TOPCON


# System Five-3D™

## Reference Manual

### Millimeter GPS™ Addendum

TOPCON
POSITIONING SYSTEMS

# System Five-3D Reference Manual

## Millimeter GPS Addendum

Part Number 7010-0700
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# Introduction

Topcon's Lazer Zone™ and Millimeter GPS™ (mmGPS) products provide unparalleled measuring accuracy at the jobsite.

- The millimeter GPS system is up to 300% more accurate than standard GPS.
- The Lazer Zone transmitter provides wide vertical measurement area of 600m/2000ft diameter and 10m/33ft height
- The system provides multiple rover support for machine and pole mounted sensors.
- The technology works with existing Topcon GPS+ systems.

For System Five-3D applications, mmGPS consists of three primary components: the PZL-1 transmitter set up over a control point, the PZS-1 sensor on a range pole with a GPS+ receiver, and the PZS-MC sensor installed on the machine (Figure 1-1).

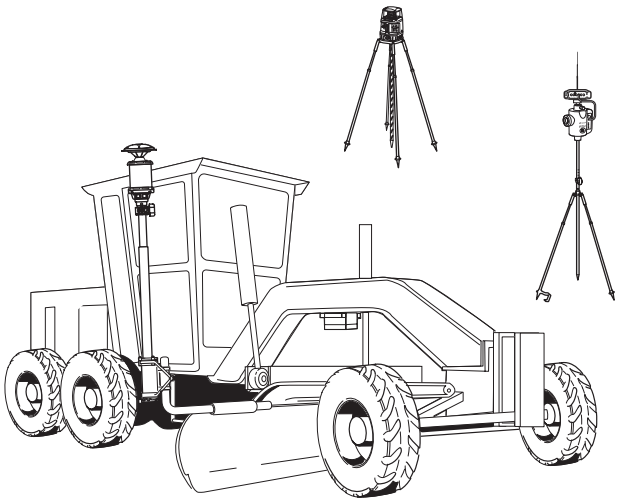

**Figure 1-1. System Five-3D with mmGPS**

# Updating for mmGPS

Control Box and Pocket-3D options enable specific functions for different applications. To update the Control Box and Pocket-3D for mmGPS, purchase these options from your Topcon Dealer. Options are activated after entering two authorization codes.

When contacting your Topcon Dealer for authorization codes to enable mmGPS options, you will need the following information:

- Device identification
- Company name
- Contact name
- Company address
- Contact phone number
- Contact email address
- Equipment type (System Five-3D or Pocket-3D)

## Updating 3DMC

1. Tap **Topcon Logo ▸ View ▸ About 3DMC**. Press **Options**, then press **Modify** (Figure 1-2).

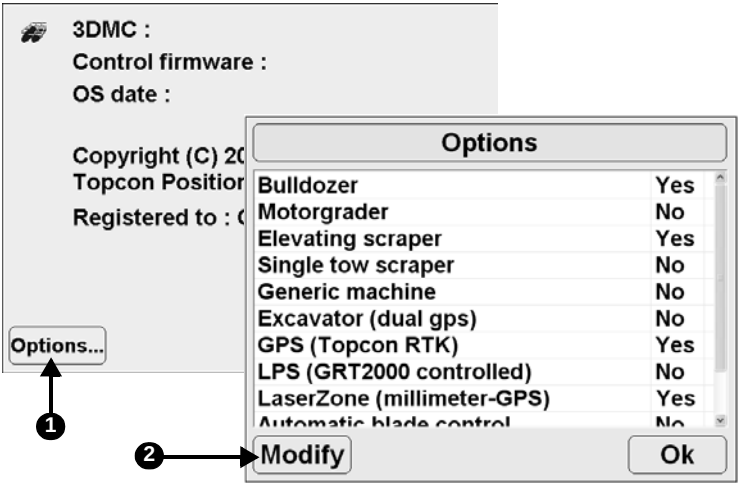


**Figure 1-2. View 3DMC Options**

2. From the ***ControlBox*** dialog box, record the *Device identification* number to give to your Topcon representative (Figure 1-3 on page 1-3). Contact your Topcon representative to purchase new authorization codes for the desired application.
3. When you have received the new authorization codes, enter the codes into the ***ControlBox*** dialog box using the alpha-numeric keyboard (Figure 1-3).

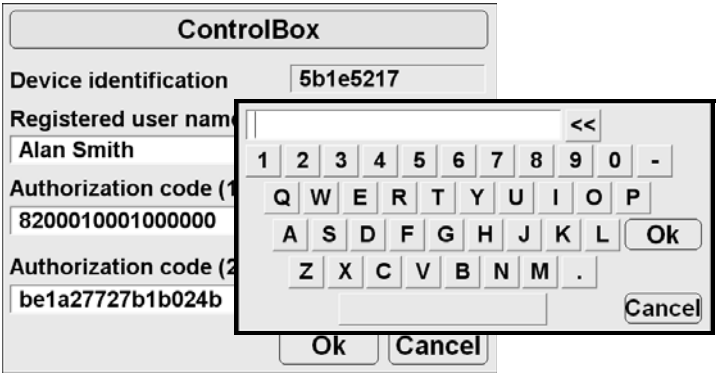


**Figure 1-3. Enter New Authorization Codes**

4. Press **Ok** to apply the new codes and options. Press **Ok** on each screen to return to the Main Screen.
5. Turn off the Control Box, wait a couple seconds, and then turn on the Control Box to activate the new passwords.

# Updating Pocket-3D

1. Connect your computer and hand-held controller.
   Because ActiveSync will automatically install Pocket-3D once it has been loaded onto the computer, this step can be performed at any time.
2. Insert the 3DMC software CD into the computer CD drive of the computer. Navigate to the CD's files using Windows® Explorer and open the Pocket-3D folder.
3. Click the Pocket-3D setup icon to run the install program and click **Next** on the ***Welcome*** screen (Figure 1-4). Follow the on-screen instructions.

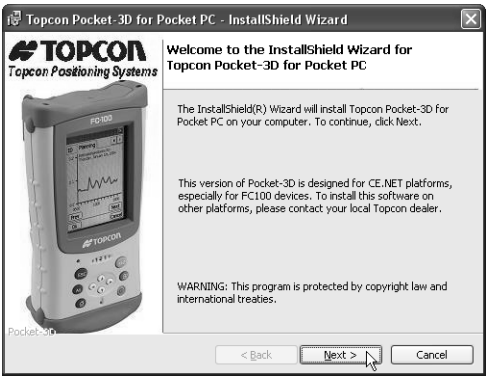


**Figure 1-4. Begin Pocket-3D Installation**

4. After installing applicable files to the computer, ActiveSync will start up and retrieve the controller's programs.
   - If Pocket-3D is already installed, ActiveSync will uninstall it from the controller. When done, double-click the Pocket-3D setup icon to install the software on the controller.
   - For new installations, ActiveSync will begin the Pocket-3D install process for the controller (Figure 1-5). Click **Yes** to install Pocket-3D to the default directory on the controller.


**Figure 1-5. Install Pocket-3D on Controller**

5. Click **Finish** to exit the install program.
6. At the controller, start Pocket-3D and record the *Device identification* number (Figure 1-6) to give to your Topcon Dealer.
7. After receiving authorization codes from your Topcon Dealer, enter them into the appropriate fields on the ***Device Identification*** screen and press **Ok** (Figure 1-6).

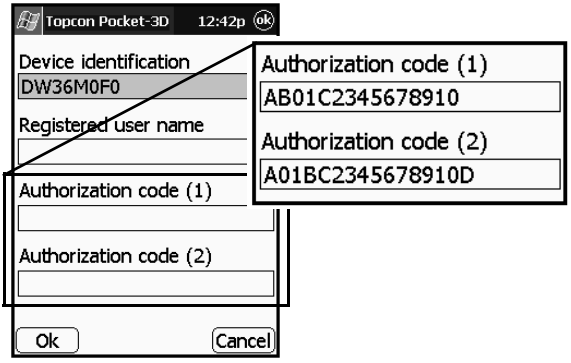


**Figure 1-6. Enter Authorization Codes**

# mmGPS Components for Machine Control

Besides the standard components as seen in the *System Five-3D Reference Manual*, mmGPS applications include the following components.

## Control Box and 3DMC

At the Control Box, the 3DMC software for mmGPS includes two extra Control menu options for setting up the PZS-MC receiver and PZL-1 transmitter. The Elevation Control Key also displays an icon indicating mmGPS control has been selected (Figure 1-7). When detecting a signal, the icon will be blue; otherwise, the icon is gray.

