



GeoMax Robot Notes

Rev: 2020.12

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

In addition to this document, iGage has three additional written resources worth reading:

- 'Zoom90_CR+_FirstCarlsonJob_Rxx' describes how exactly to setup and use a Zoom 90
- 'FAQ_Zoom90_CRx_CommonIssues_Rxxx' describes the most common user questions
- 'GeoMax_RobotPackages_2020Q4_Rxxx' a single page grid of options with real prices

Be sure to check out the iGage website for additional information:

<http://www.igage.com/Z90/index.html>

There are several nifty videos there that show Zoom 90 tracking in high traffic areas and power searching in urban conditions.

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 station 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.

Robot: slang for Robotic Total Station.

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 18 standard GeoMax models generated by 3 configuration options:

GeoMax Z90 Robotic, GeoMax Z90 Servo and GeoMax Zoom 70 (no Power Search)

Accuracy: 1", 2" or 5"

Reflectorless Measurement Range: 500 meters or 1000 meters

The Zoom 70 does not include the 'Power Search' function and is best suited for construction use where the standard search algorithm works well.



The Zoom 70 is available with or without the X-Pole prism (which has 5/8" 11 TPI threads on the top) and with or without a Long-Range Bluetooth Handle.

The price difference between the Zoom 70 (no Power Search) and Zoom 90 is minimal. Most survey/engineer users will want to only consider the Zoom 90 with Power Search.

Decide if you need 500 or 1000-meter reflectorless, then decide if you need 1" 2" or 5" accuracy.

The 5"A5 and 2"A10 are the most commonly purchased robots. iGage does not stock the 1"A5, we will upsell you to the 1"A10.

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. The Servo models are targeted at emerging markets.

In the United States only robotic models only should be considered by surveyors and contractors.

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 built with 500 meter or 1,000-meter reflectorless range. (Reflectorless measurements are made by directly measuring a surface without the benefit of a prism.)

1,000-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 1/2 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. It is not possible to upgrade the reflectorless range after purchase.

Battery Life

Expect each fully charged battery to last at least 5 hours under constant use. Two fully charged batteries are sufficient for a full day's operation.

What accessories should I purchase?

In the US Zoom 90's are sold in a standard configuration 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

Some dealers (including iGage) optionally include a second battery and a pole in their 'Kits'.

In order to be price competitive, iGage does not require that Zoom 90's be purchased kitted.



SurvCE, SurvPC, Field Genius or X-PAD?

In addition to the robot, 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 provides data collectors bundled with Carlson SurvCE/SurvPC, or the software alone.

Because of political considerations iGage does not supply MicroSurvey Field Genius, however FG is an excellent solution and works extremely well with the Zoom 90 robot.

In addition, we have robot bundles that include GeoMax X-PAD. X-PAD is the GeoMax supplied field software. It runs on most Android devices, supports GNSS receivers and manual Total Stations and is an excellent choice.

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 tripods are expensive. The GeoMax 8248660 Heavy-Duty Tripods and Crain / SECO Tri-Max Tripods are both excellent choices 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. iGage discounts maintenance that is bundled with the original sale:

1-year extended warranty	\$ 604	total of two years from the date of initial delivery
2-year extended warranty	\$1,083	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.

We strongly recommend purchasing the 1-year extended warranty (so 2-year warranty total) on robots that we finance. We don't want you paying for a robot that you can't afford to repair.

What about loaner robots during the warranty period?

Every Zoom 90 robot purchased from iGage includes 1-year iGage Advanced Loaner Program coverage:



During the first year, iGage will provide an advanced loaner robot while a defective device is tendered for **warranty** repairs. iGage prepays all shipping: UPS 2-day shipping to get a replacement robot to the customer quickly, prepaid shipping to return the defective robot to our repair depot, prepaid shipping to return the loaner device back to iGage. Customer is responsible for loaner loss and damage while it is in their possession. Customer will maintain insurance coverage on loaner.

Advanced loaners are only available for warranty service, the equipment manufacturer factory solely decides repair warranty status.

iGage Advanced Loaner coverage is provided on all robotic kits purchased from iGage and delivered in the United States (including Hawaii and Alaska) at no additional cost.

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 definitely need 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 over 4000 feet with special data collectors. The Surveyor2/Mini2 range is typically 1,200 feet, the T18 range is typically 950 feet. The Google Pixel 4a Android phone running X-PAD has a 2,000 foot range to the robot.

GeoCom Licenses for 3rd Party Data Collectors

2020 Update: GeoCom Licenses are NO LONGER AVAILABLE. You must use an 'approved' Windows Mobile device.

~~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.~~

GeoCom licenses are not required for Android or Windows 10 based tablets.

Recommended Data Collectors

The Carlson RT4 Tablet (see [RT4 Tablet \(iggps.com\)](http://iggps.com) for lots of details) is the recommended Windows 10 tablet device. Because Windows Mobile has been depreciated and has limited availability, we STRONGLY recommend using a Windows 10 tablet. The RT4 is the best rugged tablet that we know of. This tablet is also available as a Juniper Systems Mesa 3 and from Topcon.

iGage supplies two recommended Windows Mobile Data Collectors for use with the Zoom 90:

- Carlson Mini-2 (discontinued 2021)
- Carlson Surveyor 2

Because GeoCom keys are no longer available the Nautix X8 and other devices cannot be used.

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

If you have an existing data collector or existing data collection software, you may be able to use/upgrade and avoid duplicating existing equipment or software.

