GeoMax Robot Notes

A Robotic Total Station (RTS) is one of the most important and most expensive equipment purchases that a surveyor will make.

These notes are updated to include commonly asked questions about the GeoMax Robots.

History

Total Stations were introduced in 1971 and combined a transit and an Electronic Distance Measurement Meter (EDM).

Robotic Total Stations were introduced in 1990 by Geodimeter and allowed a single operator (on the prism side) to accurately measure angle/distance to derive horizontal measurements.

The Lingo

EDM: (Electronic Distance Measurement) a device that uses a modulated infrared optical signals to measure distance. A good Total stations will measure distances to 3500 meters (2.2 miles) to 1 mm (0.003') + 1.5 ppm (parts per million). So a 1-mile distance might have a 0.01' accuracy.

Total station: an optical measurement device that combines an electronic theodolite (transit) with an electronic distance measurement (EDM) to measure slope distance and azimuth which is reduced by an onboard computer to rectangular coordinates.

Gun: slang for 'Total Station'.

Robotic Total Station: (RTS) a Total Station which is motorized, allowing for one-person operation.

Data Collector: hand or pole-held computer that allows the operator to remotely control a robotic total station. Includes a radio for communication with the instrument and software for controlling the robot and storing collected results.

I am confused by the different models, what are the differences?

There are 12 standard models generated by 3 configuration options:

GeoMax Robotic or GeoMax Servo

Accuracy: 1", 2" or 5"

Reflectorless Measurement Range: 500 meters or 1000 meters

Robotic vs. Servo

The servo model lacks the ability to scan a work area and automatically find a prism, so the servo model needs to be manually motored to find the target.

In the United States only robotic models should be considered.

Accuracy

Robots are factory configured as 1", 2" or 5" accuracy models. There is (approximately) a $1,500 premium for a 2" robot over a 5" gun; a $1,700 premium for a 1" gun over a 2" gun.

It is not possible to upgrade a robot after purchase.

Reflectorless Measurement Range

Robots are factory configured to have 500 meter or 1000 meter reflectorless range. (Reflectorless measurements are made by directly measuring a surface without the benefit of a prism.)

1000 meter range is approximately $750 more than 500 meter range.

It is not possible to upgrade a robot after purchase.

What accuracy should I purchase?

Total stations are typically available with angular accuracy from ½ to 10-arcsecond accuracy. The angular accuracy is complemented by the distance accuracy.

Zoom 90 Robotic Total Stations have three distance measurement modes:

Standard Mode:	less than 10 KM / 6.2 miles	1 mm + 1.5 ppm
Long Mode:	more than 10 KM / 6.2 miles	5 mm + 2 ppm
Reflectorless:	less than 1 KM / 3280 feet	2 mm + 2 ppm

We expect 0.01 foot accuracy for a 1-mile shot to a prism, assuming the temperature and pressure are accurately compensated.

Construction Applications

Because construction surveying does not make long measurements, 5-second accuracy is usually more than adequate for layout. Rarely does a construction application reach 400 feet. Setting the robot in the center of the job allows for a 200 foot maximum measurement:

Robot Angular Accuracy	Distance	Accuracy
5”	200 feet	**2/32 inch**
2”	200 feet	**3/128 inch**
1”	200 feet	**1/128 inch**
½”	200 feet	**1/256 inch**

5-second robots are adequate for almost all construction work.

Surveying Applications

For surveyors, longer shots might be more common. Here are angular accuracies for 1-mile shots:

Robot Angular Accuracy	Distance	Accuracy
5”	5280 feet	0.128 feet
2”	5280 feet	0.051 feet
1”	5280 feet	0.026 feet
½”	5280 feet	0.013 feet

Today, 1-mile shots are very uncommon for most survey work. GNSS RTK shots have obsoleted the need for long optical measurements. So 5” robots might be good-enough for modern survey work.

What reflectorless range should I purchase?

Reflectorless measurements allow you to make a measurement to objects without setting a prism. The object must be reasonably light colored.

The spot size that is measured is dependent on the distance from the gun. At 150 feet the spot size is approximately 0.02 x 0.07 feet.

Zoom 90's have two reflectorless range options: A5 and A10. The A5 has a range of 500 meters (1640 feet), the A10 has a reflectorless range of 1000 meters (3280 feet). The range must be specified when purchasing the instrument.