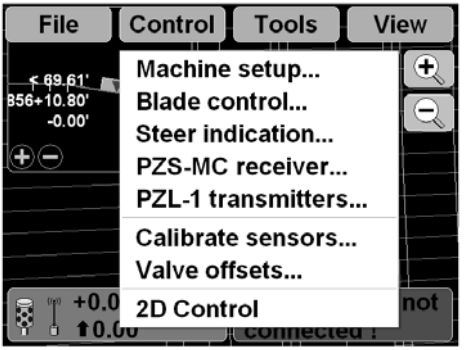


**Figure 1-7. System Five-3D Control Box with mmGPS**

## GPS MC-2.5 Receiver Box

The GPS MC-2.5 Receiver Box (Figure 1-8 on page 1-7) attaches to the machine with shock isolated magnetic mounts. The MC-2.5 Receiver Box can be easily removed at the end of each day for storage, and contains no manual adjustment.

The MC-2.5 Receiver Box combines Topcon's GPS receiver module and a radio module into a single, rugged housing. When used in conjunction with a the PZL-1 and PZS-MC, this combination provides the Control Box and operator millimeter level accuracy.

The Control Box processes these measurements to compute grade and graphical mapping information.

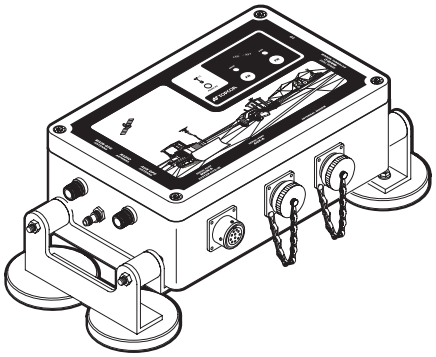

**Figure 1-8. MC-2.5 Rover GPS Receiver Box**

# PZS-MC Sensor

The PZS-MC (Figure 1-9) replaces the machine-mounted GPS antenna. The PZS-MC combines the MC-A1 GPS antenna with laser sensor technology into a total package. Lazer Zone technology allows the sensor to detect up to four different PZL-1 transmitters for increased range. The sensor attaches to a GPS vibration pole on the machine blade, and two cables connect the receiver to the MC-2.5 Receiver Box for sending corrections to the Control Box.

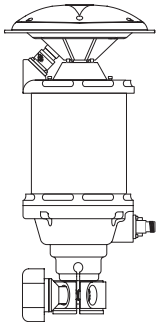

**Figure 1-9. PZS-MC Machine Control mmGPS Sensor**

# GPS Vibration Pole

The GPS Vibration Pole (Figure 1-10) installs on the machine's blade with several types of mounts.

The GPS Vibration Pole provides a lightweight, fixed mount for the PZS-MC, and utilizes shock isolation and vibration dampening.

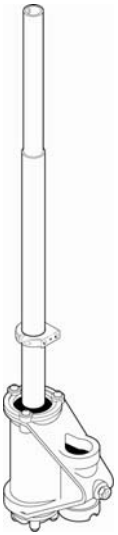

**Figure 1-10. GPS Vibration Pole**

# PZL-1 Laser Transmitter

The PZL-1 laser transmitter (Figure 1-11 on page 1-9) operates similar to a standard rotating laser, but transmits a unique signal to provide a working range of 2000ft. Instead of a traditional flat plane, the PZL-1 emits a unique beam that provides a measuring area of 33ft in height. Up to four laser transmitters can be linked for use on large sites, covering a distance of nearly 8000ft or elevation changes of over 130ft. Each PZL-1 transmitter also supports multiple rovers, even at different elevations for continuous production.

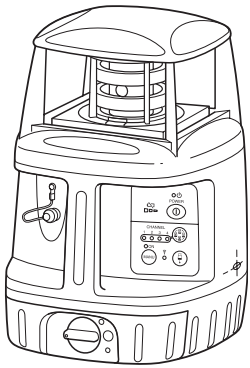

**Figure 1-11. PZL-1 Laser Transmitter**

# PZS-1 Sensor and GPS+ Receiver

The PZS-1 sensor (Figure 1-12) instantly computes precise vertical information from the PZL-1 laser transmitter. Using Lazer Zone™ technology, the PZS-1 automatically determines elevation based on job site control. Mounting the PZS-1 to a range pole and attaching a GPS+ receiver allows the sensor to receive the PZL-1 laser signal and wirelessly transmit data to the receiver.

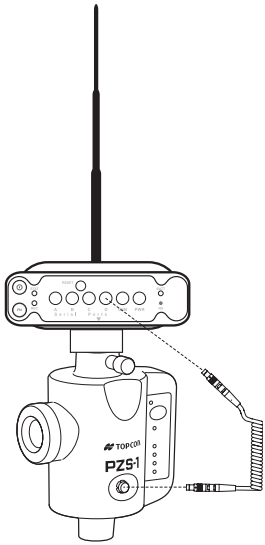


**Figure 1-12. Receiver and PZS-1 on Rover Pole**

# Pocket-3D

When enabled for mmGPS, Pocket-3D (Figure 1-13) has the following added functionality:

- set up machine files for mmGPS equipment
- set up the PZL-1 transmitter over a known or unknown point
- set up the PZS-1 sensor
- check the height of the transmitter
- perform a field calibration to adjust the transmitter
- view a history of cuts and fills

To enable Pocket-3D for mmGPS, contact your local Topcon representative to obtain the upgrade.


**Figure 1-13. Pocket-3D with mmGPS on the FC-100**

Refer to the *Pocket-3D Reference Manual* and *Pocket-3D User's Manual* for details on the software.

# Using mmGPS at the Jobsite

mmGPS uses Topcon's unique Lazer Zone™ technology to produce millimeter accuracy. Lazer Zone technology combines the simplicity of a rotating laser, the accuracy of a robotic total station, and the flexibility and multiple-user capabilities of GPS into one complete jobsite solution (Figure 1-14).

- The PZL-1 laser transmitter emits a unique laser beam that provides a working range up to 2000ft (600m).
- The PZS-MC laser sensor and GPS receiver at the machine detects the laser beam and satellite signals, sending millimeter accurate positioning data to the control box for correction control.
- The PZS-1 sensor and GPS receiver detects the laser beam and satellite signals, providing millimeter accurate spot-checks throughout the jobsite.

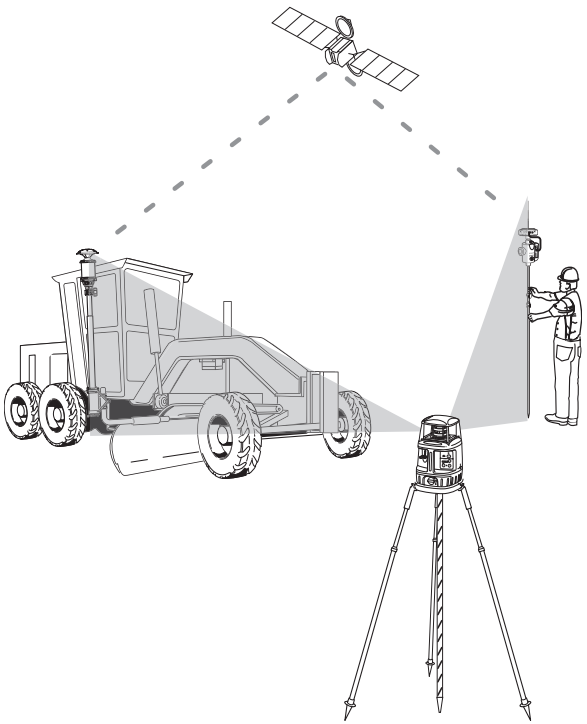

**Figure 1-14. mmGPS at the Jobsite**

# Placing Transmitters at the Jobsite

The physical location of the laser transmitter on the jobsite should be outside the actual grading area, if possible. When choosing a location to place the laser transmitter, remember the following two recommendations.

1. Minimize the working distance from the laser transmitter.

   As the distance from the laser transmitter increases, grade accuracy decreases. The following factors affect grade at long distances:

   - Ground vibration from machinery working near the laser transmitter
   - Calibration error
   - Laser movement from blowing wind
   - Atmospheric conditions

2. Keep the laser transmitter as low as possible.

   Keeping the laser transmitter low, where you can reach it, will make setup and occasional adjustments easier. The transmitter and laser receiver on the machine will also be more stable. On windy days, you may need to anchor the tripod to keep the laser transmitter from moving.

