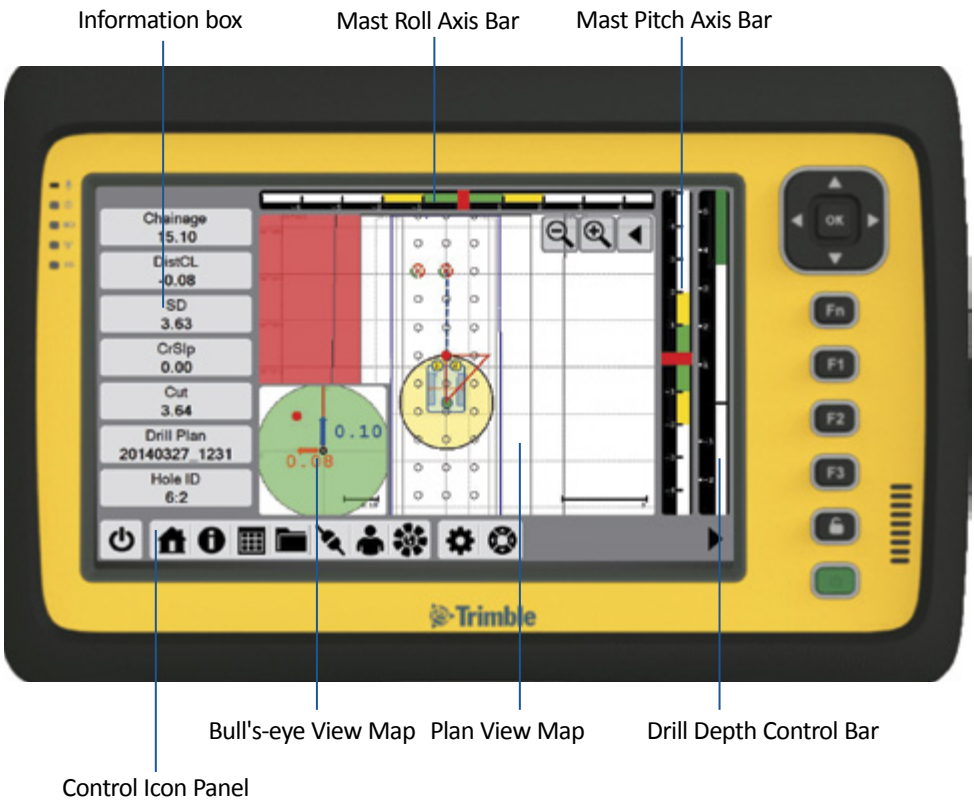
DPS900 SOFTWARE
QUICK REFERENCE CARD FOR DRILL OPERATORS

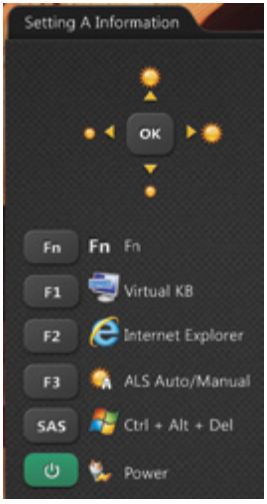
This document contains information for drill operators on how to use the Trimble® DPS900 software. For information for supervisors, please refer to the *DPS900 Software Quick Reference Card for Supervisors*, and the *DPS900 Installation and Configuration Guide*.

