

Operator's Manual

Trimble® PCS900 Paving Control System for Asphalt Pavers

Version 2.10
Revision A
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Notices

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- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Canada

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Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

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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. 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 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 — This alert warns of a potential hazard which, if not avoided, can cause severe injury.

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.

Operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

Trimble 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. If a tool, procedure, work method or operating technique that is not specifically recommended by Trimble is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

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. Dealers have the most current information available.

Safety (Laser)

The IEC and the United States Government Center of Devices for Radiology Health (CDRH) has classified this laser as a Class II laser product. The maximum radiant power output of this laser is less than 5 milliwatts.

Refer to the operator's manual of the laser transmitter for installation and operating instructions.

The laser supplied with your Laser System complies with all applicable portions of "Title 21" of the "Code of Federal Regulations, Department of Health and Human Services, Food and Drug Administration, Federal Register, Volume 50, Number 161, 20 August 1985".

This laser complies with "OSHA Standards Act, Section 1518.54" for use without eye protection. Eye protection is not required or recommended. The following safety rules should be observed:

- Never look into a laser beam or point the beam into the eyes of other people. Set the laser at a height that prevents the beam from flashing directly into people's eyes.
- Do not remove any warning signs from the laser.
- Use of this product by personnel that are not trained on this product may result in exposure to hazardous laser light.
- If initial service requires the removal of the outer protective cover, removal of the cover must be performed by trained personnel.

Crushing Prevention and Cutting Prevention

Support the equipment properly when you work beneath the equipment. Do not depend on the hydraulic cylinders to hold up the equipment. An attachment can fall if a control is moved, or if a hydraulic line breaks.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving. Also, never attempt adjustments while the engine is running.

Whenever there are attachment control linkages, the clearance in the linkage area will increase or the clearance in the linkage area will decrease with movement of the attachment. Stay clear of all rotating and moving parts.

Keep objects away from moving fan blades. The fan blade will throw objects or cut objects. Do not use a kinked wire cable or a frayed wire cable.

Wear gloves when you handle wire cable. When you strike a retainer pin with force, the retainer pin can fly out. The loose retainer pin can injure personnel. Make sure that the area is clear of people when you strike a retainer pin.

In order to avoid injury to your eyes, wear protective glasses when you strike a retainer pin.

Chips or other debris can fly off objects when you strike the objects. Make sure that no one can be injured by flying debris before striking any object.

Operation

Clear all personnel from the machine and from the area.

Clear all obstacles from the machine's path. Beware of hazards (wires, ditches, etc).

Be sure that all windows are clean.

Secure the doors and the windows in the open position or in the shut position.

Adjust the rear mirrors (if equipped) for the best visibility close to the machine.

Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.

Fasten the seat belt securely.

Warm up the engine and the hydraulic oil before operating the machine.

Only operate the machine while you are in a seat.

The seat belt must be fastened while you operate the machine. Only operate the controls while the engine is running.

While you operate the machine slowly in an open area, check for proper operation of all controls and all protective devices. Before you move the machine, you must make sure that no one will be endangered.

Do not allow riders on the machine unless the machine has the following equipment:

- Additional seat
- Additional seat belt
- Rollover Protective Structure (ROPS)

Note any needed repairs during machine operation. Report any needed repairs.

Avoid any conditions that can lead to tipping the machine. The machine can tip when you work on hills, on banks and on slopes. Also, the machine can tip when you cross ditches, ridges or other unexpected obstructions.

Avoid operating the machine across the slope. When possible, operate the machine up the slopes and down the slopes.

Maintain control of the machine.

Do not overload the machine beyond the machine capacity.

Be sure that the hitches and the towing devices are adequate.

Never straddle a wire cable. Never allow other personnel to straddle a wire cable.

Before you maneuver the machine, make sure that no personnel are between the machine and the trailing equipment.

Always keep the Rollover Protective Structure (ROPS) installed during machine operation.

Monitor the location of mounted components. Ensure that the components do not come into contact with other parts of the machine during operation.

Warnings



WARNING — When replacement parts are required for this product Trimble recommends using Trimble replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material. Failure to heed this warning can lead to premature failures, product damage, personal injury or death.



WARNING — The cutting edge of the machine may move without warning when automatic controls are on. These sudden movements could cause injury to anyone near the cutting edge, or damage to the machine. Always put the system in Manual and engage the machine's park brake before you leave the machine, or when somebody is working near the cutting edge.



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



WARNING — Movement of the transmitter could cause unexpected blade movement. Death or serious injury could occur. Turn off the transmitter before you move the transmitter or before you adjust the transmitter.



WARNING — Do not operate this system unless you are fully trained on this equipment.



WARNING — Falling Hazard. Do not climb onto the machine in order to access the GPS receiver or UTS target. Climbing on the machine could result in a fall which could cause serious injury or death. Use the raise and lower mechanism to access the GPS receiver or UTS target for all required maintenance and service.

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About This Manual

In this chapter:

- 1.1 Scope and audience
- 1.2 Trimble training classes and technical assistance
- 1.3 To learn more about Trimble
- 1.4 Your comments

Welcome to the PCS900 Paving Control System for Asphalt Pavers Operator's Manual. This manual provides procedural information for the day to day operation of the system. The system is designed specifically for paving equipment in the highway construction industry.

1.1 Scope and audience

This manual is intended for personnel who operate the system, including:

- Machine operators
- Dealers
- Installation technicians
- Site Supervisors

This manual describes how to use the standard features of the system. To learn about the underlying concepts of the system, refer to the *Trimble PCS900 Paving Control System Reference Manual*.

For information on how to use features not described in this manual, refer to the *Trimble PCS900 Paving Control System Site Supervisor's Manual*.

Even if you have used other machine guidance systems before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product.

Trimble manuals that are related to this product are available in PDF format on the PCS900 Paving Control System release media. To view or print the manuals, use Adobe Reader (provided on the media). Utilities that do not have an accompanying manual have integrated Help.

1.2 Trimble training classes and technical assistance

Contact your dealer for:

- Technical support, information notes, and other technical notes
- Information about:
 - the support agreement contracts for software and firmware
 - extended warranty programs for hardware
 - training classes

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Using the Control Box

In this chapter:

- 2.1 Introduction
- 2.2 Control box basics
- 2.3 Working with control box information
- 2.4 System beeper

As you work with the PCS900 Paving Control System, you need to set up and control the guidance system and understand the guidance information the system provides.

2.1 Introduction

The control box is a computer that runs the system software. You control the guidance system with, and are given guidance information by, the following system components:

- the control box
- the audible alarm, or beeper

This chapter describes, in general terms, how these components are used.

For more information on these components, refer to the *PCS900 Paving Control System Reference Manual*.





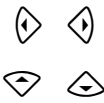



2.2 Control box basics

The control box has a color LCD screen to display guidance and other information, and push button controls to operate the system. In addition, the control box has a USB flash drive port for loading and saving machine and display configuration data, and for loading and saving data. See the following figure, and the following table that describes the items in the figure.





- | | | |
|----------------|------------------------|--------------|
| ❶ Power button | ❷ Softkey label area | ❸ Softkeys |
| ❹ Next key | ❺ Zoom-in key | ❻ Beeper |
| ❼ Zoom-out key | ❽ Escape key | ❾ Arrow keys |
| ❿ OK key | ⓫ USB flash drive port | ⓬ Menu key |

Figure 2.1 The control box


| Description | | Function |
|----------------------|---|---|
| LCD screen | | Displays guidance information |
| Softkey labels | | See 2.3.1 Working with menus and dialogs |
| Softkeys | | See 2.3.1 Working with menus and dialogs |
| Zoom-in key |  | Zoom in on the machine |
| Zoom-out key |  | Zoom out from the machine |
| Next key |  | View the next guidance screen or select the next field in a dialog |
| Menu key |  | View the <i>Setup Menu – Configuration</i> dialog |
| USB flash drive port | | See 2.2.2 System memory and the USB flash drive |
| Arrow keys |  | Pan a guidance view, select an item in a list, or enter data in a field |
| OK key |  | Save changes made in a dialog, and exit the dialog |
| Escape key |  | Exit from a dialog without saving changes, or exit from a menu |
| Power key |  | See 2.2.1 Power key |
| Beeper | | See 2.4 System beeper |

2.2.1 Power key

The  key turns the control box on and off.

To turn on the control box and the system, press . After a brief pause, an opening screen appears.

Note – *If the system reports that there are upgrade files or other system files on the control box, or that the operating system is out of date, contact your site supervisor immediately.*

To turn off the control box and the system, press and hold  for two to three seconds until the control box shuts down. (This delay reduces the risk of you turning off the power accidentally.) You can turn off the system from any screen or dialog.

2.2.2 System memory and the USB flash drive

Files and data are stored on the control box in an area known as system memory. The files and data in system memory are used by the system and there is only limited Site Supervisor access via the control box.

To access the files and data in system memory, they need to be transferred from the control box onto a USB flash drive. The files and data on the USB flash drive can then be directly accessed from a laptop, an office computer, or SiteVision Office software.

Note – When you insert a USB flash drive into the control box, system operation is temporarily disabled. System operation resumes when the USB flash drive is removed.

The USB flash drive folder structure is:

- At the root directory level is a “**Machine Control Data**” folder.
- Within the “**Machine Control Data**” folder are machine specific folders based on machine names, which contain machine specific data.

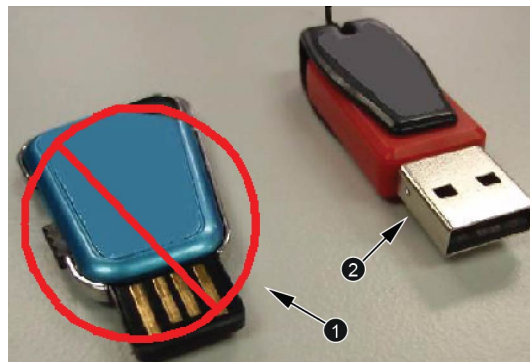
Note – If folders do not exist when files are transferred to the USB flash drive, the system will create them.



ATTENTION — It is recommended to always use a USB flash drive with a metal surround on the connector. When using a USB flash drive with no metal surround on the connector, the drive can be inserted upside down, and due to the lack of the metal part of the connector, contact can be broken and the file transfer process can be interrupted.



ATTENTION — The system only supports USB flash drives formatted as FAT32.



❶ No metal surround on the connector
(NOT recommended)

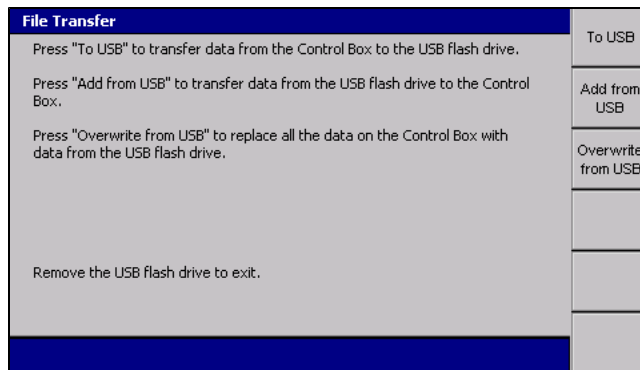
❷ Metal surround on the connector
(recommended)

Figure 2.2 USB flash drive connector examples

2.2.3 Transferring data to and from the control box

1. Start the control box.
2. Insert the USB flash drive into to the control box USB port. The *File Transfer*

dialog appears.



Transferring files to the USB flash drive

Note – If a file or folder to be transferred already has an item with a matching file name, but different contents on the USB flash drive, the destination item will be renamed to a backup name generated by appending the item’s last-modified date to its file name.