   The laser transmitter does not need to be above the machinery on the job. The benefits of keeping it low, as well as GPS capabilities, far outweigh the momentary loss of the laser beam due to passing equipment.

On small projects, place the laser transmitter off the working area (Figure 1-15 on page 1-13). The working distance from your laser will indicate the type of project (small or large).

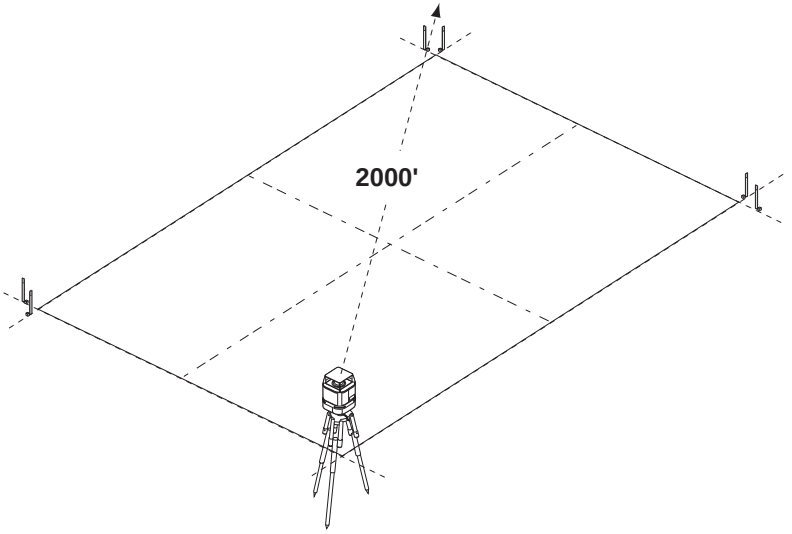


**Figure 1-15. Laser Transmitter Placement – Small Project**

On larger projects, place the laser transmitter in the center of the project to maximize the area you can grade and minimize the distance from the laser (Figure 1-16). The working distance from your laser transmitter will indicate the type of project (large or small).

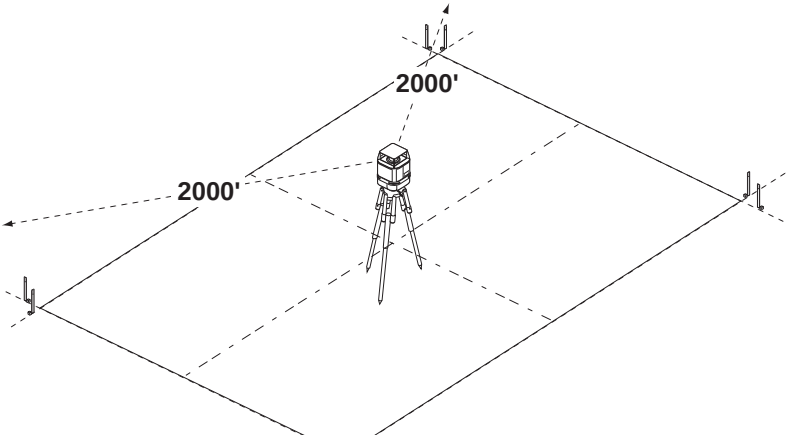


**Figure 1-16. Laser Transmitter Placement – Larger Project**

For particularly large projects, you can use up to four PZL-1 laser transmitters to increase the working range of the sensors.

# Using Multiple Transmitters

Up to four PZL-1 transmitters can be used for a single job, increasing the range of the sensors to cover nearly 8000ft (2438m) in distance or up to 130ft (40m) of elevation changes. When using multiple transmitters, you will use 3DMC and Pocket-3D to configure the PZS-MS and PSZ-1 for detecting each transmitter (see the following chapters for details).

When using multiple transmitters, place each transmitter so that its beam will partially intersect the beam of its neighbor transmitter (Figure 1-17). The PZL-1 transmitters can be placed on either level or hilly ground.

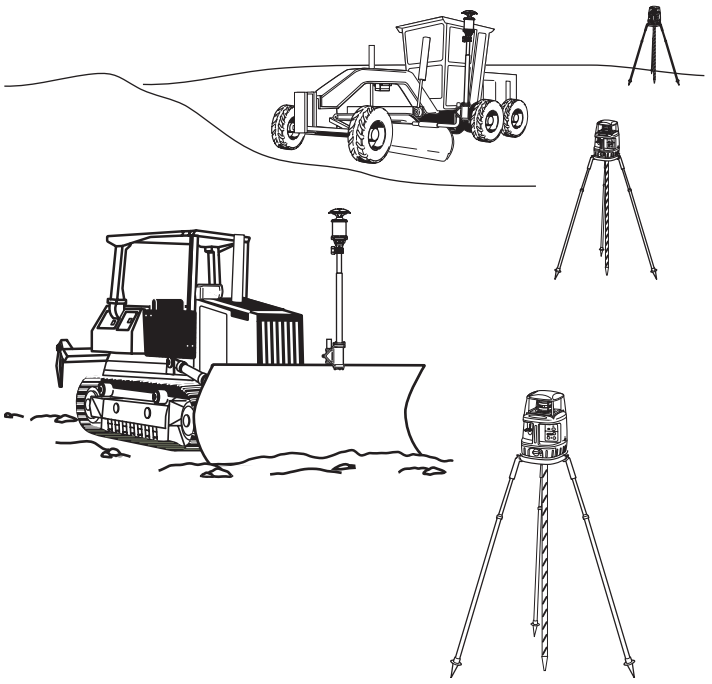

**Figure 1-17. Multiple Laser Transmitter Placement**

# Equipment Setup with Pocket-3D

When setting up the PZL-1 transmitter and PZS-1 sensor, Pocket-3D provides the interface for building equipment files, calibrating the transmitter, and initializing the sensor.

## Creating an Equipment File

Equipment configuration files contain information on the specific machine, laser or GPS+ receiver, prism, radio, etc. for the job application and setup. Pocket-3D uses this information to accurately portray jobsite information on the main screen.

Before initializing or localizing a GPS+ system, there must be an equipment configuration file defined in Pocket-3D. The following procedure is an example of a HiPer receiver configuration for mmGPS applications.

NOTICE *NOTICE*

*Incorrect measurements or typographical errors directly affect grading accuracy.*

1. Press **Setup ▸ Equipment** to create or select an equipment configuration file.
2. On the ***Machine files*** dialog box, press **New** to create the equipment configuration, or press **Edit** to change an existing equipment configuration (Figure 2-1 on page 2-2).

3. For mmGPS application, apply following equipment parameters, and press **Next** (Figure 2-1):
   - Configuration name – enter a name for the configuration file
   - Machine type – select Range pole from the drop-down list
   - Sensor – select GPS antenna from the drop-down list
   - Location – select Top of pole from the drop-down list
   - Units – select the type of unit measurement

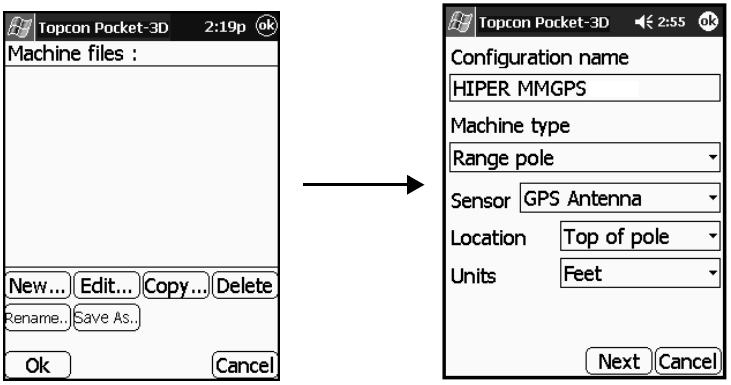


**Figure 2-1. Create or Edit an Equipment Configuration**

4. Enter the antenna information using the same units of measure entered in the previous step, then press **Next** to continue (Figure 2-2 on page 2-3). These settings have a corresponding *Image* tab to illustrate the setup.
   - Antenna type – select a mmGPS antenna selection
   - Antenna height – enter the antenna's height
   - Measured to point – select either Base or Rim
   - Connection (Pocket-3D) – select the appropriate connection port between the sensor and Pocket-3D controller