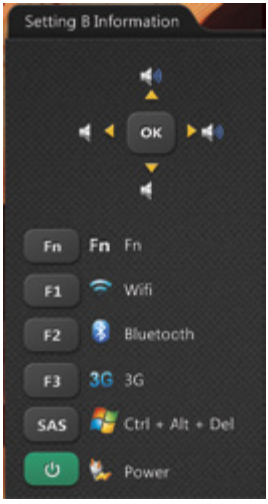
Typical DPS900 Screen Layout

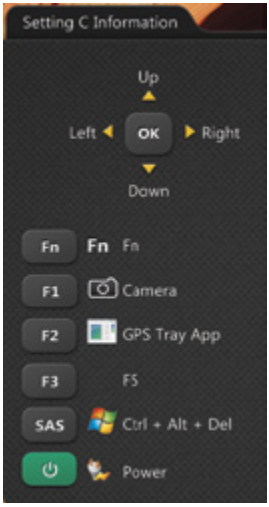


Controller Key Functions

	Hardware keys and functions	
	Up arrow	Scroll up lists
	Down arrow	Scroll down lists
	Left arrow	Scroll up lists
	Right arrow	Scroll down lists
	OK	N/A
F1	F1 key	Used to record the start of drilling
F2	F2 key	Used to record layer changes
F3	F3 key	Used to record the end of drilling
	Lock key	Accesses Windows functions Ctrl+Alt+Del: • Lock computer (Password) • Log off computer • Change Password • Start Task Manager • Switch user • Power down computer
	Power key	Short press = Power on Short press = Standby mode To shut down the computer, select *Start* / *Shutdown*.







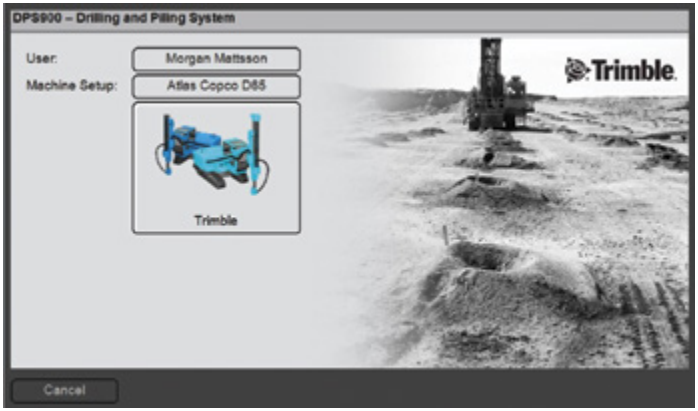
Hardware keys and functions	
Fn + Right arrow Fn + Up arrow	Increase screen brightness
Fn + Down arrow Fn + Left arrow	Decrease screen brightness
Fn + F1	Open the virtual keyboard
Fn + F2	Open Internet Explorer
Fn + F3	Set the auto screen brightness based on the light conditions
Fn Fn + Up arrow Fn Fn + Right arrow	Increase sound volume
Fn Fn + Down arrow Fn Fn + Left arrow	Decrease sound volume
Fn Fn + F1	Switch Wi-Fi on/off
Fn Fn + F2	Switch Bluetooth® technology on/off
Fn Fn + F3	Switch 3G Celllular on/off
Fn Fn Fn + F1	Access the camera
Fn Fn Fn + F2	Access the GPS Tray app
Fn Fn Fn + F3	Refresh

Starting the DPS900 Software

Starting DPS900 software

- From the Windows Desktop, double-tap the DPS900 icon on the desktop
- From the Windows Start menu, tap the *DPS900* option (Emulator version).

Selecting the correct DPS900 configuration



The options on this screen can be configured and may offer more or less options than shown. The background on this screen can also be configured—it may show Trimble, Atlas Copco, Sandvik, or Vermeer.

Mode	This mode uses GNSS GPS receivers connected to…
Trimble	the Trimble GNSS GPS receivers (Ethernet) and the Trimble sensors (CAN) for dual-axis tilt and depth measurement.
MD900	the Trimble GNSS GPS receivers (Ethernet), the AGI MD900 Tilt sensor (Serial), and the TruSense Laser distance meter (Serial) for depth.
Sandvik	the Sandvik control system (Ethernet), and uses the Sandvik tilt and depth measurement system.
Atlas Copco SmartROC	the Atlas Copco HEC3 control system (Ethernet), and uses the Atlas Copco tilt and depth measurement system.
Atlas Copco Pit Viper	the Trimble controller and the Atlas Copco CCI box to connect to the Atlas Copco sensor system for tilt and depth measurement.
Atlas Copco Roc RC S4	the Atlas Copco Serial control system, and uses the Atlas Copco tilt and depth measurement.