1. Press **To USB**.

Only files that have been generated or modified on the control box transfer to the “**Machine Control Data**” folder on the USB flash drive and are written to the machine’s sub-folder. The machine’s sub-folder name is the same as the machine name set on the control box.

The following table describes the action that is applied to each file type during a file transfer to the USB flash drive.

| File type | Copy | Move |
|----------------------|------|------|
| Design files | ✓ | |
| Program log files | | ✓ |
| ZSnap and .gif files | | ✓ |

Note – A copy action copies the file and leaves the original file on the control box. A move action copies the file and deletes the original file from the control box.

A progress bar appears, showing the progress of the data transfer.

2. To exit, press or remove the USB flash drive.

Transferring files from the USB flash drive

Two types of file transfer from the USB flash drive are available:

- Add from USB
- Overwrite from USB


Add from USB

Note – If a file or folder to be transferred already has an item with a matching file name, but different contents on the display, the destination item will be renamed to a backup name generated by appending the item's last-modified date to its file name. Files and folders matching this backup naming convention, generated by a previous "to USB" operation, will NOT be transferred from the USB flash drive to the display.

1. Press **Add from USB**.

Data in the "*Machine Control Data\MachineName*" folder and sub-folders, and the "*Machine Control Data\All*" folder of the USB flash drive transfers to the control box.


A progress bar appears, showing the progress of the data transfer.

2. To exit, press  or remove the USB flash drive.


Overwrite from USB

Note – Use with caution, as this transfer deletes all existing files from the control box.


1. Press **Overwrite from USB**. The following actions occur:

- a. A warning is displayed. Read the warning message carefully and only press  if you are sure you want to continue.
- b. The control box is backed up. All current files on the control box are saved to a backup folder on the USB flash drive. Your site supervisor can restore from backup.
- c. The entire data content is deleted from the control box.
- d. Data in the "*Machine Control Data\MachineName*" folder and sub-folders, and the "*Machine Control Data\All*" folder is transferred from the USB flash drive to the control box.

A progress bar appears, showing the progress of the data transfer.

2. To exit, press  or remove the USB flash drive.

Data transfer suspend and resume

If the USB flash drive is removed from the control box, or if the  key is pressed during a file transfer operation, the file transfer is suspended and will resume when:

- the USB flash drive is re-inserted into the control box, and/or
- the relevant softkey is pressed to resume the last file transfer operation

Data transfer error messages

When transferring data, a warning message appears when there is insufficient space on either the control box or the USB flash drive.

Available control box file storage capacities are:

- CB460 – 3.5 GB

2.3 Working with control box information

When you work with the control box, you use a mix of keys, softkeys, menus, dialogs, and guidance screens. The availability of many of these items is determined by the following factors:

- The type of machine.
- The sensors installed on the machine. For example, some configuration screens are only available when particular sensors are installed.
- The operator configuration of the system. The menus and screens selected for you by your site supervisor affect the setup information you can view and modify.

Note – This manual only covers the menu options that are available to operators by default.

Any configuration and guidance options not covered in this manual are described in the *PCS900 Paving Control System Site Supervisor's Manual*.

2.3.1 Working with menus and dialogs



Before you can begin work, you must enter configuration and set-up information into the system, and view the current system state, by using screens called menus and dialogs. Menus let you select a dialog. Dialogs let you specify setup and configuration information, or view information about the state of system components.

Softkeys

Softkeys are the six physical keys immediately to the right of the screen. The function of these physical keys depends on the information displayed and is identified by the softkey label beside the key.

Softkey labels are graphical “keys” that appear down the side of the screen.

The following table lists the softkey labels that display on the guidance screens of the control box with a brief description of each softkey's functionality.

| Icon | Functionality |
|---|---|
|  | UTS – Press to open the <i>UTS</i> dialog. |
|  | Offsets – Press to open the <i>Offsets</i> dialog. |

Softkey labels

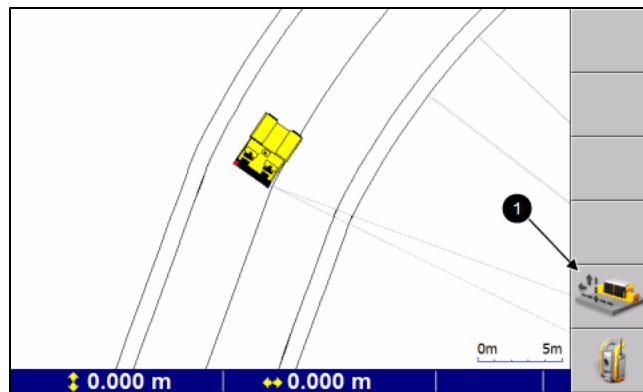
The text on a softkey label can show the following details:

- A description of the operation that is performed when you press the softkey once.
- The setting that is currently selected. The text on the softkey label changes when you press the softkey to switch between options. The top line of the softkey label ends with a colon (:) and the bottom line shows the current option or setting.

The icon on a softkey label can show the following details:

- A graphical representation of the operation that is performed when you press the softkey once.
- The setting that is currently selected. The icon on the softkey label changes when you press the softkey to switch between options.

For example, the softkey label **Offsets (1)** displays on the guidance screen.







Some softkey labels appear in more than one screen, in which case the function of the softkey they identify is always the same.

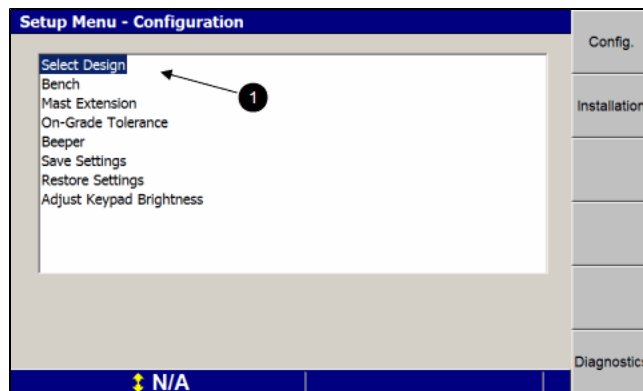
As a softkey's function relates to particular screens or dialogs, that functionality is only available when the appropriate screen or dialog appears.

If a softkey has no function in a screen or dialog, the softkey label is blank.

By convention, this manual refers to a softkey/function combination by softkey label.

Menus


Menus let you choose another menu or dialog from a list. To move up or down the list of menu items use the  or  keys. Once you highlight the item you want to view (1), press  to select it. To leave a menu without making a selection, press .





Dialogs

Dialogs let you enter data into the system. Dialogs can contain any of the following items:

- Text fields. Text fields let you enter text information, such as the name of a machine. Once you select a field, you can enter data into it. A selected field appears as white text on a blue background.
- Number fields. Number fields let you enter numerical values, such as the height of a benchmark. Once you select a field, you can enter data into it. A selected field appears as white text on a blue background.
- Lists. Lists let you select a single item from a list of items, such as a list of machine settings files.
- Check lists. Check lists let you select one or more items, or no items, from a list of items, such as a list of sensors.
- Yes/No fields. Yes/No fields let you enable and disable particular features.
- Information to help you make your selection.


To move between fields in a dialog, press .

To enter data into a text or number field, use the arrow keys as follows:


- Press  or  to scroll through the upper case alphabet (A through Z), numbers (0 through 9), the decimal point (.), the negative sign (–), the positive sign (+), a space (), and back to A.




Note – Available values depend on the type of field that is selected. For example, the only values available for number fields are 0 through 9, the decimal point (.), –, and +.


When you change a character in a field, the keys start stepping from the existing character.

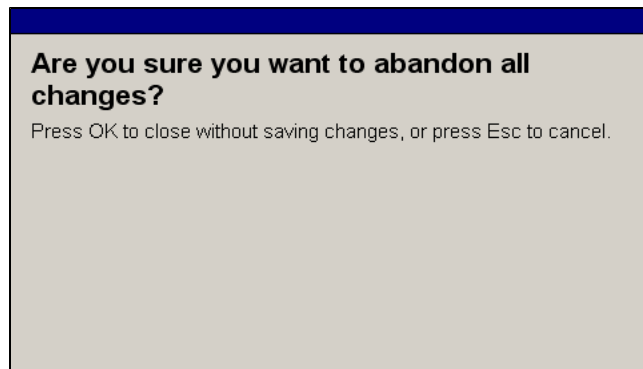
-  steps to the next character to the right.

In fields that allow spaces, press  twice to insert a space.

-  steps back one character to the left. This deletes the character in the space to the left.

To select an item from a list, press  or  to highlight the item you want to select, and press .

To leave the dialog without saving the new data or selection, press . If you have made changes to a dialog setting, and you choose to exit without saving those changes, the following warning appears.



To confirm that you want to abandon the changes you have made to the dialog, press



2.3.2 Working with guidance screens

While you work, you read guidance information from the system using guidance screens.

Guidance screens display a mix of text and graphics that give you information such as the slope or elevation of the screed or the position of the machine.

Depending on the configuration of the system, as setup by your site supervisor, you can view varying numbers of guidance screens:

- Plan view
- Cross-section view
- Text view 1
- Text view 2

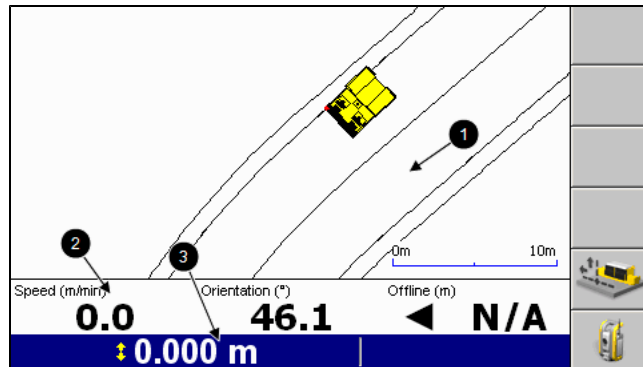
To move between guidance screens, press .

The availability of each screen, and the information the screen contains, changes with the following configuration items:

- The type of machine
- The sensors installed on the machine
- The guidance configuration of the system
- The operator configuration of the system
- The type of design currently loaded

Guidance screen components

The following figure shows the main components of the guidance screens:



The three main areas of a guidance screen are:

- **The guidance view area ①.** The guidance view area displays the machine relative to the surface being worked. There is no guidance view area in the text screens.
- **The optional text information area ②.** The text information area lets you view user-selectable information. In the text screen guidance views, the text information area uses the guidance view area.

If there are more than three text items selected for display, then the text information area appears down the right side of the screen.

If there is no text information configured for that view, the text information area does not appear.

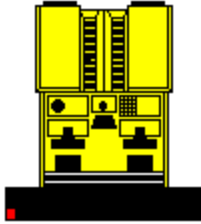

- **The guidance settings status bar ③.** The guidance settings status bar displays the current sensors and guidance settings being used to generate guidance information. For more information, see [Guidance settings, page 25](#).

Machine icons

The system uses a variety of icons to identify the machine in the guidance views:

- The screed edge in an icon corresponds exactly to the edge of the machine.
- As you move the machine, the icon mimics the movements on the screen.
- The red square indicates the side being used for 3D positioning.
- The green line on the cross-section view icon indicates the vertical guidance point(s).

Table 2.1 — Machine type and icon

| Machine type | Plan View icon | Cross-section view icon |
|---------------|---|--|
| Asphalt Paver |  |  |

If the machine you are operating is not shown, contact your site supervisor.

Guidance settings








To display guidance settings, the system uses a variety of icons to identify the sensors being used to generate guidance information, and text to display numerical values.