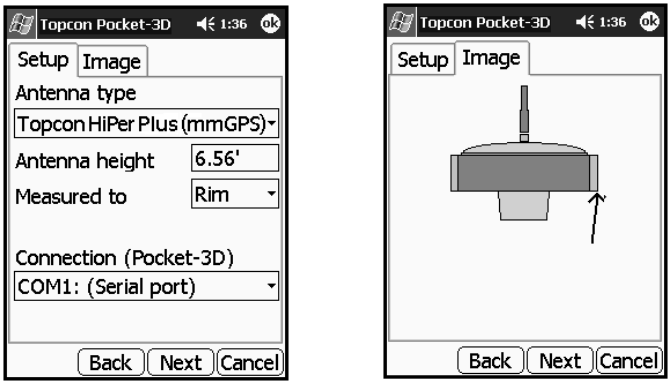


**Figure 2-2. Antenna Information Dialog Box**

5. Set the radio parameters, and press **Next** to continue (Figure 2-3):
   - Radio type – select Pacific Crest PDL UHF or Internal Spread Spectrum
   - Connected to – select serial port (usually Port C)
   - Baud rate – select 38400
   - Format – select CMR

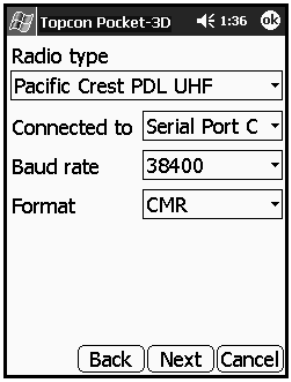


**Figure 2-3. Radio Setup Dialog Box**

6. Select the following Lazer Zone parameters (Figure 2-4 on page 2-5):
   - GPS port – select the port used for GPS communication between receiver and sensor (typically port D).
   - Sensitivity – select the sensitivity level for detecting the transmitter, usually Auto. Select a different setting when working at very short or very long distances, or during inclement weather that can affect laser detection.
   - Channels – select the channel to scan for mmGPS connection. The "All" selection will allow the sensor to independently select the transmitter with the smallest error rate[1]. If setting up only one transmitter, but the job has been configured for multiple transmitters, select the individual ID of the transmitter for the sensor to detect.
   - LaserZone aided init – select to use the mmGPS signal to assist in initializing the GPS receiver. This option is useful to decrease the initialization time when satellite visibility is limited (for example, tracking only four or five satellites).
   - Calc. LaserZone/GPS weighted elevations – select to combine Lazer Zone elevations and GPS elevations. When selected, this option will force the receiver/sensor to always consider the angle and distance when determining the elevation, then combine the two elevations accordingly. This option works well at large (300m) distances and steep angles.

1. Note the following exception:
   If using more than one transmitter, and all transmitters have been previously calibrated and initialized, selecting "All" will cause the Pocket-3D program to search for the transmitter with the smallest error rate, even if the physical unit is not set up. In this case, the sensor will not detect the transmitter.

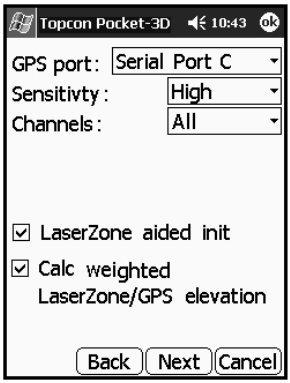


**Figure 2-4. Select Lazer Zone Information**

7. Press **Finish** to save the configuration file.

NOTICE *NOTICE*

*Press Finish to save the file. Failure to do so results in losing all information and will require you to repeat the process.*

8. On the ***Equipment configuration*** dialog box, select the new or edited configuration file, and press **Ok** to continue (Figure 2-5).
9. Press **Yes** to apply the configuration file as the current equipment (Figure 2-5).

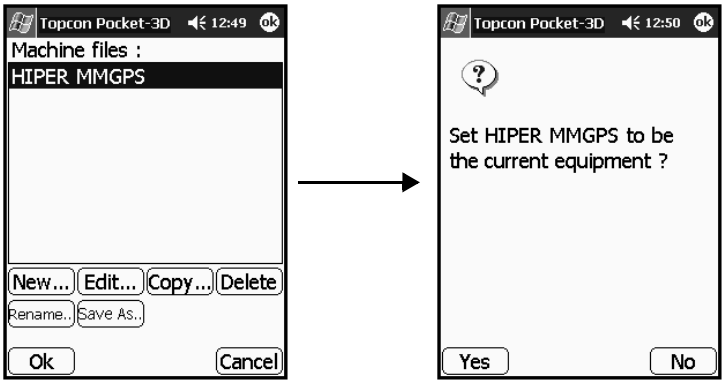


**Figure 2-5. Select Equipment Configuration**

# PZL-1 Transmitter Setup and Calibration

For machine control applications, the PZL-1 transmitter attaches to either a standard tripod or a fixed 2m tripod over a surveyed point.

1. Locate a control point over which to set up the PZL-1 transmitter.

   Or, see “Performing a Resection” on page 4-1 to automatically locate the transmitter over an unknown point.
2. Attach the transmitter to the tripod (Figure 2-6).

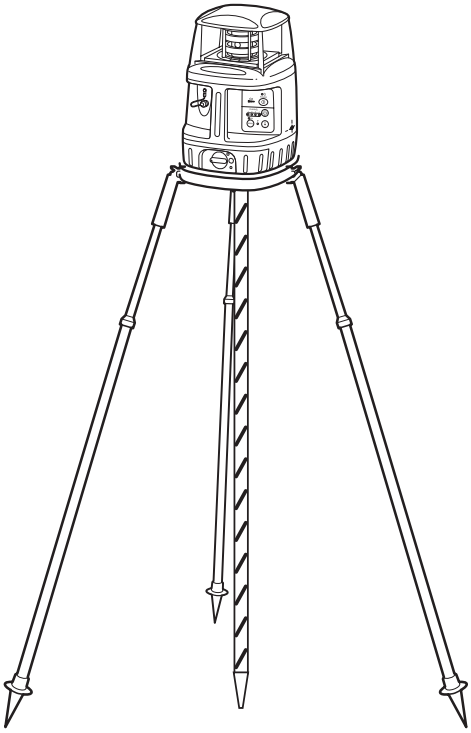

**Figure 2-6. Setup PZL-1 Transmitter**

3. Turn on the transmitter’s power and select a channel for the transmitter (Figure 2-7 on page 2-7).

   To assign a channel to the transmitter, press the channel button until the corresponding LED lights up.

4. Connect the transmitter and Pocket-3D controller (Figure 2-7). Check that a mmGPS-enabled machine configuration is loaded.

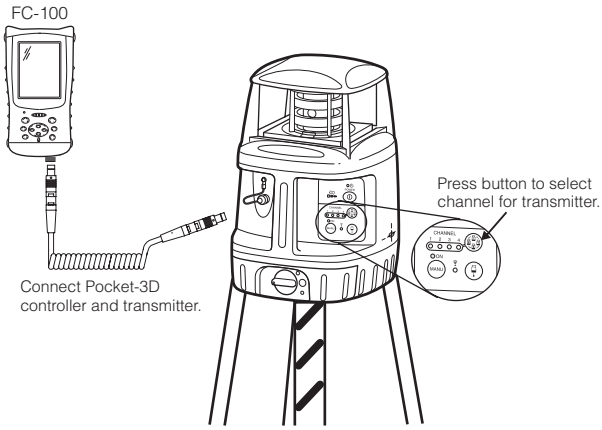


**Figure 2-7. Select Channel and Connect Controller**

5. Tap **Setup ▸ LaserZone Transmitters** to set up from one to four transmitters in Pocket-3D.
6. Tap the **right arrow** to scroll through the tabs on the ***transmitter setup*** dialog box. Then tap the **Transmitters** tab (Figure 2-8 on page 2-8).
   - **To load transmitter data for the first time** – tap **Download** to retrieve calibration data from the connected transmitter. The download is complete when the firmware version displays in the *Firmware* column.
   - **To add a transmitter** – tap **Add** and enter a transmitter serial number or other description.
   - **To delete a transmitter** – select a transmitter and tap **Delete**.
   - **To adjust the transmitter** – see "Transmitter Adjustment" on page 4-6.

   Once the *Transmitters* tab contains a list of transmitters, each transmitter must be setup on a unique channel. The channel button on the transmitter determines the channel that the transmitter broadcasts on.