Connecting the GPS and drill sensors

1. From this screen, tap **Connect**. If all configured sensors connect correctly, two green bars will appear.

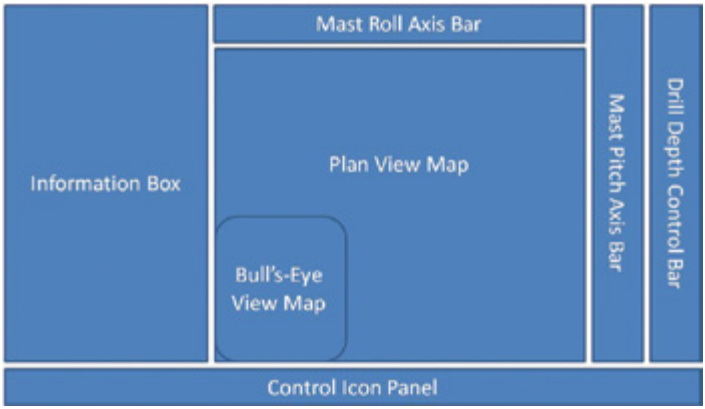
   If a sensor is trying to connect, the bar will be yellow.

   If a sensor fails to connect, the bar will be red.

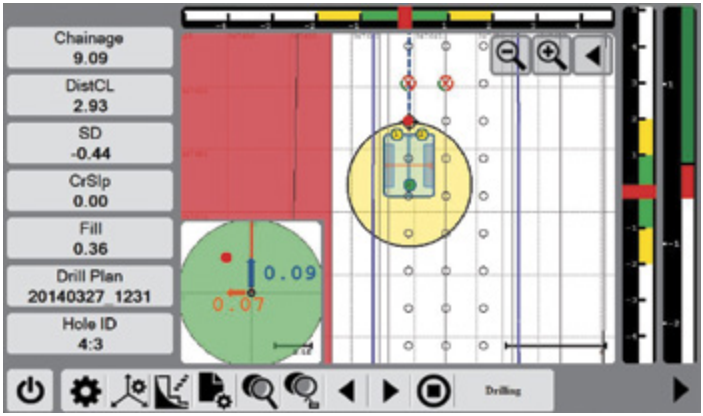
2. If you get a connection failure, try a second time.
3. To check the connected peripherals, tap  .
4. If you continue to get failure, contact the drill supervisor.
5. When both bars are green and connection is complete, tap **Accept** to go to the next step.

Using the DPS900 Software

Typical DPS900 screen layout



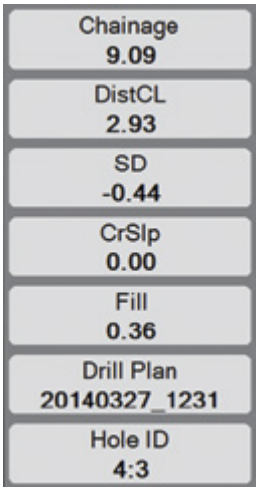
DPS900 screen area functions



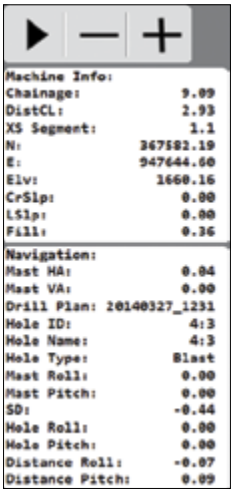
Information box

Displays data values of planned and actual drilling operation. The Information box can be configured for a Basic or Advanced view.

Basic view



Advanced view



- Tap in the Information box to add or remove data values to suit your needs.
- Tap + or − to increase or decrease the text height.
- Tap ▶ to display more data items.
- Tap ⓘ to hide/show the information box.

Plan View Map

Displays plan view of machine, drill plan, and optional site design information.

Minimized icon bank

Expanded icon bank

Yellow highlighted icons are active in the map at all times. The above example shows that the Pan and Machine-centered modes are active.

Use the icons to zoom in  , out  , or access expanded view controls  .

- Tap and drag function depends on settings in the expanded icon bank.
- A yellow highlighted icon  makes that function active.
- A grey icon  makes that function inactive.

	Mode	Description
	Pan	Tap the map and drag your finger or stylus in the direction that you want to move the map.
	Zoom	Tap the map and drag a box down and to the right to zoom in. Tap the map and drag a box up and to the left to zoom out.
	Machine Centered	This places the machine tool position in the center of the map plan view at all times when highlighted in yellow.
	Zoom Extents	Zoom your view to a distance which makes the whole map visible and centered in the map plan view.

