Id” window.

Note: In the “Login Confirmation” window, if “No” is selected, the “Select User Id” window will then display.

3. Press the “OK” on the touchscreen or press “OK” button on the display.

Unknown Login

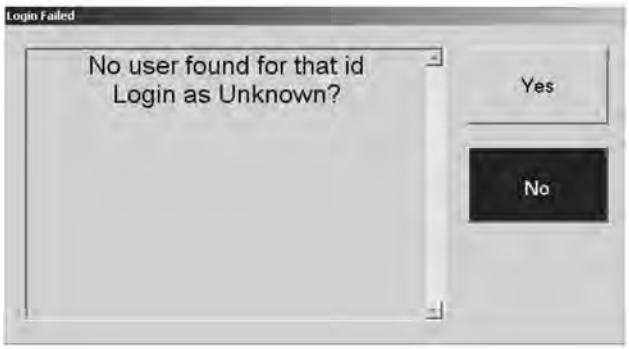

Illustration 34 g02155702

“Login Failed” window

The system will allow a user to perform a login as “Unknown” . This feature allows operators that cannot provide an ID to continue to operate the machine. If the operator enters an ID which is not found in the operator ID file, the “Login Failed” window will appear.

Logging Out

Change operator – This button may be configured to display on the toolbar of the display. Press this button to log into the system.

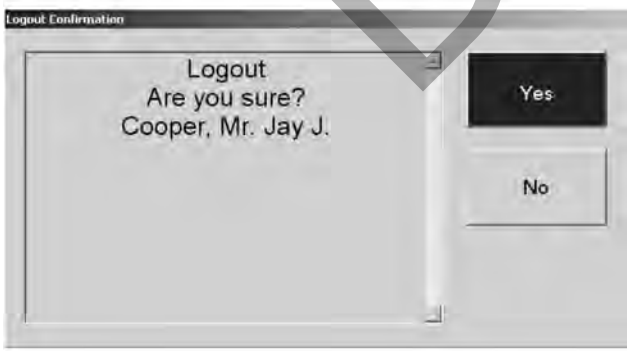

Illustration 35 g02155713

“Logout Confirmation” window

To log out of the system, perform the following procedure:

1. Press the “Change Operator” button on the toolbar.

The “Logout Confirmation” window will appear.

2. Press “Yes” to confirm the logout.

The “Select Id” window appears for the next operator to log in.

Note: Confirmation is not required if the office has disabled the operator confirmation window.

Pre-Operation Check

A pre-operation check may be configured to display at operator login. Each item in the checklist must be verified. Then each item is selected as pass or fail and the information is sent to the office.

Note: The items in the checklist are customized by the site.

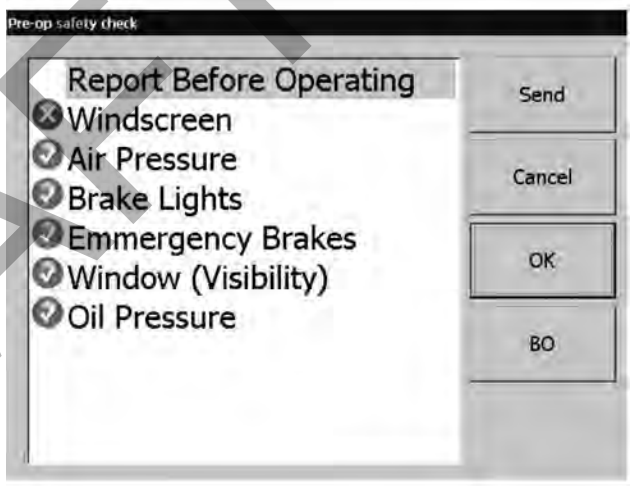

Illustration 36 g02645850

“Pre-op safety check” window

Perform the following procedure to process the pre-operation check:

1. Select the first item in the list and the press “OK” if the item is operational or press “BO” if the item is broken.

The next item will be highlighted automatically once the previous item has been processed.

2. Continue until all items in the list have been processed.

3. Press the “Send” button to send the information to the office.

Note: The checklist window may also be configured not to display the “Cancel” button. This feature ensures that the checklist is processed before operating the machine.

Sending a Mayday Message

Send mayday – This button may be configured on the toolbar of the display. Press this button to send a mayday to the office.

If a machine operator requires assistance in a situation, the operator can send a mayday message to the office. The system asks for confirmation before sending the notification. If the message is accepted by the dispatcher in the office, the office can then send a mayday message to all machines on the site.

⚠ WARNING

The mayday feature is for non-critical situations where the operator requires assistance from office personnel. Due to the nature of wireless communications, the mayday message is not ensured to reach the office in a timely manner. Failure to follow the instructions or heed the warnings could result in injury or death. Proper care is your responsibility. Use other methods of communication for safety critical situations.

