



X-22

2D Excavator Indicate System



Installation and Calibration Manual



X-22

Excavator Indicate System

Installation and Calibration

Manual

Part Number 7010-1019

Rev A

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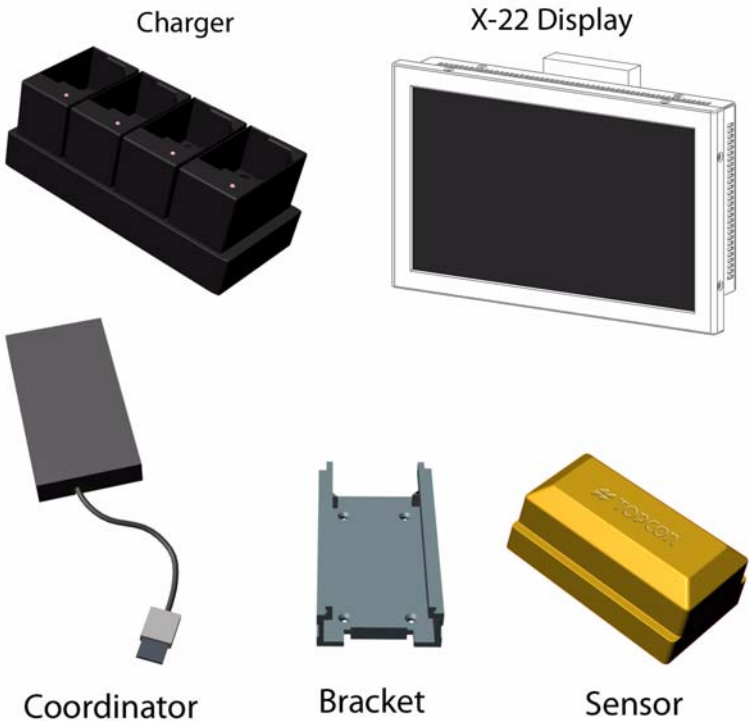
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Introduction

Congratulations on your new X-22 System.

System Components



Measuring and installation equipment is also available separately (not shown).

Installation and Calibration

Getting Started

Before you can start using your X-22 System for excavation, you need to set it up. Read on to find out how to install X-22 on your excavator in nine simple steps.

Step 1: Charge the Sensors

The first thing you must do is charge the sensors for several hours (i.e. overnight). The charger's LEDs may briefly turn on and off as the sensors go through their charging cycle. This is normal. Leave the sensors on the charger to ensure a full charge. If the batteries are completely flat, it takes around 12 hours to charge them fully. Make sure the contacts on the charger and the sensors are free of debris before charging.

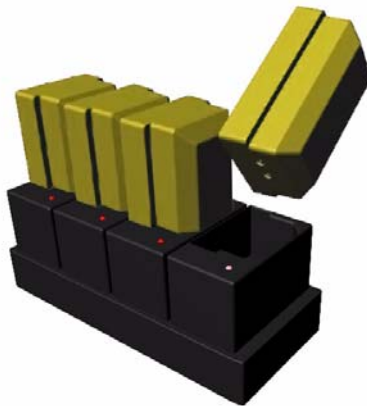


Figure 2-1. Battery Charger

Step 2: Attach the Brackets

Attach the aluminum brackets using the self-tapping screws provided. The drill and bit for the screws are also included. The drill is 4.6 mm and the screws Taptite M5x10 have a recessed head.



Rub a little grease or oil onto the screws before screwing them in.



When determining the location of the sensor brackets, make sure you allow room to install and uninstall the sensors onto the brackets.

A weld plates can be purchased separately, if drilling is not possible.

Bracket for Boom Sensor

The bracket for the boom sensor must be attached to the side of the boom that faces the cab.



Figure 2-2. Boom Sensor Bracket Location

The bracket for the boom sensor must be attached to a face of the boom that does not slant in relation to the boom bolt. The following picture shows how the boom is widest down by the boom bolt and gets narrower towards the center. The bracket must not therefore be attached in this area.



Figure 2-3. Do Not Install Bracket on Slanted Area of Boom

The bracket for the ArticBoom sensor should be attached to the articulated (extended) boom, if the machine has one, in the same way.

It makes no difference to the wireless communication or angle measurements for the sensors whether the bracket for the boom sensor is positioned as shown in Figure 2-4,

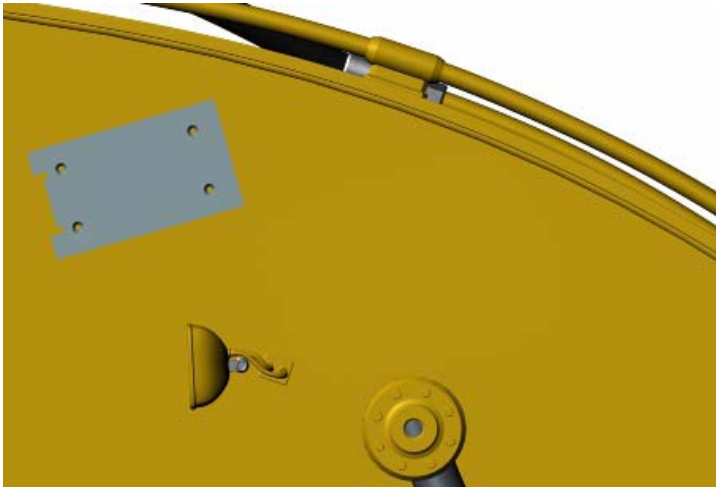


Figure 2-4. Boom Sensor Bracket Orientation

or as shown in Figure 2-5.

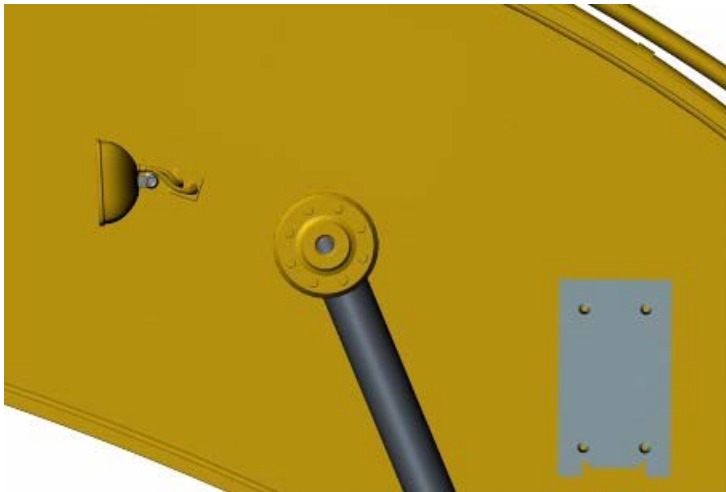


Figure 2-5. Boom Sensor Bracket Orientation

Bracket for Arm (Stick) Sensor with Laser Detector

The bracket for the arm (stick) sensor must be attached to the side of the arm (stick) that faces the cab.

Position the bracket so that the sensor is roughly vertical when the laser hits it. Take care not to attach the bracket too high on the arm (stick) to avoid problems with getting the laser beam to hit the sensor.



Attach the bracket for the arm sensor with the spring clips at the top so that the sensor slides in from above.

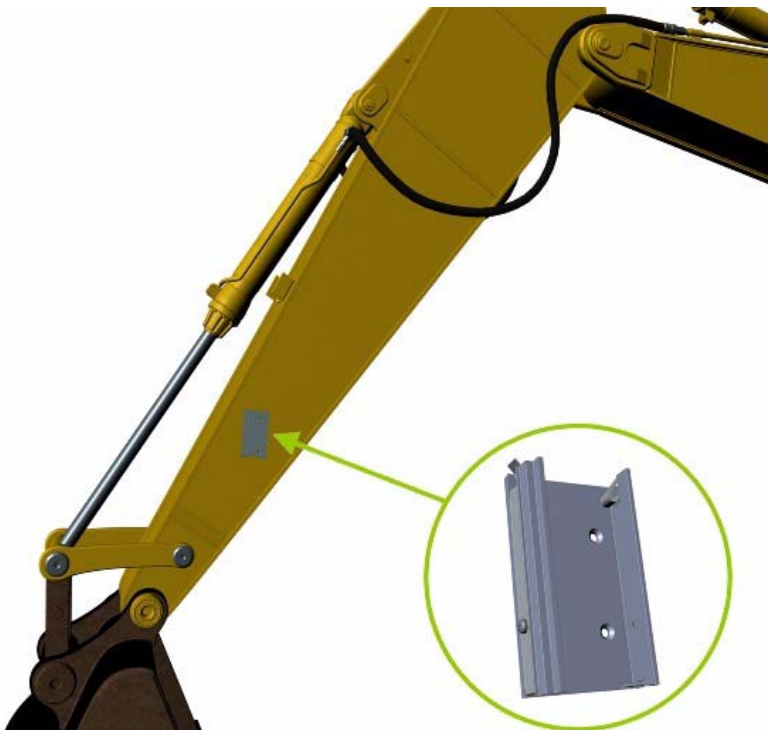


Figure 2-6. Arm (Stick) Sensor Bracket Location

Bracket for Bucket Sensor

The best place to attach the bracket for the bucket sensor depends on the size of the excavator and if the joints are tight or loose.