Power Search and Tracking Videos

The GeoMax Zoom 90's Power Search and Tracking abilities are amazing:

- False prism rejection
- Ability to hold tracking lock when vehicles pass
- Ability to reject reflective vests
- Tilted and skewed prism compensation
- AiM operation (ability to measure without robotically moving to prism center)
- Fast measurements (ability to measure on prism's in motion, even if close to robot)

There are some videos that highlight these functions [[here](#)]

Things to watch out for when purchasing a Zoom 90

iGage quotes Zoom 90 'kits' that include a GeoMax 360 prism, a prism pole, two GeoMax batteries, GeoMax charger and a hard case.

When comparing to other dealer's pricing, make sure that:

1. You are getting a GeoMax 360 prism: PN 832680 ZPR1 360 Prism. This prism has a suggested price of \$1,095. Sometimes an inexpensive 360 knock-off prism is substituted, these are commonly available from Amazon or eBay for around \$210. The inexpensive prisms are suitable for many purposes; however, a supplier should disclose that you are NOT getting the high quality GeoMax prism.

2. You are getting a long-range Bluetooth handle. It is possible to use the Zoom 90's internal Bluetooth, however the range will be greatly reduced.
3. If you purchase a 1" gun, make sure that it is provisioning it with the ZTR201 Advanced (heavy duty) tribrach.
4. The supplied batteries are GeoMax ZBA400 battery (PN 776093) and not an inexpensive 3rd-party knockoff. The GeoMax batteries are excellent quality and will have nearly full capacity after many charge cycles. List price for the GeoMax battery is \$230, knockoffs are available for as little as \$36. Knockoffs suffer from poor performance after only a few charge cycles.
5. You are getting a fully robotic Zoom 90. The Zoom 90 is also available in a 'Servo' model that does not track or search like the fully robotic Zoom 90.
6. You are getting a Zoom 90, not a Zoom 70. (We also stock Zoom 70 robots, but will fully disclose them on a Quotation.) The Zoom 70 does not have 'Power Search' and is suitable for some applications, however they are significantly less than a Zoom 90 and should not ever be substituted without full disclosure.
7. Have a clear understanding of the resources available if there is an issue with the robot.

GeoMax Zoom 90 Robot Repairs and Maintenance

First, before sending a robot in for repair or calibration, perform a standard field calibration. (See the Common Questions document.) Nearly all problems will be solved by a field calibration. We have stories of dropped robots being fully restored after a field calibration.

There are several repair depots in the USA. iGage **strongly** recommends that GeoMax Zoom 90 robots **only be sent to the factory in Jacksonville AR** (near Little Rock) for warranty and non-warranty service. Because of the probability of extremely long repair cycles at other providers, we **ONLY** use the factory for warranty work when we are providing Advanced Loaner devices.

Repair prices are nearly the same everywhere however the factory maintains the spare parts for all of the Americas. Literally ALL of the spare parts are at the factory depot. If your repair needs parts, they will have to come from the factory which will add additional time to service. It is ALWAYS faster to send the robot to the factory unless you are positive that the external depot has every part that would possibly be required.

In addition, the factory repair team is best qualified to work on your robot for both warranty and non-warranty work.

Current prices for GeoMax Factory service:

Zoom90 Basic Inspection USD \$500.00

Includes: 1) General Inspection, 2) Mechanical housing and optical cleaning, 3) Checking and adjusting bubble level and laser plummet, 4) Checking and adjusting Vertical and Horizontal angle, 5) Checking EDM measurements, 6) Service report.

We perform by GeoMax Service Program: First Readout, Incoming Test.

Not included: Spare parts, Calibration report, Particular maintenance if needed, Freight costs

Zoom90 Standard Maintenance USD \$795.00



Includes: 1) General Inspection, 2) Mechanical (housing & Hz axis) and optical cleaning, 3) Checking and adjusting bubble level and laser plummet, 4) Checking and adjusting Vertical and Horizontal angle, 5) Checking and adjusting automatic compensator, 6) Checking EDM signal, EDM alignment and measurement, 7) Firmware upgrade, 8) Checking data transfer, 9) Service report.

We perform by GeoMax Service Program: First Readout, Incoming Test, Theo-NLQ-EDM adjusting, Outgoing Test

Not included: Spare parts, Calibration report, Particular maintenance if needed, Freight costs

Zoom90 Extended Maintenance USD \$1660.00

Includes: 1) General Inspection, 2) Mechanical (housing, Vz & Hz axis and optical cleaning,) 3) Checking and adjusting bubble level and laser plummet, 4) Cleaning of H and V circles, 5) Checking and adjusting Vertical and Horizontal angle, 6) Checking and adjusting automatic compensator, 7) Checking and adjusting EDM signal, 8) EDM alignment and measurements, 9) Firmware upgrade, 10) Checking data transfer, 11) Service report, 12) Calibration report

We perform by GeoMax Service Program: First Readout, Incoming Test, Adj. Motor Get gear parameter, Cleanliness, Adj. Theo, Adj. NLQ, Adj. EDM, Adj. Aim360, Adj. NavLight, Adj. Scout360, Outgoing Test, Base line Test.

Not included: Spare parts, Particular maintenance if needed, Freight costs

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There is one important caveat to Zoom 90 service. If the case is punctured or severely damaged the robot will have to be sent to Switzerland or Singapore for repair because a required environmental chamber critical to repair is only available at these two locations. In this case, it may be more cost effective to just replace the robot.

Do not horse around with your robotic total station!