- ① Vertical offset icon
- ② Vertical offset
- ③ No horizontal offset icon
- ④ Horizontal offset





Figure 2.3 Example guidance setting area

Table 2.2 — Guidance setting icons used by the system

| Guidance setting icon | Meaning |
|---|---|
|  | Positive vertical offset |
|  | Negative vertical offset |
|  | Positive (right of alignment) horizontal offset |
|  | Negative (left of alignment) horizontal offset |
|  | No vertical offset |
|  | No horizontal offset |
|  | UTS error or warning (flashing) |

Zooming the view


There are four possible ways of zooming a view:

- Press  to zoom in on the current view.
- Press  to zoom out of the current view.
- Press and hold  to zoom the machine.
- Press and hold  to zoom out as much as possible.



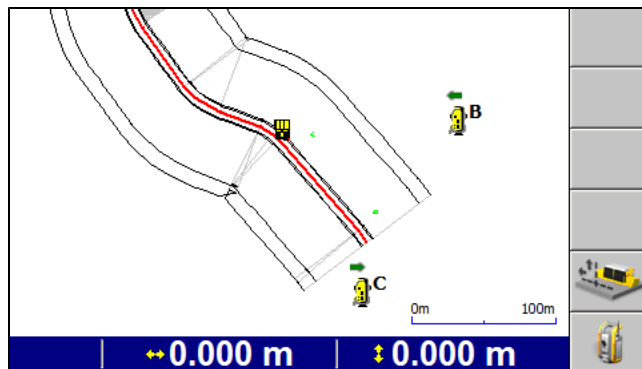
Tip – The system saves the sizes of the views when you turn off the control box. The views automatically load at their previous size when you next use the system.

2.3.3 Guidance views

Guidance views enable the operator to view the machine guidance in a variety of ways. Press  repeatedly to cycle through the guidance views.

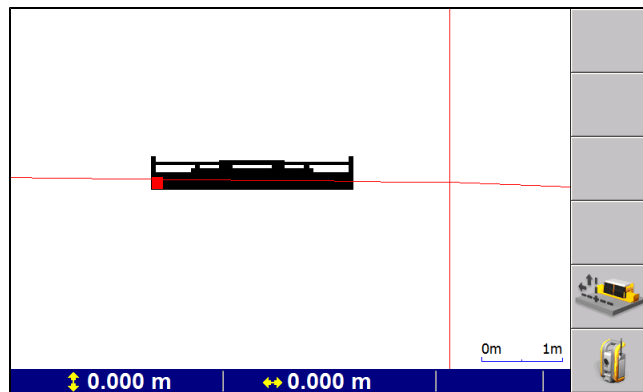
Plan view

Plan view is the default view shown on a guidance screen. Plan view shows the machine in a top-down view on the design.



Cross-section view

Cross-section view shows the screed relative to the guidance surface.



Text views

The site supervisor configures the text items that display in text view 1 and text view 2. The following figure shows an example text view guidance screen.

| | |
|-------------------------------------|----------------------------------|
| Northing (m) 704846.103 | Easting (m) 288348.539 |
| Elevation (m) 16.107 | Cross Slope (%) ≤ 0.2 |
| Design Elev. (m) N/A | Design Mfall (%) N/A |
| Design Slope (%) N/A | |
| ↔ 0.000 m ↑ 0.000 m | |

Note – Up to 10 text view items can be displayed in full screen view and the text size scales automatically to fit the available screen space.

2.4 System beeper


In addition to the display the system also uses an audible alarm, or beeper, to alert you to status changes and other events.

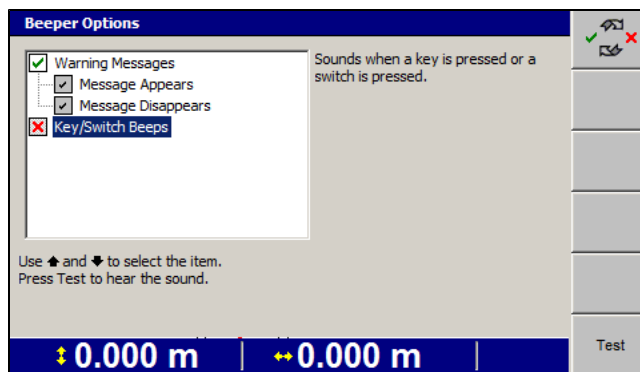
2.4.1 Beeper patterns

The following table lists the pattern of sounds generated by the beeper, and the events that cause them. By default, the beeper will sound for all the events listed in the table, but alerts for some events may be turned off by your site supervisor.

| Event | Sounds when ... | Pattern |
|----------------------------|---|--|
| Warning Message Appears | a warning message appears. | Once only: 200 msec on, 200 msec off, 200 msec on |
| Warning Message Disappears | a warning message automatically disappears. | Once only: 200 msec on |
| Key/Switch Beeps | a key or a switch is pressed. | Once only: 200 msec on |
| UTS Tracking | the UTS loses lock on the machine target. | Once only: 200 msec on |


2.4.2 Beeper options



1. From any guidance screen, press .
2. Select *Beeper*.



3. Use the arrow keys to select the option to configure.

| Option | Description |
|---------------------------------------|--|
| Warning Messages | Switches warning message beeps on or off. |
| Message Appears (not configurable) | Sounds when a warning message is displayed. |
| Message Disappears (not configurable) | Sounds when a warning message automatically clears. |
| Key/Switch Beeps | Sounds when a key is pressed or a switch is pressed. |

4. To enable or disable a selected option, press .

5. To hear the option sound, press **Test**.
6. To confirm the settings, press ; to exit without saving changes, press .

Preparing to Work

In this chapter:

- 3.1 Introduction
- 3.2 Power up checks
- 3.3 Control box power up
- 3.4 Software option keys
- 3.5 Work preparation checks
- 3.6 Configuring the machine radio
- 3.7 Benching the system
- 3.8 2D machine control considerations

Before you begin work with the PCS900 Paving Control System, you need to check the state of the machine and its system components to ensure the system provides accurate guidance.

3.1 Introduction

This chapter describes how to check the machine before you turn on the system, what to look for as the system powers up, and how to check the general system setup once the system is running.

2D machine control considerations are also covered.

3.2 Power up checks



ATTENTION — In cold environments, when you start the machine to warm it up turn on the control box as well.

When you power up the system to begin work, observe the system's start-up sequence to make sure that all components function correctly.

3.3 Control box power up

Observe the control box after the system has powered up.

You should see a guidance screen, softkeys, and optional text items (if configured).

If the machine has one or more 3D sensors installed and configured, the following items appear:

- A plan view guidance screen.
- The correct machine icon for your machine type.
- A site plan, if the system has a site plan file.
- A design or map, if one was loaded when the system was last powered down.

The following problems may occur when you power up the control box and the system:

| Problem | Action |
|--|--|
| Control box does not start | Check that the master disconnect switch and machine power switch are on. Check the ignition switched power cable section of the system harness. |
| Start-up completes but the error message "Some of the required devices are not responding" appears | A device specified during system configuration is missing or not connected. Follow the procedure described in 5.3 Running system diagnostics . |

| Problem | Action |
|---|--|
| Start-up completes but the error message "Check Machine Measurements" appears | The system has detected a discrepancy between a configured machine dimension, and an observed one, possibly because an incorrect machine configuration file has been loaded. Consult your site supervisor. |
| Start-up completes but the wrong machine icon appears on the guidance screen | An incorrect machine configuration file has been loaded. Consult your site supervisor. |

3.4 Software option keys

The system supports an enhanced option key model based on specific machine types and functionality. For more information contact your dealer.

3.4.1 Software support

For new CB460 control boxes the software will self-generate the initial 12 months of software support. If no software support date is set then an initial dialog screen will be presented to the operator. The operator can either press softkey 3 to activate software support or decide not to do this at that time.

If software support is not activated, the software will function normally for 60 minutes after which time it will cease to calculate machine positions, making the software unusable for machine control. On the next power cycle, if software support is still not set then the same initial screen is presented to the user.

To extend this software support date, software support extension option keys are available via the Trimble Store.

To update or add option keys, select *Software Support* from the *Setup Menu – Installation* menu.

3.4.2 Troubleshooting option keys

In the absence of a valid option key for at least one machine type, the system displays a persistent **Option not Installed** flashing message and does not resolve any machine position information.

When a machine settings file is restored that specifies a machine type not supported by the current option key set, the following full screen error message is displayed:

The system lacks the Option Keys necessary to support the configured machine type.

When a machine settings file specifies a supported machine type but includes settings relating to a level of functionality not currently supported, the settings will be loaded but will not be enabled. After the load has completed, the following full screen warning message is displayed:

Not all the settings in the selected machine settings file can be accessed, the system lacks the Option Keys necessary to fully support the specified machine configuration.

After the correct option key is loaded the settings, as described by the loaded machine settings file, should be usable.

3.5 Work preparation checks


As you get ready to begin work, you need to prepare the system for the job. Perform the following work preparation tasks as and when described below:

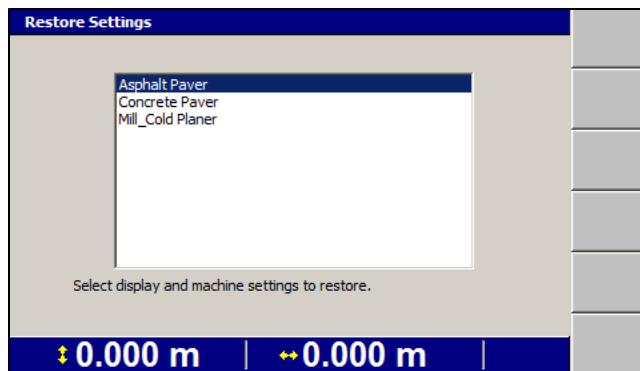
| Check and set ... | When | To learn how, see ... |
|-----------------------------|---|---|
| Machine settings | As instructed by your site supervisor, or if an error in machine measurements is reported | 3.5.1 Machine settings |
| Quick display brightness | As required | 3.5.2 Display brightness |
| Keypad backlight brightness | Every power-up | 3.5.3 Keypad backlight brightness |
| Mast extensions | Every power-up (manual masts only) | 3.5.4 Mast extensions |



3.5.1 Machine settings

To ensure accurate guidance, you must use the correct machine settings. Machine settings are typically saved in a machine settings file.

Restore settings

1. From any guidance screen, press .
2. Select *Restore Settings*.




3. Select the correct setting file for your machine.
4. To confirm the settings, press ; to exit without saving the changes, press .

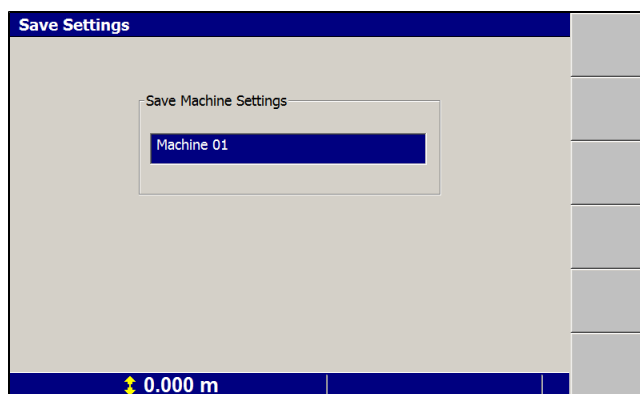
Changes take effect immediately.

The following problems may occur when you try to restore machine settings:



| Problem | Action |
|---------------------------------------|--|
| Invalid machine settings file | The machine settings file is corrupt. The machine settings are for the wrong machine type. Consult your site supervisor. |
| No settings suitable for your machine | The machine settings data is incorrect. Consult your site supervisor. |

Save settings

1. From any guidance screen, press .
2. Select *Save Settings*.







3. Use the control box arrow keys to name the settings file for your machine.

4. To confirm the settings, press ; to exit without saving the changes, press .

Changes take effect immediately.

