Troubleshooting

In general, as long as you follow the maintenance and safety instructions provided in this manual, you should have few problems with your System Five-3D™. This chapter will help you diagnose and solve some common problems you may encounter with the various components.

Before contacting TPS Customer support about any problems, try the following and see the following sections:

- Check that the various components (radio, Rover Receiver Box, control box, Base Station receiver, GRT-2000, etc.) have power and are powered up.
- Check that all cables are securely and properly connected to the various components of the System Five-3D (control box, TM-1 mast/Round Vibration Pole, laser receiver/antenna, valves, sensors, etc.). See the Machine Setup section for your control application.
- Disconnect cables and inspect them for damage or contamination. Clean all connections with an electrical contact cleaner.

Do not attempt to repair equipment yourself. Doing so will void your warranty and may damage the hardware.

Base Station

This section lists possible Base Station problems you may encounter (also refer to the Base Station's documentation). If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
Legacy-E+ or Hiper receiver does not power on.	
Causes	Solutions
The PWR button was pressed too quickly.	Make sure you hold the PWR button down for at least one second. A quick press will not activate the receiver.
The power cable is incorrectly connected or damaged.	Check that the power cable is correctly connected to the battery—RED to positive and BLACK to negative—and that the battery is charged. Check that the RED dots on the power cable connector and the socket on the receiver are aligned, and the cable is pushed in as far as it can go. If the power cable is damaged, contact your dealer to replace it.
Problem	
Radio modem does not power on.	
Causes	Solutions
The power cable is incorrectly connected or damaged.	Check that the power cable is correctly connected to the battery—RED to positive and BLACK to negative—and that the battery is charged. If the power cable is damaged, contact your dealer to purchase a new cable.

The radio receives power through the Legacy-E+ receiver.	Some radios do not require a separate power supply, but are supplied power through the port on the Legacy-E+. For these radios, check that the Legacy-E+ is also switched on.
Problem	
Pocket-3D does not connect to Legacy-E+ or Hiper.	
Causes	Solutions
The Legacy-E+ or Hiper may be off.	Check that the Legacy-E+ or Hiper is switched on.
The cable may be incorrectly connected.	Check that the cable is connected to the COM port on the computer and Port A on the Legacy-E+. If still no connection, try to reset the computer and repeat.
Problem	
Pocket-3D is waiting for satellites.	
Causes	Solutions
The cable is incorrectly connected or damaged.	Check that the Legant antenna cable is not cross-threaded and is screwed in all the way. If the cable is damaged, contact your dealer to purchase a new cable.
The antenna has poor PDOP.	Check that the LegAnt antenna has a clear view of the sky.
The receiver is collecting an almanac.	If this is the first time connecting to the Legacy-E+, or if an internal reset has recently been performed, this message may persist for several minutes while the Legacy-E+ obtains a new almanac.

Problem	
Radio modem light is not flashing	
Causes	Solutions
The cable is incorrectly connected or damaged.	Check that the cable from the Legacy-E+ is properly connected to the radio. If the cable is damaged, contact your dealer to purchase a new cable.
The radio does not have a TX LED.	Some radios may not have a TX (Transmit) LED so the radio may in fact be functioning.
The radio has a TX LED, but it is not yet flashing.	All radio types specifically listed for the Base Station kit have a TX light and should flash every second. It may take several seconds after connection for this flashing to commence.

LPS Station

This section lists possible LPS Station problems you may encounter. If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
The GRT-2000 does not power on.	
Causes	Solutions
The cable is incorrectly connected or damaged.	Check that the power cable is correctly connected to a fully charged battery—RED to positive and BLACK to negative. A weak battery can cause intermittent errors. If the power cable is damaged, contact your dealer to purchase a new cable.
The fuse may be blown.	Check that the fuse placed in the base plate of the GRT-2000 is not blown.

Problem	
Pocket-3D does not communicate with the GRT-2000.	
Causes	Solutions
The GRT-2000 may be turned off or may have no power.	Check that they are turned on. Check that the battery has a full charge.
The cable may be incorrectly connected.	The GRT-2000 serial cable (gray/ 3 pins - DB9socket) and the iPAQ serial cable (black/ iPAQ connector - DB9pin) should be firmly connected. If still no connection, try to reset the computer and repeat.
The cable settings in the GRT-2000 may be incorrect.	Check that the RS-232 settings at the GRT-2000 are as follows. BIT FORMAT: D8 S1 NONE TRANSMIT SPEED: 38400 TERMINATE: EXT+CRLF If still no connection, try to reset the computer and repeat.
Problem	
GRT-2000 displays an error code.	
Causes	Solutions
The GRT-2000 has an internal error.	Refer to chapter 10, “Error Displays”, in the GRT-2000 Instruction Manual for help diagnosing the error code.
Problem	
GRT-2000 loses signal or tracking.	
Causes	Solutions
The GRT-2000 is out of range.	The working range of the LPS system is 10 to 300 meters (approximately 35ft-1,000ft) in optimum conditions.

Environmental conditions are affecting the working range.	The system applies a high rate optical scanning and measuring technology that although free from electromagnetic noise (radio interference), dusty, hot and other environmental conditions may affect the working range during operation. If this occurs, turn off automatic control and grade manually until you are back with the working range or where the environmental conditions no longer affect the signal.
Excessive undulations in the grade or sharp blade movements can also cause tracking loss, especially at short distances.	If this is the case, balance the material in manual control, then change back to automatic when the grade is somewhat close to the Design Surface.
Problem	
RC-2 remote does not resume tracking	
Causes	Solutions
The RC-2 is not connected to the GRT-2000.	First, check that “RC-2 CONNECTED?” displays when powering up the GRT-2000, and that you answer “YES”.
The GRT-2000 does not ask to if an RC-2 is connected.	If there is no message, the internal search settings are incorrect; contact customer support to enable the RC setting.
The RC-2 is outside its working range, being blocked, or moving excessively.	The RC-2 working range is up to 250 meters. Prevent obstacles from interfering with the infrared beam pass. Hold the remote controller steady as its emitting window faces toward the GRT-2000, especially great distances.

Reflective object interfere with the transmission of the infrared beam.	Try not to shoot through the cab's window glass. If there is a prism (e.g. backsite) close to the machine or in close alignment on the machine, move away and try again.
The searching parameters in Pocket-3D and on the GRT-2000 are incorrect.	Change the searching parameters for RC-2 usage as follows: 1. First, ensure the Pocket-3D search parameter, "Set search area at GRT", is checked ON. 2. Then ensure the GRT-2000 search parameters are set as follows, SEARCH PATTERN is set at HIGH and SEARCH AREA is set to H = 5, V = 15

Rover GPS+ Receiver Box

This section lists possible Rover GPS+ Receiver Box problems you may encounter. If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
Power indicator does not flash red.	
Causes	Solutions
The power cable may be incorrectly connected.	Power is supplied through the cable connected on the Power port. Check that the cable is properly connected
The control box does not have power.	The Receiver Box turns on only while the control box is powered on.

The Receiver Box receives power from another source, which is not on.	If power is supplied through another cable connected to the power port, check that the origin of the power cable, and other connectors, are secure. The power cable may be connected to an ignition switch or a master circuit on the machine, if so, turn on the power source.
Problem	
Satellite Status indicator does not flash green.	
Causes	Solutions
The cable is incorrectly connected or damaged.	Check that the antenna cable is not cross-threaded at the antenna and is connected to the intermediate cable installed on the machine. Check the connection at the GPS Antenna port on the Receiver Box. If the cable is damaged, contact your dealer to purchase a new cable.
The antenna has poor PDOP.	Check that the Rover Antenna has a clear view of the sky.
The receiver is collecting an almanac.	If this is the first time connecting to the Receiver Box, no LED flashing may persist for several minutes while the GPS+ receiver obtains a new almanac.
Problem	
Radio Status indicator does not flash yellow.	
Causes	Solutions
The Base Station and/ or Base Station radio has a problem.	Check that the Base Station is running correctly and the TX light on the radio modem flashes on.

Different channels are used between the Base Station and the Rover machine.	Check that the Base Station and Machine use the same radio channel. • For the Base Station, use the button on the radio modem or use "GPS Radio Configuration" program with the Pocket-3D connected. See "Equipment Setup: Base Station" on page 5-2. • For the machine, use the control box function. See "Changing Radio Channels" on page 5-24.
The antenna at the Rover or Base may be too low, incorrectly placed, or too far away.	If the yellow LED flashes when near the Base Station, but not when farther away, check that the Rover Radio Antenna mast is mounted vertically at the highest point on the machine. If the Rover machine gets too far from the Base Station, elevate the radio antenna at the Base Station or move it to a closer Control Point.

GPS Localization

This section lists possible GPS localization problems you may encounter. If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
Measurement takes too long.	
Causes	Solutions
The machine may be blocking satellite signals to the range-pole or tripod-mounted antenna.	Watch the status of the measurement screen. If the status indicates "waiting for satellites" move the machine away from the antenna.

The Control Point may be located too close to obstructions.	Move to an alternative Control Point or have the surveyor place a new Control Point away form the obstructions.
The Rover GPS+ has not yet initialized; the system may be tracking many satellites.	The status indicates “waiting for better precision”. The Rover GPS+ may take several minutes to initialize.
The range-pole was unsteady.	Make sure that the pole is held steady while measurement is taking place. Any movement will make for a lengthy initialization and/or measurement.
Problem	
Localization produces large errors.	
Causes	Solutions
A typographical error occurred.	If errors are 10s or 100s of feet or meters, it is likely that a typographical error has occurred. If coordinates are manually entered, check that longitudes are correctly prefixed with a minus sign if working in the western hemisphere (e.g. USA). Re-enter the coordinates.
The range-pole was unsteady.	If the errors are decimeter level in magnitude, it may point to either inaccurately measured local site coordinates or not holding the range-pole vertical when measuring the GPS coordinates.
Inaccurate local site coordinates or erroneous GPS measurement.	If error values of the first few points are reasonable but increase when a new point is measured, the point just measured must have either inaccurate local site coordinates or erroneous GPS measurement.

	To isolate the error, disable horizontal and/or vertical localization for each Control Point in turn and observe the set of errors. When the errors become acceptable due to certain isolation, the point isolated is most likely to detract from the quality of the localization. Also, as a general rule, if error values of the first few points are reasonable but increase when a new point is measured, the point just measured must have either inaccurate local site coordinates or erroneous GPS measurement. Once a problematic Control Point is discovered, try to re-measure the point again to see any improvement. If it is still suspect and affects the acceptable tolerance, the horizontal and/or vertical localization for this point may be disabled.
Problem	
There are no H.Error and V.Error values.	
Causes	Solutions
“Use for horizontal GPS localization” and/or “Use for vertical GPS localization” check boxes may not have been selected.	These check boxes need to be selected for a minimum of three points. Note that the error value will be calculated once three Control Points are measured and used for the GPS localization. This troubleshooting is useful when the Pocket-3D is being used to perform GPS localization as well as the control box.

Control Box

This section lists possible control box problems you may encounter. If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
Control box does not power on.	
Causes	Solutions
The cable is the wrong cable, incorrectly connected, or damaged.	Check that the power cable supplies 12 to 24 VDC and is negative conductive. • A socket (positive) = 12 to 24 VDC • E socket = Ground Check that the power cable is connected to the correct port (“Control Box Connectors” on page 2-9) and the ends are securely fastened. If the cable is damaged, contact your dealer to purchase a new cable.
Problem	
Screen display turns off by itself.	
Causes	Solutions
The fan may be damaged, causing the control box to overheat.	Check that the fan is rotating. If the fan is not rotating, it may be damaged and needs to be replaced with new one. Contact your dealer. Contact your dealer for information on replacing the fan.

Problem	
Screen display gets dim by itself	
Causes	Solutions
The fan may not be rotating.	Check that the fan is rotating. If the fan is not rotating, it may be damaged and needs to be replaced with new one. Contact your dealer for information on replacing the fan.
The control box has the self-adjusting ability of screen brightness.	Brightness may be reduced when the control box gets over-heated with high temperature around the cab, as well as when the ambient light becomes dim. The backlight also reduces when the ambient light becomes dim.
Problem	
Screen has transferred to operating system.	
Causes	Solutions
“Exit 3DMC” function may have been pressed unexpectedly or incorrectly.	If the screen displays the desktop, the “My Computer” folder should be visible. 1. Double-tap “My Computer” folder. 2. Look for the folder named “Disk C”, and double-tap on it. 3. Look for the “Control Box” icon and double-tap on it. The application program will open and return to the Main Screen.

Problem	
“Control file has no GPS localization” message.	
Causes	Solutions
Not enough Control Points used for localization.	Press the Ok pad to exit the message screen. Check that the Control Points file used has a minimum of three localized points. Perform the localization process again.
No GPS localization has been performed for the project.	Plan to implement the GPS localization. See “GPS Localization” on page 5-26 for detailed instructions.
An LPS application is the current job	Create or select the correct LPS Machine Configuration file so the Control Points file will require no GPS localization.
Problem	
“Loading….” or “Building….” message.	
Causes	Solutions
The program in the control box is in the middle of loading files or making graphics.	If the pointer on the Main Screen moves, when you tap in different places, the control box is computing. When the system is busy, the pointer becomes an hourglass. Wait for a few more minutes to let it complete the process. Remember, computing will take longer when a larger file is selected.
If the pointer does not move, the control box may have a computing problem.	Switching off the control box can fix the computing problem.