Settings

General settings

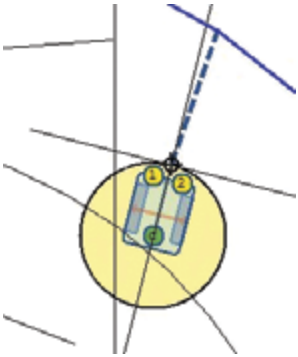
Use this icon  to access map display settings and machine display settings.

Setting	Description
Use map rotation	When switched on, the map rotates as the machine changes orientation. The map is oriented with the positive direction in the pitch axis being top of the screen. When switched off, the map is oriented with North at the top of the screen.
Map grid	This allows the Map grid to be switched on or off.
Show alignment markings	Displays alignment geometry information on corridor design models (Station, Radius, A Parameter).
Show point names	Displays point names in the map screen. It applies only to SQL .SDF file design data.
Show triangles	When a design is loaded (surface model or corridor model), this function enables the triangles of the model to be displayed or hidden. Triangles are displayed in red, so that they can be differentiated from the linework in a design. The boundary of a surface model is displayed in blue (yellow if the screen is inverted). The surface boundary is always displayed when a design is loaded. The triangles and linework are optional.
Invert background color	The Map display color can have a white (normal) or black (inverted) background color. Black background improves night vision if working in low light conditions.

Alarm settings

Setting	Description
Distance	When an avoidance zone boundary is loaded as a part of a design, it is displayed on screen as a red filled area. This distance setting warns you when the drill tool is within the entered distance or inside the avoidance zone. For a warning when any part of the machine body could be inside or close to the avoidance zone, enter the value of the greatest distance of the machine body from the tool position.
Sound	When an avoidance zone is being approached, a warning appears at the top of the map screen. If an audible alarm is required, enable this function.

Drilling Rig display settings



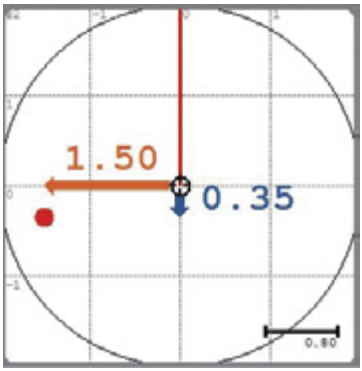
Setting	Description
Show GNSS	Enable/disable display of the GNSS receiver positions as small yellow circles.
Show machine	Enable/disable display of the machine body and pitch/roll axis indicators.
Show mast	Enable/disable display of the machine mast and inclination orientation as a dashed blue line.
Show circle	Enable/disable display of the machine rotation circle (excavator type machines).
Show machine sight line (Pitch)	Enable/disable display of the machine sight line indicator as a solid black line through the tool and parallel to the track axis of the machine.

Setting	Description
Show machine sight line (Roll)	Enable/disable the display of the machine sight line indicator as a solid black line through the tool and perpendicular to the track axis of the machine.
Limit to show as vertical	Limitation for showing the current orientation of the mast. If set to 2, the mast orientation will not move while you are within 2 degrees of vertical.

Drilling View settings

Setting	Description
Show in graphics	Enable/disable the display of the drill plan hole indicators.
Show hole IDs	Enable/disable the display of drill hole ID in the displayed drill plan.
Show hole names	Enable/disable the display of drill hole names in the displayed drill plan.
Show hole positions at tool elevation	When working with inclined holes, this should always be enabled. Drill hole locations are continually adjusted on screen to display the hole locations at the current tool elevation. This function provides no benefit for vertical drilling. When enabled, the closest holes only to the tool position are displayed.
Target horizontal acceptance	The target acceptance value is the horizontal accuracy that you require for the drill positions. The bull's-eye turns yellow when you are within 2x the position tolerance and green when you are within your specified position.
Target vertical acceptance	The target acceptance value is the vertical accuracy that you require for the drill hole target depth/elevation.

Bull's-eye navigation

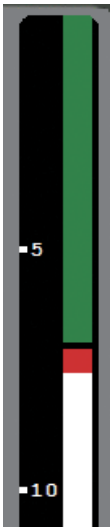


- When a drill hole is selected, Bull's-eye displays drill position at center and selected drill hole as a red dot .
- The blue arrow indicates movement required in the pitch axis (track axis) of the machine (0.35 for backwards).
- The red arrow indicates movement required in the roll axis of the machine (1.50 to the left).
- The values count down to zero as you approach the hole position.
- Move until the drill position and selected drill hole are in the same location in the bull's-eye.
- The bull's-eye turns yellow when you are within 2x the position tolerance and green when you are within your specified position tolerance.