A10 robots are far more commonly purchased at all accuracies. If you choose an A5, make sure you understand the limit of 1,640 feet (500m) for reflectorless measurements. It is not possible to

What accessories should I purchase?

The Zoom 90 is sold in a kit that includes:

- The Robot in a hard-shell field case
- One battery with a battery charger, wall cord and cigarette adapter cord
- A tribrach attached to the bottom of the robot
- A long-range Bluetooth handle for connecting to the data collector
- A 1-GB Industrial Grade SD card (easily the most expensive SD card in the world)
- A ZPR 360 degree Prism

Most dealers include a prism pole to hold the prism, some dealers include a second battery.

In addition to the robot kit, you will need a data collector and a bracket to hold the data collector on the prism pole and a high-quality tripod for the robot.

iGage Zoom 90 kits include a pole and a second battery. Most of our data collector kits include pole and data collector brackets.

High Quality Tripod

You will also need a VERY HIGH QUALITY Tripod with screw locks or 'Lever and Screw Dual Locks'. Robots put high forces on the tripod when starting and stopping. Over a setup, the tripod must remain fixed. Do NOT use a metal tripod for a Total Station (Manual or Robotic) as your instrument will creep as the legs heat and cool.

Wood tripods rot and require careful storage. Fiberglass is heavy. Composite are expensive.

The Crain / SECO Tri-Max Tripods are an excellent choice for robotic use.

Should I purchase an extended warranty?

The short answer is yes.

A longer answer is: extended warranties allow you to fix the price of the instrument over a longer period of time. Zoom 90 robots include a standard 1-year factory warranty. During the first year if anything goes wrong (that is not your fault) you should expect your dealer to provide a loaner robot while your robot is being fixed.

Robot repairs are very expensive. They don't break very often, but there are a lot of moving parts and stuff happens.

Extended maintenance can be purchased anytime while the Robot is still in maintenance, however the best time to purchase maintenance is at the time of initial purchase.

1-year extended warranty	$ 636	total of two years from the date of initial delivery
2-year extended warranty	$1,140	total of three years from the date of initial delivery

During the first year, in the event your robot needs to return to the factory for warranty service iGage provides a loaner robot via 2-day shipping, the loaner will arrive cased and boxed with no accessories. A prepaid shipping label will be provided to return your robot directly to the factory for repair. When your robot is returned we will provide prepaid shipping to return our loaner robot back to us. You must provide 'Named Equipment' insurance for our gun or we are unable to supply you with a loaner.

What kind of insurance should I maintain on my Robot?

It is very important to maintain 'Named Equipment' or 'Inland Marine' insurance on your robot in case of non-warranty loss or damage. You need your Robot to be covered if it is stolen from a vehicle, from a motel room, from a job site, from your office, dropped or run over.

If you need your Robot to stay in business and you don't have the cash to replace it, you have to maintain complete coverage.

We will not finance Robots without Named Equipment coverage. We also won't provide loaners to you if you don't have coverage.

Data Collector Considerations

Communications: the radio

A variety of data-collectors and field software can be used with the Zoom 90's. Other robots may require a special radio or external radio in the data collector.

The Zoom 90 does not use a proprietary radio, a long-range Bluetooth radio built into the ZRT82 handle on the top of the instrument provides excellent range with standard Long-Range Bluetooth radios.

The range of this handle varies depending on the data collector. The best case scenario is 1800 feet.

Battery Life

GeoCom Licenses for 3rd Party Data Collectors

The GeoMax robots require a $700 GeoCom License (834476) for use with non-registered/approved data collectors. The Carlson Surveyor2, Carlson Mini-2, LT35 and T18 are compatible devices and do not require a GeoCom License. For this reason, if a customer is contemplating adding a GeoMax Robot at a later date, they should favor the purchase of a pre-approved data collector.

Recommended Data Collectors

iGage has three recommended Windows Mobile Data Collectors for use with the Zoom 90:

- Carlson Mini-2
- Carlson Surveyor 2
- Howay T18

All three are provided with Carlson SurvCE, pole and collector brackets bundled into a standard kit.

The T18 is available with and without an external Long Range Bluetooth antenna (must be specified at the time of purchase.)

Typically purchasing a data collector bundled with software will reduce the price.