Problem	
Elevation/Slope Control pad displays: "GPS receiver not connected!"	
Causes	Solutions
Either the GPS+ signal or radio signal is invalid. The graphic may indicate what causes the problem.	For GPS+ signal, check cable connections along the GPS antenna cable from the GPS Antenna port on the Receiver Box to the Rover Antenna. Check connections at the System Five port on the Receiver Box and Connector D (bottom) on the control box.
Problem	
Elevation Control key displays: "Waiting for radio link"	
Causes	Solutions
Radio transmission, radio antenna, lights status on the Legacy-E+ receiver, and/or power may have a problem.	Check that the Base Station is working correctly. See "Base Station" on page 12-2 to troubleshoot Base Station problems. Also check that the Rover Radio Antenna on the machine and its cable connections are properly connected. Make sure that the radio channel is identical between the Base Station and the Machine Rover, and that the radio is correctly configured on the control box. See "Equipment Setup: Base Station" on page 5-2 and "Machine Setup" on page page 5-10 for information.

Problem	
Elevation Control key displays: "Waiting for Initialization"	
Causes	Solutions
The GPS+ receiver has not been successful tracking enough valid satellites.	Check that the Rover Antenna has a clear view of the sky. Check for obstructions, such as trees, buildings, and vehicles, that can block or reflect satellite signals.
The system is still in the process of determining a solid position.	If this is the very first time operation, this message may persist for several minutes while the Legacy-E+ or Hiper obtains a new almanac.

Problem	
Elevation Control key displays: "Out of design area"	
Causes	Solutions
The machine is out of the Design Surface area.	Make sure that the correct Control Point File and Design Surface file is selected. Move into the Design Surface area so the operator can start grading.

Problem	
Elevation Control key displays : "No GPS localization"	
Causes	Solutions
The Control Points file currently selected has not been localized properly.	Make sure that the correct Control Point file currently is selected.

You are in a process of building a Control Point file or just starting the process.	Disregard the message until the localization is complete. See “GPS Localization” on page 5-26 to perform localization.
Problem	
Slope Control key displays: “Slope sensor not connected!”	
Causes	Solutions
Cross slope system is not connected properly.	Check cable connections from the Connector C on the control box (third from the top), the Mainfall Sensor, the Rotation Sensor and to the Blade Sensor.
Problem	
Elevation Control key displays: “LS2000 not connected!”	
Causes	Solutions
The incorrect cables or cords are used.	Make sure the correct coil cords are used.
The cable connections may be incorrect or loose.	Check cable connections on the LS-2000, the TM-1, the Junction Box and the Connector C on the control box.
Problem	
Elevation Control key displays: “Waiting on data from GRT”	
Causes	Solutions
The LS-2000 is not receiving correct position data on the fan beam from the GRT-2000.	If the machine is close to the GRT-2000, move away from it and check the progress of the machine Check that the Pocket PC is working properly and ensure that the correct Design Surface file is selected in the Pocket-3D.

Problem	
Elevation Control key displays: "ELEV sensor not connected!"	
Causes	Solutions
2D Control sensor is not properly connected.	Use the correct coil cord Ensure the cable connections between the Mainfall Sensor (grader) or the Junction Box (dozer), and the elevation sensor are correct and secure. Use the correct location at the Mainfall Sensor or the Junction Box to connect the coil cord. For example, when direction the right side for elevation control, use the right side connector on the Mainfall Sensor to connect the coil cord.
Wrong control mode selected.	If in 3D GPS+ or 3D LPS Control, deactivate 2D Control Mode: select **Topcon Logo ▸ Control ▸ 2D Control**.

Blade Response

This section lists possible Blade Response problems you may encounter. If you still have problems after trying the solutions listed here, contact TPS customer support.

Problem	
Blade is moving too slowly. The blade seems to move too slowly in Control Mode. The Grade Indicator takes too long to reach grade.	
Causes	Solutions
The Valve Gain setting is too low.	Increase the Valve Gain setting, which will cause the hydraulics to respond quicker. See “Adjusting Valve Gain” on page 10-19 for details. Check which control is slow before adjusting the Valve Gain. Remember that the larger number setting (or turning the knob clockwise) speeds up the response.
Problem	
Blade is moving too fast. The blade seems to move too fast in Control Mode. The Grade Indicator skips through on-grade.	
Causes	Solutions
The Valve Gain setting is too high.	Decrease the Valve Gain setting, which will cause the hydraulics to respond slower. See “Adjusting Valve Gain” on page 10-19 for details. Check which side control is fast before adjusting the Valve Gain. Remember that the lower number setting (or turning knob the counterclockwise) slows down the response.

Problem	
Blade reacts, but does not reach On Grade	
Causes	Solutions
Valve Offsets are too small.	Assume that Valve Offsets are too small, and perform a Valve Offsets Calibration. See “Adjusting Valve Gain” on page 10-19.
Problem	
Blade reacts, but overshoots around On Grade	
Causes	Solutions
Valve offsets are too large.	Assume that Valve Offsets are too large, and perform a Valve Offsets Calibration. See “Adjusting Valve Gain” on page 10-19.

Pocket-3D Getting Started Guide

Pocket-3D is grade and staking control software for hand-held controllers. At the jobsite, Pocket-3D provides a way to make quick changes and updates to files, double-check control points, initialize the GPS base, and many other useful functions.

3DMC and Pocket-3D save files in the same format, making it simple to share files and updates between surveyors, machine operators, grade checkers, etc.

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

Before performing any Pocket-3D configuration or application function, check the units used at the job. Units are the method of measurement used for measuring various data. To check, change, or apply units to the project, tap **Setup** ▸ **Units** (Figure A-1).

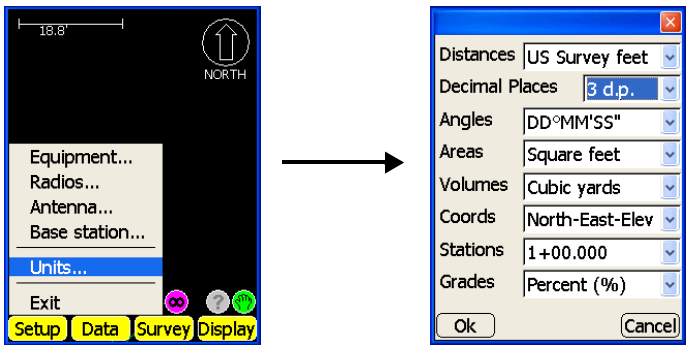

Figure A-1. Setup Units

Equipment Setup: GPS

Equipment setup consists of jobsite files to ensure correct data is used for positioning activities and a machine file to ensure the correct measurements are taken.

Step 1: Create a Control Point File

First, create a control point file (Figure A-2):

1. Tap **Data** ▸ **Control** ▸ **[<none> or file name]**.
2. Tap **New** to create a control point file.
3. Enter a name for the file and press **Ok**.
4. Select the control point file and press **Ok**.
5. Press **Yes** to apply the file to the jobsite.

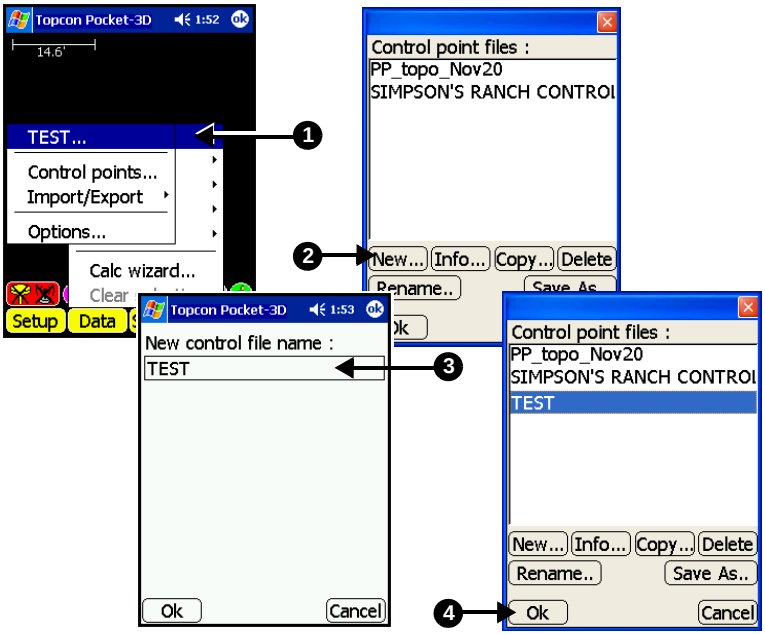

Figure A-2. Create a Control Point File

Then, enter control point data into the file (Figure A-3):

1. Tap **Data** ▸ **Control** ▸ **Control points**.
2. Tap **Add** to enter the local coordinates for the control point.
3. Enter a name and description for the control point and its local coordinates. Press **Ok**.
4. Repeat steps 2 and 3 for each control point.
5. Press **Ok** to save the data.

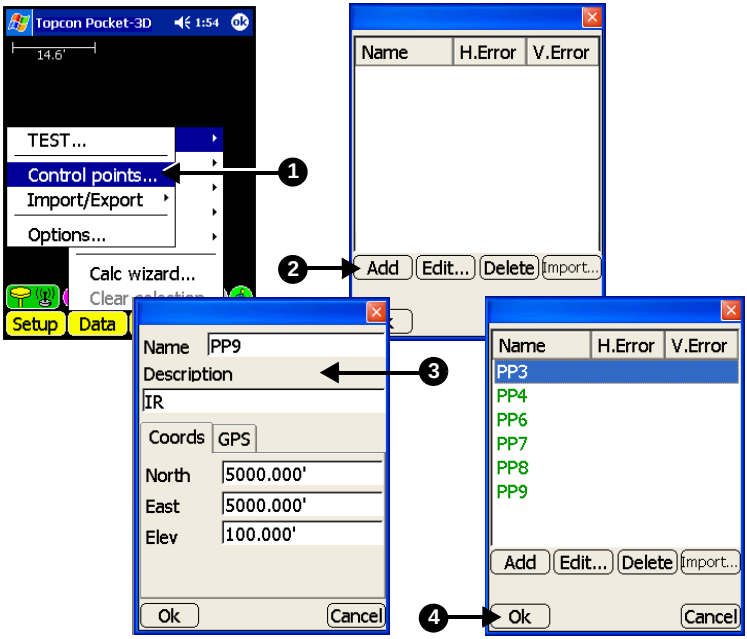

Figure A-3. Enter Control Points

Step 2: Setup and Initialize a Base Station/Transmitter

For a GPS Base Station, enter antenna and radio information (Figure A-4):

1. Connect the controller and receiver. Tap **Setup ▸ Base station**.
2. Select the control point over which the base station is installed and the connection between controller and receiver. Press **Next**.
3. Enter antenna type and height information. Press **Next**.
4. Enter radio type and communication information. If using a Pacific Crest PDL UHF radio, press **Configure** to select channel information and press **Set**. Press **Next**.
5. Select GPS receiver settings. Press **Finish** to initialize the GPS receiver and start the Base.
6. Immediately disconnect the Pocket-3D controller from the receiver. Performing any other activities while connected will convert the Base to a Rover.

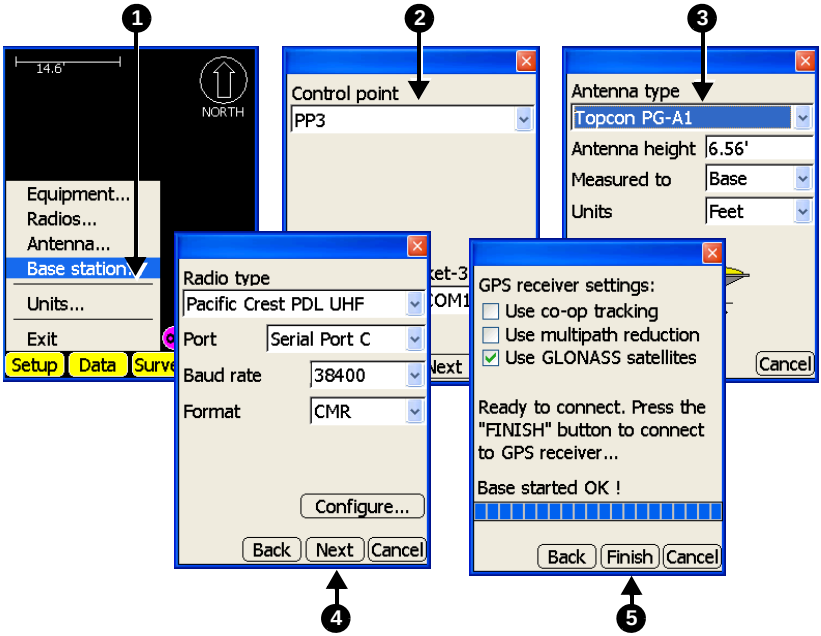

Figure A-4. Enter Base Station Information and Start Base

For a mmGPS transmitter, enter transmitter information:

1. Connect the controller and transmitter. Check the channel of the transmitter. Tap **Setup ▸ mmGPS transmitters**.
2. Tap the ***Transmitters*** tab and press **Download** to retrieve calibration data from the connected transmitter. Refer to the *Pocket-3D User's Manual* to calibrate or adjust the transmitter.
3. Tap the ***Channel*** tab and press **Edit Channel** to select the channel, the transmitter description, the transmitter ID, and the control point over which the transmitter is installed. Enter the height of the tripod.
4. Press **Ok**. Transmitter information is stored in the control point file; copy this file to the machine for mmGPS grading applications.