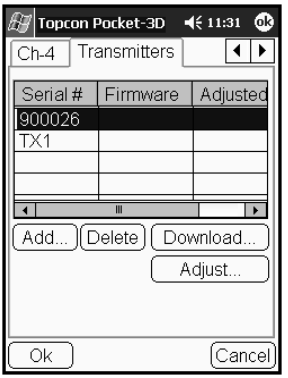


**Figure 2-8. Load Transmitters into Pocket-3D**

7. Tap the channel tab for the connected transmitter and set the following parameters (Figure 2-9 on page 2-9):
   - From the *Transmitter* drop-down list, select the description of the connected transmitter.
   - Select the control point that the transmitter is set up over.
   - Enter the height of the antenna:
     – If using a two meter fixed tripod, select this checkbox.
     – If using another tripod, enter the height of the transmitter from the ground to the mark on the transmitter's side.
8. If needed, repeat step 7 for up to three other transmitters.

9. Press **OK** when done.

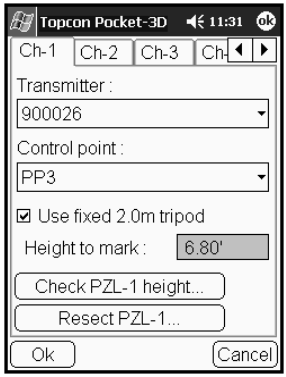


**Figure 2-9. Enter Transmitter Channel and Control Point Data**

# PZS-1 Sensor Setup and Initialization

For machine control applications, the PZL-1 transmitter attaches to either a standard tripod or a fixed 2m tripod over a surveyed point.

The following procedure requires a mmGPS-enabled machine configuration file to be selected in Pocket-3D.

1. Connect the GPS+ receiver to the 5/8inch plug on the PZS-1 sensor.
2. Connect the PZS-1 to the range pole.
3. Connect the serial cable from port D of the GPS+ receiver to the serial port on the PZS-1 sensor.
4. Turn on the power to both the receiver and sensor.
5. Connect the Pocket-3D controller and GPS+ receiver using one of the following techniques:
   - A serial cable connected to port A of the receiver.
   - Bluetooth wireless technology.

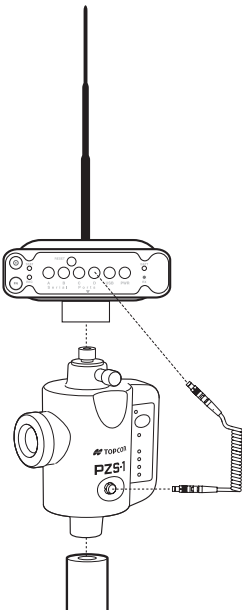


**Figure 2-10. Connect Receiver and Sensor**

6. In Pocket-3D, tap **Setup ▸ LaserZone receiver**.
7. Select the following Lazer Zone parameters (Figure 2-11):
   - GPS port – select the port used for GPS communication between receiver and sensor (typically port D).
   - Sensitivity – select the sensitivity level for detecting the transmitter, usually Auto. Select a different setting when working at very short or very long distances, or during inclement weather that can affect laser detection.
   - Channels – select the channel to scan for mmGPS connection. See page 2-4 for details.
   - LaserZone aided init – select to use the mmGPS signal to assist in initializing the GPS receiver. See page 2-4 for details.
   - Calc. LaserZone/GPS weighted elevations – select to combine Lazer Zone elevations and GPS elevations. See page 2-4 for details.
8. Tap **OK**.

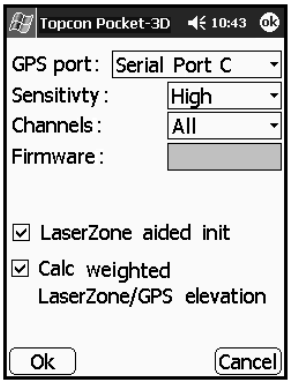


**Figure 2-11. Select Lazer Zone Information**

# Notes:

# Machine Setup with 3DMC

When setting up the machine for mmGPS, the control box and 3DMC software provides the interface for building machine files, entering PZS-MC receiver information, and selecting channels for one or more transmitters. Transmitter information, such as serial number/ description, firmware and adjusted status, comes from a copied Pocket-3D control point file.

## Creating a Machine Setup File

The Machine Configuration file provides vital information about the type of machine, the setup of the components on the machine, machine measurements, and radio configuration information. You must have a machine configuration file before beginning to grade.

If you need to set up the Control Box on the machine, refer to the specific control application's chapter in the *System Five-3D Reference Manual*.

1. Press **Topcon Logo ▸ Control ▸ Machine setup** to display the ***Machine files*** dialog box (Figure 3-1 on page 3-2).
2. Press **New** to create a new machine configuration or **Edit** to change a current configuration.
3. Enter the following information and tap **Next** (Figure 3-1 on page 3-2):
    - Configuration name – enter a name for the configuration using the pop-up keyboard
    - Machine type – select the type of machine
    - Sensor – for mmGPS application, select *GPS antenna*

- Location – select the sensor's location on the machine
- Units of measure – select the unit of measure used in the project (meters, feet, inches, or centimeters)

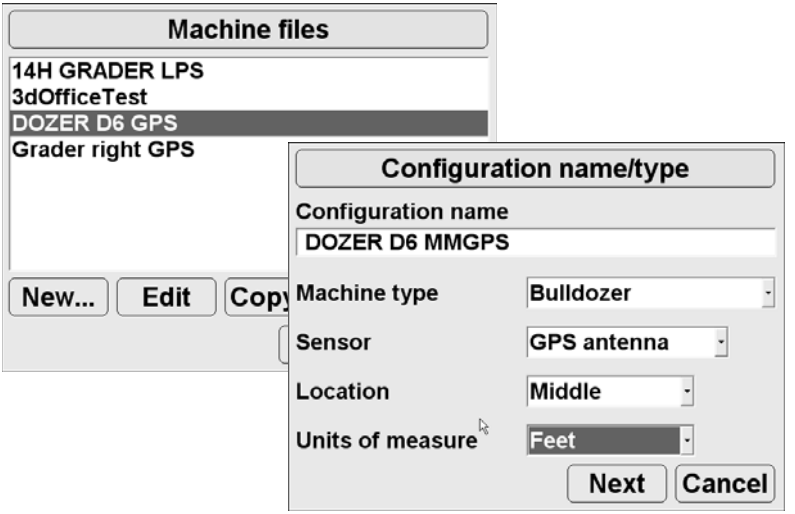


**Figure 3-1. Enter Machine Configuration Information**

4. Enter antenna information using the same units of measure selected in the previous step (Figure 3-2 on page 3-3). Then tap **Next**.
   - Antenna – select *Topcon PZS-MC (mmGPS)*
   - Height – enter the height of the PZS-MC using the most vertical distance between the corner on the rim of the antenna and the cutting edge
   - Behind – enter the distance of the sensor behind the blade
   - Width – enter the width of the blade
   - Beyond – only for graders, enter the distance of the sensor beyond the end of the blade
   - From right – only for dozers, enter the distance of the sensor from the right edge of the blade

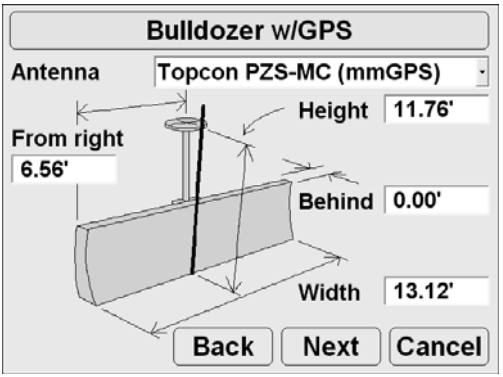


**Figure 3-2. Enter Sensor and Blade Information**

NOTICE *NOTICE*

*Incorrect measurements or data entry errors directly affect grading accuracy. Take each measurement twice.*

5. Select radio configuration information (Figure 3-3 on page 3-4), then tap **Next**:
   - Radio type – depending radio type, either Pacific Crest PDL UHF, TeleDesign UHF, or Internal Spread Spectrum
   - Connected to – the serial port the radio is connected to, usually Serial Port B
   - Baud rate – 38400
   - Format – CMR

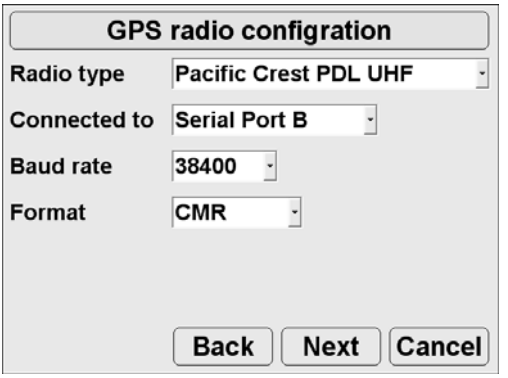


**Figure 3-3. Enter Radio Configuration**

6. Select Lazer Zone information (Figure 3-4 on page 3-5) and tap **Next**:
   - GPS port – select the port used for GPS communication on the MC-2.5 Receiver Box; usually, Serial Port C.
   - Sensitivity – select the sensitivity level for detecting the transmitter, usually Auto. Select a different setting when working at very short or very long distances, or during inclement weather that can affect laser detection.
   - Channels – select the channel to scan for mmGPS connection. See page 2-4 for details.
   - LaserZone aided init – select to use the mmGPS signal to assist in initializing the GPS receiver. See page 2-4 for details.
   - Calc. LaserZone/GPS weighted elevations – select to combine Lazer Zone elevations and GPS elevations. See page 2-4 for details.