It is easiest to make X-22 measure accurately if the bucket sensor is attached directly on the bucket/quick coupler. This is especially the case if the joints are loose.

Alternative 1: The inside of the quick coupler/bucket

If the excavator is large enough, the bracket for the bucket sensor can be attached on the inside of the quick coupler/bucket. Attach the bracket on the part of the quick coupler/bucket closest to the cab.



Figure 2-7. Quick Coupler/Bucket Bracket Location - Inside



Fully extend and retract the bucket cylinder before fitting and make sure that the bracket and the sensor do not meet any obstructions.



If the bucket sensor is attached on the inside of the quick coupler/bucket, the sensor direction of the bucket sensor must be changed from **Normal** to **Reverse**. Select **Main Menu ▶ Setup ▶ Hardware ▶ Sensors** and mark the bucket sensor. Then select **Details**. Select **Sensor direction** and press **Edit**.

Alternative 2: The outside of the quick coupler/bucket

The bracket for the bucket sensor can also be attached on the outside of the quick coupler / bucket. Attach the bracket on the part of the quick coupler/bucket closest to the cab.



Figure 2-8. Quick Coupler/Bucket Bracket Location - Outside

Alternative 3: The inside of the control arm (dog-bone)

If the excavator is large enough and the joints are tight, the bracket for the bucket sensor can be attached on the inside of the control arm (dog-bone). Attach the bracket on the control arm closest to the cab.



Fully extend and retract the bucket cylinder before fitting and make sure that the sensor do not meet any obstructions.



Figure 2-9. Inside of Control Arm (Dog-bone)



If the bucket sensor is attached on the inside of the control arm (dog-bone), the direction of the bucket sensor must be altered from **Normal** to **Reverse**. Select **Main Menu ▶ Setup ▶ Hardware ▶ Sensors** and mark the bucket sensor. Then select **Details**. Select **Sensor direction**, and press **Edit**.

Alternative 4: The outside of the control arm (dog-bone)

If the excavator is too small to fit the bracket with the bucket sensor on the inside of the control arm and the joints are tight, the bracket can be attached on the outside of the control arm. Attach the bracket on the control arm closest to the cab.



Fully extend and retract the bucket cylinder before fitting and make sure that the sensor do not meet any obstructions.

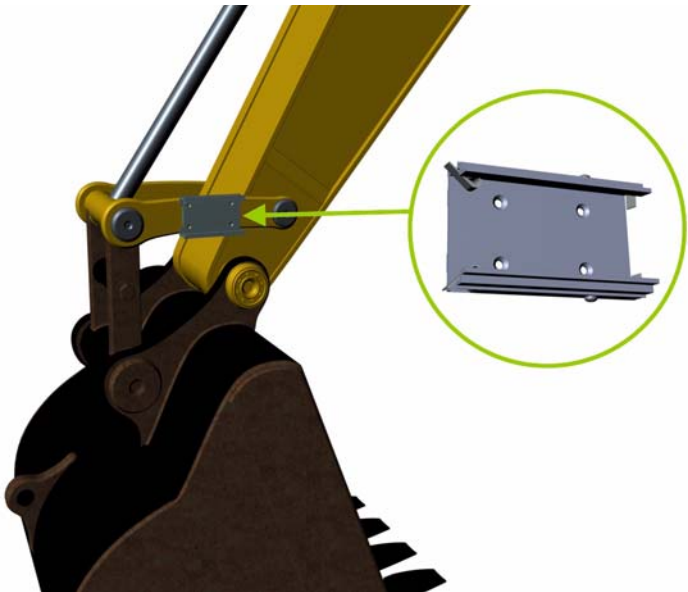


Figure 2-10. Outside of Control Arm (Dog-bone)



Attach the bracket with the spring clips on the left so that the sensor slides into the bracket from the left.

Bracket for Tilt Bucket Sensor (Optional)

The bracket for the tilt bucket sensor must be attached so that the sensor rotates sideways or lengthways.

Alternative 1: Sideways

When the tilt bucket sensor is installed sideways, the long axis of the sensor is used to measure how much the bucket is tilted to the side.



The long axis must move as shown in the pictures below when the bucket is tilted to the side, or else the sensor will not measure correctly.

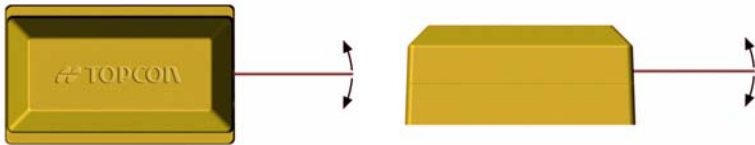


Figure 2-11. Sideways Installation

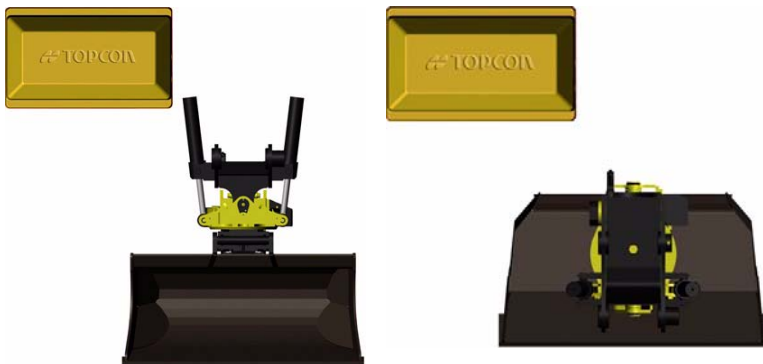


Figure 2-12. Sideways Installation

Example of sideways installation on a tilt bucket:

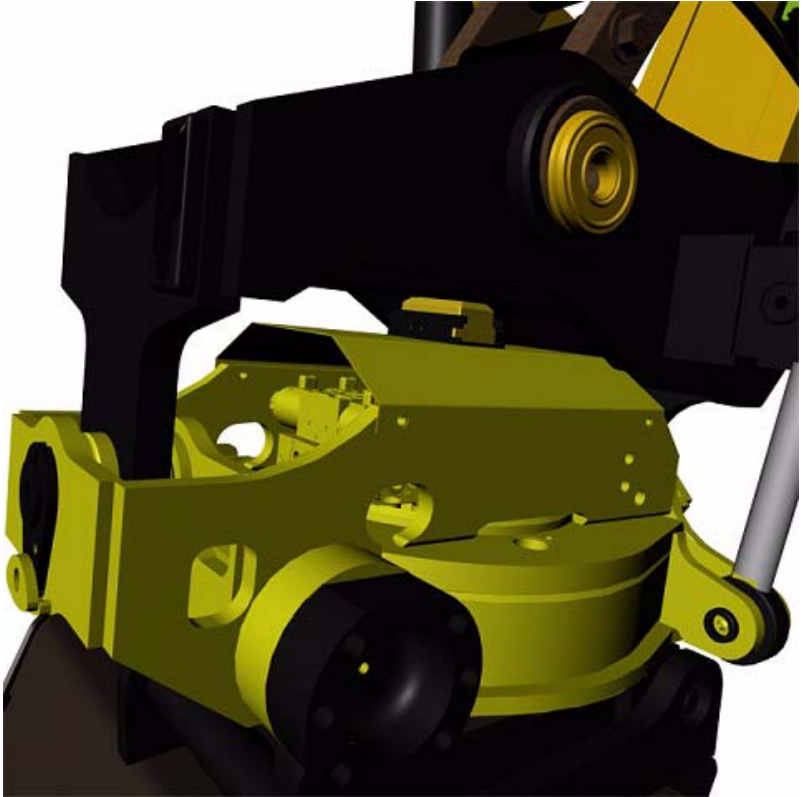


Figure 2-13. Sideways Installation

Alternative 2: Lengthways

When the tilt bucket sensor is installed lengthways, the short axis of the sensor is used to measure how much the bucket is tilted to the side. Note that the short axis must move as shown in the pictures below when the bucket is tilted to the side, or else the sensor will not measure correctly.