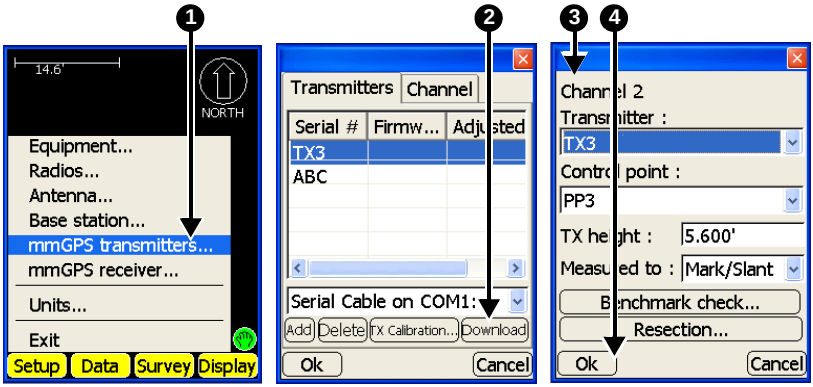

Figure A-5. Enter Base Transmitter Information

Step 3: Create a Range Pole Equipment Configuration

Pocket-3D creates an equipment configuration for a range-pole Rover (Figure A-6 to Figure A-8). A Rover can be used to check and verify grade.

1. After initializing the Base, connect the Pocket-3D controller to the Rover GPS receiver. Tap **Setup ▸ Equipment**.
2. Tap **New**. Enter a configuration name and equipment information. Press **Next**.

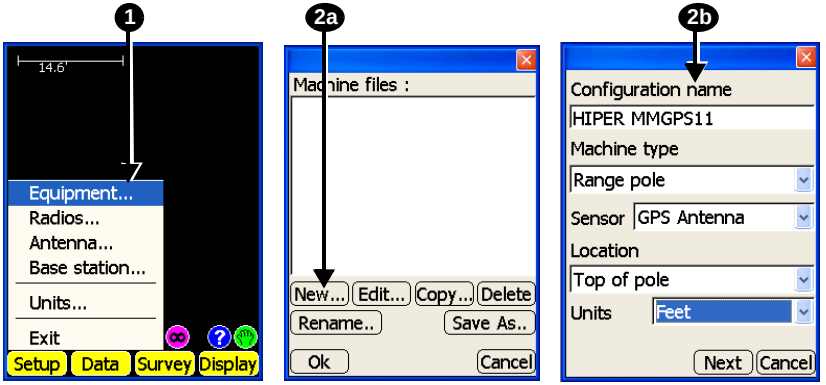

Figure A-6. Enter Configuration Type

3. Enter antenna information for the range-pole. Press **Next**.
4. Enter radio information. Press **Next**.

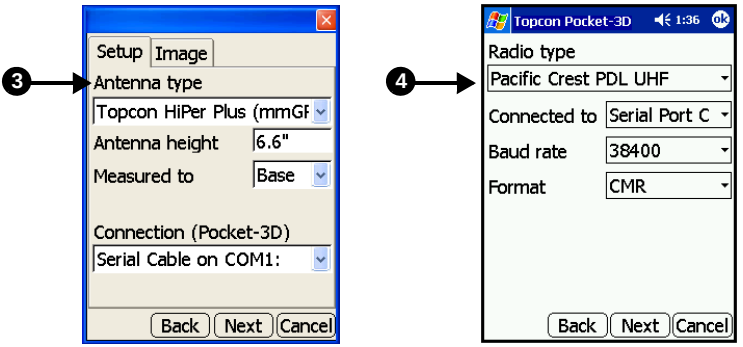

Figure A-7. Enter Antenna Information and Measurements

5. For a mmGPS Rover (PZS-1 and receiver), enter mmGPS parameters. Refer to the *Pocket-3D User's Manual* for important information about these settings. Press **Next**.
6. Select the configuration and press **Ok**. Press **Yes**.

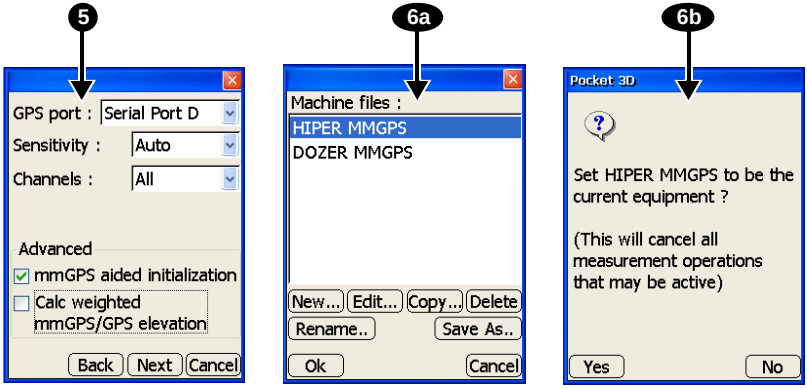

Figure A-8. Enter Radio (and mmGPS Information); Set As Equipment

Step 4: Setup the Rover Radio

Configuring the range pole Rover radio (Figure A-9) ensures proper communication with the Base.

1. Tap **Setup** ▸ **Radios**.
2. Select the radio type and enter its communication settings. If needed, press **Configure** to select the channel.
3. Press **Ok**.

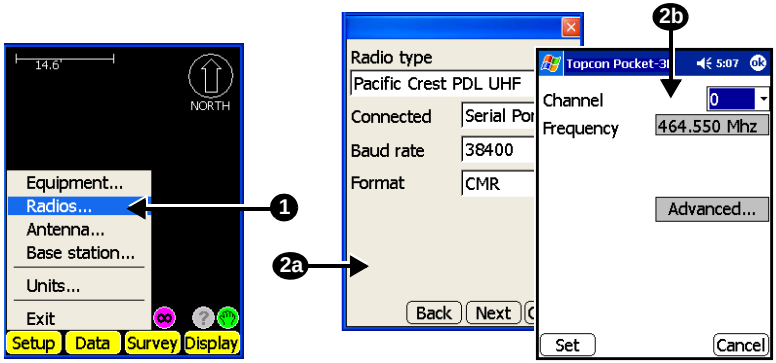

Figure A-9. Enter Radio Parameters

Step 5: Setup the Rover Antenna

Setup the Rover antenna's type and measurements (Figure A-10).

1. Tap **Setup** ▸ **Antenna**.
2. Select the type of antenna and enter its measurement information. Press **Ok**.

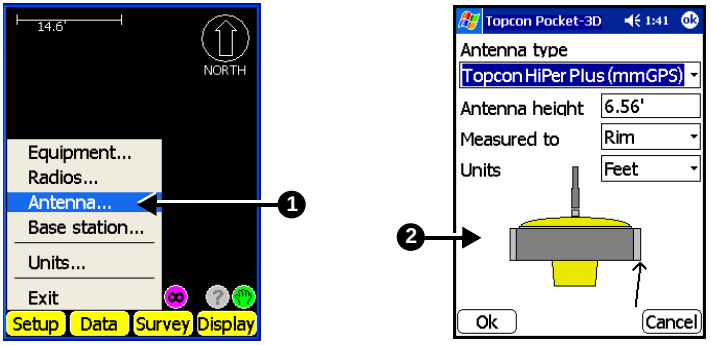

Figure A-10. Enter Antenna Information for GPS+ (or mmGPS Rover)

Step 6 for mmGPS: Setup the mmGPS Receiver

For mmGPS, setup the mmGPS receiver.

1. Tap **Setup** ▸ **mmGPS receiver**.
2. Enter mmGPS parameters. See Pocket-3D or 3DMC manuals for important information about these settings. Press **Ok**.

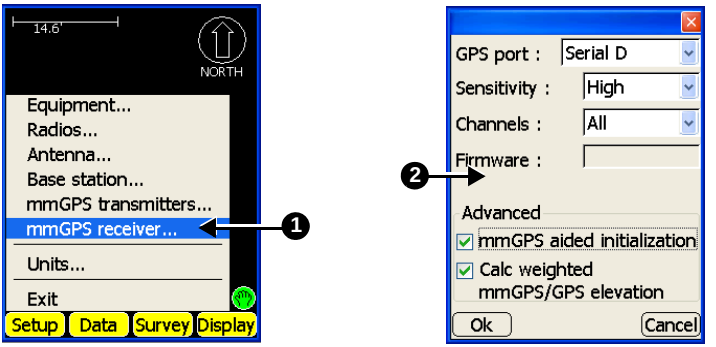

Figure A-11. Enter mmGPS Information for mmGPS Rover

Step 7: Connect to the Rover

After setting up the rover, connect to the GPS receiver to begin using Pocket-3D at the jobsite (Figure A-12).

1. On the main screen, tap the **GPS setup** button.
2. Once the connection has been established, press **Ok**.

Notice that the GPS setup button changes color from red to green, indicating successful communication between the Base and Rover.

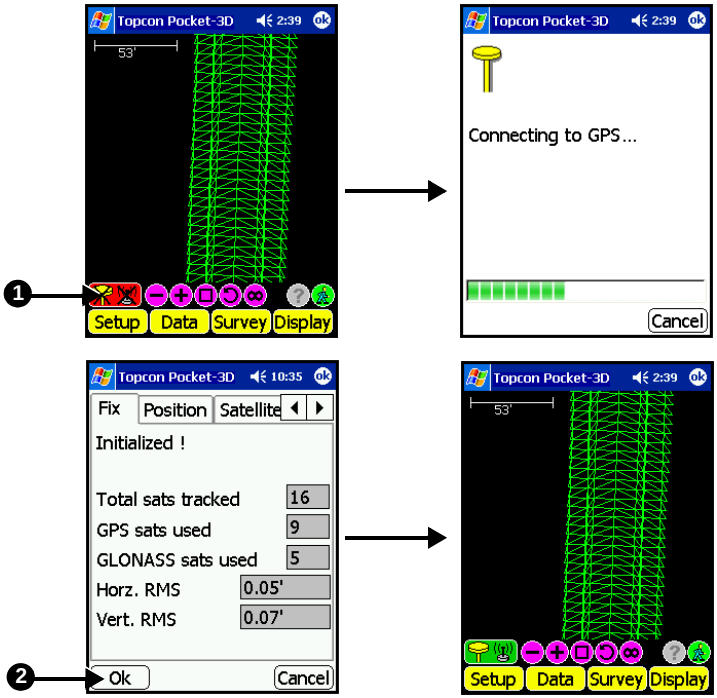

Figure A-12. Connect to GPS

Equipment Setup: LPS

Pocket-3D creates an equipment configuration for a motor grader. with an LS-2000 receiver. Refer to the *Pocket-3D User's Manual* for more information.

Step 1: Create an Equipment Configuration File

1. Tap **Setup** ▸ **Equipment**.
2. Tap **New**. Enter a configuration name and equipment information. Press **Next**.
3. Enter blade measurements for the motor grader. Press **Next**.

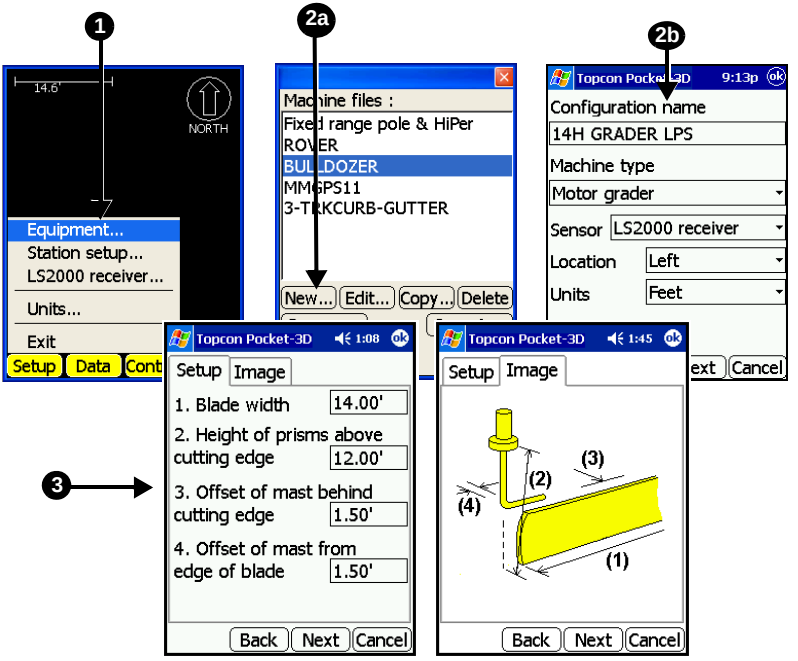

Figure A-13. Enter Configuration Type/Check Sensor Information

4. Enable "Machine has 3D display". Press **Next**.
5. Press **Finish** to complete.

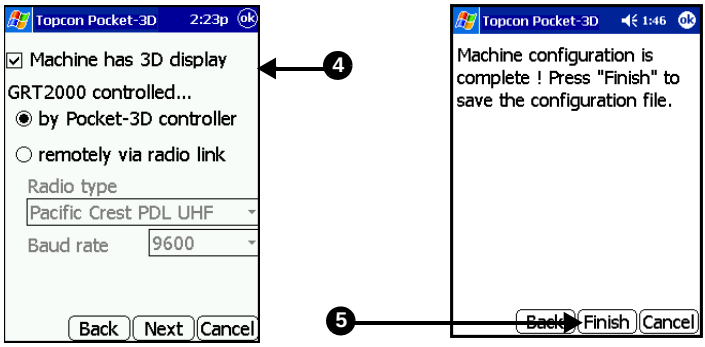

Figure A-14. Select In-Cab Display Option

Step 2: Setup the Station

1. Tap **Setup** ▸ **Station Setup**.
2. Select a setup method. Press **Next**.
3. Enter or select backsight setup parameters and press **Next**.
4. Enter station coordinates and press **Finish**.
5. Sight the backsight and press **OK**. The backsight results display.