1. Press the send mayday button on the touchscreen for the display.

   The “Mayday” window appears.

2. Press “OK” to confirm sending a mayday message. Press “OK” on the display or “Yes” on the touchscreen.

   A mayday message will be sent to the office. When received in the office, the mayday displays as an “Urgent Alarm” pop-up message on every “MineStar Client” that is running at the time of the event. The event is also captured in the alarm monitor page in the system.

Marking a Hazard

Hazard marking button – Press this button to mark the location of on-road hazards.

Detect Proximity Awareness on-board provides a method to allow machine operators to mark the location of on-road hazards that are encountered while in transit. Once the operator presses the hazard marking button, the operator selects the type of hazard and then locates the hazard using a polygon on the screen. This information is then sent to the office. The hazard information is then sent to other machines for display on the screen.

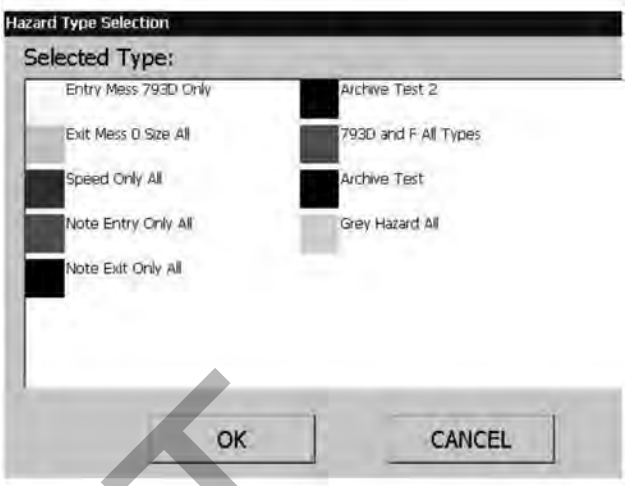

Illustration 37 g02645979

“Hazard Type Selection” screen

Perform the following procedure to mark a hazard:

1. Press the hazard marking button.

   The hazard type selection screen will appear.

2. Select the type of hazard from the list and then press “OK” .

   The plan view window now displays a box around the machine.

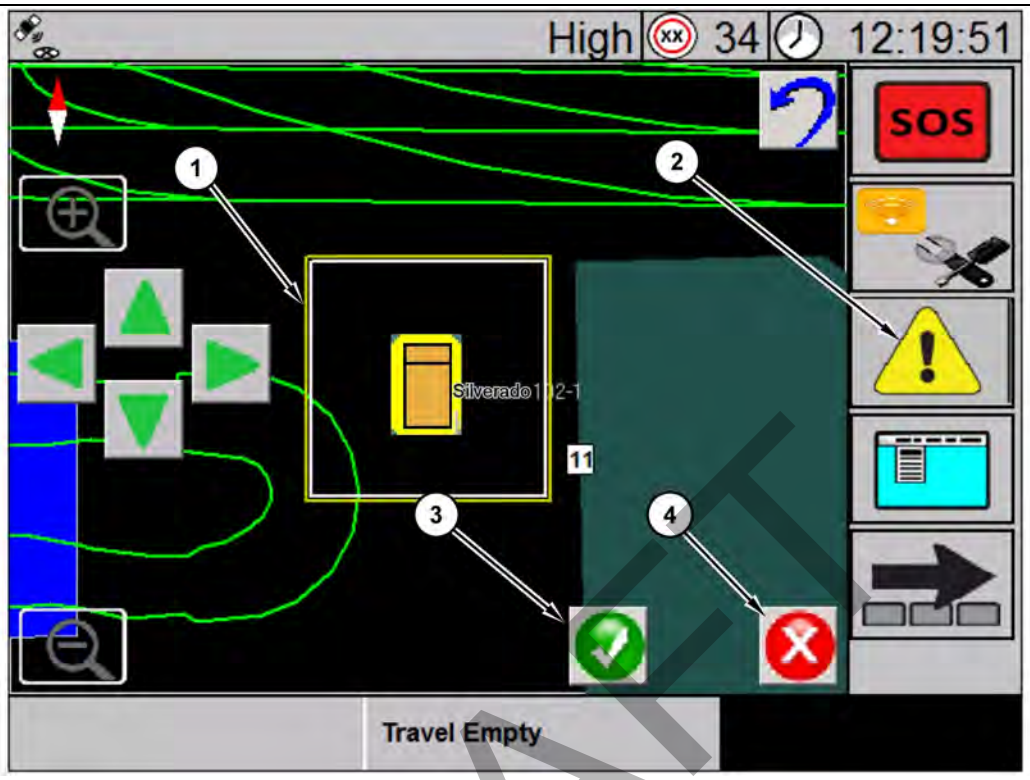

Illustration 38 g02645985

Polygon in plan view

(1) Adjustable poly
(2) Hazard marking tool button
(3) Confirmation key
(4) Cancel key

3. Use the arrow keys shown on the plan map or the physical keys on the display to position the box around the hazard.

Note: If the GPS accuracy of the machine is too low, then this feature will be disabled. A dialog box will appear indicating to the operator that the functionality is disabled.