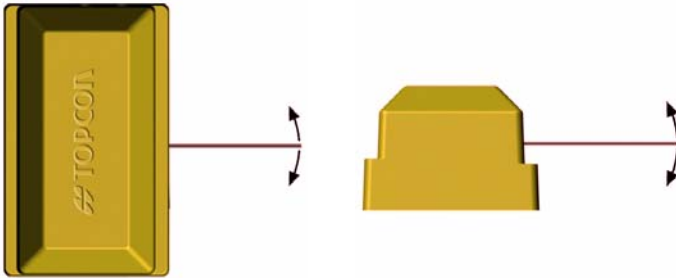


Figure 2-14. Lengthways Installation

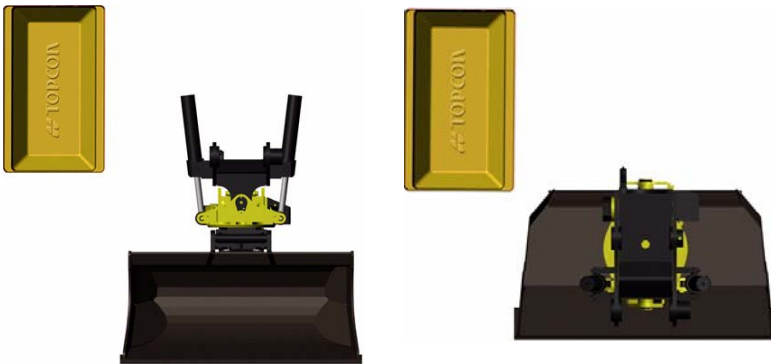


Figure 2-15. Lengthways Installation

Example of lengthways attachment:

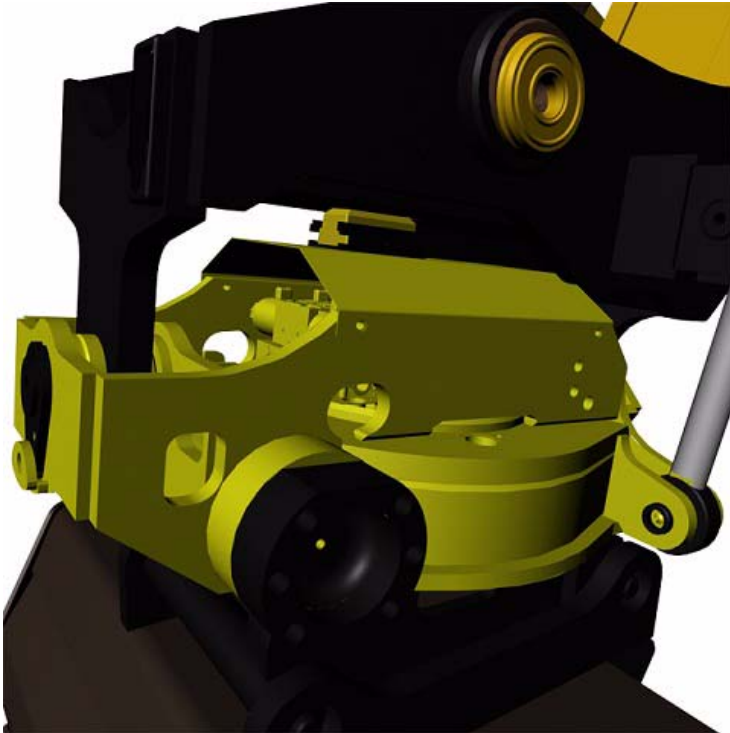


Figure 2-16. Lengthways Installation

Step 3: Attach the Mast for the PitchRollCompass

A mast is supplied with X-22 for the PitchRollCompass sensor. We recommend mounting the mast on the back of the machine's counterweight. Position the bracket on top of the mast, parallel with the tracks of the machine.

The optional welding mast ring (sold separately) is to be welded to the machine. Bolts and nuts are supplied with the mast. When the

mast ring is in place, attach the aluminium bracket firmly to the mounting ring with the M8x30 Allen screws provided.



Figure 2-17. Mast and Mast Ring Installation



Position the mast (or mast ring) so that it holds the mast steady and vertical on the excavator.

Step 4: Attach the X-22 Display

You can easily attach the X-22 Display to the side window in the cab using the suction cup provided. Clean the glass before attaching the suction cup. This prevents air from getting into the suction cup.

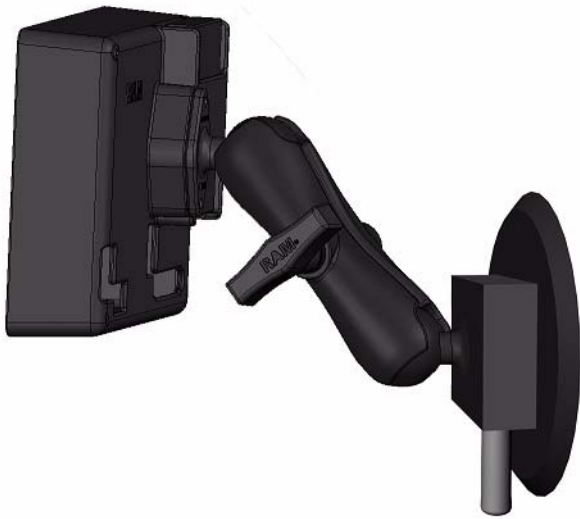


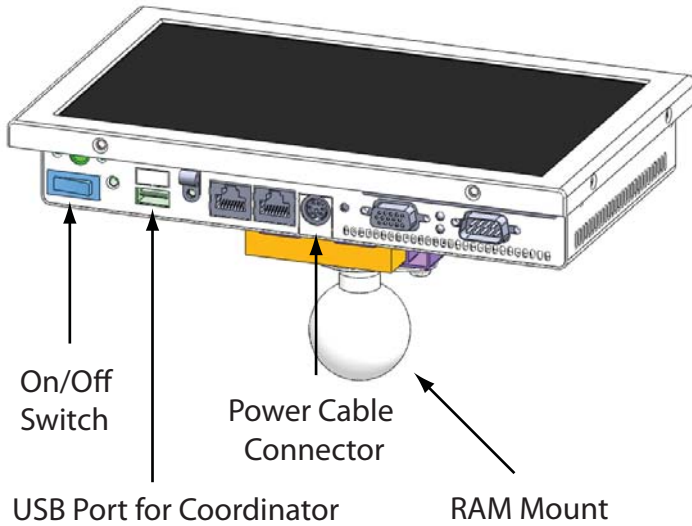
Figure 2-18. X-22 Display - Side View



Check regularly that the suction cup is firmly attached and take it off when it is not being watched.

The X-22 Display's on/off switch is on the bottom of the unit.

Bottom View



Back View

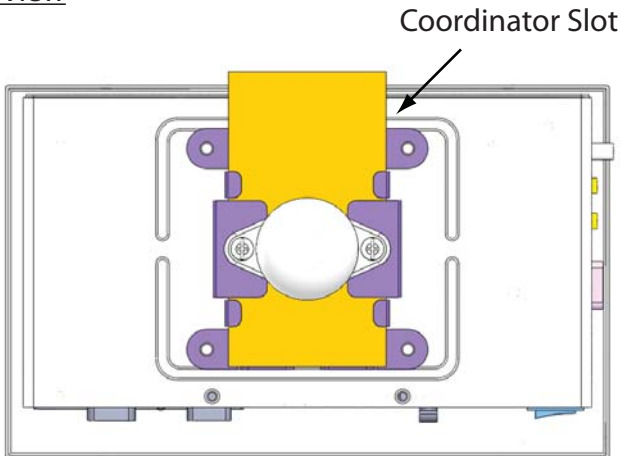


Figure 2-19. X-22 Display Features

Step 5: Measure the Excavator

Turn the X-22 Display on and select **Main menu ▶ Setup ▶ Excavators ▶ New** to enter your excavator.



Figure 2-20. Create a New Machine

Later in this manual you will find a list of the measurements you need to take. Use it for reference and making notes while measuring. You will find a tape measure in the case.



It is important to measure the excavator accurately. If the dimensions are wrong, X-22 will not measure as accurately as it should.

Step 6: Entering the Sensors on the X-22 Display

Once the sensors are fully charged and have been taken out of the charger, they have to be entered on the X-22 Display. Select **Main menu ▶ Setup ▶ Hardware ▶ Sensors**. If the sensors have been entered already they are listed on the screen.

Select **New** and enter all the sensors one by one if they are not already entered. Entering a new sensor can take few minutes.



It is important to take all the sensors out of the charger before starting to enter them on the X-22 Display. The radio for the sensors is switched off when they are in the charger.

Each sensor has a unique serial number, which can be found on the back of the sensor preceded by “SN:”. It is important to keep the serial numbers of all the sensors for reference, and we recommend making a note of them in the table below. It is not possible to communicate with the sensor without the serial number.

Sensor	Serial Number
Boom	
Arm (Stick)	
Bucket	
PitchRollCompass	
ArticBoom	
Tilt Bucket	



Figure 2-21. Serial Number Label

Step 7: Attach the Sensors to the Excavator

Now you are ready to attach the sensors to the excavator. Slide the boom sensor into the bracket you have attached to the boom, the arm (stick) sensor into the bracket on the arm and the bucket sensor into the bracket on the control stick. If you have a PitchRollCompass sensor, an ArticBoom sensor, and/or a Tilt sensor, then attach them in the same manner.