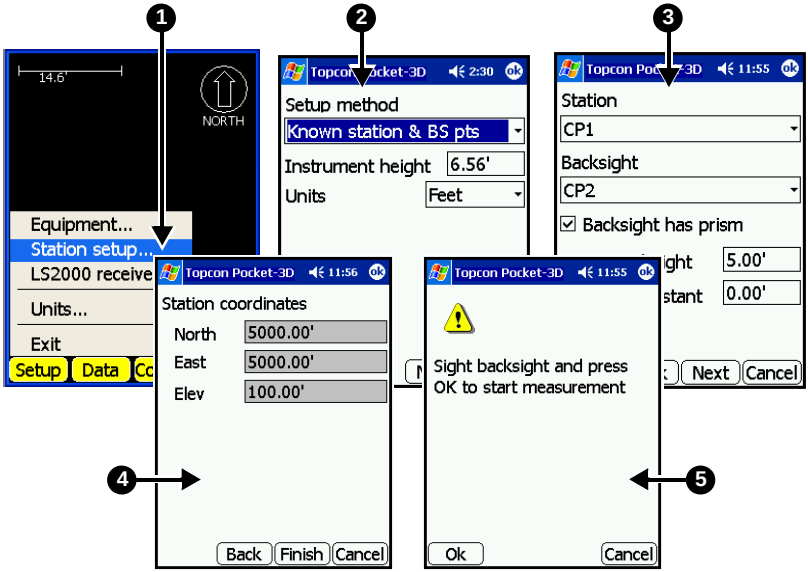

Figure A-15. Setup LPS Station

Step 3: Setup the LS-2000 Receiver

1. Tap **Setup** ▸ **LS2000 Receiver**.
2. Follow the instructions on each screen. Press **Next** to continue.
3. Enter height of receiver and press **Finish**.

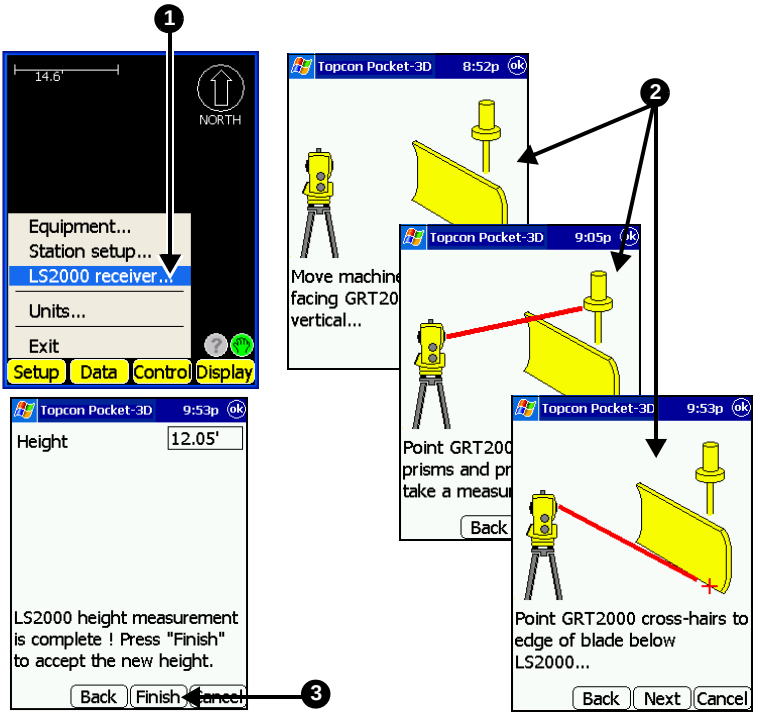

Figure A-16. Setup the LS-2000 Receiver

Step 4: Start LPS Control and Check Status

1. To start LPS control, tap **Control ▸ Start/Stop LPS control**.
2. Tap the **LPS Status** button to view LPS status information, change search area, or change track sensitivity and speed. Refer to the *Pocket-3D Reference Manual* for more information.
3. Press **OK** to exit.

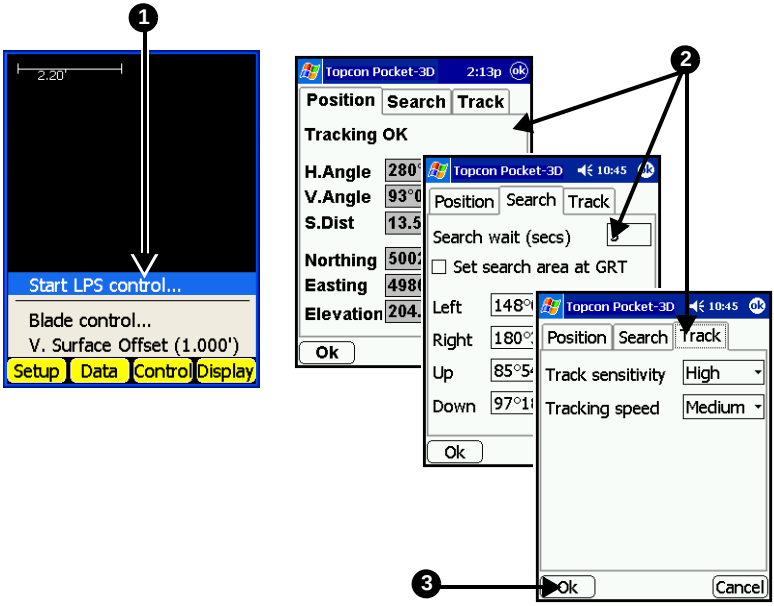

Figure A-17. Start LPS Control

Localizing with Pocket-3D

After setting up the Base Station, localize the jobsite coordinates with GPS+ coordinates.

1. Ensure the control point file for the jobsite is selected (**Data ▸ Control**) and select the equipment configuration for the current setup (**Setup ▸ Equipment**) (Figure A-18).
2. Tap **Data ▸ Control ▸ Control points**. Select the point to edit and press **Edit**.
3. Check the local coordinates and press the **GPS** tab.

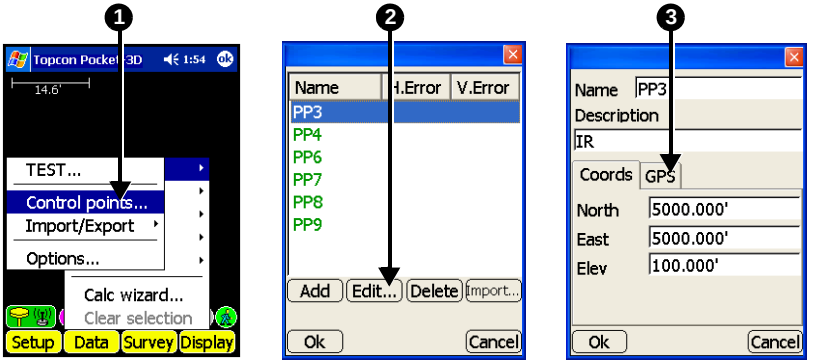

Figure A-18. Select Control Point to Localize

4. Enable "Use horizontal" and "Use Vertical" and press **Measure**. Press **Ok** to save the measurement (Figure A-19).

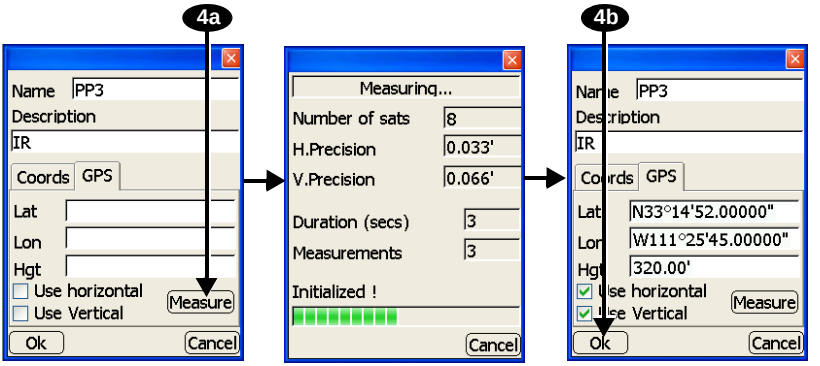

Figure A-19. Measure Control Point

5. Repeat steps 2, 3, and 4 for each control point.

6. View the results and press **Ok** to save the control point file.

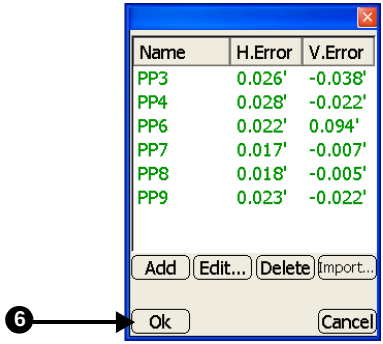

Figure A-20. Localized Control Points

Creating Files in Pocket-3D

In preparation for collecting point and polyline data, create a points file and a linework file for the jobsite.

Creating a Points File

1. Tap **Data** ▸ **Points** ▸ **[<none> or file name]**. Press **New**.
2. Enter a name for the points file and press **Ok**.
3. Press **Layers**.

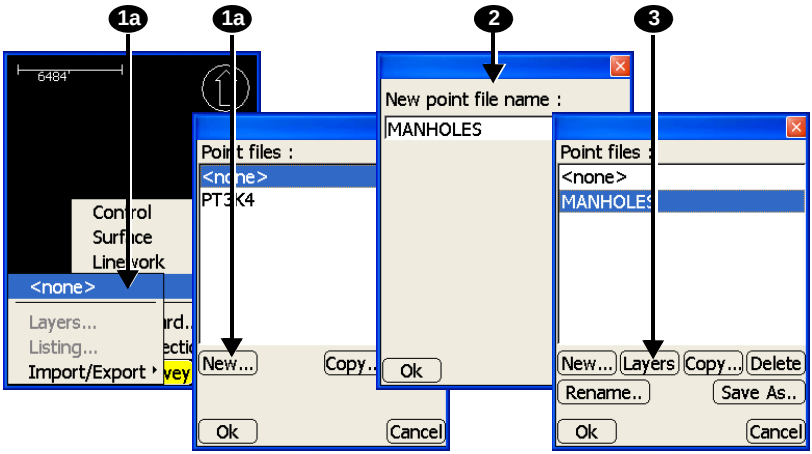

Figure A-21. Create Points File

4. Press **New**. Enter a name for the layer and the layer's parameters. Press **Ok**.
5. Repeat step 4 for any other layers.
6. Press **Ok** to save the file. Press **Yes** to apply the file to the current jobsite.

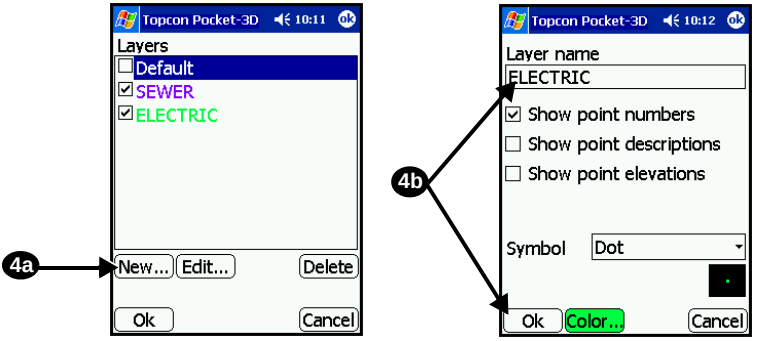

Figure A-22. Add Layers to Points File

Creating a Linework File

1. Tap **Data** ▸ **Linework** ▸ **[<none> or file name]**. Press **New** (Figure A-23).
2. Enter a name for the linework file and press **Ok**.
3. Press **Layers**.