3.5.2 Display brightness


To quickly adjust the brightness of the control box display for your working conditions, use the following key combinations:

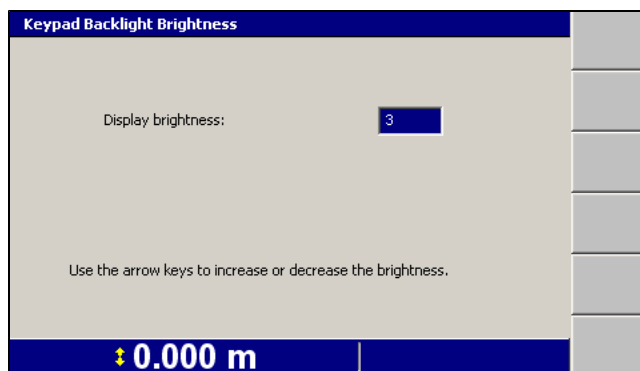
- To increase the display brightness, hold down  and press .
- To decrease the display brightness, hold down  and press .



3.5.3 Keypad backlight brightness

The control box keypad backlight brightness can be adjusted by the operator to suit operating conditions.

To check and adjust the keypad backlight brightness:

1. From any guidance screen, press .
2. Select *Adjust Keypad Brightness*



3. Use the arrow keys to increase or decrease the value of the *Display Brightness* field.
4. To confirm the settings, press ; to exit without saving the changes, press .

3.5.4 Mast extensions



Note – Mast extensions are only used with manual masts.

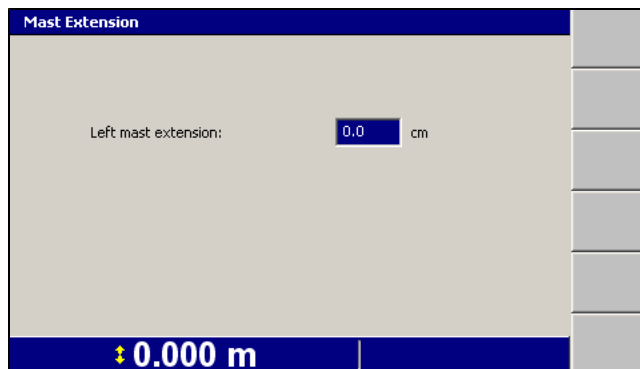
When using a manual mast, the mast height (extension) can be changed as required by the operator, using the *Mast Extension* dialog.

The following table details the options available for mast extensions:

| Mast type | Options |
|--------------------------------|---|
| Manual mast – English Imperial | Single manual mast mounted on left or right – (English/Imperial or Metric), page 37 |
| Manual mast – Metric | Two manual masts mounted on both left and right – (English/Imperial or Metric), page 37 |



Single manual mast mounted on left or right – (English/Imperial or Metric)

1. From any guidance screen, press .
2. Select *Mast Extension* and press .





Note – If the system is configured for an English/Imperial manual mast, the dialog will show the mast extension field units in “ft” instead of “cm”.



Note – If the system is configured for a right manual mast, the dialog will display the field label “Right mast extension”.

3. Enter a value, as read from the measurement scale on the mast, in the *Left/Right mast extension* field.
4. To confirm the settings, press ; to exit without saving the changes, press .

Two manual masts mounted on both left and right – (English/Imperial or Metric)

1. From any guidance screen, press .
2. Select *Mast Extension* and press .


Note – If the system is configured for an English/Imperial manual mast, the dialog will show the mast extension field units in “ft” instead of “cm”.



3. Enter a value, as read from the measurement scale on the mast, in the *Left mast extension* field.
4. Enter a value, as read from the measurement scale on the mast, in the *Right mast extension* field.
5. To confirm the settings, press ; to exit without saving the changes, press .

3.6 Configuring the machine radio

The machine radio communicates with the UTS instrument radio.

To open the *Machine Radio Configuration* dialog:

1. From any guidance screen, press .
2. Press **Installation**.
3. Select *Machine Radio Configuration*. The *Machine Radio Configuration* dialog appears, and the system searches for a radio.

- Use the arrow keys to enter information into the *Machine Radio Configuration* dialog. To save the changes, press ; to exit without saving changes, press .

The *Radio Status* field in *Diagnostics – Device Connections* can provide the following messages:

| This message ... | Displays when the ... |
|--|--|
| <i>Not Found</i> | System cannot communicate with the radio. |
| <i>Configuring</i> | Radio is currently being configured. |
| <i>Configuration failed</i> | Radio configuration failed. |
| <i>Connected</i> | Radio connects to the system. |
| <i>App <version num.> required</i> | Radio firmware must be upgraded to the specified version. |
| <i>Loader <version num.> required</i> | Radio firmware must be upgraded to the specified version. |
| <i>System Error</i> | Firmware is not installed correctly. |
| <i>This radio type cannot be configured.</i> | System connects to an unsupported radio. |
| <i>UTS incompatible</i> | System connects to a 900 MHz radio for use with an SPSx30 UTS. |

The *Machine Radio Configuration* dialog enables you to set either the network or channel that both the system and UTS communicate over. The following table outlines how to configure your machine radio:

| Confirm that you have turned on the ... | Enter this into the <i>Machine Radio Configuration</i> dialog ... | Also configure the same ... |
|---|---|---|
| SNR2400 | <ul style="list-style-type: none"> A channel number between 31-60 A network ID between 0 and 255. Default is 1. | Channel number on the internal UTS radio (using the UTS face plate) |

The changes take effect immediately. The network number is uploaded to the machine radio, and the machine radio is programmed as a rover radio.

The network number is stored in the control box. Whenever you start the control box, the control box automatically sets the same network number in the machine radio. For example, if a radio is moved from one machine to another, the control box automatically sets the same radio network that was configured for the previous radio.


3.7 Benching the system

Benching the system allows for any changes in the height (elevation) of the UTS instrument since the last time it was used.


Benching the system also provides a way to remove any small machine measure-up errors prior to starting the job, for example, to allow for cutting tooth wear.


For more information on the recommended start sequence, refer to the *PCS900 Paving Control System Quick Start Guide*.

Note – *The following procedure describes benching the PCS900 Paving Control System, not the UTS instrument.*

1. From any guidance screen, press .



Tip – To directly access the *Bench* dialog from a guidance screen, press and hold .

2. Select *Bench* and press .


| Bench | | Clear Bench |
|--|---------------------------------------|-------------|
| Before benching, make sure the screed is at the working position and return the screed crown angle and extensions to the same positions they were in when the machine measurements were taken. | | |
| Current Target: Left | | |
| Current screed tip elevation: | <input type="text" value="15.000"/> m | |
| Left bench elevation: | <input type="text" value=""/> m | |
| WARNING: Ensure the screed controls are in manual and the machine is stationary during the benching process. Tow point movement may result if the screed controls are in auto. | | |
| ↑ 0.000 m | | Bench Left |

To clear an existing bench, press **Clear Bench**. The *Setup Menu – Configuration* menu appears.

3. Before benching, return the screed crown angle and extensions to the same positions they were in when the machine measurements were taken.



ATTENTION - Ensure the screed controls are in manual and the machine is stationary during the benching process. Tow point movement and an inaccurate bench may result if the screed controls are in auto.

4. If required, edit the *Left bench elevation* or *Right bench elevation* value.
5. To bench the UTS, press **Bench Left** or **Bench Right**; to exit without saving the changes, press .

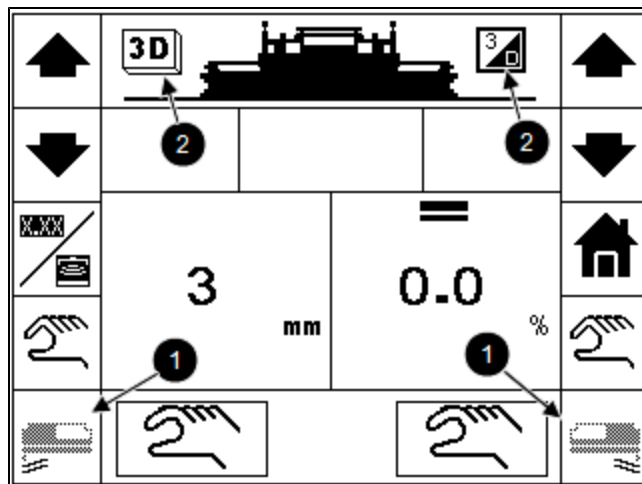
3.8 2D machine control considerations

When using the 3D system to control elevation:

- Some 2D guidance functions may not be available. See [3.8.1 PCS400 2D system icons grayed out](#).
- A different procedure is required depending on the type of 2D machine control system selected by your site supervisor. See [3.8.2 Machine control procedure for 2D systems](#).

3.8.1 PCS400 2D system icons grayed out

When using the 3D system to control elevation, the **Bench (Null)** button (❶) is not available on the 2D system control box, as benching (nulling) is controlled by the 3D system (❷):



3.8.2 Machine control procedure for 2D systems

When setting up the system for its first paving run, the type of 2D machine control system must be taken into consideration. The 2D machine control system set up by your site supervisor could be one of the following:

- PCS400 2D machine control. See [PCS400 2D machine control](#), page 42.
- MOBA-matic 2D machine control. See [MOBA-matic 2D machine control](#), page 42.

Depending on the 2D machine control system, a slightly different procedure needs to be carried out when preparing the asphalt paver for its first paving run.

The 3D system operation is the same no matter which type of 2D system is being used.

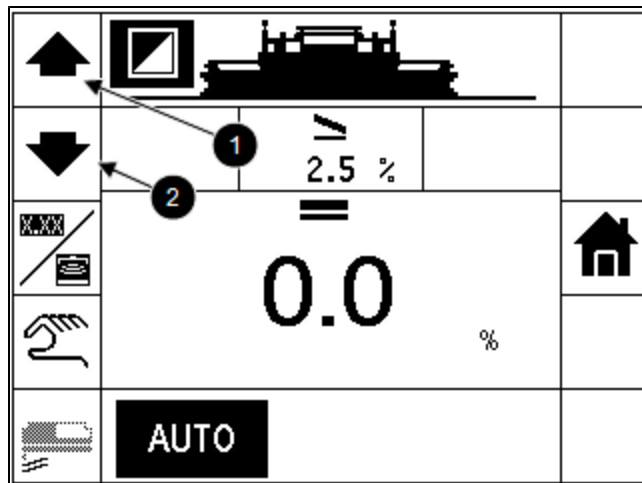
The 3D system calculates and uses two different sets of positioning/deviation numbers, being:

- The main control position, which is calculated as a point directly below the MT900 machine target. The height difference between the main control position and the design surface is sent to the underlying 2D control system and fundamentally controls the machine tow point cylinders.
- The screed exit position is calculated relative to the screed trailing edge. This position is displayed on the 3D control box as the elevation and raise/lower text items. This position is also used to calculate the AutoAdjust offset. The AutoAdjust offset is gradually combined with the main control position deviation to keep the trailing edge of the screed automatically on grade.

Note – Occasionally the AutoAdjust offset may not provide enough offset to keep the trailing edge of the screed on grade. To adjust the screed trailing edge back to design, a manual control offset can be introduced via the underlying 2D control system.

PCS400 2D machine control

Use the increment (❶) or decrement (❷) buttons on the 2D control box to enter the control offset while the 2D system is in Auto.



MOBA-matic 2D machine control

Use the increment or decrement buttons on the DLSII display to enter the control system offset while the 2D system is in Auto.

Note – For the above example, this will be displayed as 0.3 on the DLSII runtime screen.

Using 3D Guidance in the Field

In this chapter:

- 4.1 Introduction
- 4.2 Preparing 3D sensors
- 4.3 Loading a design
- 4.4 Working with 3D guidance

This chapter describes how to set up 3D guidance systems and use them in the field.