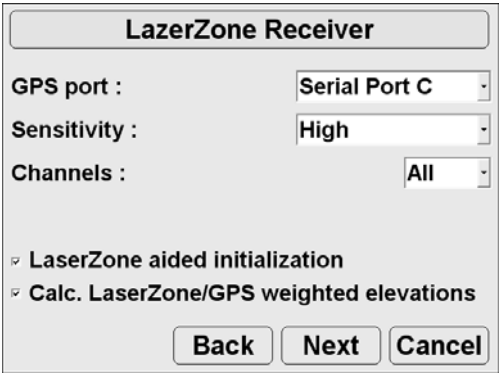


**Figure 3-4. Select LaserZone Information**

7. Press **Finish** to complete and save the machine configuration file (Figure 3-5) and return to the ***Machine setup*** dialog box.

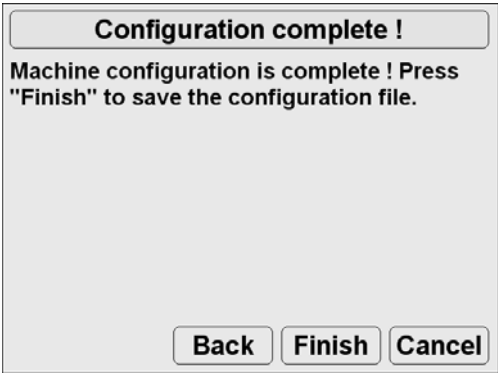


**Figure 3-5. Configuration Complete**

NOTICE *NOTICE*

*You must press Finish to save the file. Failure to do so will result in losing all information and require you to repeat the process.*

# Copying the Control Point File

For mmGPS applications, the control point file also stores transmitter information, including calibration data, setup location, and height data. This information is copied from a Pocket-3D controller to the Control Box via a compact flash card.

1. Save the Pocket-3D control point file to a compact flash card.
2. Insert the CF card that contains the mmGPS control point file into the CF card slot on the Control Box.
3. Tap **Topcon Logo ▸ File ▸ Control points** and tap **Copy**.
4. Select "from data card to internal disk" and the file to copy from the *Project files* list (Figure 3-6). Tap **OK**.

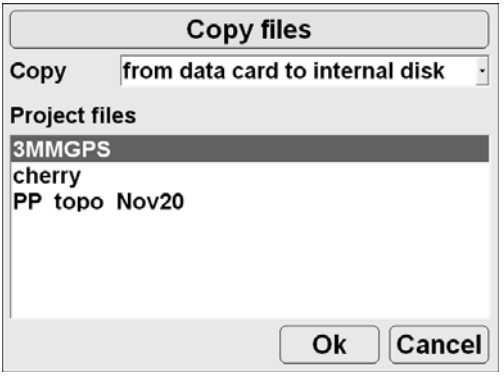


**Figure 3-6. Copy File**

During the copy process, an hourglass displays to indicate the system is busy.

5. When done, select the copied file on the ***Control point files*** dialog box and tap **OK**.

# PZS-MC Receiver Setup

After mounting the PZS-MC receiver to the vibration pole, use 3DMC to configure the receiver for the machine.

NOTICE *NOTICE*

*Note the following setup requirements:*

- *Face the receiver's logo and LEDs forward; face the connectors towards the machine.*
- *Connect the right-angle end of the serial cable to the PZS-MC receiver.*

1. With the blade placed on level ground, position the pole vertically, then mount the receiver on the pole.
2. Connect the antenna cable and serial cable to the receiver (Figure 3-7).
3. At the MC-2.5 Receiver Box, connect the antenna cable to the Main GPS antenna port and the serial cable to the Main C serial port (Figure 3-7).

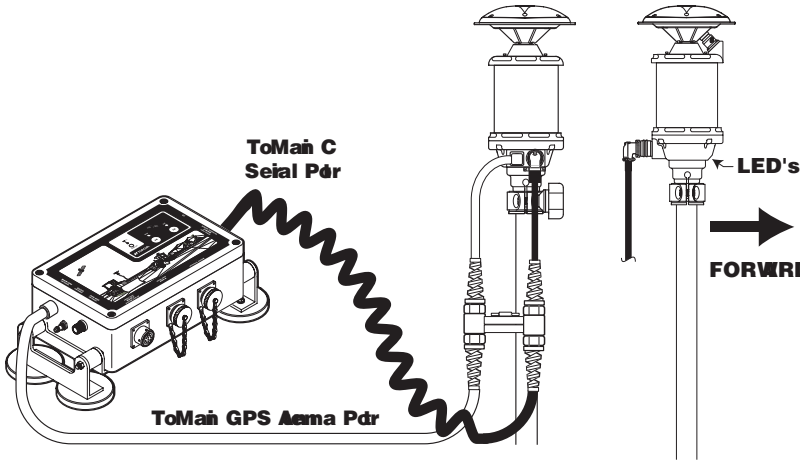


**Figure 3-7. Mount Receiver and Connect Cables**

4. At the control box, press **Topcon Logo ▸ Control ▸ PZS-MC receiver** and select the following receiver parameters. Then press **OK** (Figure 3-8 on page 3-9):
   - Receiver port – select the port used for GPS communication at the MC-2.5 Receiver Box; usually Serial Port C.
   - Receiver sensitivity – select the sensitivity level for detecting the transmitter, usually Auto. Select a different setting when working at very short or very long distances, or during inclement weather that can affect laser detection.
   - Transmitter selection – select the channel to scan for mmGPS connection. The "Any" selection will allow the sensor to independently select the transmitter with the smallest error rate[1]. If setting up only one transmitter, but the job has been configured for multiple transmitters, select the individual ID of the transmitter for the sensor to detect.
   - LaserZone aided init – select to use the mmGPS signal to assist in initializing the GPS receiver. See page 2-4 for details.
   - Calc. LaserZone/GPS weighted elevations – select to combine Lazer Zone elevations and GPS elevations. See page 2-4 for details.

1. Note the following exception:
   If using more than one transmitter, and all transmitters have been previously calibrated and initialized, selecting "Any" will cause the 3DMC program to search for the transmitter with the smallest error rate, even if the physical unit is not set up. In this case, the sensor will not detect the transmitter.

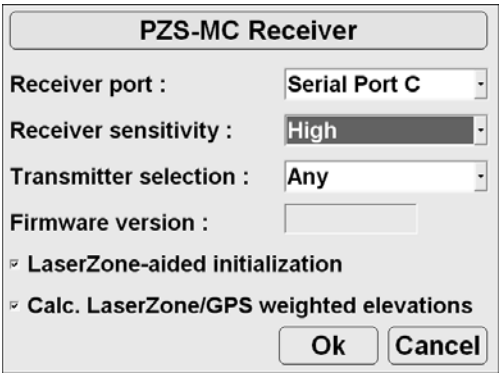


**Figure 3-8. Select PZS-MC Receiver Information**

# PZL-1 Transmitter Setup

After loading a control point file that has mmGPS information, set up the machine configuration for using the transmitter(s). To increase the range of the machine, up to four transmitters can be configured.

1. Make sure the correct Control Point file is selected. The Control Point file stores all transmitter information, including calibration data, setup location, and height data.

NOTICE *NOTICE*

*Changing a Control Point file will change the transmitter information.*

2. Press **Topcon Logo ▸ Control ▸ PZ-L1 transmitters**, then tap the tab that corresponds to the channel of the transmitter. See page 2-6 for assigning a channel to the transmitter.

   If using two to four transmitters on the jobsite, perform the following step for each transmitter.