Mast Roll/Pitch axis bar

- Displays the planned mast roll or pitch (0 if vertical) as the center of the green bar.
- Displays the actual mast roll/pitch as the small red bar.
- Tilt the mast in the roll/pitch axis until the red bar is in the center of the green bar.

Drill Depth control bar



When drill depth control is enabled:

- Displays the progress of drilling towards the target depth of drilling from the selected drill plan.
- The bar displays a black horizontal line indicating the target bottom of hole.
- The bar fills yellow when drilling starts, then changes to green once the minimum drill depth is met.
- When you over drill below the target depth, the bar turns red indicating over drilling.
- If you retract the drill while drilling, the retraction depth is displayed in blue to indicate the depth to which the hole had previously been drilled.
- Drill Start and End points are recorded using the F1 key to start and F3 key to stop drilling. *Note: The icon controls in the touch screen also start and stop drilling.*

Control icon panel

Provides the operational controls to access all necessary functions of the system (see page 15 and 16).

Managing and Using the Information Box Data Items

Recommended Information Box display items

The following table shows the available positioning information data items with descriptions. Items marked with a (✓) are recommended to display. If the values displayed fall above or below the recommendations, contact the drill supervisor.

Data Item	Description	Display
Sat	**Satellites** – The number of satellites being used at your current location. You need a minimum of 5 to operate.	✓
HDOP	**Horizontal Dilution of Precision** – HDOP is the Horizontal component. The value should be less than 7. *DOPs indicate positioning condition issues such as GPS shadows caused by high wall blocking or ghosting caused by reflected signals from the satellites.*	×
VDOP	**Vertical Dilution of Precision** – VDOP is the vertical component. The value should be less than 7.	×
PDOP	**Positional Dilution of Precision** – PDOP is a 3D value. The value should be less 7.	×
GDOP	**Geometry Dilution of Precision** – GDOP takes into account the satellite positions in relation to each other in the sky. The value should be less than 7.	×
QI Head	**Quality Indicator** – To get the accuracy of the system, this needs to display **Fixed**.	×
QI MB	**Quality Indicator** – To get the accuracy of the system, this needs to display **RTK Fixed**.	✓
HRMS	The GPS positioning systems estimate of its current horizontal position accuracy. If you are chasing 0.2' accuracy and this value is greater than that, contact the drill supervisor.	✓
VRMS	The GPS positioning systems estimate of its current vertical position accuracy. If you are chasing 0.5' accuracy and this value is greater than that, contact the drill supervisor.	✓
Heading	Heading direction provided by the GNSS.	×
Battery	Remaining GNSS battery (Heading receiver).	×
Elv	Elevation of the Heading receiver.	×
Elv MB	Elevation of Moving Base receiver.	×

The following table shows the available *Info Box* data items and indicates those that are recommended (✓) or not recommended (×) for Site (Site, Mine, Quarry) or Linear (Road, Rail, Pipe) projects.

Information Box Data Item		Site	Linear
Station	Stationing along corridor.	×	✓
DistCL	Distance to centerline of road.	×	✓
XS Segment	Design surface element name.	×	×
N	Tool Northing coordinate.	×	×
E	Tool Easting coordinate.	×	×
Elv	Tool Elevation coordinate.	✓	✓
CrSlp	Cross slope of design surface in machine roll axis direction.	×	×
LSlp	Long slope of design surface in machine pitch axis direction.	×	×
Cut/Fill	Vertical distance to target.	×	×
SD	Slope distance to target elevation point, that is, drill distance to go.	✓	✓
Mast HA	Orientation of the inclined mast.	×	×
Mast VA	Mast inclination angle (combination of pitch and roll angles).	✓	✓
Drill Plan	Active Drill Plan name.	✓	✓
Hole Name	Hole name for active hole.	✓	✓
Hole ID	Hole ID for active hole, typically Col:Row.	✓	✓
Hole Type	Type of hole.	✓	✓
Mast Roll	Current mast roll angle.	✓	✓
Mast Pitch	Current mast pitch angle.	✓	✓
Hole Roll	Hole inclination angle for the active hole in machine roll axis.	✓	✓
Hole Pitch	Hole inclination angle for the active hole in machine pitch axis.	✓	✓
Distance Roll	The distance the drill needs to move in the roll axis in order to be in the hole starting location.	✓	✓
Distance Pitch	The distance the drill needs to move in the pitch axis in order to be in the hole starting location.	✓	✓

Using the Control Panel Icons

If any of the control panel icons are missing and you require them in your installation of the DPS900 software, contact your drill supervisor.