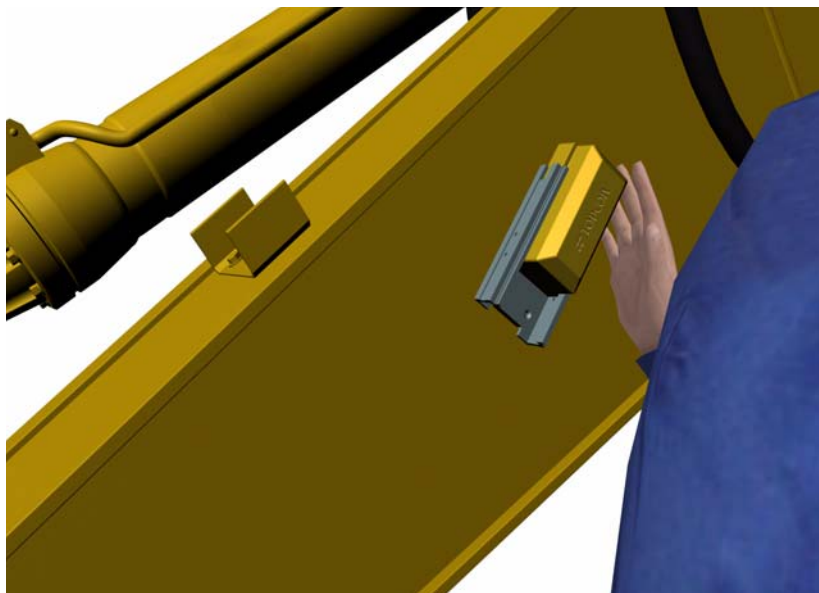


Figure 2-22. Install Sensors onto Brackets



The sensors only go into the brackets one way. Slide the sensor into the bracket with the charging pins on the sensor pointing away from the bracket.

Slide the PitchRollCompass sensor into the bracket on top of the mast. If needed, loosen the fastening screws of the mast base, and rotate the mast until sensor is pointing straight ahead. Then tighten the fastening screws so that the mast stays in this position.

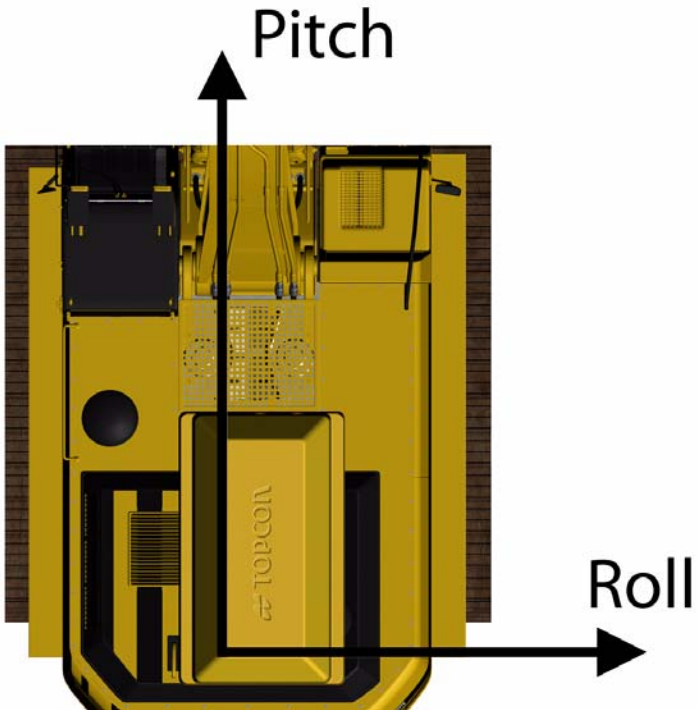


Figure 2-23. PitchRollCompass Sensor Orientation

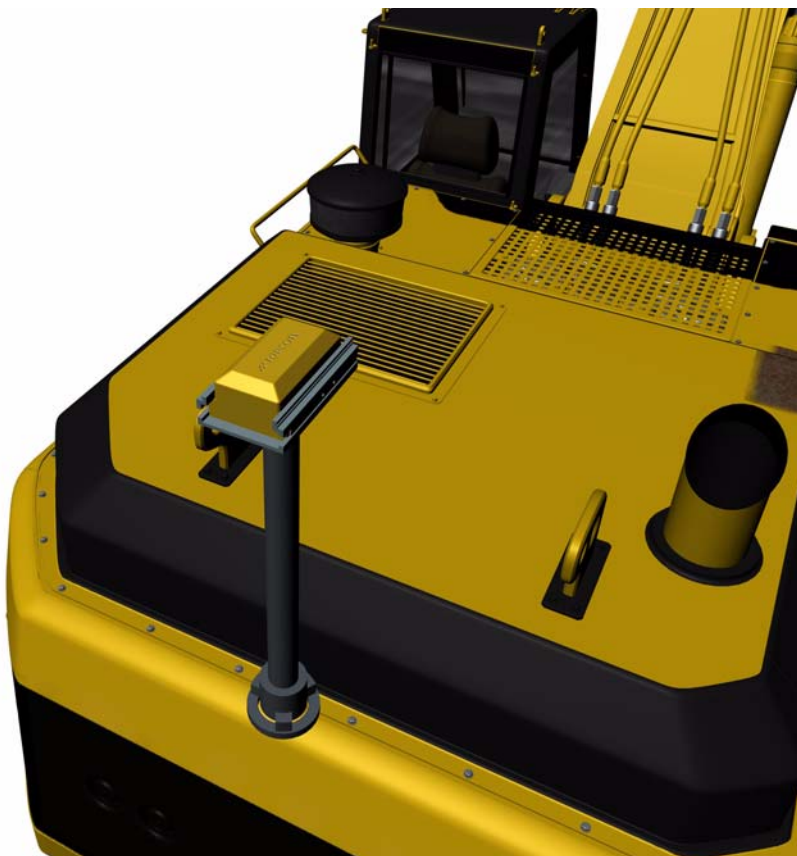


Figure 2-24. PitchRollCompass Sensor Orientation

Step 8: Calibrate the Sensors

The sensors should now be in position on the excavator. Press **Start digging** in the *Main Menu* and you are asked to calibrate the sensors. Follow the on-screen instructions.



It is important to calibrate the sensors accurately. If calibration is not done correctly, X-22 will not measure as accurately as it should.

The most accurate sensor calibration is achieved by using a rotating laser, theodolite or a total station instead of the spirit level and plumb line provided.

Calibrating the Boom Sensor

Attach one magnet in the center of the boom bolt and another in the center of the stick bolt. Then thread the line through the spirit level, pull it tight, and secure the ends to the magnets. When the spirit level is level, the boom is level.

Calibrating the ArticBoom Sensor (Optional)

If the excavator has an articulated (extended) boom, the boom sensor is calibrated by positioning the boom vertically, and the ArticBoom sensor is calibrated by positioning the articulated boom horizontally.

Calibrating the PitchRollCompass

Park the excavator on a horizontal surface and position the superstructure so that it is parallel to the tracks, following the on-screen instructions.

Then rotate the superstructure slowly.

Calibrating the Stick Sensor

Attach a magnet in the center of the stick bolt and hang a plumb line from it. When the plumb bob is still and the line passes through the center of the bucket bolt, the stick is vertical.

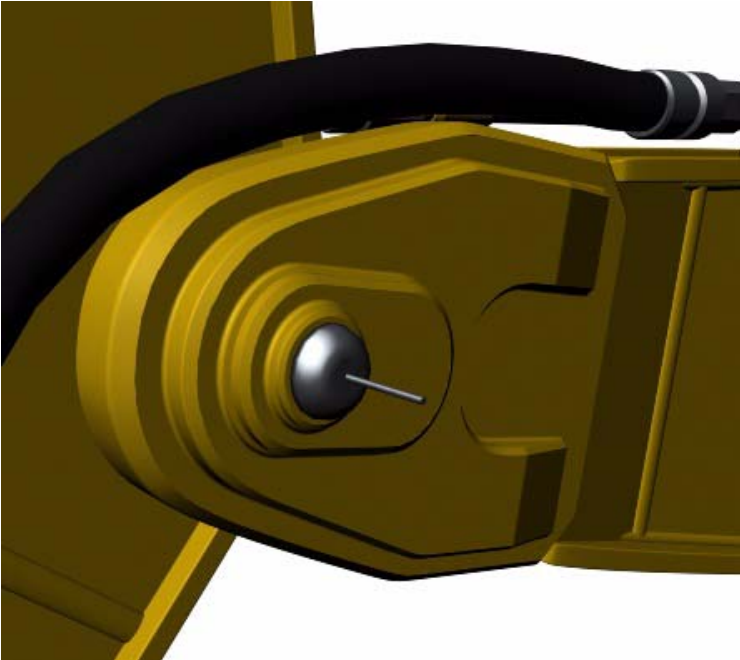


Figure 2-25. Calibrating the Arm (Stick) Sensor

Calibrating the Bucket Sensor

How the bucket sensor is to be calibrated depends on how the sensor has been attached:

On the inside or outside of the control arm (dog-bone)

Attach a magnet in the center of each bolt at the ends of the control arm (dog-bone). Pull the line with the spirit level on it tight and attach the ends to the magnets. The spirit level shows when the control stick is level.