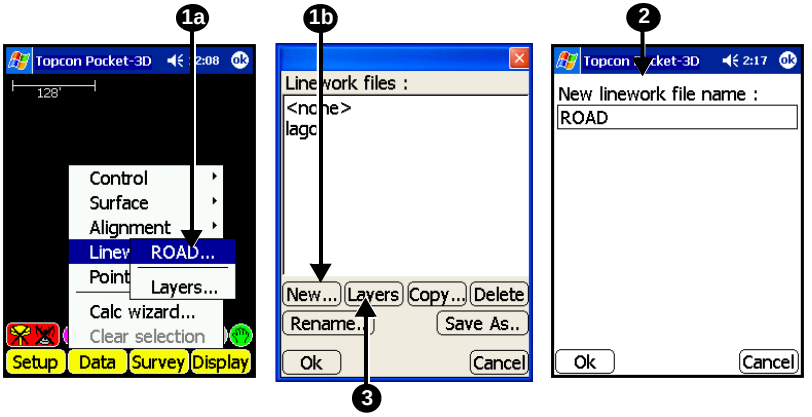

Figure A-23. Create Linework File

4. Press **New**. Enter a name for the layer and the layer's parameters. Press **Ok**.
5. Repeat step 4 for any other layers.
6. Press **Ok** to save the file. Press **Yes** to apply the file to the current jobsite.

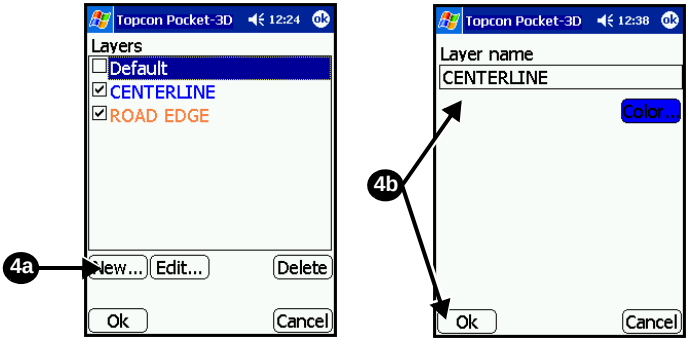

Figure A-24. Add Layers to Linework File

Collecting Data

Pocket-3D can be used to collect points, create polylines, or measure a control point. When collecting data, the project must be localized.

Collecting Points

The following procedure collects individual points (Figure A-25 on page A-18).

1. Tap **Survey** ▸ **Measure pts** ▸ **Topo-shot**.
2. Enter a point number and point descriptor.
3. Select a layer in which to add the point.
4. Press **Ok** to measure the point and return to the main screen.

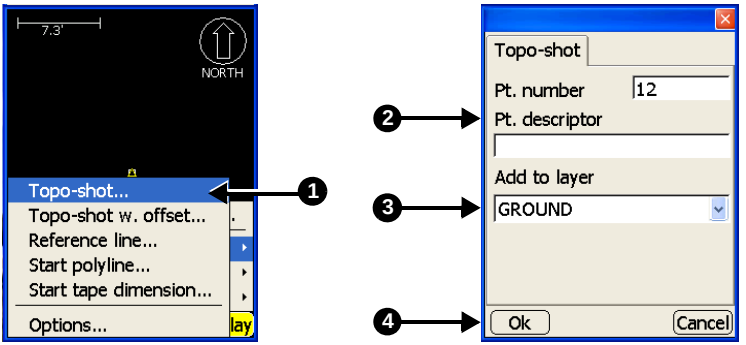

Figure A-25. Measure a Point

Creating Polylines

The following procedure collects points along a line, creating a polyline in a linework layer (Figure A-26 on page A-19).

1. Tap **Survey ▸ Measure pts ▸ Start polyline**.
2. Select a layer in which to add the polyline.
3. Press **Ok** to collect the point.
4. Move to the next point and press the **Enter** button on the controller to collect the next point. Repeat this step for all points in the polyline.
5. At the end of the polyline, tap **Survey ▸ Measure pts ▸ End polyline**.
6. If collecting three or more points to create a closed polygon, tap **Survey ▸ Measure pts ▸ Close polyline** to connect the first and last points.

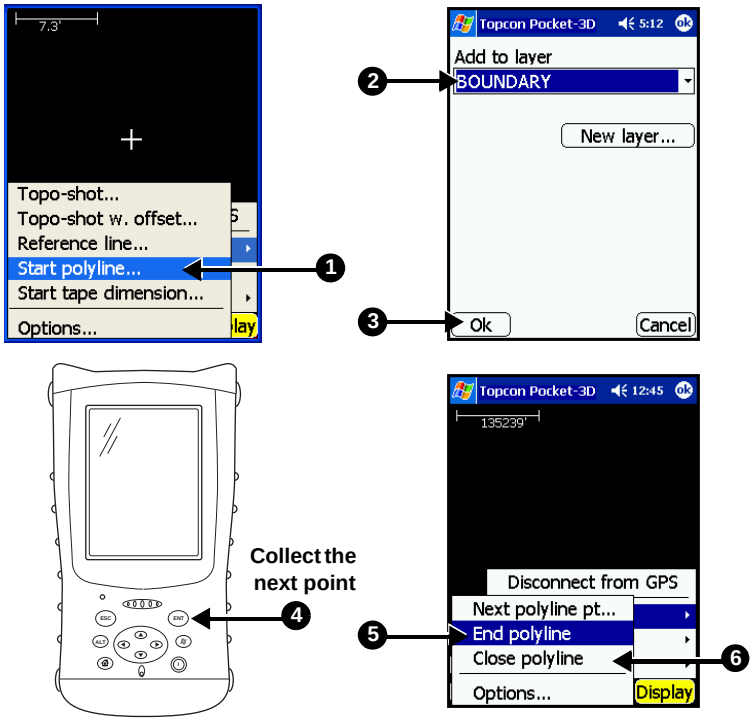

Figure A-26. Collect a Polyline (Using Pocket-3D on an FC-100 Controller)

Performing a Survey

The following procedure is for performing an auto-topo survey based on distance traveled (Figure A-27 on page A-20).

1. Tap **Survey** ▸ **Auto-topo** ▸ **By distance**.
2. Enter a minimum distance for measuring points and select a method to check the distance between points.
3. Select a layer in which to add the surveyed points and enter a point number to start with. If desired, enter a point descriptor.
4. Press **Start** to collect the first point.
5. Travel in a regular pattern to survey the desired area.
6. When done, tap **Survey** ▸ **Stop auto-topo**.

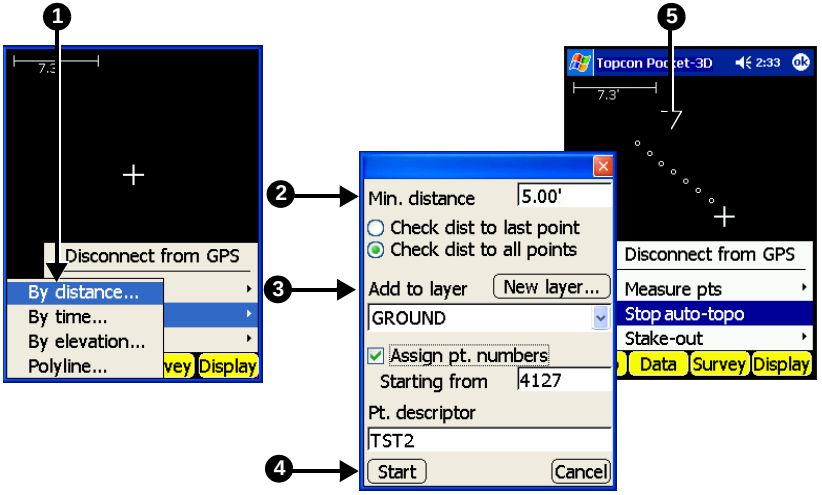

Figure A-27. Perform an Auto-topo Survey by Distance

Performing a Stakeout

Among the most common stakeouts performed with Pocket-3D are point and surface check stakeouts.

Staking out Points

1. Tap **Survey ▸ Stake-out ▸ Point list**.
2. Select the layer and the point to stakeout. Press **Ok**. If needed, travel to the point using the main screen directions.
3. Position the Rover at the point and tap **Survey ▸ Stake-out ▸ Measure stake**. After measuring the point, view the results.
4. To stakeout the next point in the list, press **Next** (Figure A-28 on page A-21).

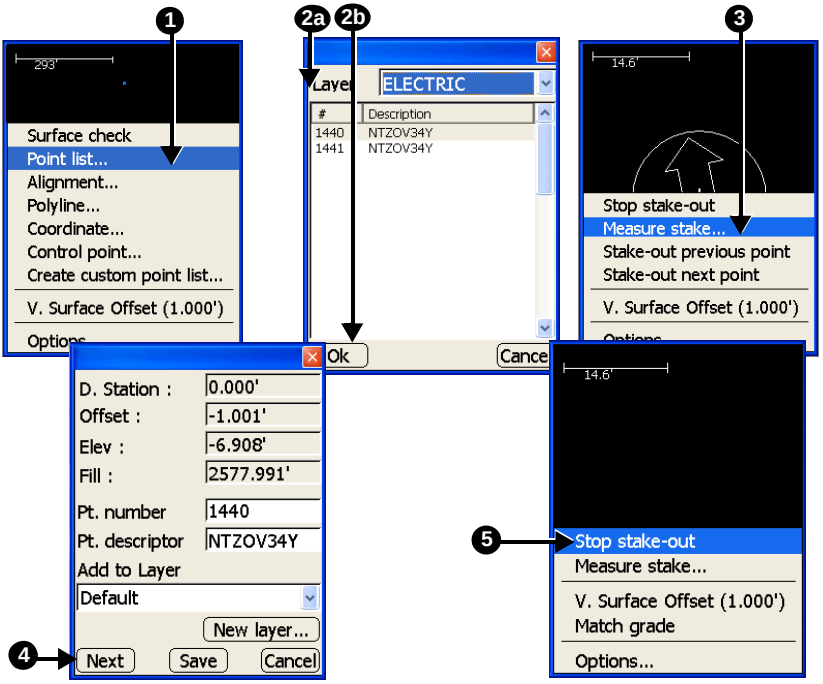

Figure A-28. Stakeout Point

5. To stop the stakeout, press **Ok** and tap **Survey ▸ Stakeout ▸ Stop stake-out** (Figure A-28).

Checking the Surface

1. Tap **Survey** ▸ **Stake-out** ▸ **Surface check** (Figure A-29).
2. View the cut or fill and current elevation.
3. Tap **Survey** ▸ **Stake-out** ▸ **Stop stake-out**.

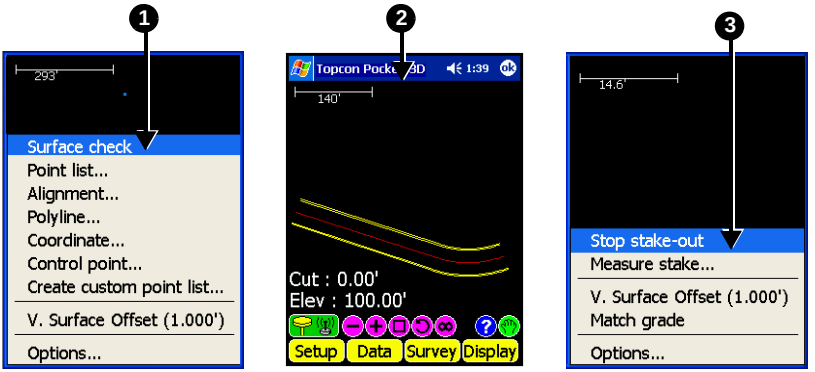

Figure A-29. Perform a Surface Check

Calculating the Inverse Between Two Points

An inverse calculation in Pocket-3D calculates the opposite direction and distance between two points (Figure A-30 on page A-23).

1. Tap the Selection Window icon and drag a selection box around two points.
2. Tap **Survey** ▸ **Calc wizard**.
3. With "Inverse between two pts" selected, press **Next**. The results of the calculation display.
4. Press **Cancel** to exit the ***results*** screen.
5. Tap **Survey** ▸ **Clear selection**.

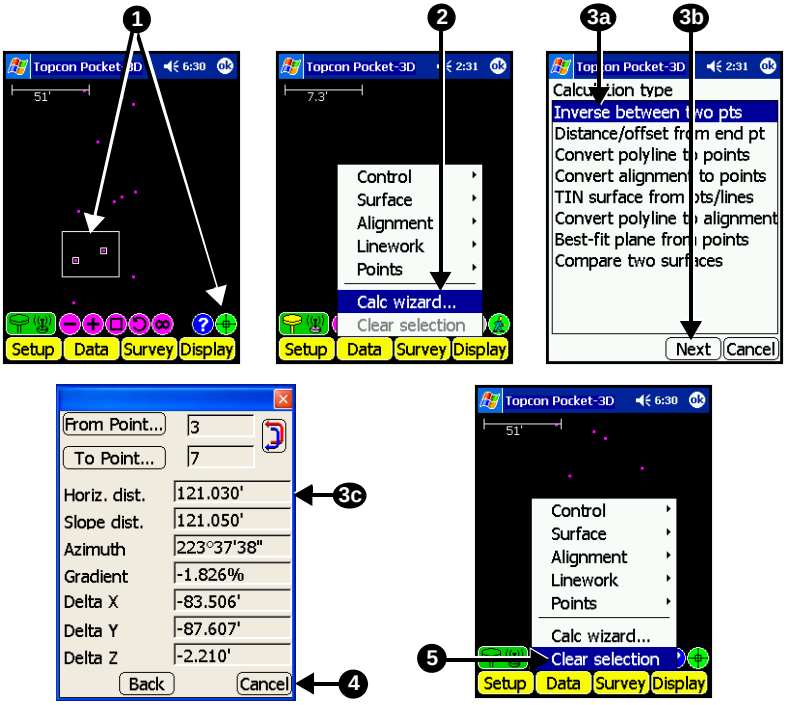

Figure A-30. Perform an Inverse Calculation

Notes:

Safety Information

It is your responsibility to be completely familiar with the cautions described in this manual. These messages advise against the use of specific methods or procedures which can result in personal injury, damage to the equipment, or unsafe operating conditions. Remember, most accidents are caused by failure to observe basic safety precautions.