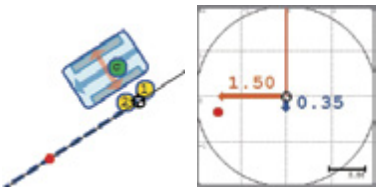
The control icon panel provides access to all key functionality of the DPS900 software. The availability of the control functions listed can be managed by the drill supervisor. The list below shows the icon, the description, and suggests whether the function is typically required for the operator.

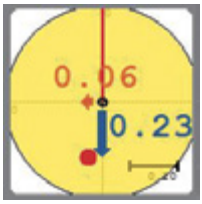
Icon	Description	Required
	Machine sensor setup, sensor calibration, and machine measure up functions. Typically once setup, this is locked to prevent accidental changes.	×
	Change view settings, add, and remove views from map display area. Typically set to show Plan view and Bull's-eye view and then locked for operator.	×
	Main menu, advanced settings, measure up, sensor configuration, and sensor calibration.	×
	Set up site, select a design, and select a drill plan. On a permanent site (mine, quarry, long life project), once the site is setup, you only need to select a drill plan. If you will import/load the drill plans from a USB stick, then this function should be enabled.	✓
	Create, select, review and delete drill plans and/or drill plan production statistics.	✓
	Bench drill hole settings.	×
	Drill hole override parameters allows operator to apply inclined drilling parameters to vertical holes and to add sub drilling extensions to provided drill plans.	×
	Start drilling F1 and record start position.	✓
	Stop drilling F3 and record end position (and key in depth when no depth sensor is available).	✓

Icon	Description	Required
	Automatic Drill Hole selection is enabled. The system automatically selects and navigates you to the nearest unfinished drill hole. *Note – Tapping any manual control while in Automatic mode switches the software to Manual mode.*	✓
	Manual Drill Hole selection is enabled. The operator can manually select the drill hole using one of the following methods. *Note – Tapping any manual control while in Automatic mode switches the software to Manual mode.*	✓
	Manual Mode – Select the nearest unfinished drill hole to current drill position.	✓
	Add hole to existing Quality file (Log file).	✓
	Manual Mode – Select the previous or next drill hole in the drill plan. Step through the drill holes one by one. Tap a drill hole on map screen (small black circle) and set as the active hole.	✓
	Shut down the DPS900 software or shut down the entire system.	✓
	Showing dashboard view. Penetration rate, Percussion pressure, Feeder pressure, Damp pressure, Rotation pressure, and Flow pressure. Must have MWD data to be able to show this dashboard.	✓
	Showing map view. This icon is swapped with the dashboard view.	✗
	Open/close the Information box window.	✓

Automatic Hole Selection and Machine Navigation

Automatic Hole Selection mode will automatically select the nearest hole to the drill position. As the machine moves, the active hole changes to any hole that comes nearer to the drill position. On completion of a hole, the next nearest hole is automatically selected.

Step	Description of Process	How/Action
1	Set the DPS900 software into Automatic Hole Selection mode.	Tap . If the icon already looks like this , the software is already in Automatic Hole Selection mode. When the icon displays , it indicates Automatic Hole Selection mode is activated.
2	The nearest hole to the drill bit in the currently loaded drill plan is colored with a red dot .	This is the “active hole” for navigation of the machine.
3	The Bull's-eye view shows the direction and amount of movement required to get from the current machine location to the active hole location. The values displayed are Pitch axis movement (in the direction of the tracks) and Roll axis movement (perpendicular to the tracks). 	Start moving the machine towards the active hole. • Up in the Bull's-eye view is forward movement. • Down in the Bull's-eye view is reverse movement. • Right in the Bull's-eye view is right movement. • Left in the Bull's-eye view is left movement. Use the Pitch Line indicator to line the machine up with the active hole as you tram towards the hole. To access the Pitch line indicator On/Off, tap from the map view controls.
4	Move the mast to a vertical or inclined position using the Mast Pitch and Roll Axis bars. The mast is in the correct location when the red bar is in middle of the green bar.	