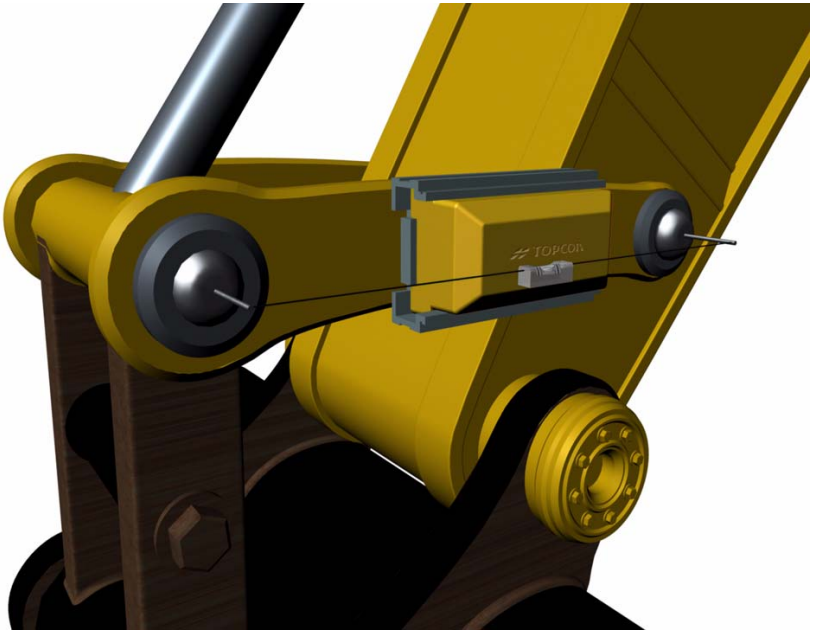


Figure 2-26. Calibrate Control Arm (Dog-bone) Sensor

Directly on the quick coupler / bucket

If the bucket sensor has been attached directly on the quick coupler / bucket, the sensor is calibrated by positioning the bucket vertically.

Calibrating the Tilt Bucket Sensor (Optional)

If the excavator has a tilt bucket, the tilt bucket sensor is calibrated by positioning the tilt bucket horizontally. Follow the on-screen instructions.

Step 9: Measure and Calibrate the Buckets

The final step is to measure and enter the excavator's buckets.

To enter the excavator's buckets, select **Main Menu ▶ Setup ▶ Buckets ▶ New**.



It is important to measure the buckets accurately. If the dimensions are wrong, X-22 will not measure as accurately as it should.

Each bucket also has to be calibrated. Follow the instructions on the X-22 Display.

The bucket teeth/blade can be worn down and become shorter with time. In this case the bucket radius should be measured again and the bucket recalibrated.

Finding Your Way Around the Software

Buttons and lists that are displayed on screen can both be pressed.

Tracking


You can see where you are in the software right at the top of each screen. If, for example, you press **Setup** in the *Main Menu* followed by **Excavators**, *Main menu > Setup > Excavators* is displayed at the top of the screen.

Wizards

When you press **New** to enter a new excavator, a new bucket or a new sensor, a wizard starts up and guides you through everything you have to do. You can see how far you have progressed in the wizard in the top right-hand corner of the screen.

Wizards also start up when you select the type of digging work.

How to Return to the Main Menu

To return to the previous menu, press the **Back** button 

in the bottom left-hand corner, as shown in Figure 2-27. If you are following a wizard, you can also go back a step by pressing **Back** button. If you press **Back** several times, you ultimately return to the *Main Menu*.



Figure 2-27. Press the Bottom Left Button to Return to Main Menu



Refer to the X-22 User's Manual for more information on using the X-22 software.

Before You Start to Dig

Check that X-22 is Measuring Correctly

Once you have X-22 ready for digging work, we recommend checking that the system is measuring as accurately as it should. This can be done by running through the verification routine. The first time you press **Start digging** in the *Main Menu*, you are asked to verify the calibration. Otherwise, you can start the verification routine from the menu in the digging window by pressing **Check ▶ Verify**.

If the system is not measuring as accurately as it should, a dimension or calibration value is probably wrong. In the menu in the digging window, press **Check ▶ Troubleshooting**, X-22 helps you identify the problem and rectify it.

Backup

Once you have checked that X-22 is measuring correctly, we recommend making a backup copy of all the data you have entered on the X-22 Display.

1. Plug a USB memory stick into the X-22 Display.
2. Select **Main Menu ▶ Setup ▶ Hardware ▶ Computer ▶ Backup/Import ▶ Backup**.
3. Press **Start backup** to save the measurements for all excavator(s) and bucket(s), sensor serial numbers, etc. to the memory stick.

Applications

You can perform a wide range of digging work with X-22. In the user manual, you will find an overview of the different types of work and how X-22 can be used.

Arm (Stick) Sensor with Laser Detector

You should be aware that the laser detector of the arm (stick) sensor has some limitations. It is designed for rotary lasers with laser diodes of 1mW or more, and 630nm wavelength (visible red light). It cannot be guaranteed that the laser detector will work with other rotary lasers, nor if the sun shines directly onto it.

If you are unable to get the laser detector of the stick sensor to work properly, you can use a machine detector instead. Do the following:

1. Attach the machine detector next to the stick sensor. Mark its position so that you can attach it on the exact same place if you have to take it off again.
2. Measure the center of the machine detector just like you did with the stick sensor.
3. Select **Main Menu ▶ Setup ▶ Hardware ▶ Sensors**.
4. Select **Stick with laser**, and press **Details**. The two measurements specifying the center of the laser detector are at the bottom of the list displayed on the screen. Edit and enter the measurements of the machine detector instead.
5. Continue to dig and use the machine detector to reference instead of the laser detector of the stick sensor. Make sure that “Laser” is selected as “Reference” of the project you are working on, and reference when the laser beam hits the center of the machine detector.

Handling Damaged Sensors

There is a powerful lithium battery in every sensor. It is just inside the cover bearing the serial number, so it is well protected by the sensor housing and the aluminium bracket when the sensor is on the excavator.

If in spite of this a sensor is seriously damaged, be careful. If a sensor is so badly damaged that the lithium battery is punctured or squashed, there might be a risk of explosion, fire or injury.

Damaged sensors are special waste and must be handled accordingly.

Important Information On Use

This section describes how the equipment should be handled. If the guidelines are not followed, there might be a risk of explosion, fire, injury or damage to the equipment.

Charger

The charger is for indoor use only. Avoid moisture. Batteries charge faster at lower temperatures, but the sensors must never be charged at temperatures below 0°C (32°F).

Operating temperature	0°C to +35°C 35°F to +95°F
Not waterproof	
For indoor use only	



Never put wet sensors in the charger.



Make sure the contacts on the sensors and the charger are free of debris before charging.

Sensors

The sensors are waterproof, but are not designed for digging in water. The wireless connection does not work in water either, so remove the bucket sensor and stick sensor if you intend to dig in water.

Operating temperature	-20°C to +60°C -4°F to +140°F
Charging temperature	+5°C to +35°C -41°F to +95°F
Storage temperature	-20°C to +35°C -4°F to +95°F
Operating time	approx. 4 weeks on one charge



Never expose the sensors to temperatures above 100°C (212°F), or there might be a risk of explosion.



Take the sensors off when using a pick hammer.

X-22 Display and Power Supply

The kit contains a power cable for the X-22 Display with a cigarette lighter plug, which can be used for both 12V and 24V supply.

Operating temperature	0°C to +50°C 35°F to +122
Storage temperature	-20°C to +70°C 35°F to +158°F
Not waterproof	

Machine and Bucket Measurements

On the next several pages there are pictures illustrating all excavator and bucket measurements that must be taken. Refer to these pictures and make a note of the dimensions beside them while taking the measurements.

You will find more pictures showing each measurement in greater detail on the X-22 Display, if you press **Details** as shown in Figure 2-28 on page 2-33. We recommend looking through the pictures on the X-22 Display first and familiarizing yourself with the various measurements before starting to measure.