3. Select the following transmitter parameters and press **OK** (Figure 3-9 on page 3-10):

   - Transmitter S/N – select the serial number or description of the transmitter used on this channel

- Control point – select the control point over which the transmitter is set up
- Height – enter the height of the transmitter

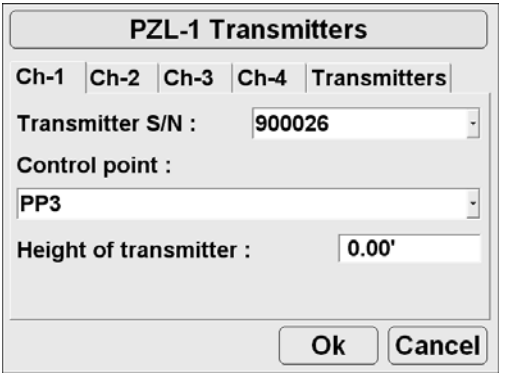


**Figure 3-9. Setup Transmitter**

4. To view firmware and adjustment status for the transmitters, tap the **Transmitters** tab (Figure 3-10).

   The Adjusted column shows whether the transmitter has been adjusted to compensate for significant changes in ambient temperature. This information is included in the Control Point file.

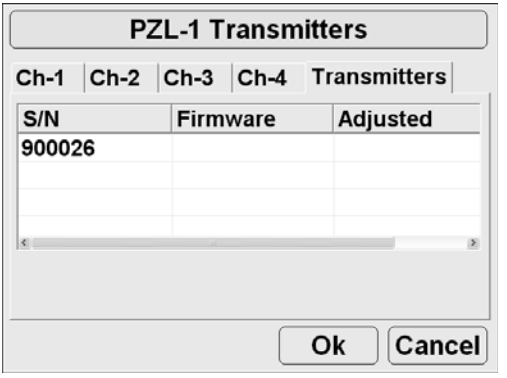


**Figure 3-10. Transmitter Details**

# mmGPS Operations

In the event that a point has been lost, the resection operation can measure an unknown point based on the measurements of three or more surrounding points. The self-leveling mechanism may also need to be measured and the transmitter calibrated to ensure correct grade.

NOTICE *NOTICE*

*The following operations require that the transmitter and sensor have already been setup as seen in Chapter 2.*

For details on setting up the transmitter or sensor, see “PZL-1 Transmitter Setup and Calibration” on page 2-6 or “PZS-1 Sensor Setup and Initialization” on page 2-10.

## Performing a Resection

The resection function measures an unknown transmitter location using the rover and three or more points. In general, the results from a resection are adequate for horizontal positioning of the transmitter (an error estimate will also display). Performing a height check and adjustment will fine-tune the calculated elevation.

When performing a resection, use the following guidelines to ensure accurate measurements at the Rover points:

- take measurements at three or more points around the Base transmitter in a balanced, symmetrical pattern (not clustered in one area)
- have the sensor facing towards the transmitter during each measurement
- angle the sensor between 6° higher or lower than the transmitter’s beam, not straight on

1. Set up the transmitter at an unknown location. Power on the transmitter and select a channel to transmit on.
2. Set up the PZS-1 sensor. Power on the sensor and receiver. Connect the sensor and Pocket-3D controller.

TIP

Use a bi-pole to ensure the sensor remains steady throughout the calibration process.

3. Walk several feet away from the transmitter and face the sensor towards the transmitter (Figure 4-1).

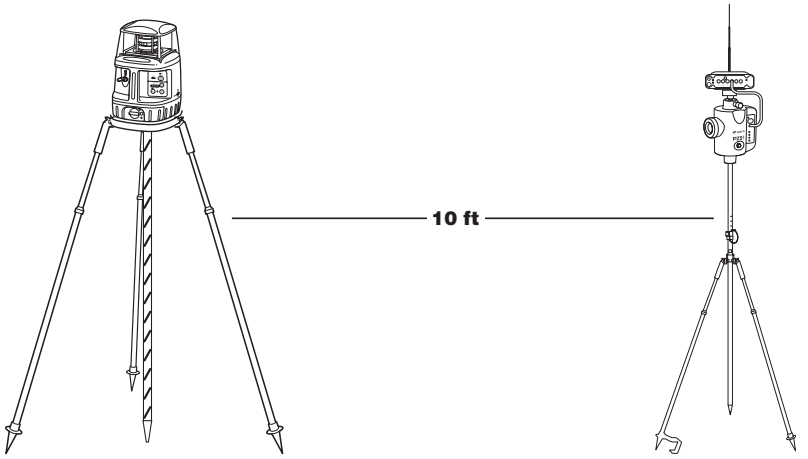


**Figure 4-1. Setup Transmitter and Sensor**

4. In Pocket-3D, tap **Setup ▸ LaserZone transmitters** and tap the tab that corresponds to the channel of the transmitter (Figure 4-2).
5. Press **Resect PZL-1** (Figure 4-2).
6. If desired, enter the following measurement parameters on the ***resection*** dialog box (Figure 4-2).
   - Duration (secs) – enter the duration, in seconds, in which to measure the point
   - H. Precision / V. Precision – enter a horizontal / vertical precision, in the project's units, with which to measure the point

The point name will be automatically added to the list of control points as “TX-[n] (Resected)”, where “n” is the channel number. Subsequent resections with the same transmitter will overwrite any previous points.

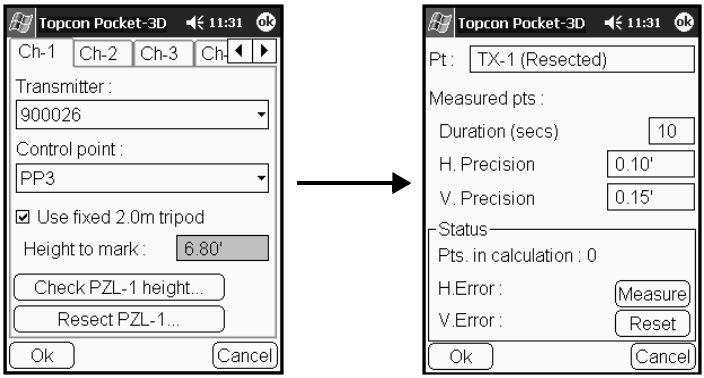


**Figure 4-2. Begin Resection**

7. Press **Measure**. The ***Measuring*** dialog box displays during the measurement. When done, the *Pts. in calculation* field will increment by one.
8. Move to the next point and repeat step 7. Continue until at least three points, evenly located around the transmitter, have been measured.

   To clear the measurements and begin again, press **Reset**.

   After three points have been successfully measured, horizontal and vertical errors for the measured point will display. Further measurements should improve the positional error.
9. Press **OK** when done.

# Checking the Transmitter's Height

1. Set up the transmitter and tripod at an known control point. Power on the transmitter and select a channel to transmit on.
2. Set up the PZS-1 sensor over a known point. Power on the sensor and receiver. Connect the sensor and Pocket-3D controller.


TIP

Use a bi-pole to ensure the sensor remains steady throughout the calibration process.

3. In Pocket-3D, tap **Setup ▸ LaserZone transmitters** and tap the tab that corresponds to the channel of the transmitter (Figure 4-3 on page 4-5).
4. Press **Check PZL-1 height** (Figure 4-3 on page 4-5).
5. Use one of the following options to enter the location or elevation of the point (Figure 4-3 on page 4-5):
   - If the Transmitter is set up over a known control point, tap the radio button then select the control point from the drop-down list.
   - If the Transmitter is set up over a point with a known elevation, select the radio button then enter the elevation.

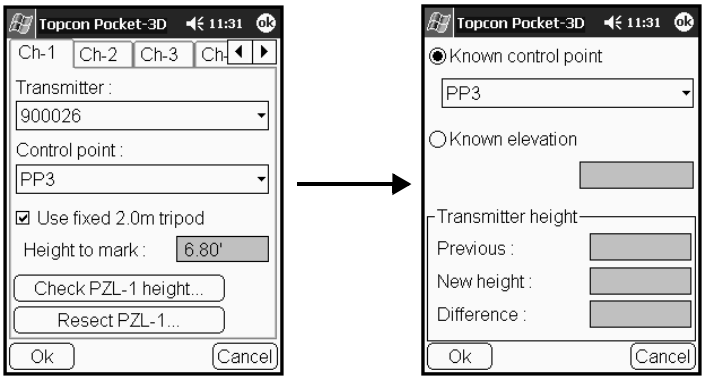


**Figure 4-3. Begin Height Check**

6. Press **OK**. The ***Measuring*** dialog box displays during the measurement. When done, the *Transmitter height* field displays the calculated difference between the height originally specified for the transmitter and the calculated height (Figure 4-4).