4. Press the confirmation button to create the polygon. The hazard waypoint information is then sent to the office. The office then sends the hazard information to other machines for display on the screen.

Adjusting Screen Brightness

Brightness button – The brightness button is used to adjust the screen brightness. The screen will toggle between two settings. Press once to set the screen to the brightest mode, press again to set the screen to dimmest mode.

Illustration 39 g03057509

Brightness adjustment mode

(5) Dim button
(6) Brighten button

Two brightness modes may be set. A day mode and a night mode are configured by the operator.

Press and hold the brightness button for 3 seconds. The screen brightness adjustment window will display to set the two modes. Move the slider button towards the dimmer button to change the level of the minimum brightness and then release the slider button. This action will set the night mode level. Then move the slider button towards the brighter button to change the level of the maximum brightness and then release the slider button. This action will set the day mode level. Once the two modes are set, switching between the modes is possible by pressing the brightness button once.

Note: At night, adjust the brightness of the display to a level that allows viewing comfort while not distracting from night time operation.

Maintenance Section

i07071803

Maintenance Interval Schedule

SMCS Code: 1400

Every 8 Service Hours or Daily

Every 2000 Service Hours or 1 Year

i06552490

Dimensional Coverage - Verify

SMCS Code: 7347

After 2000 hours or 1 year of service, ensure the machine measurements recorded in MineStar office are correct. Perform the machine measure up as described in Special Instruction, REHS9127 and compare the current results with the previously documented results in MineStar Office. Update values as needed.

i06535635

Display - Clean

SMCS Code: 7347-070

To maintain sufficient vision, the display must be inspected and/or cleaned for dust and debris at the beginning of each shift due to the environment.

Use a soft, damp cloth with water only to clean the display.

i06546889

GPS Accuracy - Check

SMCS Code: 7348-535; 7490-535

After start up, ensure that the system is displaying a GPS accuracy in the “Status” and “System Information” windows. Verify that the level that is not reading “fault” . If the GPS mode is faulted, the Proximity Awareness system will not be active. Refer to “Cat ® Detect Proximity Awareness User Guide”UENR3246 for GPS troubleshooting information.

i06546890

GPS Mast - Align

SMCS Code: 7348-535; 7490-535

⚠ WARNING

Improper operation of an access platform could result in injury or death. Operators must carry out their duties properly and follow all instructions and guidelines given for the machine and access platform.

Note: When accessing the GPS antenna mast for cleaning of inspection, be sure to observe safe procedures for access. Maintain a three-point contact and or use a body harness.

Always inspect the condition of the GPS antenna mast and the condition of the GPS antenna mast mounting hardware before you operate the machine. Replace any parts that are damaged or worn before you operate the machine. Make sure that the mounting bolts are tight.

i06547119

GPS Orientation - Adjust

SMCS Code: 7348-025; 7490-025

After start up, ensure that the system is displaying the correct machine icon associated with your machine. Verify that the machine is positioned correctly relative to other machines or geographical features. If the orientation is incorrect, the Proximity Awareness system will not alarm correctly. To verify the system configuration, refer to “Cat ® Detect Proximity Awareness User Guide”UENR3246 for GPS configuration information.

i07070734

V2x Module - Check

SMCS Code: 1639-535

Check that the power and communication lights illuminate when powered “ON” . Check for physical damage to the module.

i07070757

Harness and Cable - Inspect

SMCS Code: 1408-040; 4459-040

Illustration 40 g06214673

PL671 inspection

Inspect for damaged wires or cables routed to the V2x modules. Refer to Illustration 40 .

Index

V

Product and Dealer Information

Note: For product identification plate locations, see the section “Product Identification Information” in the Operation and Maintenance Manual.

Delivery Date: _____

Product Information

Model: _____

Product Identification Number: _____

Engine Serial Number: _____

Transmission Serial Number: _____

Generator Serial Number: _____

Attachment Serial Numbers: _____

Attachment Information: _____

Customer Equipment Number: _____

Dealer Equipment Number: _____

Dealer Information

Name: _____ Branch: _____

Address: _____

_____

_____

	Dealer Contact	Phone Number	Hours
Sales:	_____	_____	_____
Parts:	_____	_____	_____
Service:	_____	_____	_____

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