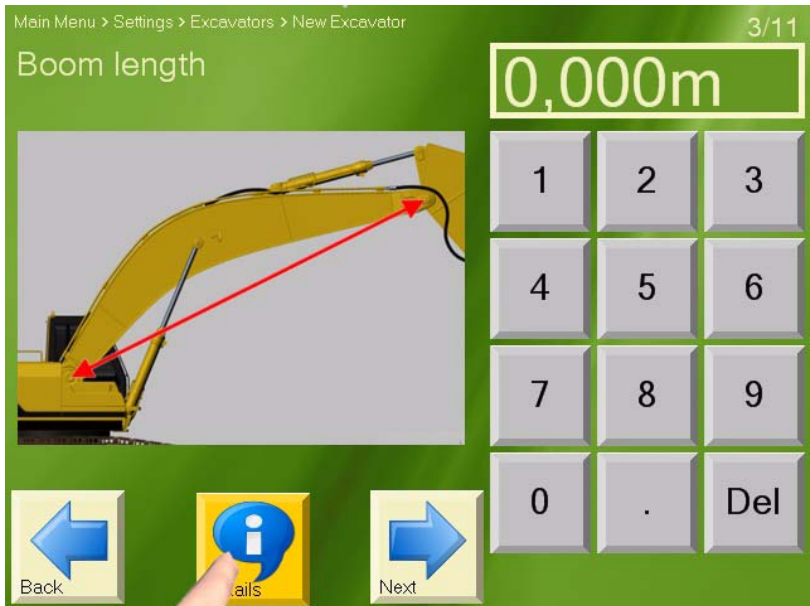
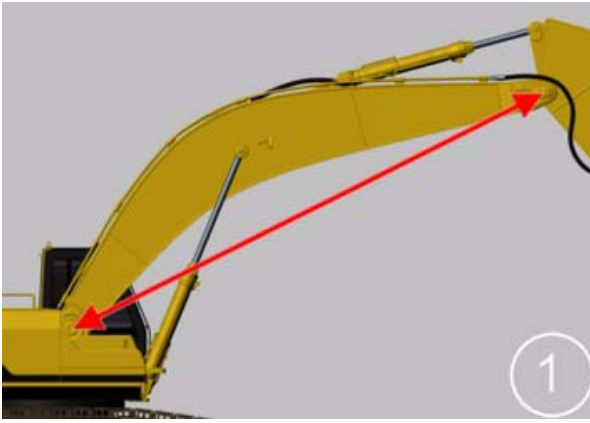
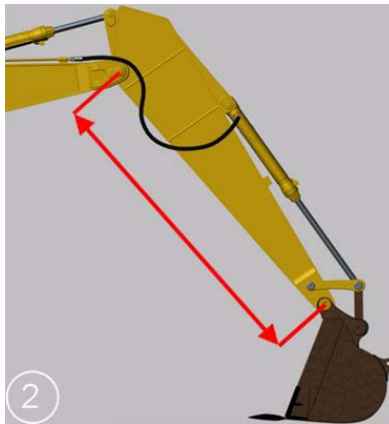


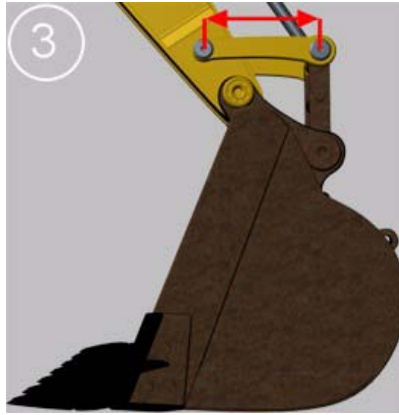
Figure 2-28. Entering Measurements



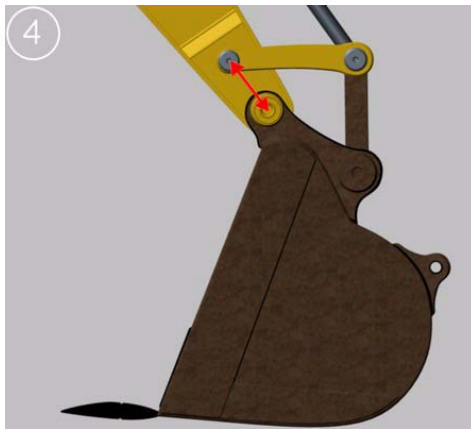
Machine Dimension	Measurement
Boom ¹	
Articulated boom	



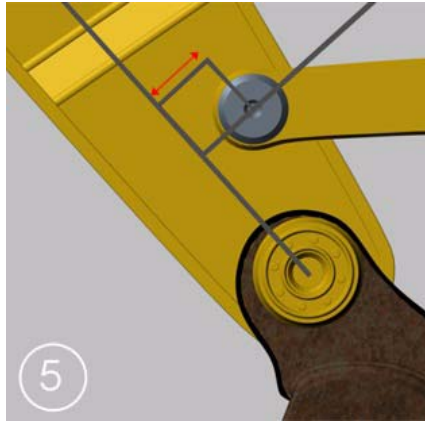
Machine Dimension	Measurement
Arm (Stick) ²	



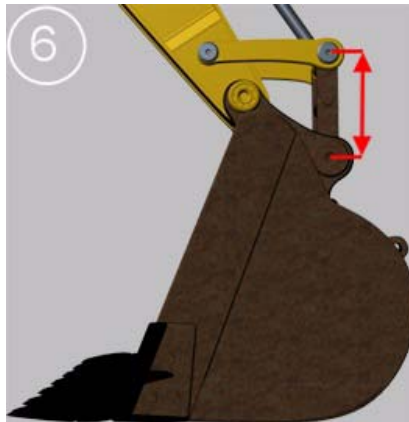
Machine Dimension	Measurement
Control Arm (Dog-bone) ³	



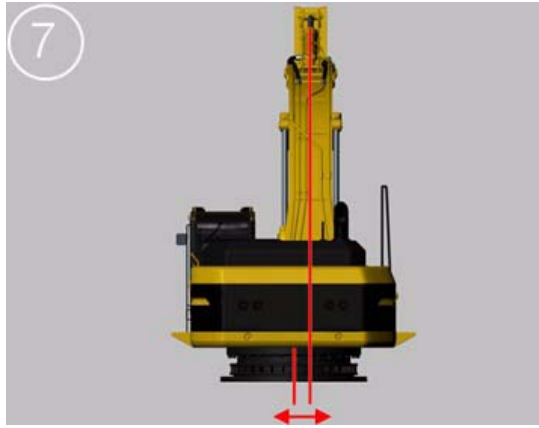
Machine Dimension	Measurement
Bucket bolt to control arm bolt ⁴	



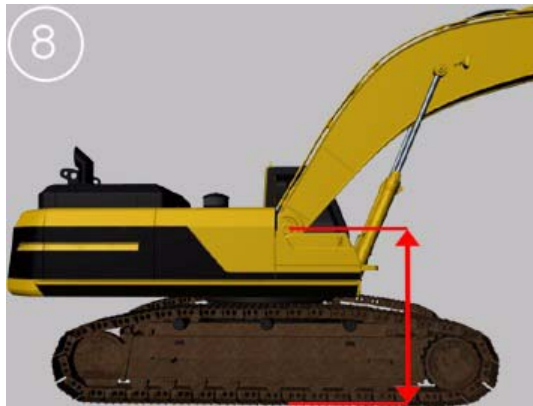
Machine Dimension	Measurement
Arm (Stick) axis to control arm (dog-bone) bolt ⁵	



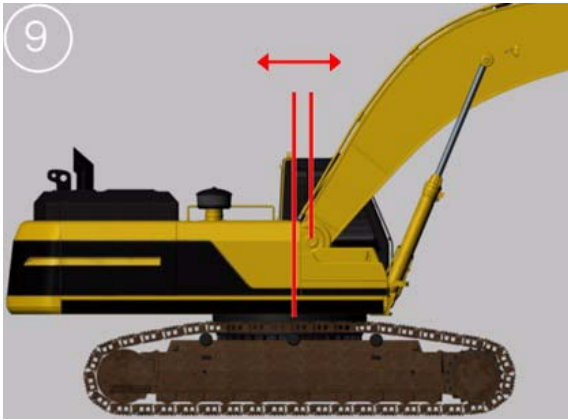
Machine Dimension	Measurement
Link ⁶	



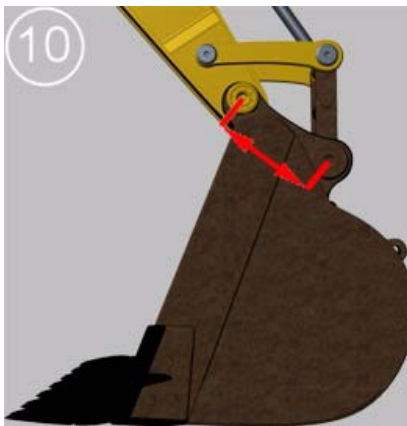
Machine Dimension	Measurement
Roll length ⁷	



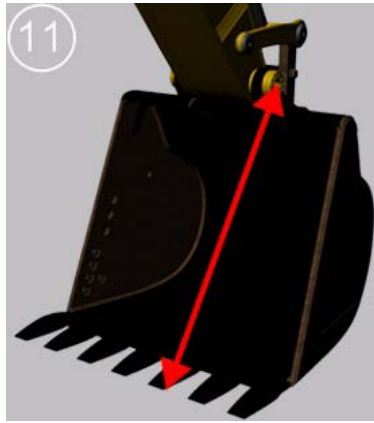
Machine Dimension	Measurement
Height to boom pin ⁸	