General Precautions

1. Read and become familiar with the machine manufacturer's operating instructions, including safety information, before installing or using your Topcon equipment.
2. Use extreme caution on the jobsite. Working around heavy construction equipment can be dangerous.
3. DO NOT attach System Five-3D brackets or hose connections while the machine is running.
4. DO NOT allow any System Five-3D component to limit the visibility of the operator.
5. Use Ty-wraps, supplied with System Five-3D, to keep hoses and wires secured and away from possible wear or pinch points.
6. Use eye protection whenever welding, cutting or grinding is being done on the machine.

7. Protect yourself at all times, and wear protective clothing, when working on or near hydraulic lines. Hydraulic lines can be under extreme pressure, even when the machine is turned off.

Relieve all pressure in the hydraulic lines before disconnecting or removing any lines, fittings or related components. If injury does occur, seek medical assistance immediately.

8. Avoid direct exposure to your eyes when using laser control.

DO NOT stare into the laser beam or view the beam directly with optical equipment.

9. Use appropriate welding precautions and practices when welding. After welding, all paint all affected areas with a rust inhibitor..

DO NOT weld near hydraulic lines or on any equipment when in operation.

Disconnect all Topcon system electrical cables prior to welding on the machine.

All mounting bracket welds must be secure and strong to prevent the sensor equipment from vibrating excessively or from becoming detached at the weld during operation.

10. To prevent vandalism or theft, do not leave removable Topcon components on the machine at night. Remove the components each evening and store appropriately in the Carrying Case.
11. Keep the Carrying Case dry at all times.

DO NOT allow moisture to get inside the case. Moisture trapped in the case can adversely affect components.

If moisture does enter the Carrying Case, leave it open and allow it to thoroughly dry before storing any components.

Radio Usage Information

All users must obtain an FCC (Federal Communications Commission) license before operating the GPS+ system (GPS RTK (Real-Time Kinematic) or simultaneous calculation of Global Positioning System and Global Navigation Satellite System).

- **The Federal Communications Commission is at:**

  http://www.fcc.gov/

- **The rules are at:**

  http://www.access.gpo.gov/nara/cfr/waisidx_00/47cfr90_00.html

There have been many problems in the past with RTK base radio modems interfering with voice users. The issue finally culminated with the FCC refusing to grant licenses until something was done to ensure that surveyors did not interfere with voice users. The solution was to stop using frequencies in the 469MHz range, to add an identifier to the broadcast message, and other measures designed to minimize interference with voice users. The user and his employer are subject to fines of up to $82,500, confiscation of surveying equipment and legal action, if the rules are ignored.

Topcon cannot obtain the license for the user. There are companies to assist with licensing. Two are listed here:

- **Professional Licensing Consultants Inc.**

  P.O. Box 1714
  Rockville, MD 20849-1714

- **Atlas License Company and Data Services**

  1725-A North Shadeland Avenue
  Indianapolis, IN 46219

  http://www.alcds.com/

Notes:

Specifications

The sections in this appendix give the features and specifications for the physical components of the System-Five 3D™.

Control Box

The 9168 control box is backward compatible with System Four+ and System Five sensors and remote switches. Table C-1 lists specification details for the 9168 control box.

Table C-1. Control Box Specifications

Housing	Cast aluminum
Weight	11.75 lb. (5.3 kg)
Display	Color LEDs 6-1/4" diagonal, sunlight viewable 640 x 480 enhanced color, 1300 nit Touch screen Three-color, linear grade indicators with automatic adjustable brightness
Supply Voltage	10 to 30 VDC
Operating Current	Typical: 3.0 A Maximum: 15 A
Operating Temperature	-20 to +60°C (-4 to 140° F)
Moisture	MIL standard 810D
Valve Drive	Progammable dual hydraulic control.
External data storage	One slot for compact flash card to download/upload job files

Table C-1. Control Box Specifications

USB Port	One port for keyboard or mouse hookup
Connectors	Four connectors for power, valves, RS485, RS232
Speaker	For the tones, beeps, and chimes of audible alerts
Computer Board	300 MHz processor 28 MB SDRAM
Operating System	Microsoft Windows® CE.NET™

Figure C-1 shows the dimensions of the 9168 control box:

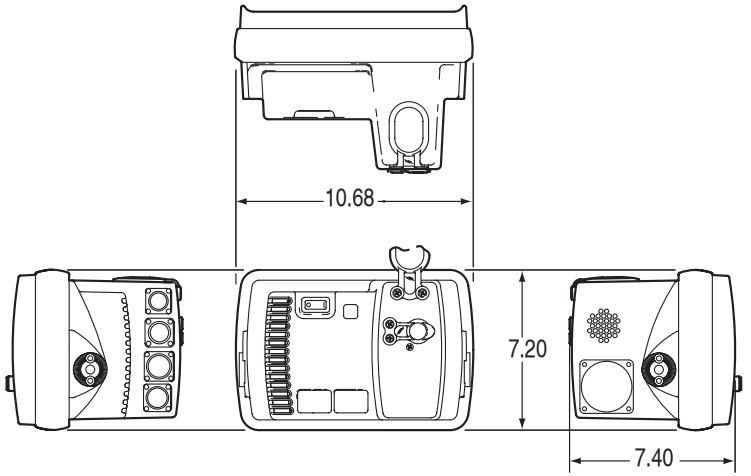

Figure C-1. Control Box Dimensions

Remote Smart Knobs

The Remote Smart Knobs mount on the left and right control lever for easy access. Table C-2 lists specification details for the Remote Smart Knobs.

Table C-2. Remote Smart Knob Specifications

Housing	Black ABS plastic
Buttons	Two each for grade and elevation control
Switches	One each for Manual/Auto control, a momentary switch to control slope or toggle set points
Operating Temperature	0 to +60°C (32 to 140° F)
Supply Voltage	10 to 30 VDC
Supply Current	100 mA (typical operating current)

Figure C-2 shows the dimensions of the Remote Smart Knobs:

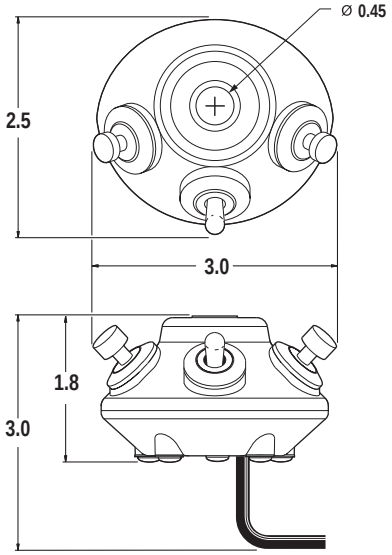

Figure C-2. Remote Smart Knob Dimensions

Simple Auto/Manual Knob

The Simple Auto/Manual Knob mounts on the control lever for easy access. Table C-3 lists specification details for the Simple Auto/ Manual Knob.

Table C-3. Simple Auto/Manual Knob Specifications

	Details
Profile	Epoxy
Switches	One for switching between Auto and Manual control
Mounting Threads	.375-16 x.60 inch deep course threads

Figure C-3 shows the dimensions of the Simple A/M Knob:

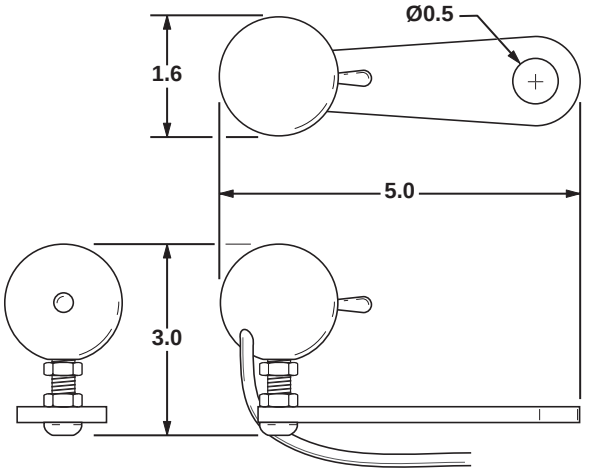

Figure C-3. Simple Auto/Manual Knob Dimensions

Blade Slope Sensor

The Blade Slope Sensor provides superior accuracy and repeatability, is free adjusting, and has a rugged, sealed design. Table C-4 lists component specification for the Blade Slope Sensor.

Table C-4. Blade Slope Sensor Specifications

Housing	Cast aluminum Epoxy sealed electronics
Supply Voltage	10 to 30 VDC
Supply Current	200 mA (typical operating current)
Operating Temperature	0 to +60°C (32 to 140° F)
Resolutions	+/-0.025% slope
Range	9150P: 0 to +/-20% slope 9152P: 0 to +/-100% slope

Figure C-4 shows the dimensions of the Blade Slope Sensor:

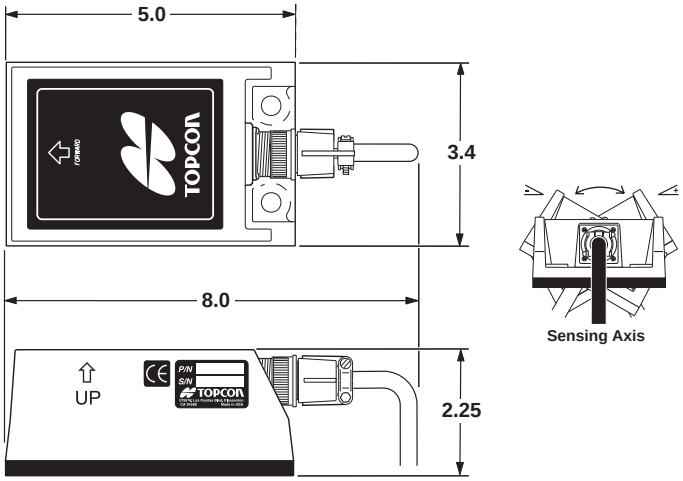

Figure C-4. Blade Slope Sensor Dimensions

Rotation Sensor

The Rotation Sensor provides precise angle measurement and has a rugged, sealed design. Table C-5 lists specification details for the Rotation Sensor.

Table C-5. Rotation Sensor Specifications

Housing	Cast aluminum
Color	Topcon yellow
Supply Voltage	5 VDC
Supply Current	1 mA (typical operating current)
Operating Temperature	0 to +60°C (32 to 140° F)
Resolutions	0.5 degrees
Range	360 degrees

Figure C-5 shows the dimensions of the Rotation Sensor:

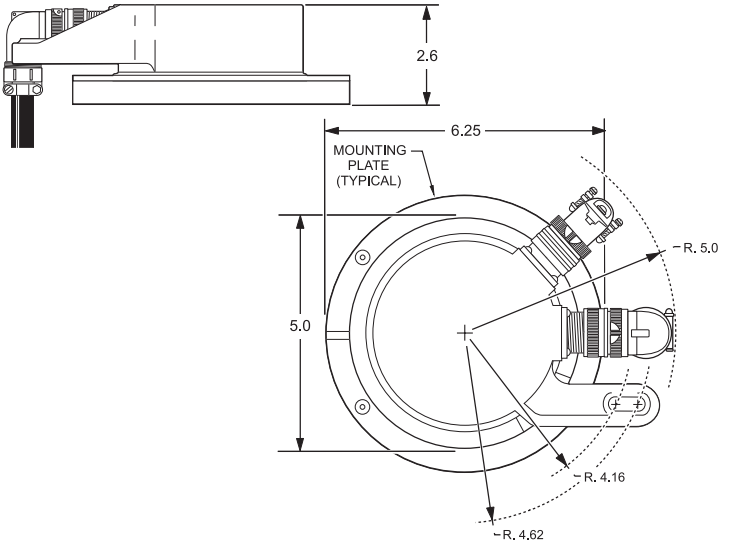

Figure C-5. Rotation Sensor Dimensions

Mainfall Sensor

The Mainfall Sensor provides superior accuracy and repeatability, is free adjusting, and has a rugged, sealed design. Table C-6 lists specification details for the Mainfall Sensor.