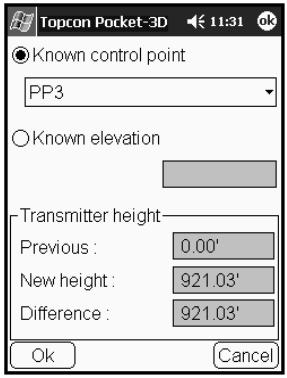


**Figure 4-4. Measure Height of Transmitter**

7. To apply this change to the transmitter setup, press **OK**. Or press **Cancel** to exit without saving the measurement.

# Transmitter Adjustment

The adjustment function fixes errors in incline in the self-leveling mechanism of the transmitter, applying an offset to the transmitter.

1. Set up the transmitter and tripod at an known control point.
2. At the transmitter, hold the **plumb beam key**, then press and release the **power key** to put the transmitter into calibration mode.
3. Turn the front of the transmitter towards the sensor.
4. Set up the PZS-1 sensor at the same level as the transmitter, on relatively level ground, and approximately 50 meters (100 feet) away. Power on the sensor and receiver (Figure 4-5). Connect the sensor and Pocket-3D controller.

TIP

Use a bi-pole to ensure the sensor remains steady throughout the calibration process.

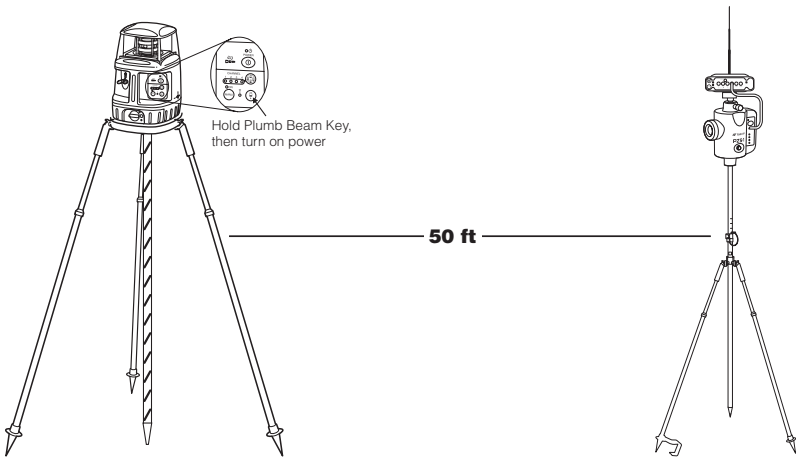


**Figure 4-5. Setup Transmitter and Sensor**

5. In Pocket-3D, tap **Setup ▸ LaserZone transmitters** and tap the **Transmitters** tab (Figure 4-6 on page 4-7).

6. Press **Adjust** (Figure 4-6).

   If indicated, check the setup listed on-screen (Figure 4-6).

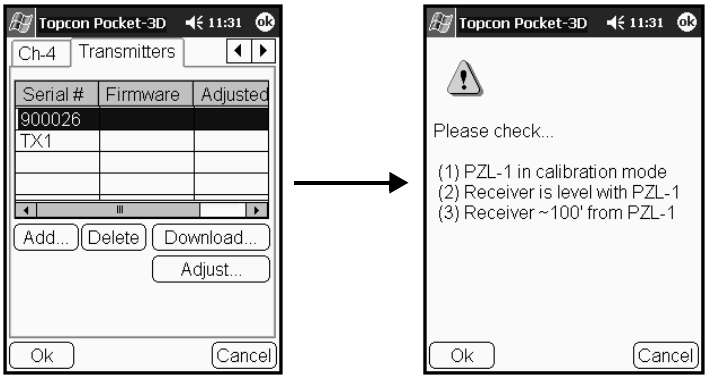


**Figure 4-6. Begin Field Calibration Adjustment**

7. Press **Next** to begin the first phase of the adjustment (Figure 4-7).
8. If needed, adjust the height of the sensor so the angle is less than 1°. Once the angle is ok, tap **Next**.

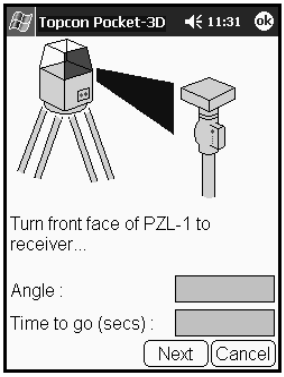


**Figure 4-7. Begin Adjustment**

NOTICE *NOTICE*

*If the sensor experiences excessive movement during any stage of the adjustment, an error message will display. Press Cancel and stabilize the Rover pole. Then press Adjust again.*

9. Follow the on-screen instructions, pressing **Next** to measure.

   If indicated, check the setup listed on-screen.

When the adjustment completes, the ***Adjustment*** dialog box displays the offsets (Figure 4-8).

- If both *Axis* measurements are less than 10", no adjustment is needed at the transmitter.
- If either or both *Axis* measurements are more than 10", disconnect from the sensor and connect to the transmitter. Press **Finish** to upload the adjustments to the transmitter. When finished uploading, the transmitter will apply the adjustments and turn off.

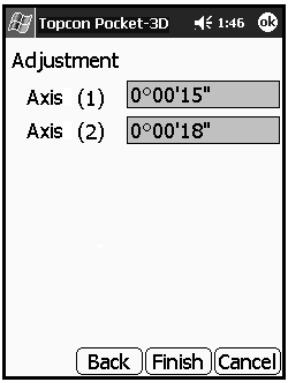


**Figure 4-8. Adjustment Results**

TIP

After loading the new self-leveling offset data into the transmitter, re-calibrate to check the system. The transmitter may need to be calibrated a couple of times depending on site conditions.

Note that this process only applies an offset to the self-leveling mechanism to ensure correct grade, the control point file is not affected.

# Viewing a Cut/Fill History

For mmGPS applications, both 3DMC and Pocket-3D have an option to view the cut/history of the loaded project.

- In Pocket-3D, tap **Display ▸ Cut/fill history**.
- In 3DMC, tap **Topcon Logo ▸ View ▸ Lower window ▸ Cut/fill history**.

The cut/fill window (Figure 4-9) displays the on-going highs and lows of the project as determined by both laser and GPS readings. The red line indicates mmGPS detection; the blue line indicates GPS only detection.

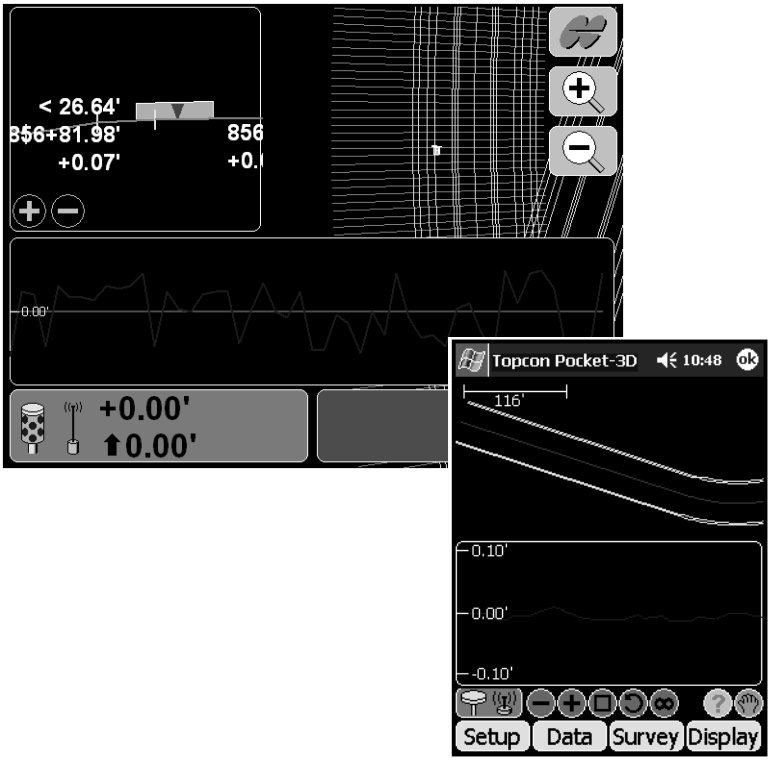


**Figure 4-9. Cut/fill History Windows for 3DMC and Pocket-3D**

# Notes:

# Notes:

# Notes:

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