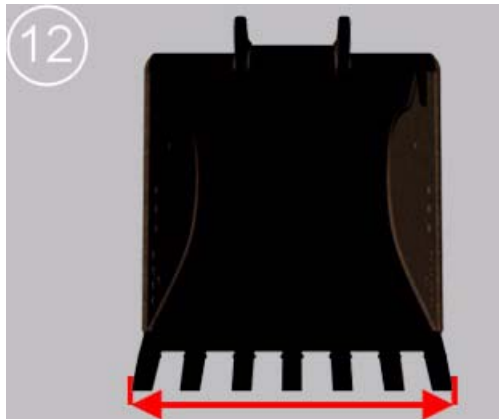
Machine Dimension	Measurement
Pitch length ⁹	



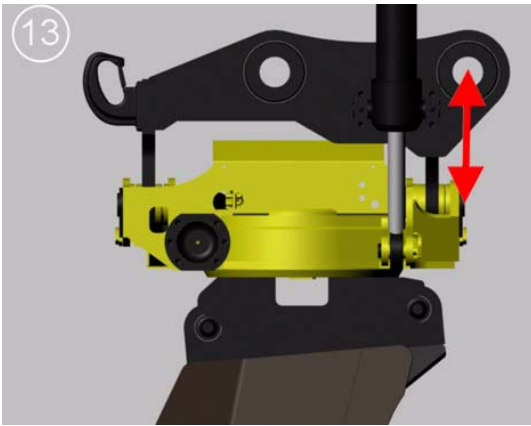
Machine Dimension	Measurement
Bucket Web ¹⁰	



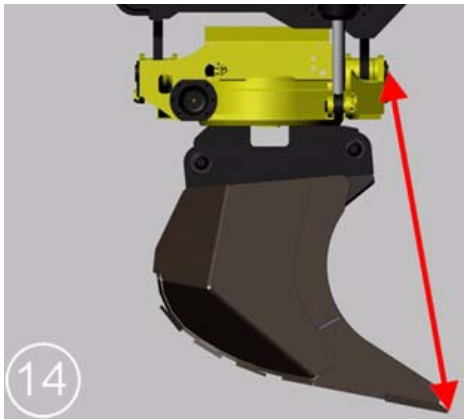
Machine Dimension	Measurement
Bucket Front ¹¹	



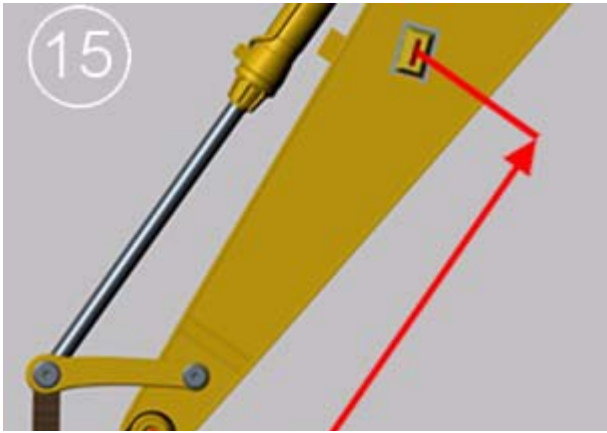
Machine Dimension	Measurement
Bucket Width ¹²	



Machine Dimension	Measurement
Bucket bolt to tilt axis ¹³	



Machine Dimension	Measurement
Bucket tip to tilt axis ¹⁴	



Machine Dimension	Measurement
Bucket bolt to laser sensor ¹⁵	



Machine Dimension	Measurement
Arm (Stick) axis to laser sensor ¹⁶	

Measure Additional Buckets

Name of Bucket:

Bucket Dimension	Measurement
Web ¹⁰	
Front ¹¹	
Width ¹²	
Bucket bolt to tilt axis ¹³	
Bucket tip to tilt axis ¹⁴	

Name of Bucket:

Bucket Dimension	Measurement
Web ¹⁰	
Front ¹¹	
Width ¹²	
Bucket bolt to tilt axis ¹³	
Bucket tip to tilt axis ¹⁴	

Name of Bucket:

Bucket Dimension	Measurement
Web ¹⁰	
Front ¹¹	
Width ¹²	
Bucket bolt to tilt axis ¹³	
Bucket tip to tilt axis ¹⁴	

Name of Bucket:

Bucket Dimension	Measurement
Web ¹⁰	
Front ¹¹	
Width ¹²	
Bucket bolt to tilt axis ¹³	
Bucket tip to tilt axis ¹⁴	

Troubleshooting

In this section you will find answers to the following questions:

The X-22 Display is not responding, what should I do?..... page 3-1

The sensors are not responding, what should I do?.....page 3-1

A sensor is damaged, what should I do?.....page 3-1

How do I recalibrate a sensor?.....page 3-1

The system is not measuring accurately, what should I do?..page 3-2

The compass is measuring incorrectly, what should I do?.....page 3-2

The laser sensor is not working, what should I do?.....page 3-2

The X-22 Display is not responding, what should I do?

Most X-22 problems can be solved by turning the X-22 Display off and on.

The sensors are not responding, what should I do?

If you are having problems making contact with the sensors, proceed as follows: Turn the X-22 Display off and put all the sensors in the charger for a few minutes. The sensors will then be reset while they are being charged. Take all the sensors out of the charger and turn the X-22 Display back on.

A sensor is damaged, what should I do?

You can obtain a new sensor by contacting your dealer. Delete the damaged sensor from the X-22 Display before entering the new one.

How do I recalibrate a sensor?

If you have already calibrated the sensors and want to recalibrate one, proceed as follows: Select **Main menu** ▶ **Setup** ▶ **Hardware** ▶ **Sensors** and highlight the sensor you want to calibrate. Select **Details**. Then select *Calibrated* and press **Change**.

The system is not measuring accurately, what should I do?

If the system is not measuring accurately, a dimension or calibration value is probably wrong. Select **Verify**



from the menu in the

digging window, and press **Troubleshooting**. X-22 will then help you identify the problem and rectify it. Follow the on-screen instructions.

The compass is measuring incorrectly, what should I do?

The compass in the PitchRollCompass sensor is magnetic and has to be calibrated in order to measure correctly.

Therefore try recalibrating the compass to see if this helps. Select **Main Menu** ▶ **Setup** ▶ **Hardware** ▶ **Sensors** ▶ **PitchRollCompass** ▶ **Details**. Then select *Calibrated*, and press **Change**.

If you want to check how well the compass is calibrated, you can select **Main Menu** ▶ **Setup** ▶ **Hardware** ▶ **Sensors** ▶ **PitchRollCompass** ▶ **Verify**. When the machine is stationary and the superstructure is rotated, the compass measurements should ideally form a perfect circle with the center at the origin.

In certain special circumstances the magnetic compass can be disrupted so much that it should not be used. In this situation the heading on the screen can change even if the machine is at a complete standstill.

If this happens, the compass should be turned off. Select **Main menu** ▶ **Setup** ▶ **Hardware** ▶ **Sensors** and highlight the PitchRollCompass sensor. Select “*Details*”. Then select “*Compass on*” and press “*Change*”. All the software functions that use the

heading measurements from the compass will now disappear and you will have to keep track of the heading yourself.

In situations where there are large fluctuations in the magnetic field around the machine all the time, the compass calibration will not be able to compensate for the disturbances. An example of such a situation is if the machine is close to a railway line that is in use: Trains are surrounded by a strong magnetic field, which will badly disrupt the compass measurements whenever a train goes past. In this case the heading displayed on the screen could change even if the machine is at a complete standstill.

Working in the vicinity of high-voltage cables can also cause problems for the magnetic compass.

The laser sensor is not working, what should I do?

The laser sensor may have problems detecting the laser beam in strong sunlight, particularly if the sun is shining straight into the photoelectric cell. If this happens, the amount of sunlight hitting the cell will have to be reduced by turning the sensor away from the sun, for example.

If the laser sensor is exposed to strobe lighting, a rotating flashing light or the like, the sensor may be misled into thinking that it has detected the laser.

If the laser sensor does not respond to the laser beam at all, even at close range, the photoelectric cell has probably been damaged. In this case you will have to contact your dealer to have the sensor replaced.

Specifications

X-22 Sensor

The following section provides specifications for the X-22 Sensor.