Table C-6. Mainfall Sensor Specifications

Housing	Cast aluminum
Supply Voltage	10 to 30 VDC
Operating Current	Typical: 100 mA
Operating Temperature	0 to +60°C (32 to 140° F)
Resolutions	+/-0.025% slope
Range	0 to +/-20% slope

Figure C-6 shows the dimensions of the Mainfall Sensor:

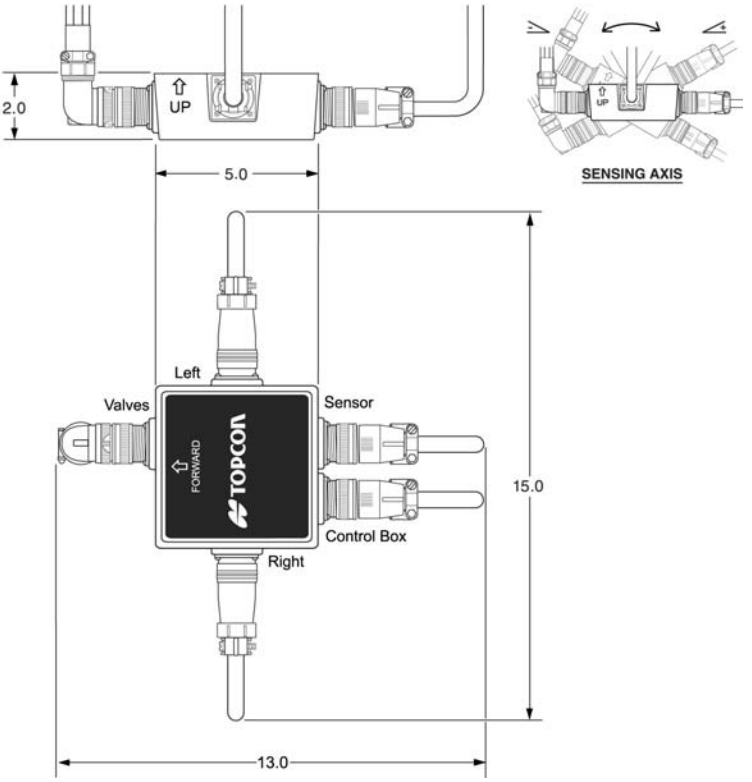

Figure C-6. Mainfall Sensor Dimensions

Rover GPS+ Receiver Box

The Rover GPS+ Receiver provides the industry's most advanced GLONASS and GPS dual-frequency satellite tracking system in a heavy-duty construction design with a shock absorbing mounting bracket. Four, high-power, bottom mounted magnets keep receiver in place on machine. The receiver also features compliance with CMR and RTCM industry standards and has optional advanced multipath mitigation and optional in-band interference rejection. Table C-7 lists specification details for the Rover GPS+ Receiver Box.

Table C-7. Rover GPS+ Receiver Box Specifications

Housing	Cast aluminum
Weight	12.10 lb. (5.5 kg)
LEDs	Three LEDs: Power (red); Satellite status (green for GPS; green and red GPS and GLONASS); Radio status (yellow)
Supply Voltage	10 to 30 VDC
Radio	Built in UHF or Spread Spectrum
Radio Frequency Band	UHF 450 to 470 MHz Spread Spectrum 915
Channels	14 for Pacific Crest PDL 6 for TeleDesign TS4000
Channel Switching	Manual for Pacific Crest PDL Clear channel scan for TeleDesign TS4000
Baud Rate	Up to 38400 bps
RTK Update Rate	10 Hz
GPS+ Tracking Channels	20 channels GPS L1+L2+GLONASS

Figure C-7 shows the dimensions of the Rover GPS+ Receiver Box:

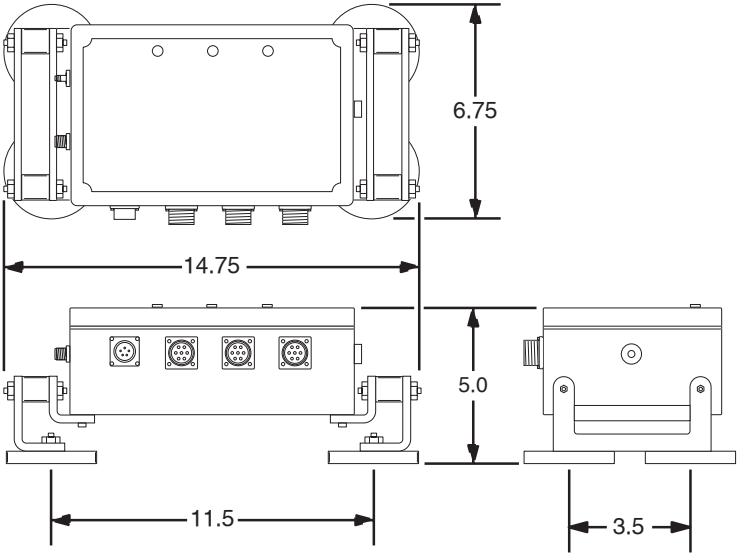

Figure C-7. Rover GPS+ Receiver Box Dimensions

MC-A1 Antenna

The MC-A1 Antenna is specifically designed to mount on the machine's blade. Table C-8 lists specification details for the MC-A1 Antenna.

Table C-8. MC-A1 Antenna Specifications

Antenna Type	Aluminium ground plane with plastic dome
Mounting Clamp	ID 1.75 in
Mounting Thread	5/8 - 11 in

Figure C-8 shows the dimensions of the MC-A1 Antenna:

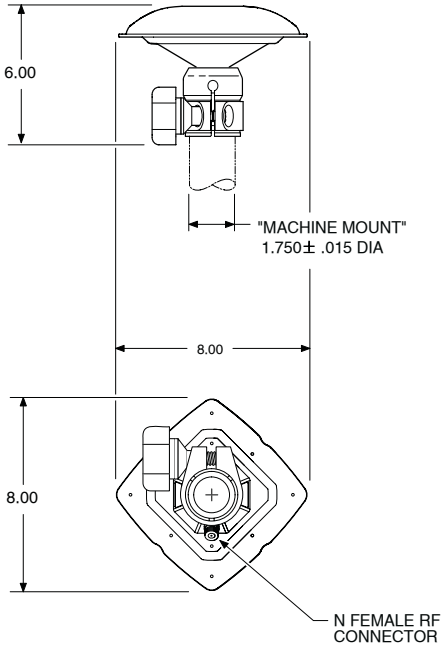

Figure C-8. MC-A1 Antenna Dimensions

LS-2000 Laser Sensor

The LS-2000 Laser Sensor is a rugged, waterproof design that detects optical and digital beams, has height resolution using the linear sensor, and detects conventional rotating lasers. Table C-9 lists specification details for the LS-2000 Laser Sensor.

Table C-9. LS-2000 Laser Sensor Specifications

Housing	Base: cast aluminum; Body: extrusion plastic
Operating Temperature	-20 to +50°C (-4 to 122° F)
Waterproof	IPX6
Beam Detection	360°
Prism Constant	-31mm (prism constant value +31)
Mounting Clamp	ID 1.75 in
Detector Height	200mm

Figure C-9 shows the dimensions of the LS-2000 Laser Sensor:

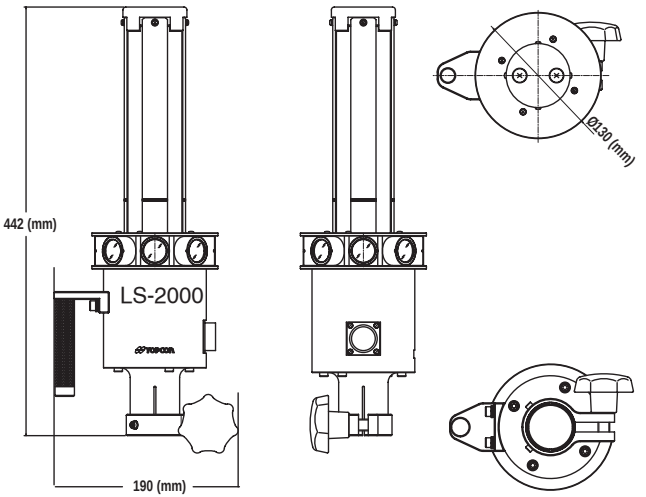

Figure C-9. LS-2000 Laser Sensor Dimensions

Round Vibration Pole

The Round Vibration Pole has a lightweight, shock isolation, and vibration dampening design, as well as a high vertical range. Table C-10 lists specification details for the Round Vibration Pole.

Table C-10. Round Vibration Pole Specifications

Housing	Base: Cast aluminum; Pole: OD 1.75 in extruded aluminum
Range	5 ft 5-1/2 in (169cm)
Weight	19.9 lbs (9.05 kg)

Figure C-10 shows the dimensions of the Round Vibration Pole:

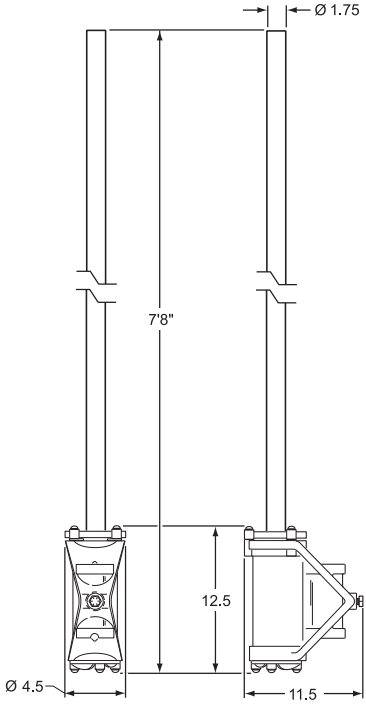

Figure C-10. Round Vibration Pole Dimensions

Trackerjack Vibration Pole

The Trackerjack Vibration Pole has a lightweight, shock isolation, and vibration dampening design and is reinforced for rough applications. Table C-10 lists specification details for the Trackerjack Vibration Pole.

Table C-11. Trackerjack Vibration Pole Specifications

Housing	Base: Cast aluminum; Pole: OD 1.75 in extruded aluminum
Range	5 ft 1-1/2 in (156.2cm)
Weight	22.3lbs (10.15kg)

Figure C-10 shows the dimensions of the Trackerjack Vibration Pole:

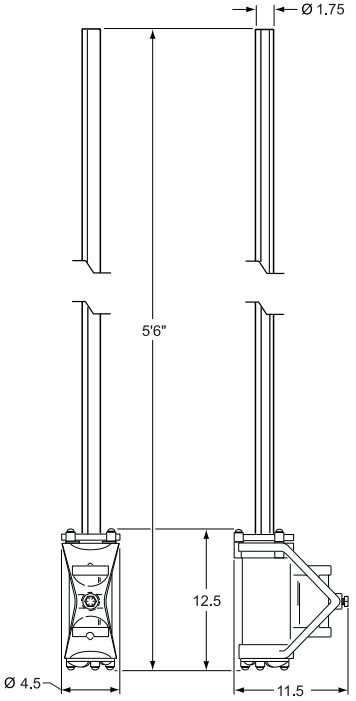

Figure C-11. Trackerjack Vibration Pole Dimensions

GPS Vibration Pole

The GPS Vibration Pole features a steel pole with a larger diameter to improve stiffness. Increased temperature range is provided by the use of high or low temperature bushings. Table C-10 lists specification details for the GPS Vibration Pole.

Table C-12. GPS Vibration Pole Specifications

Housing	Base: Cast aluminum; Pole: OD 1.75 in extruded aluminum
Range	6 ft 7-1/2 in (201.9cm)
Weight	29.0 lbs (13.0 kg)

Figure C-10 shows the dimensions of the GPS Vibration Pole:

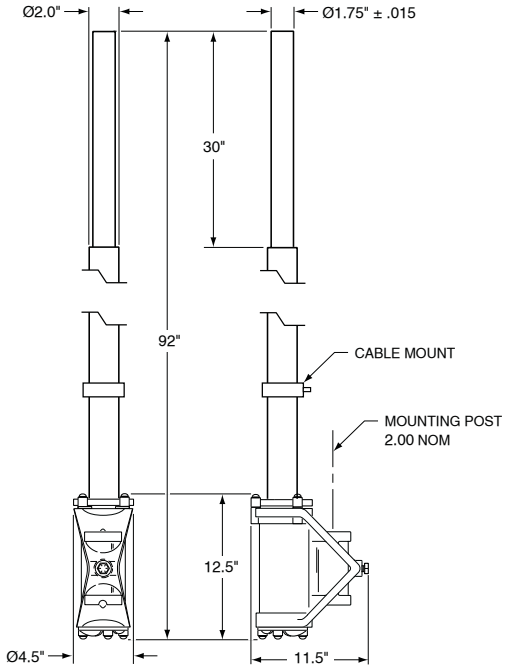

Figure C-12. GPS Vibration Pole Dimensions

TM-1 Telescoping Mast

The TM-1 Telescoping Mast is a heavy duty design with high resolution, ramping acceleration, and electric brake, and feedback servo positioning with no slipping. Table C-13 lists specification details for the TM-1 Telescoping Mast.

Table C-13. TM-1 Telescoping Mast Specifications

Housing	Base: cast aluminum; Extension and main tube: extruded aluminum; Top pole: OD 1.75 in DELRIN
Travel Range	42in (1.06m)
Weight	64 lbs (29 kg)
Mounting Pins	3.00 in diameter tube 4 bolt plate with dowel.
Supply Voltage	10 to 32 VDC
Power Requirement	10A at 12 VDC
Operating Temperature	0 to +50 deg C (32 to 122 deg F)
Power	Over current, overload, and over voltage protection.