For more information about 3D guidance systems and their sensors, refer to the *PCS900 Paving Control System Reference Manual*.

4.1 Introduction

The system stores a three dimensional (3D) digital map of the design surface in the control box. Using 3D sensors, the system fixes the location and elevation of the machine and its screed on this surface. The system then calculates the difference between the screed elevation and the design elevation.

Systems that have this capability are called 3D guidance systems and use a UTS (Universal Total Station) instrument, a type of robotic total station.

4.2 Preparing 3D sensors

Common tasks that you must perform before you can use a UTS system are:

| Task | When | To learn how, see ... |
|------------------------------------|---|--|
| Set up the UTS instrument | Every time the instrument is moved or when a new job is started | See your site supervisor or refer to the <i>Trimble SCS900 Getting Started Guide</i> . |
| Start UTS positioning | When you need to use UTS position information for guidance | 4.2.1 Starting the UTS system |
| Set On-Grade Tolerance color bands | Every time a new job is started | 4.2.2 On-Grade tolerance |

4.2.1 Starting the UTS system

When using two masts the UTS instrument can be configured to track either the left side or right side MT900 target, depending on your requirements.



Tip – The system supports up to five UTS instruments (labelled by the PCS900 Paving Control System with a single uppercase letter) and multiple MT900 targets. In the following procedure, use the control box arrow keys to highlight the UTS instrument you want to configure.

Note – *The single uppercase letter identifier for each UTS instrument is set in the PCS900 Paving Control System the first time a UTS instrument is used with a control box, and is then retained through power cycles and different jobs. When the same UTS instrument is used with the same control box then the same uppercase letter will always be used. However, if a UTS instrument is used with multiple control boxes, each control box may assign a different uppercase letter identifier to the same UTS instrument*

To start and connect the UTS instrument(s) to the system:



- From any guidance screen, press **UTS**. For a list of softkey icons and their functions, see [Working with menus and dialogs, page 19](#).

| UTS | | | | | | |
|--------------------------------|-------------------|--------|----------|-------|-----------------------|----------------------|
| Instruments used for guidance: | | | | | | Target ID |
| UTS | Status | Target | Distance | Power | | Change Target |
| Other instruments: | | | | | | Start |
| UTS | Status | Target | Distance | Power | Horizontal Difference | Elevation Difference |
| A | Waiting for start | ← | N/A | 70 % | N/A | N/A |
| B | Waiting for start | → | N/A | 70 % | N/A | N/A |
| | | | | | | Diagnostics |
| | | | 0.000 m | | 0.000 m | |

Note – The 'Other instruments' column automatically shows all available UTS instruments. If they don't appear they are either out of range, or they haven't been set with the correct radio Network ID and Channel on either the UTS instrument or on the PCS900 Paving Control System.

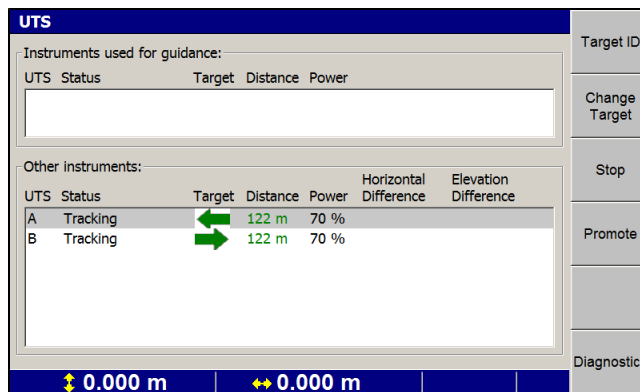
Note – All UTS instruments must be configured with the same radio Network ID and Channel.

- To switch between the left and right MT900 targets, press **Change Target**.
- To set each target's ID:
 - Select the required UTS instrument and press **Target ID**.

- Enter the selected target ID into the required *Left target ID* and/or *Right target ID* fields. By convention, target IDs of 9 through 16 are used for machine control applications, with IDs of 1 through 8 reserved for site positioning applications. To set the left target default value to 9, or the right target default value to 10, select the required field and press **Default**.
- To confirm the settings, press ; to exit without saving changes, press .

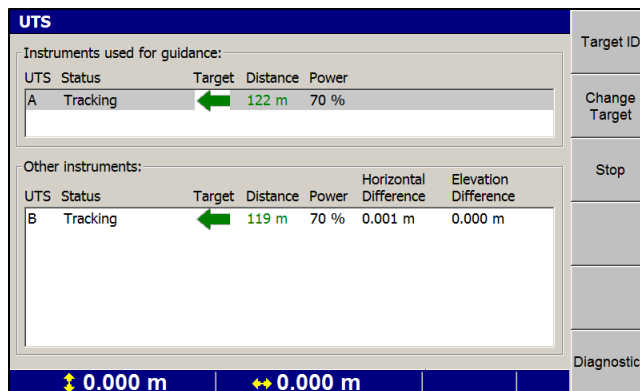
- Use the control box arrow keys to select the required UTS instrument and press **Start**.

When the target is acquired; the selected *Target* and *Distance* columns change color (dependent on the distance between UTS target and UTS instrument, as defined in the *UTS Transition Tolerance* menu), the *Status* column changes to "Tracking", the **Start** softkey changes to **Stop**, and the **Promote** softkey is displayed.




- To activate the selected UTS instrument, press **Promote**. The selected UTS instrument is moved into the *Instruments used for guidance* section of the dialog.

Note – If the required number of UTS instruments have NOT been promoted, the "Start UTS" flashing message is displayed.



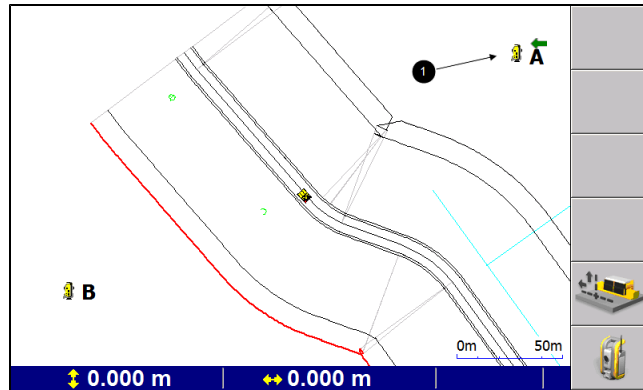
| Field | Description |
|-------|---|
| UTS | A single upper case character that denotes each UTS instrument. |

| Field | Description |
|-----------------------|---|
| Status | <p>States are:</p> <ul style="list-style-type: none"> – Tracking – Waiting for start – Not found – UTS configuration failed – UTS battery low – UTS out of range – UTS out of level – Waiting for UTS – Target lost – Auto searching – Quick searching – Full searching |
| Target | <p>The arrow direction indicates whether the UTS target being tracked is on the left or right side of the machine.</p> <p>The arrow color is a distance indicator and the color changes depending on the Warning or Error threshold ranges defined in <i>UTS Transition Tolerances</i>.</p> |
| Distance | The distance between the MT900 target and the UTS instrument. |
| Power | The remaining level of battery power in the UTS instrument. When using an external power source, power is displayed as a power plug icon. |
| Horizontal Difference | The horizontal difference at the MT900 target, between the UTS instrument currently being used for guidance and each of the other instruments |
| Elevation Difference | The vertical difference at the MT900 target, between the UTS instrument currently being used for guidance and each of the other UTS instruments |

6. To stop tracking, select a UTS instrument and press **Stop**.
7. To confirm the UTS Machine Target and Backsight positions, select an instrument and press **Diagnostics**. For more information, see [5.3.2 UTS diagnostics](#).
8. To return to the guidance screen, press .

The following image shows a machine on design with two UTS instruments configured for tracking, with the active instrument indicated by an arrow (➔),

showing which target is being tracked (left), and the color (defined in the *UTS Transition Tolerance* menu) indicating the distance range between the UTS instrument and the MT900 target. In this example, UTS 'A' is tracking the left target and the arrow is colored green (within range).




Some common UTS problems are:

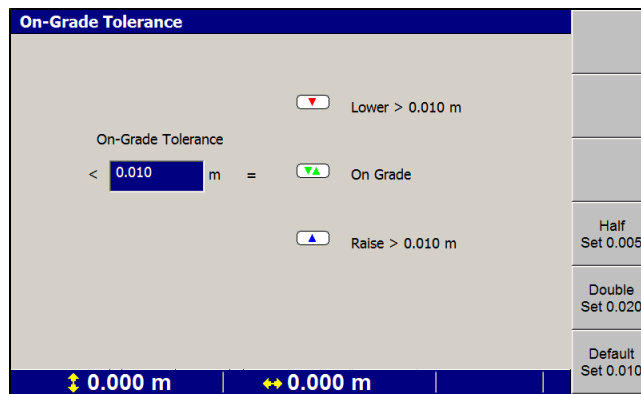
| Problem | Action |
|---|---|
| No Start softkey in <i>UTS</i> dialog. | <p>The machine data radio has not synchronized with the UTS instrument data radio. Follow the procedure described in 5.3 Running system diagnostics, to check that the UTS components are connected and running.</p> <p>Check that the UTS instrument data radio is turned on.</p> <p>Check the instrument battery.</p> |
| UTS not displayed in <i>UTS</i> dialog | <p>Ask your site manager to check that the radio channel and network are compatible with the instrument radio. Follow the procedure described in 5.3 Running system diagnostics, to check that the UTS components are connected and running.</p> |
| Target LEDs not flashing | Check cables and connections to target. |
| Not tracking | Start the instrument or check the target ID. |



See [Table 5.1](#) on [page 58](#) for a description of the *UTS* dialog field values.

4.2.2 On-Grade tolerance

Use the *On-Grade Tolerance* dialog to set color band values for the *Raise / Lower* text items.

1. From any guidance screen, press . The *Setup Menu – Configuration* dialog appears.
2. Select *On-Grade Tolerance*.



3. Use one or more of the following tools to set the *On-Grade Tolerance* value:
 - Directly edit the field.
 - To halve the current setting, press **Half Set <value>**.
 - To double the current setting, press **Double Set <value>**.
 - To reset the value to the default, press **Default Set 0.010**.
4. To confirm the settings, press ; to exit without saving changes, press .

4.3 Loading a design

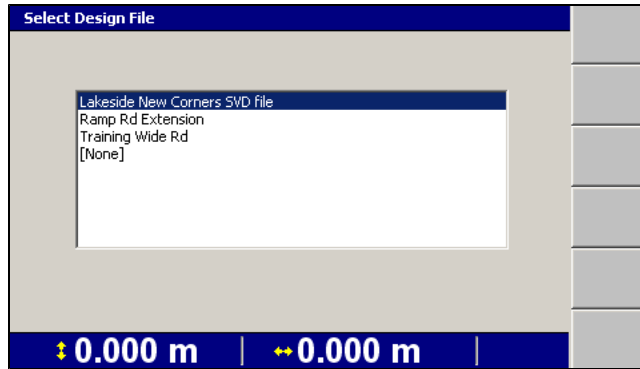
Before you can receive guidance, you must have a design loaded into the system. You can load a design supplied by an engineer in the office.



Most design types are loaded using a few simple key presses. However, if you are loading a 3D lines design file, once the file is loaded, you must select the 3D line you want to work with.