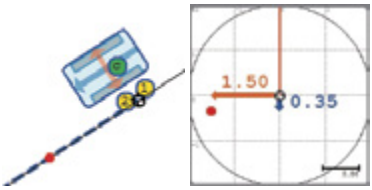
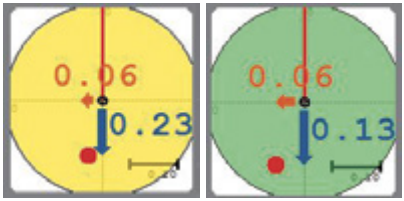
Step	Description of Process	How/Action
5	As the drill approaches the active hole, the bull's-eye turns yellow when you are within 2 x the position tolerance and green when you within your specified position tolerance. Navigate the machine until the bull's-eye goes fully green.	 
6	Collar the drill, check that the mast inclination matches the hole inclination, and that the bull's-eye is still green.	Press the F1 key on the controller or tap the ⦿ icon to “Start Drilling”. This records the start of hole position.
7	Drill until the Drill Depth Control bar shows the green depth indicator hit the hole bottom line. If you continue to drill beyond that line, the green bar turns red. When the drill depth indicator shows yellow, the minimum drilling has not been met. When the indicator is green, it is approaching the target drilling depth. When the indicator is red, you have exceeded the target drill depth. If the indicator displays blue, you have retracted the drill—the blue indicates the depth to which you had drilled before retraction.	

Step	Description of Process	How/Action
8	Stop drilling. Retract the drill from the hole.	Press the F3 key on the controller or tap ⏵ to “Stop Drilling”. This records the end of hole position. The completed hole is marked × to indicate that it has been completed. Around the completed hole you will see a circle for each time the hole has been drilled.  . The top third of the indicator is green/ red, if the hole/pile was in/out of tolerance horizontally. The bottom left third of the indicator is green/ red, if the hole/pile was in/out of tolerance for orientation. The bottom right third of the indicator is green/red, if the hole was in/out of tolerance vertically. Where no drill depth measurement sensor is in use, you can manually enter the depth drilled as read from the in-cab control system.
9	The next nearest hole is selected and displayed as  .	Repeat Step 3 through Step 8 for each hole in the drill plan. You can accept this hole and start to move towards it or you can start moving towards the next logical hole. As you move towards the next logical hole, when it becomes the nearest hole it will be automatically selected and will turn red as shown.

Manual Hole Selection and Machine Navigation

Manual Hole Selection Mode allows the operator to manually select the active hole for drilling.

Step	Description of Process	How/Action
1	Set the DPS900 software into Manual Hole Selection mode.	Tap  . If the icon already looks like this  , the DPS900 software is already in Manual Hole Selection Mode. Tip: Tapping  or  also places the DPS900 software into Manual Hole Selection mode.
2	To select a hole as the "active hole", do one of the following options. • Select the nearest hole to the drill position. Tap  to search the drill plan for the nearest hole to the current drill position. • Manually step through the available holes in the drill plan. Tap  to step through the hole list in the drill plan. Once selected, the active hole is displayed as  .	Tap the hole on the screen using the stylus or your finger and then tap **Select as active hole**. If you are zoomed out and tap an area where there is more than one hole, you will be prompted to select a hole from a list.