Figure C-13 shows the dimensions of the Round Vibration Pole:

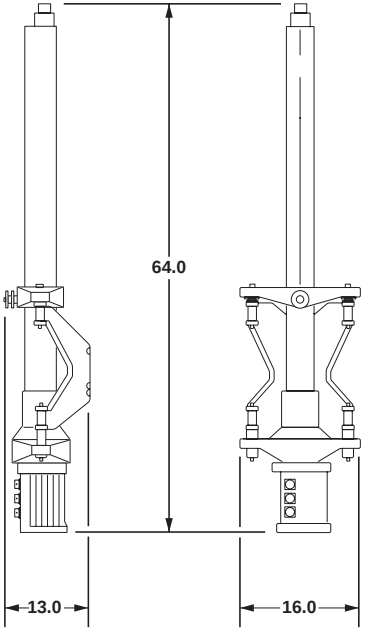

Figure C-13. TM-1 Telescoping Mast Dimensions

GRT-2000 Robotic Total Station

The GRT-2000 Robotic Total Station has a digital fan beam transmitter and full capability as an auto-tracking total station. A radio for radio transmission can be optionally added. Table C-14 lists specification details for the GRT-2000 Robotic Total Station. Refer to your total station's documentation for more details.

Table C-14. GRT-2000 Robotic Total Station Specifications

Housing	Cast aluminum
Weight	19.8 lbs (9.0 kg)
Port	1 external, RS232C port for communication
Supply Voltage	12 VDC
Power Requirement	5 to 18 W
Operating Temperature	-20 to +50 deg C (-4 to 122 deg F)
Moisture	Waterproof
3D Controlling Range	Approx. 10 to 300 m
Distance Measurement Accuracy	+/- 20 mm
Data Update Ratio	Approx. 100 msec.
Laser Classification	Class II
Telescope Magnifications	30 X
Radio Type (optional)	Satellite-2ASd
Radio Channels	16 total
Radio TX/RX Frequency Range	433.400 to 433.775 MHz
Radio Channel Spacing	25 kHz
Radio Power	1 W

Figure C-14 shows the dimensions of the GRT-2000 Robotic Total Station:

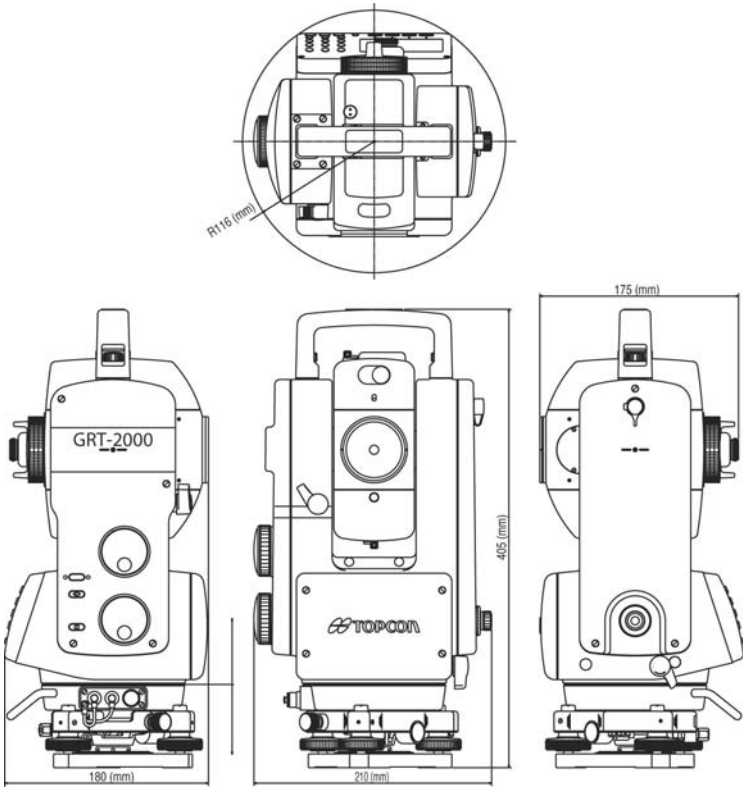

Figure C-14. GRT-2000 Robotic Total Station Dimensions

Sonic Tracker II

The Sonic Tracker II™ has ruggedly sealed electronics, a field replaceable sonic transducer, and temperature compensation for atmospheric disturbances that contribute to industry standard accuracies. With bright grade indication lights and a patented working window, it's easy to use and see for controlling grade. Table C-15 on page C-20 lists specification details for the Sonic Tracker II.

Table C-15. Sonic Tracker II Specifications

Housing	Cast aluminum; Epoxy sealed electronics
Connector	1 for power and communication
Display	Raise/lower/on-grade LED's
Supply Voltage	10 to 30 VDC
Operating Current	Typical: 200 mA
Operating Temperature	0 to +60 deg C (32 to 140 deg F)
Range	Adjustable from 14 to 55 inches (35.5 to 140 cm)
Working Window	On-grade adjustable Course: 0.15 ft Fine: 0.05 ft
Resolution	0.0025 ft.
Transducer Frequency	50 kHz with 40 Hz maximum repetitive rate

Figure C-15 shows the dimensions of the Sonic Tracker II:

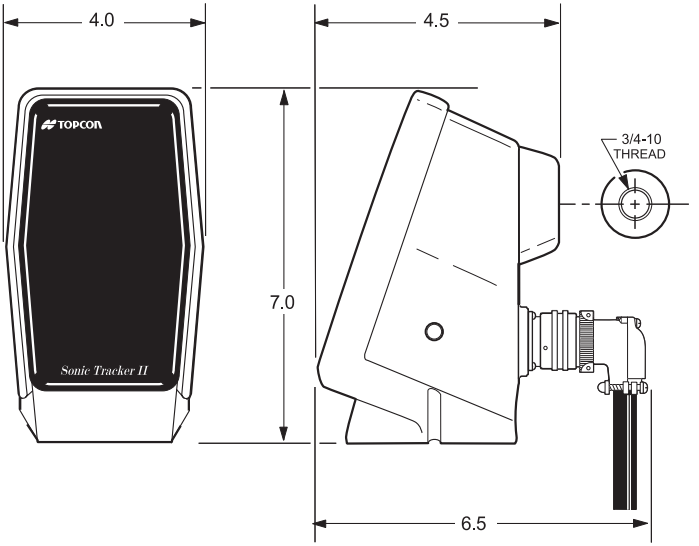

Figure C-15. Sonic Tracker II Dimensions

Laser Tracker

The Laser Tracker features bright indication lights, built in valve drivers for indicate and proportional automatic control, and a motor drive for attachment to the Trackerjack. Table C-16 lists specification details for the Laser Tracker.

Table C-16. Laser Tracker Specifications

Housing	Base: cast aluminum Body: polycarbonate
Detector Height	5 1/2 in
Mounting Thread	5/8-11 in
Supply Voltage	10 to 30 VDC
Operating Current	Typical: 200 mA
Operating Temperature	0 to +60 deg C (32 to 140 deg F)
On-grade Zone	+/- 0.013ft (variable with beam spot)
Beam Acceptance	360°

Figure C-16 shows the dimensions of the Laser Tracker:

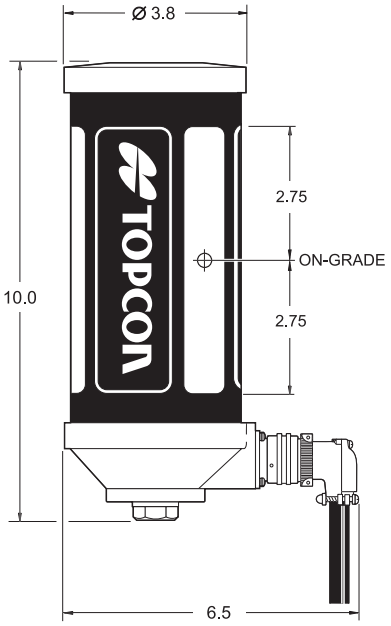

Figure C-16. Laser Tracker Dimensions

Trackerjack

The Trackerjack has driving capabilities on a Trackerjack Vibration Pole, is lightweight, and has manual override buttons for pole installation. Table C-17 lists specification details for the Trackerjack.

Table C-17. Trackerjack Specifications

Enclosure	Cast aluminum
Weight	4.7 lbs (2.13 kg)
Supply Voltage	12 VDC for 9221 24 VDC for 9220
Operating Current	Typical: 0.5A Maximum: 10.5A

Table C-17. Trackerjack Specifications

Operating Temperature	0 to +60 deg C (32 to 140 deg F)

Figure C-17 shows the dimensions of the Trackerjack:

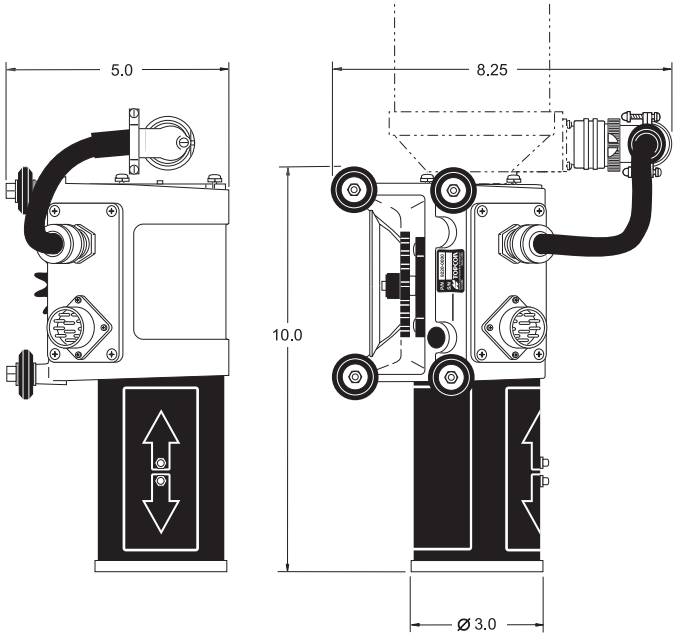

Figure C-17. Trackerjack Dimensions

PZS-MC Sensor

The PZS-MC sensor combines the MC-A1 GPS antenna with laser sensor technology. The sensor attaches to a GPS vibration pole on the machine blade, and cables connect the receiver to the control box. Table C-18 lists specification details for the PZS-MC.

Table C-18. PZS-MC Specifications

Beam Detection	±10° by ±10° window
Channels	4
Weight	6.6 lbs (3kg)
Power Supply	DC 8V~DC 32V
Waterproof	IPX6
Operating Temperature	-20°C to +50°C (-4°F to 122°F)

Figure C-18 shows the dimensions of the PZS-MC:

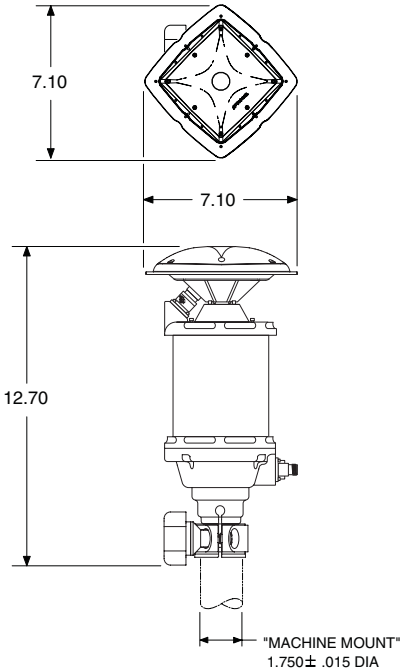

Figure C-18. PZS-MC Dimensions

Regulatory Information

The following sections provide information on this product's compliance with government regulations for use.

FCC Compliance

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Move the equipment away from the receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
- Consult the dealer or an experienced radio/television technician for additional suggestions.

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.

UHF Radio Usage

Using a UHF radio requires a license. Operating a UHF radio without a license may result in fines or other penalties. Be sure you comply with all local laws before operating a UHF radio. Contact your local authorities (such as, the FCC in the United States) for details.

Surveying in RTK mode has made UHF the most popular choice for communications between Base and Rover receivers. Know the strengths and weaknesses of this technology to get the best use out of your receiver. The quality and strength of the UHF signals translates into range for UHF communications.

1. The system's range will greatly depend on the local conditions. Topography, local communications and even meteorological conditions play a major role in the possible range of RTK communications. If needed, use a scanner to find clear channels.
2. The system's range will increase by adjusting the Base station's antenna using the following methods.
   - Ensure the Base radio has a fully charged battery.
   - Use directional antennas and/or repeaters to increase your system's range. Directional antennas concentrate the signal power within a more narrow direction, significantly increasing the range of your system.
   - Check the TPS accessory line for items to raise the Base radio.

Community of Europe Compliance

The product described in this manual is in compliance with the R&TTE and EMC directives from the European Community.

WEEE Directive

Following information is for EU-member states only:

The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.

Notes:

Warranty

TPS laser and electronic positioning equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by TPS' Authorized Dealers.[1]

During the warranty period, TPS will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized TPS warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall TPS be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

1. The warranty against defects in Topcon batteries, chargers, or cables is 90 days.

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ISO 9001:2000
FM 68448

System Five-3D Reference Manual
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