4.3.1 Loading the design file

To select and load a design:

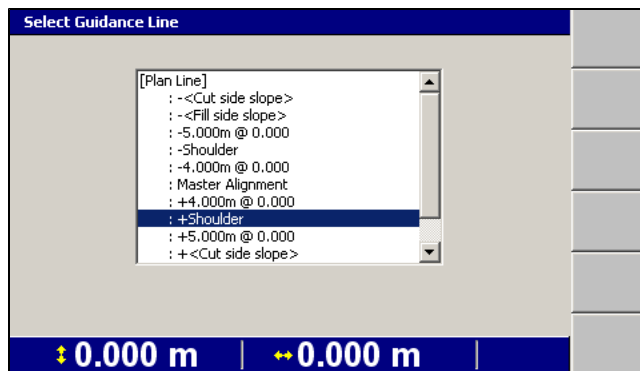
1. From the *Setup Menu – Configuration* menu, select *Select Design*.



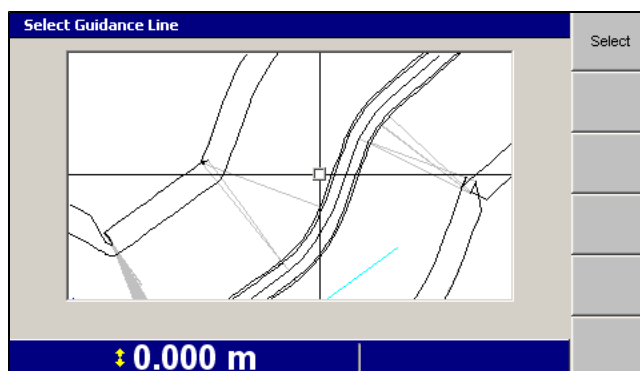
2. Highlight the design you want to load.
3. To confirm the settings, press ; to exit without saving changes, press . If the loaded design specifies only a single design surface, the plan view guidance screen appears.
4. If the loaded design supports a horizontal alignment, the following options are available:

| To select ... | Choose ... |
|--|-------------------------|
| A road alignment in a road design | The alignment by name |
| The master alignment in a sloping surface design | <i>Master Alignment</i> |
| The design boundary or linework in the Site Map or Background Plan | <i>[Plan Line]</i> |
| No alignment | [None] |



5. If you selected a plan line or a 3D line for horizontal alignment, the *Select Guidance Line* dialog appears.



6. If you select a Plan Line, the following dialog appears:

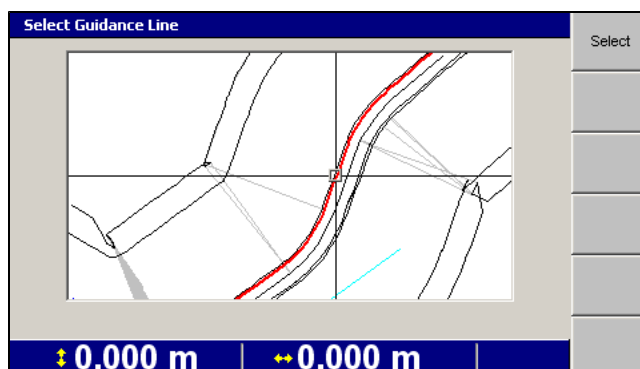




7. Use any of the following tools to move the cross-hairs in the *Guide to Horizontal Alignment* dialog:

- Use the arrow keys to move the cross-hairs around the screen.
- To zoom the current view in and out, press  or .

All linework for the design, including the site map and any avoidance zones, is shown in this dialog.

8. To select the line for horizontal guidance, press **Select**. The line closest to the center of the cross-hairs is selected. The selected line appears as a thick red line.



9. To confirm the settings, press ; to exit without saving changes, press . A guidance screen appears.

4.4 Working with 3D guidance

Common tasks that you may perform while you work with 3D guidance methods are:

| Task | When | To learn how, see ... |
|-------------------------------------|--|--|
| Set a horizontal or vertical offset | Every time you select a new alignment, or you want to work a new section of design surface using the same alignment. | 4.4.1 Setting offsets |
| Stop using UTS data for guidance | Every time you finish using guidance information from a UTS system. | 4.4.2 Turning off UTS guidance |

4.4.1 Setting offsets

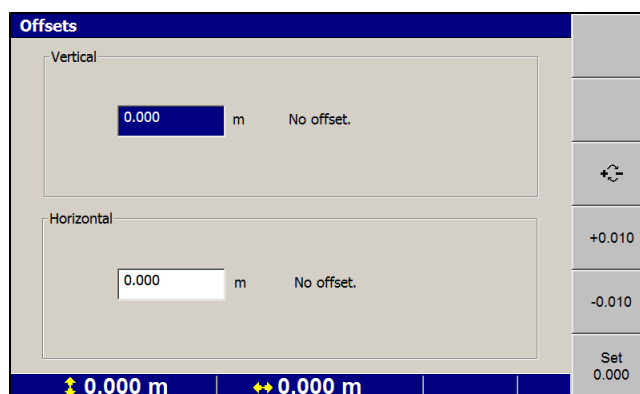
Design offsets are the vertical and horizontal changes applied to the 3D design.


Offsets ensure that the screed height (elevation) and the horizontal alignment both match the required design.


A negative vertical offset value tells the system to build below the design surface; a positive vertical offset value tells the system to build above the design surface.

1. Select an alignment as described in [4.3 Loading a design](#). Until an alignment is specified, any offset has no effect.
2. From any of the guidance views, press **Offsets**. For a list of softkey icons and their functions, see [Working with menus and dialogs, page 19](#).

The default *Offsets* dialog shows the *Vertical Offset* softkeys.





3. To change the sign of the offset, press .

4. To set the vertical offset value, use one or more of the following tools:
 - Directly edit the field using the arrow keys.
 - To increase or decrease the offset by 10 mm (0.4 inches), press **+0.010** or **-0.010**.
 - To reset the offset value to zero, press **Set 0.000**.
5. To edit the *Horizontal Offset* press . The following dialog shows the *Horizontal Offset* softkeys.

6. To select an alignment for horizontal guidance or to change the horizontal alignment, press **Alignment: <value>**.

Note – When a design is selected and loaded the PCS900 Paving Control System prompts you to select an alignment for horizontal guidance.

7. To set the horizontal offset value, use one or more of the following tools:
 - Directly edit the field, using the arrow keys.
 - To increase the offset by half the screed width, press **+ Half Screed**.
 - To decrease the offset by half the screed width, press **- Half Screed**.
 - To increase or decrease the offset by 10 mm (0.4 inches), press **+0.010** or **-0.010**.
 - To reset the offset value to zero, press **Set 0.000**.
8. To confirm the settings, press ; to exit without saving changes, press .

4.4.2 Turning off UTS guidance

Before you turn off the system, turn off UTS guidance:

1. From any guidance screen, press **UTS**.
2. Select the required UTS instrument.

3. Press **Stop** and then wait for the UTS status to change to *Waiting for Start*.
4. Complete the above steps for each UTS instrument that is tracking.

Note – *Turning off UTS guidance **does not** turn off the UTS instrument. You must manually turn off the power at the UTS instrument.*

Troubleshooting in the Field

In this chapter:

- 5.1 Introduction
- 5.2 General troubleshooting
- 5.3 Running system diagnostics
- 5.4 Troubleshooting flashing warning messages
- 5.5 Troubleshooting error messages
- 5.6 Troubleshooting system components
- 5.7 Troubleshooting UTS systems
- 5.8 Before you contact your dealer

Occasionally, problems will occur. Good troubleshooting techniques can significantly reduce the time it takes to isolate the problem and, ultimately, reduce the length of downtime.

5.1 Introduction

The approach you take to troubleshooting depends on the configuration of the system you are working with.

The following sections outline some basic troubleshooting strategies.

5.2 General troubleshooting

Check these items when troubleshooting:

- Is there a warning or error message that indicates a problem? Use the information in [5.4 Troubleshooting flashing warning messages](#), and [5.5 Troubleshooting error messages](#), to understand errors and warnings.

Make a note of any messages that appear on the screen. You can also check the program log file (LOG_<machine name>_<date&time>.txt).

- Are all the devices on the system receiving power? Use the information in [5.6 Troubleshooting system components](#) to quickly check the status of the easily accessible devices.
- Are all the devices in the system communicating? Use the information in [5.3 Running system diagnostics](#) to make sure all the required devices have been detected.
- Do the devices have the correct firmware versions loaded? Use the information in [5.3 Running system diagnostics](#) and the program log file to check current firmware versions. Contact your site supervisor to get a list of correct firmware versions.
- Are the orientations of installed slope sensors configured correctly?
- Are the machine measurements correct?
- Are all cables and connections secure and undamaged?
- What were the steps that led to the problem occurring?
- Can the problem be repeated?



5.3 Running system diagnostics

The system expects certain components to be connected, depending on the system configuration.

When you first turn on the system, it automatically completes an initial check for devices that are configured to be connected to the CAN bus. If the system does not

detect one or more of the devices, the *Diagnostics* dialog appears so that you can identify the problem.


To view the diagnostics menu:

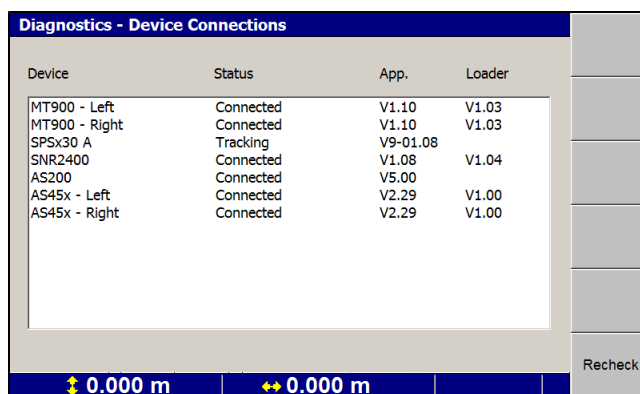
1. From any guidance screen, press . The *Setup Menu – Configuration* menu appears.
2. Press **Diagnostics**.
3. Select the required menu item and press .


| Menu item | Description | See ... |
|--------------------|---|--|
| Device Connections | Displays the current status of each device. | 5.3.1 Device Connections |
| UTS | Select from the list of available UTS instruments to display location and configuration data for that instrument. | 5.3.2 UTS diagnostics |
| Sensors | Displays useful information about the status of the system sensor(s). | 5.3.3 Sensors diagnostics |
| Controller Outputs | Allows you to test the operation of the controller outputs to the 2D machine control system. | 5.3.4 Controller outputs diagnostics |
| About | Displays the current software version, hardware revision, serial number, and guidance hours. | 5.3.5 About the system |

5.3.1 Device Connections


To view a list of expected components and their status:

1. From the *Setup Menu – Diagnostics* menu, select *Device Connections* and press .



2. Press **Recheck** at any time to refresh the data in this screen.
3. Press  to exit.

Note – If a configured device does not respond while the system is running, the following message appears:

Some of the required system devices are not responding. Press  to check the details in the Diagnostics item of the Setup Menu, or press  to continue.

The screen displays a list of devices that are currently connected to the system. The *Diagnostics* dialog lists each device and reports the following information:

- The device name.
- The status of the device.
- The application firmware version number.
- The loader firmware version.

The application firmware must be the correct version before the device can be used in the system.

The application firmware version number indicates which devices are detected and which devices have the correct version of the firmware loaded.

Note – When none of the devices display “old version”, you can use the system.

If either the firmware or the loader is too old, the device is detected, but you cannot use the system until the device firmware is updated. The *Status* column displays the minimum firmware required.

If the message **Not Found** appears beside a device, the system is configured to use the device, but the device was not detected.

5.3.2 UTS diagnostics



The *Diagnostics* dialog *Status* field values and the *UTS* dialog *UTS status* field values are listed in [Table 5.1](#).