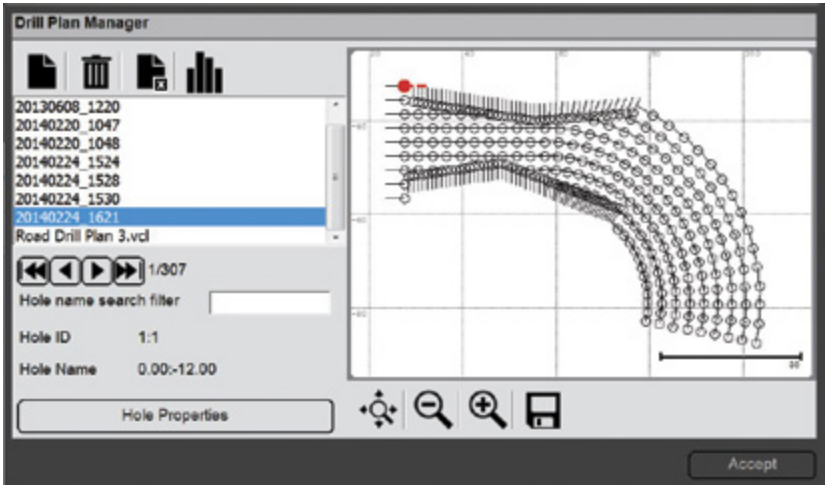
Step	Description of Process	How/Action
3	The Bull's-eye view shows the direction and amount of movement required to get from current machine location to the active hole location. The values displayed are pitch axis movement (in the direction of the tracks) and roll axis movement (perpendicular to the tracks). 	Start moving the machine towards the active hole. • Up in the Bull's-eye view is forward movement. • Down in the Bull's-eye view is reverse movement. • Right in the Bull's-eye view is right movement. • Left in the Bull's-eye view is left movement. Use the Pitch Line indicator to line the machine up with the active hole as you tram towards the hole. Access the Pitch line indicator using the icon from the map view controls ⚙.
4	Move the mast to vertical position or the inclination required using the Mast Pitch and Roll Axis Bars. The mast is in the correct location when the red bar is in the middle of the green bar.	
5	As the drill approaches the active hole, the bull's-eye center turns yellow when you are within 2x the position tolerance and green when you are within your specified tolerance. Navigate the machine until the bull's-eye goes fully green.	
6	Collar the drill, check that the mast inclination matches the hole inclination, and the bull's-eye is still green.	Press the F1 key on the controller or tap the ⊙ icon to “Start Drilling”. This records the start of hole position.

Step	Description of Process	How/Action
7	Drill until the Drill Depth Control Bar shows the green depth indicator hit the hole bottom line. If you continue to drill beyond that line the green bar turns red. When the drill depth indicator shows yellow, the minimum drill depth has not been met. When the indicator is green, it is approaching the target drilling depth. When the indicator is red, you have exceeded the target drill depth. If the indicator is blue, you have retracted the drill—the blue indicates the depth to which you had drilled prior to retraction.	
8	Stop drilling. Retract the drill from the hole.	Press the F3 key on the controller or tap the icon to "Stop Drilling". This records the end of hole position. The completed hole is marked × to indicate that it has been completed. Around the completed hole you will see a circle for each time the hole has been drilled . The outermost circle is the most recent drilling. The top third of the indicator is green/red if the hole is inside/outside of the horizontal tolerance. The bottom left third of the indicator is green/red if the hole is inside/outside the direction tolerance. The bottom right third of the indicator is green/red if the hold is inside/outside the vertical tolerance. Where no drill depth measurement sensor is in use, the operator can manually enter the depth drilled as read from the in-cab control system.
9	Select the next hole using one of the options in Step 2.	Repeat Step 3 through Step 8 for each hole in the drill plan.

Selecting a Drill Plan

When the drill plan is updated or changed, you need to load it for use.

1. To select a new drill plan, tap . The *Drill Plan Manager* appears:



   The drill plans available are listed in the middle of the left side of the dialog. The currently selected drill plan is highlighted in blue and is displayed in the map window to the right.

2. To select a different drill plan, tap the one required in the list of available drill plans. It will be displayed in the map display window to the right.
3. Use the arrow keys to step to the first or last hole or step to the next or previous holes in the drill plan.

   The **Hole Properties** button provides access to the information for the currently selected hole (highlighted with a red dot). The Hole Properties also shows the planned and actual information for a completed hole:

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4. Navigate the map using the Zoom In, Zoom Out, and Zoom Extents controls below the map display. Pan is always active in this map display.
5. The icon controls within the Drill Plan Manager provide the following capabilities:

Icon	Function
	Create a new drill plan.
	Delete the currently selected drill plan.
	Deselect the currently selected drill plan (so that no drill plan is selected).
	Review drilling production statistics, for example, the number of holes drilled today/this week, and the total drill length today/this week.
	Layer reporting. Shows the active quality drill plan layers hole by hole. To export the report as a CSV file, click **Export**.

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