Table A-1. X-22 Sensor General Specifications

General Details	
Enclosure	Xenoy CL 100 Polycarbonate Resistant to hydraulic fluids, diesel and UV exposure IP67
Color	Topcon Yellow
Dimensions	W: 112 mm x H: 48 mm x D: 68 mm W: 4.4 in. x H: 1.89 in. x D: 2.68 in.
Weight	230g (standard sensor) 0.5 lbs.
Battery	Operating time: Up to four weeks with normal use Material: Lithium-ion polymer Nominal capacity: 5600mAh Charging time: Overnight Expected battery life: Beyond 3 years
Operating temperature	-20°C to +60°C -4°F to +140°F
Charging temperature	+5°C to +35°C -41°F to +95°F
Storage temperature	-20°C to +35°C -4°F to +95°F
Radio	Range: Over 50m (164 ft) line-of-sight Frequency: 2.4 GHz license-free ISM-band Proprietary packet radio protocol
Connectors	2 charging pins (6V DC input, no polarity)

X-22 Display

The following section provides specifications for the X-22 Fanless 8.9" WSVGA TFT Multifunctional Touch Panel PC.

Table A-2. X-22 Sensor General Specifications

Display Screen	
LCD Size	8.9"
Display Type	WSVGA TFT
Resolution	1024 x 600
Color	256K
Pixel Pitch	0.1905mm (H) x 0.189mm (V)
Luminance	220cd/m ²
Contrast Ratio	500
Viewing Angle	50 (U), 60 (D), 70 (L), 70 (R)
Response Time	30ms
Backlight	LED
Touch Screen	5-Wire Resistive
Light transmission	80%
Touch Interface	USB Onboard Touch Interface
System	
CPU	Onboard AMD Geode LX800 @ 0.9W 500MHz with 128K L2 Cache CPU
Cooling Method	Passive CPU Heatsink
System Chipset	AMD Geode LX800/ CS5536
System Memory	Onboard 512MB DDR Memory
SSD	One CF Socket by IDE Secondary Slave Channel Supports Type I/II Compact Flash Card

Table A-2. X-22 Sensor General Specifications (Continued)

Rear Panel I/O	
Serial Port	1 x RS-232, 1 x RS-232 or Optional RS-422/ 485
Ethernet	2 x RJ-45 (Realtek RTL8101L LAN)
WIFI	Optional USB WiFi 802.11 b/g (Occupies One USB Port)
VGA	1 x DB-15
Audio	Line-out, Mic-in
USB	2 x USB 2.0
Mouse & K/B	1 x PS/2 Keyboard Connector
Environment & Mechanical	
Color	Front Panel Black; Rear Panel Black
Mounting	Wall/ Stand/ VESA 75mm x 75mm
Power Input	100 ~ 250Vdc/ 47 ~ 63Hz
Power Output	+12Vdc/ 5A (60W)
Operating Temperature	-10°C ~ 60°C 14°F to +140°F
Storage Temperature	-20°C ~ 70°C -4°F to +158°F
Relative Humidity	10% to 95% @ 40°C, Non-condensing
Dimension	W: 225mm x H: 139mm x D: 38.9mm W: 8.86 in. x H: 5.47 in. x D: 1.53 in.
Weight	1.26Kgs (2.78 lbs.)

Safety Warnings

General Warnings

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 brackets while the machine is running.
4. DO NOT allow any X-22 system component to limit the visibility of the operator.
5. Use Ty-wraps, 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. 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.

-
8. 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 sensor equipment from vibrating excessively or from becoming detached at the weld during operation.

9. 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.
 10. 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.

Sensor Warnings



Never attempt to open the X-22 sensors! Lithium-Ion batteries can be dangerous if mishandled!



Do not incinerate or heat battery pack above 212 degrees fahrenheit (100 degrees celsius). Excessive heat can cause serious damage and possible explosion.



Tampering with the batteries by end users or non-factory authorized technicians will void the battery's warranty.

- Do not attempt to open the sensors.
 - Do not disassemble the sensor.
 - Do not charge in conditions different than specified.
 - Do not use other than the specified battery charger.
 - Do not short circuit.
 - Do not crush or modify.
-

Usage Warnings



If this product has been dropped, altered, transported or shipped without proper packaging, or otherwise treated without care, erroneous measurements may occur.

The owner should periodically test this product to ensure it provides accurate measurements.

Inform Topcon immediately if this product does not function properly.



Only allow authorized Topcon warranty service centers to service or repair this product.

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, you are 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.

FCC Compliance

This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles). 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.

Federal Communication Commission Declaration of Conformity (DoC) Statement



Model No: HiPer II

Trade Name	Topcon
Responsible Party	Topcon Positioning Systems, Inc.
Address	7400 National Drive, Livermore, CA 94550
Telephone No	+925-245-8300

Canadian Emission Labeling Requirements

This equipment complies with IC radiation exposure limits set forth for uncontrolled equipment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles).

1. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
2. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.
3. This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte conform a la norme NMB-003 du Canada.

IC RF Radiation Exposure Statement

This installer of this device must ensure that the antenna is located or pointed such that it dose not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website at www.hc-sc.gc.ca/rpb.

Community of Europe Compliance

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

European Community Declaration of Conformity with R&TTE Directive 1999/5/EC

The following standards were applied: (R&TTE Directive 1999/5/EEC)

- EN 301 489-1 V1.8.1 (2008-04)
- EN 301 489-17 V1.3.2 (2008-04)
- EN 300 328 V1.7.1 (2006-10)
- EN 60950-1:2001 + A11:2004

The following CE mark is affixed to the device:



Declaration of Conformity with Regard to the R&TTE Directive 1999/5/EC

<p>[cs] Český [Czech]</p>	<p>(Topcon) tímto prohlašuje, že tento (HiPer II) je ve shod se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES.</p>
<p>[da] Dansk [Danish]</p>	<p>Undertegnede (Topcon) erklærer herved, at følgende udstyr (HiPer II) overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.</p>
<p>[de] Deutsch [German]</p>	<p>Hiermit erkläre (Topcon) dass sich das Gerät (HiPer II) in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.</p>
<p>[et] Eesti [Estonian]</p>	<p>Käesolevaga kinnitab (Topcon) seadme (HiPer II) vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.</p>
<p>[en] English</p>	<p>Hereby, (Topcon) declares that this (HiPer II) is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.</p>
<p>[es] Español [Spanish]</p>	<p>Por medio de la presente (Topcon) declara que el (HiPer II) cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.</p>
<p>[el] [Greek]</p>	<p>ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ (Topcon Positioning Systems, Inc.) ΔΗΛΩΝΕΙ ΟΤΙ (GRX1) ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.</p>
<p>[fr] Français [French]</p>	<p>Par la présente (Topcon) déclare que l'appareil (HiPer II) est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.</p>

<p>it Italiano [Italian]</p>	<p>Con la presente (<i>Topcon</i>) dichiara che questo (<i>HiPer II</i>) è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.</p>
<p>la Latviski [Latvian]</p>	<p>Ar šo (<i>Topcon</i>) deklar, ka (<i>HiPer II</i>) atbilst Direktvas 1999/5/EK btiskajm prasbm un citiem ar to saisttajiem noteikumiem.</p>
<p>li Lietuvi [Lithuanian]</p>	<p>Šiuo (<i>Topcon</i>) deklaruoja, kad šis (<i>HiPer II</i>) atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.</p>
<p>nl Nederlan ds [Dutch]</p>	<p>Hierbij verklaart (<i>Topcon</i>) dat het toestel (<i>HiPer II</i>) in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.</p>
<p>mt Malti [Maltese]</p>	<p>Hawnhekk, (<i>Topcon</i>) , jiddikjara li dan (<i>HiPer II</i>) jikkonforma mal-tijiet essenzjali u ma provvedimenti orajn relevanti li hemm fid-Dirrettiva 1999/5/EC.</p>
<p>hu Magyar [Hungarian]</p>	<p>Alulírott, (<i>Topcon</i>) nyilatkozom, hogy a (<i>HiPer II</i>) megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.</p>
<p>pl Polski [Polish]</p>	<p>Niniejszym, (<i>Topcon</i>) , deklaruje, e (<i>HiPer II</i>) spenia wymagania zasadnicze oraz stosowne postanowienia zawarte Dyrektywie 1999/5/EC.</p>
<p>pt Português s [Portugues]</p>	<p>(<i>Topcon</i>) declara que este (<i>HiPer II</i>) está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.</p>
<p>sl Slovensk o [Slovenian]</p>	<p>(<i>Topcon</i>) izjavlja, da je ta (<i>HiPer II</i>) v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/ES.</p>
<p>da Slovensy [Slovak]</p>	<p>(<i>Topcon</i>) týmto vyhlasuje, že (<i>HiPer II</i>) spa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.</p>

fi Suomi [Finnish]	<i>(Topcon)</i> vakuuttaa täten että <i>(HiPer II)</i> tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
sv Svenska [Swedish]	Härmed intygar <i>(Topcon)</i> att denna <i>(HiPer II)</i> står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

WEEE Directive

Following information is for EU-member states only:

The use of the symbol below indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, to 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 a supplier where you purchased the product or consult.



Warranty Terms

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 a Topcon battery, charger, or cable is 90 days.



Topcon Positioning Systems, Inc.
7400 National Drive, Livermore, CA 94550
800-443-4567 www.topconpositioning.com



ISO 9001:2000
FM 68448

X-22 Installation and Calibration Manual
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