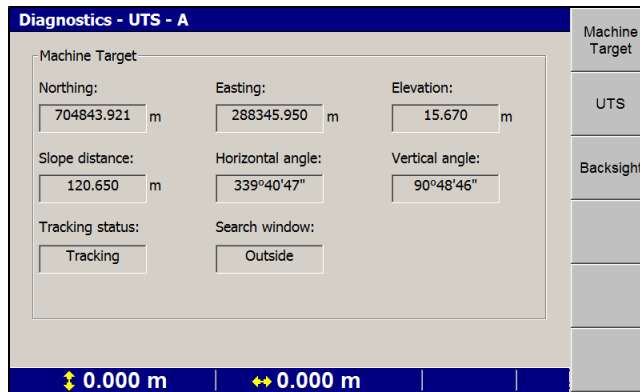
Table 5.1 — Values of the *Status* and *UTS status* fields for UTS systems

| UTS tracking status | Meaning |
|---|--|
| UTS battery is low | The UTS instrument battery is too low to operate reliably. |
| UTS configuration failed | UTS instrument configuration failed. |
| UTS does not support Active Target ID <num> | The UTS instrument does not support the MT900 target ID specified. |
| UTS not level | The tilt compensator on the UTS instrument is out of range. |
| UTS not benched | The UTS elevation was not set at the instrument, so the target must be benched before use. |

| UTS tracking status | Meaning |
|--|--|
| UTS not supported | The firmware in the UTS instrument is not interoperable with the system. |
| UTS not supported: Cannot determine firmware version | The firmware in the UTS instrument is not interoperable with the system. |
| UTS not supported: No Positioning support | The firmware in the UTS instrument is not interoperable with the system. |
| UTS not supported: No Tracker support | The firmware in the UTS instrument is not interoperable with the system. |
| UTS not supported: Not a construction UTS | The firmware in the UTS instrument is not interoperable with the system. |
| Check UTS: station setup error | UTS instrument configuration has failed. |
| Check machine radio | The system cannot communicate with the machine radio. |
| Check machine target | The system cannot communicate with the machine target. |
| Check radio channel | The radio network ID/channel number combination set up for your system is also being used by another machine within radio range. |
| Communication timed out | The delay in the response from the UTS instrument was greater than the maximum allowed. |
| Configuring UTS | The UTS instrument is being configured. |
| Connecting UTS | The system is establishing a radio link with the UTS instrument. |
| Disconnecting UTS | The system is dropping the radio link to the UTS instrument. |
| Full Searching for Target ... | The UTS instrument is carrying out a full search for the machine target. |
| Machine target search failure | System error. |
| Measuring Error | System error. |
| Multiple UTS detected | The radio network ID/channel number combination setup for your machine and instrument is also being used by another instrument within radio range. |
| Quick Searching for Target ... | The UTS instrument is carrying out a quick search for the machine target. |
| Radio Link Lost: Reconnecting ... | Radio contact with the UTS has been lost, and the system is attempting to re-establish the link. |
| Search Error | System error. |
| Target Lost | The UTS instrument has lost track of the machine target. |
| Tracking | The UTS instrument is correctly tracking the machine target. |
| Waiting for UTS | Occurs when you first start the UTS and when you enter the <i>UTS</i> dialog. The system is waiting for information from the UTS instrument. |
| Waiting for start | Waiting for the UTS system to start. |

To view detailed UTS diagnostics:

1. From the *Setup Menu – Diagnostics* menu, select *UTS* and press .
2. Select a UTS instrument to inspect and press .



The first *Diagnostics – UTS* screen is *Machine Target*. This is the screen that appears if you press **Machine Target**. The fields in this screen are explained below:

| Field | Explanation |
|--|---|
| Northing Easting Elevation | The computed location of the machine target, in terms of northing, easting and elevation. |
| Slope distance Horizontal angle Vertical angle | The observed location of the machine target relative to the UTS, in terms of slope distance, horizontal angle and vertical angle. |
| Tracking status | UTS tracking status. |
| Search window | The position of the machine target relative to the search window specified during UTS set up. |

The UTS instrument reports its tracking status to the system. UTS tracking status message are listed in the following table.

Table 5.2 — UTS Tracking Status messages

| Tracking Status | Meaning |
|-----------------|--|
| N/A | No data being received from the instrument |
| No signal | No target is being tracked |
| Tracking | A target is being tracked |

- From any screen in the *Diagnostics – UTS* dialog, press **UTS**.

The fields within this screen are explained below.

| Field | Explanation |
|----------------------------------|--|
| Northing Easting Elevation | The known or measured setup location of the UTS instrument, in terms of northing, easting and elevation. |
| Compensator | The instrument's compensator status. |
| Inst. height | The setup height of the instrument. |
| Scale factor | The scale factor. |
| PPM | Parts per million. The instrument's Electronic Distance Meter (EDM) is affected by the temperature and pressure at which the instrument is being operated. Accurate entry of the ambient air temperature and barometric pressure correctly adjusts the EDM measurements for the PPM (parts per million) error associated with this effect. |
| Point Name | The name of the point at which the UTS instrument was set up, if the point has a name |

- From any screen in the *Diagnostics – UTS* dialog, press **B backsight**.

This screen displays information about the backsight taken to establish the orientation of the UTS instrument. The fields within this screen are explained below.

| Field | Explanation |
|------------------------------------|---|
| Northing Easting Elevation | The known location of the control point used for the backsight, in terms of northing, easting and elevation |
| Slope distance Horizontal angle | The observed location of the control point relative to the UTS, in terms of slope distance and horizontal angle |
| Point Name | The name of the point at which the UTS instrument was set up, if the point has a name |

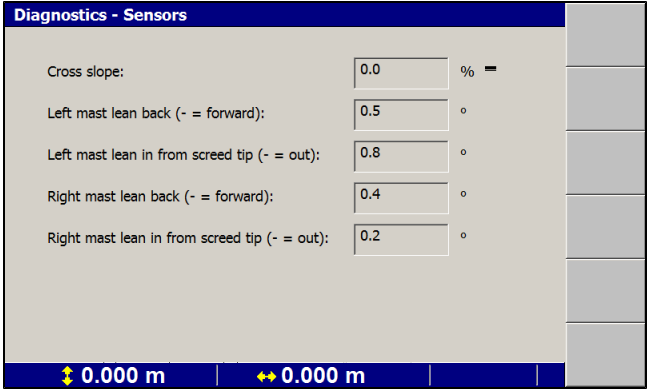
5.3.3 Sensors diagnostics

The sensor options displayed depend on the configuration of your system, and can include:



- AS45x angle sensor(s)
- GS420 grade sensor(s)

To view the sensors diagnostics:

1. From the *Setup Menu – Diagnostics* menu, select *Sensors* and press .




Note – The above dialog shows the mast lean fields for a two mast system.

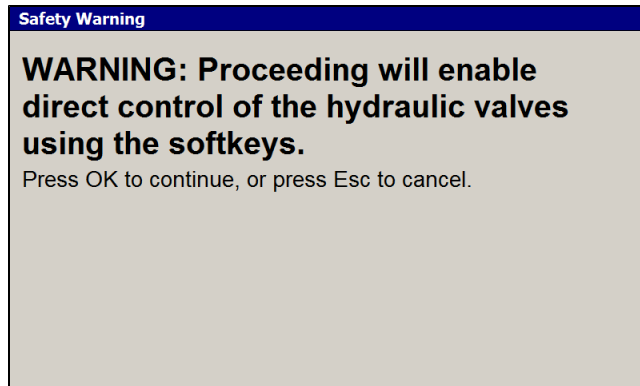
2. Raise the right hand side of the screed and make sure that the cross slope value increases.
3. Observe the settings to ensure they match the actual sensor configuration.
4. Press  or  to exit to the *Setup Menu – Diagnostics* menu.

5.3.4 Controller outputs diagnostics

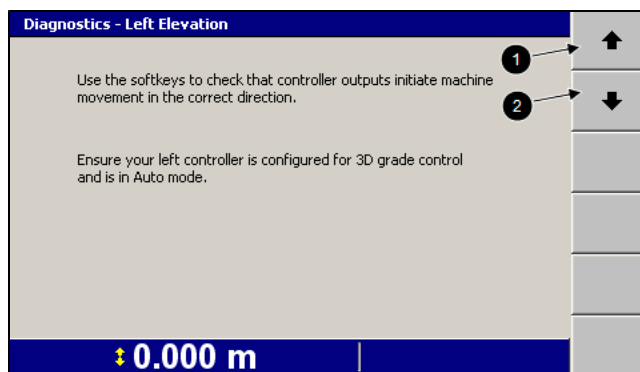
Note – The 2D control system must be in Auto to allow the machine to move and test the controller outputs.

To view the controller outputs diagnostics:


1. From the *Setup Menu – Diagnostics* menu, select *Controller Outputs* and press . The following safety warning appears.

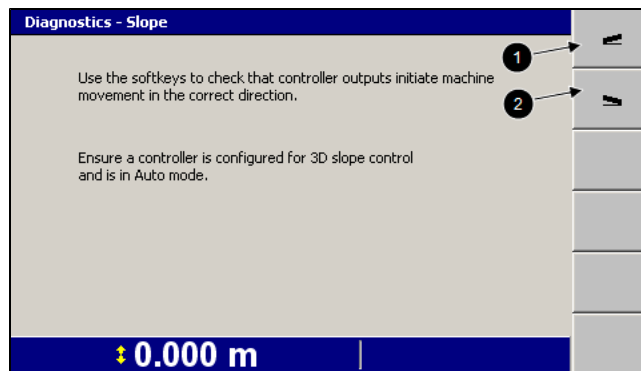


2. Select *Left Elevation* and/or *Right Elevation* and press .



Note – The above image shows an example of the left elevation controller outputs dialog.

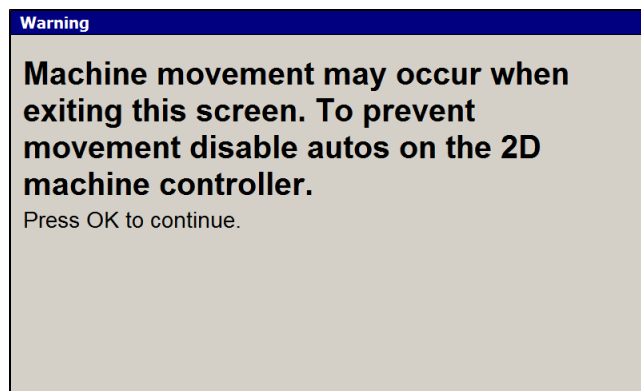
3. Press and hold **Softkey 1** (1) and **Softkey 2** (2) respectively, and make sure the machine moves up or down as required. This confirms that the selected output controller is configured for 3D grade control.
4. Select *Slope* and press .




5. Press and hold **Softkey 1** (❶) and **Softkey 2** (❷) respectively, and make sure the machine moves in the correct direction. This confirms that the slope output controller is configured for 3D slope control.

6. Press  or  to exit to the *Diagnostics – Controller Outputs* menu.

As this operation required the 2D control system to be in Auto, the following full screen message appears.




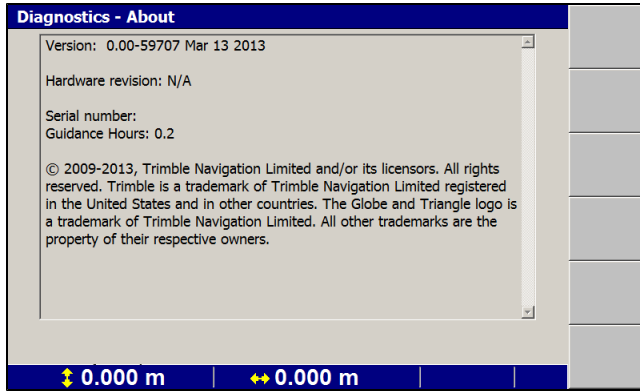
Press  to continue.



7. Press  to exit to the *Setup Menu – Diagnostics* menu.

5.3.5 About the system

To view the information about the system:

1. From the *Setup Menu – Diagnostics* menu, select *About* and press .



2. Press  to exit to the *Setup Menu – Diagnostics* menu.
3. Press  again to exit to the Guidance screen.

5.4 Troubleshooting flashing warning messages

The system generates flashing warning messages in situations where you need to take some action to ensure that the system continues to provide accurate guidance information. These warning messages are also written to the program log file (LOG_<machine name>_<date&time>.txt).

5.4.1 General warning messages

Table 5.3 — General warning messages

| Message | Problem | Solution |
|----------------------------|--|--|
| Check Machine Measurements | The set of dimensions that was entered is incomplete, or inconsistent with a machine dimension that can be measured by the system. | To restore a suitable machine settings file, use the procedure in 3.5.1 Machine settings . Otherwise, ask your site supervisor to enter the correct machine measurements. |
| Check Machine Type | The stored machine settings are invalid. | To restore a suitable machine settings file, use the procedure in 3.5.1 Machine settings . Otherwise, ask your site supervisor to correct the system configuration. |

| Message | Problem | Solution |
|----------------------|--|---|
| Loading Data | The control box is loading the current design information or Layered Lift surface. | Wait for the message to stop. It will disappear after a short period. |
| Option Not Installed | You have tried to use a feature that needs a valid option key entered. | Ask your site supervisor to provide an option key for the feature you want to use. |
| Unknown Status | The system has encountered an unexpected error. | Use the procedure in 5.8 Before you contact your dealer , to take a zsnap snapshot of the system, and then contact your dealer. |

5.4.2 UTS warning messages

Table 5.4 — UTS warning messages

| Message | Problem | Solution |
|-------------------------------|--|---|
| Check UTS Battery | The system detected that the UTS instrument battery is low. | Check that the battery is still connected to the instrument. Otherwise, replace the instrument battery with a fully charged one. |
| Check UTS Radio | The system cannot communicate with the UTS instrument's data radio. | Check that the instrument's radio is powered. Check the cable to the radio. |
| Check Machine Radio | The system cannot communicate with the machine's data radio. | To check that the radio is powered, use the procedure in 5.6.1 SNRx10 data radio status indicators . Check the cable to the radio. |
| Bench UTS | The target needs to be benched because the UTS height has changed. | To bench the target, use the procedure in 3.7 Benching the system . Otherwise, ask your site supervisor to set up the instrument with an elevation. |
| Check Machine Target | The system cannot communicate with the target. | Check that the target is powered and that the visible LEDs are flashing. Check the cable to the target. To check the MT900 machine target, use the information in 5.6.2 MT900 machine target status indicators . |
| Check Radio Channel | The radio network ID/channel number combination set up for your system is also being used by another machine within radio range. | Contact your site supervisor. |
| Level UTS and Check UTS Setup | The tilt compensator on the UTS instrument is out of range. | Stop the UTS positioning on the machine, remove power to the instrument, and repeat the instrument setup, making sure the instrument is level. Power up the instrument, and repeat the SPS900 setup. |

| Message | Problem | Solution |
|-----------------------|---|---|
| Multiple UTS Detected | The radio network ID/channel number combination set up for your machine and instrument is also being used by another instrument within radio range. | Contact your site supervisor. |
| No UTS Data | The UTS is not currently operating as part of the system. | To check that the UTS system is running and tracking the machine, use the procedure in 5.3 Running system diagnostics , particularly 5.3.2 UTS diagnostics . Check that the target ID is set correctly. To check the MT900 machine target ID, use the procedure in 4.2.1 Starting the UTS system . |
| Start UTS | The UTS system is not providing guidance data. | To start the UTS system, use the procedure in 4.2.1 Starting the UTS system . |

5.5 Troubleshooting error messages

The system generates error messages when you need to take some action, or when the system cannot perform the selected function.

These error messages occupy the full display screen and are also written to the program log file (LOG_<machine name>_<date&time>.txt).

Many of these errors cannot be resolved by the operator, in which case make a note of the error message and the actions which caused the message to display, and then contact your site supervisor.

Only errors that can be resolved by the operator or site supervisor are listed in the following sections.

5.5.1 Software support option errors

When you first start up, the software checks that the correct software option keys are entered. If the keys are not found, a message appears. If this occurs, talk to your site supervisor.

5.5.2 Other selected error messages

A system error has occurred. The application has been shut down for safety.

On start-up, one or more of the system's software components failed to start.

Contact your site supervisor.

No data

The system is not receiving any information from a sensor.

Try one of the following actions:

- Check the cable connections.
- Inspect the sensor for physical damage.
- To check that all the required components are responding, use the procedure in [5.3 Running system diagnostics](#).
- Switch off the power and then switch it on again.

No devices were detected on the CAN bus

The system uses a CAN bus to pass data and commands between its components (for example, the control box and a sensor). If this message is displayed, the components are not responding.

Try one of the following actions:

- Check all cabling.
- To check that all the required components are responding, use the procedure in [5.3 Running system diagnostics](#).

If problems persist, contact your dealer.

Not enough memory to load the ...

The control box has run out of memory to load the design, design Avoidance Zone, Site Map file, or Background Plan file. This may occur when using large:

- Designs
- Design Avoidance Zones
- Site Map files
- Background Plan files

As the Site Map and Background Plan files do not contain vertical guidance information, you can continue working if they fail to load.

Failure to load the design Avoidance Zone will result in the design being unloaded.

Try one of the following actions:

- Shut down the control box and then restart it.
- Ask the design staff to reduce the size of the files.

Out of memory!

The control box has run out of memory. You may have turned on wireless communications support when a large design or Background Plan file is loading.

Try one of the following actions:

- Shut down the control box and then restart it.
- Ask the design staff to reduce the size of the files.

Parameter Value Error

The value entered in the current field may exceed the recommended limits, or the value is invalid. Check the value entered.

Reverting to factory default settings

This message appears after you update the control box firmware. All the settings in the control box are reset to the default values.

Try one of the following actions:

- To restore the settings file for your machine, use the procedure in [3.5.1 Machine settings](#).
- Ask your site supervisor to configure the system for use on your machine. Save the new settings in a settings file.

Some of the required system devices are not responding

The system uses a CAN bus to pass information between its components (for example, to a slope sensor). In this situation, some of the components are not responding. You cannot use the system until all the devices respond.


Try one of the following actions:

- Check the cables.
- To check which devices are not responding, use the procedure in [5.3 Running system diagnostics](#).

If problems persist, contact your dealer.

Some of the required system devices have old firmware versions

If the firmware on a required component is too old, this message appears. You cannot use the system until the firmware is updated.

Press . The *Diagnostics* dialog appears. The dialog lists the firmware that needs to be updated.

Contact your site supervisor to update the component firmware.

Some settings are missing or invalid, and will be reset to factory defaults

On start-up, or after restoring display or machine settings files, some of the settings on the control box are missing or invalid. These will be set to the default values.

Try one of the following actions:

- To restore the settings file for your machine, use the procedure in [3.5.1 Machine settings](#).
- Ask your site supervisor to configure the system for use on your machine. Save the new settings in a settings file.

System Startup Error

On start-up, one or more of the system's software components failed to start.

Contact your site supervisor.

This radio does not support the required protocol

The on-machine data radio does not support the data transfer protocol used by the UTS instrument.

5.6 Troubleshooting system components

Some system components are installed on the machine in easily accessible locations. To help you troubleshoot problems, inspect the component's status indicators (typically LEDs).

5.6.1 SNRx10 data radio status indicators

The SNRx10 data radio housing is fitted with an LED data/power indicator light (❶).



The LED can flash in a number of different patterns depending on the situation, as shown below:

| LED pattern | Status |
|-------------------------|--|
| Off | No power to radio. |
| On solid | Power is available, but the radio is not synchronized with the base station. |
| Irregular flashing | Power is available, the radio is synchronized, but the radio is losing data. |
| Steady flashing at 1 Hz | Power is available, the radio is synchronized, and receiving data. |

5.6.2 MT900 machine target status indicators

The status indicators (❶) show if the unit is receiving power and functioning correctly. There are four status indicators visible.



The indicator patterns showing the machine target's status are as follows:

| Indicator flashing pattern | Meaning |
|---|--|
| Slow flash (0.1 second on, 0.9 seconds off) | Normal operation |
| Not illuminated | No power |
| Fast flash (0.1 second on, 0.1 second off) | Power up (approximately 0.5 seconds), otherwise low battery (<9 VDC) |
| Blink (3 seconds on, 0.1 second off) | Hardware fault |

5.7 Troubleshooting UTS systems

To quickly assess the UTS components of a system, check the following:

- Are the yellow MT900 machine target LEDs, located at the top of the target, flashing? If these LEDs are not flashing, then the UTS instrument will not be able to lock onto the target.

Note – The red LEDs do not flash and do not indicate target lock.


- Use the information in [5.3 Running system diagnostics](#), particularly [5.3.2 UTS diagnostics](#), to check the following:
 - Is the UTS connected?
 - Does the UTS instrument have the correct software and firmware loaded? Contact your site supervisor to find out what the correct software and firmware is for the UTS.
 - Place the focus point at a control point. Is the position of the focus calculated correctly?
- Check that the correct model of radio is installed.
- Use the information in [5.6.1 SNRx10 data radio status indicators](#), to check the following:
 - Is the data radio getting power?
 - Is the data radio synchronized?
 - Are you on the correct radio channel?
- Use the information from the *UTS* dialog to check the following:
 - Is the UTS tracking?
 - Does the UTS have adequate power?
- Is the UTS instrument free from vibrations caused by passing machinery or the wind? Complete the following procedure:
 - a. Stop the machine.
 - b. Put the automatic controls in Manual.
 - c. Rest the screed on the ground.
 - d. To view the *Machine Target* screen of the *Diagnostics – UTS* dialog, use the procedure in [5.3 Running system diagnostics](#), particularly [5.3.2 UTS diagnostics](#).
 - e. Observe the Northing, Easting, and Elevation values. At a distance of 150 m (492 ft) you would not expect to see any variation in the Northing

and Easting values, and no more than ± 5 mm (± 0.2 inches) variation in elevation.

- Observe the site and work area, and check the following:
 - Is the UTS machine target between 15 m (50 ft) and 300 m (985 ft) from the UTS instrument?
 - Does the UTS instrument have a continuous line of sight to the UTS target? Check for occasional passing vehicles or dust clouds which could block the line of sight. Check that the line of sight is maintained for all machine orientations across the whole work area.
 - Is the work area within the search window specified when the UTS instrument was started?
 - Are the lenses of the UTS instrument clean?

5.8 Before you contact your dealer

The more information you can provide for the support personnel, the less time it will take them to solve your problem. It is *essential* that you provide the following information:

- A system state “snapshot”. To generate the system state snapshot files, hold down  and press the fourth softkey from the top.

Note – Make sure you take the snapshot as soon as possible after encountering a problem.

The software creates:

- a “snapshot” of the current system state and saves it as a .zsnap file in the root directory of the system
- a bitmap file of the current display and saves it as a .gif file in the root directory of the system

The names of the files indicate the date and time that the files were created. You can view the bitmap file in a drawing package on an office computer, such as Microsoft Paint. You cannot view the system state snapshot file. Your site supervisor can arrange to access these files.

- The system log. The system log data is written to the program log file (LOG_<machine name>_<date&time>.txt) located in the root directory of the system. Your site supervisor can arrange to access this file.
- A description of the problem, including the steps that led to the problem.

Make sure that you contact the correct person for support. In the first instance this is your site supervisor, then your dealer, and finally Trimble support.

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