

## Model-30 Frequently Asked Questions

**1. What are the differences between the Roto-Lok<sup>®</sup> Drive and Worm Drive systems?**

Answer: The Model 30 currently has two different drive trains. The worm drive system uses stepper motors and a 60:1 worm drive to achieve high torque at low cost. The system does have up to 8 arc-minutes of backlash in each axis, which will be a factor in some applications. The drive system will accommodate heavy payloads and very high payload inertia, but at lower slew rates than the Roto-Lok<sup>®</sup> drive system. An encoder on the motor shaft provides high positional resolution, particularly for payloads that are counterweighted to drive out the backlash.

The Roto-Lok<sup>®</sup> drive system uses Sagebrush Technology's patented drive technology to provide low friction, high positional accuracy and zero backlash. Servo motors provide very high acceleration and slew rates with minimal backlash. This system also incorporates encoders on each motor shaft to obtain high positional resolution. The Roto-Lok<sup>®</sup> drive system was designed to permit gyro-stabilization for shipboard or vehicle applications.

**2. What is the accuracy of the Worm Drive?**

Answer: Pointing accuracy in the worm drive system can be as high as a couple of encoder counts and as low as the amount of backlash in the gearbox. Accuracy is highly dependent on the balance in the payload. The worm drive system includes an encoder on the motor shaft and operates with a closed-loop controller. The encoder has a positional resolution of 0.0015 degrees in the output space. When operated as a unidirectional system (always approaching a point from the same direction) the repeatability is 0.002 degrees. In bi-directional operation, the repeatability is approximately 0.012 degrees. These measurements were taken in a static environment without wind loading. Vibration or wind loading can induce motion within the limits of the gimbal backlash and affect the accuracy of the system.

**3. How does an imbalanced payload help the Worm Drive system?**

Answer: The elevation axis in particular can benefit by an imbalanced payload. By weighting the payload at the front or back, gravity can be used to drive out the backlash. Our tests have shown that in elevation, bi-directional repeatability improves to nearly equal the unidirectional repeatability with an imbalanced payload.

**4. I can operate the Worm Drive on 24V or 48V. Which is better? Do I need to specify?**

Answer: The worm drive accepts any input voltage between 24 VDC and 75VDC, so there is no need to specify the voltage when ordering. Our testing has shown that performance, particularly the slew rate, improves with voltage. In addition, testing has shown that motor resonances at 24 Volts can adversely affect the gimbal performance. These resonances are significantly reduced at 48 Volts and above. All of the published performance specifications are at 48 Volts.

As an option, the gimbal can be configured to work on 120 or 220 Volt AC power, using an integral 48 Volt DC power supply.

**5. How do I communicate with the gimbal?**

Answer: We provide a serial interface and GUI or terminal window for use on a PC to control the gimbal using our electronics. This is adequate for many users. We also provide the command message format for users who want to integrate the gimbal commands into their programs. We also support a joystick connected directly to our electronics.

**6. Since I have my own computer, I might want to bypass your processor. Can this be done, and what are the pros and cons?**

Answer: It can be done. We have customers who started out using our electronics and then transitioned to their own controller. We also have customers who buy our drives for integration with their own motors and controls. The biggest advantage is that you can customize the software to your application and eliminate the overhead of passing position commands to our controller. You will also have more flexibility in customizing the control algorithms if you have all of the inputs and outputs available to you.

Nearly all of the drawbacks that our customers have seen involve driving the gimbal against the stops at the limits of travel and breaking things. This situation usually occurs during initial integration of the software and during loop tuning as you are working out the bugs in your software.

Our electronics are mounted in the elevation and azimuth housings of the gimbal, and with the exception of power and serial communications all of the wiring is internal to the gimbal. If your long-term intent is to use your computer in place of our electronics, we can supply a loopback connector that brings the necessary signals to the azimuth housing. With the loopback connector in place, the signals are sent to our electronics. With the connector removed, the signals will be available to your computer. We will provide a drawing of the cable pin-out so that you can build an interface cable between your computer I/O and the gimbal.

Please understand that our warranty is limited to gimbals operated using our electronics and software. Gimbals sold without electronics or gimbals

converted to third-party electronics do not carry a warranty against damage caused by your controls.

**7. I need to mount everything on an optical bench, which has 1/4-20 holes in a 1-inch grid. Can it be delivered ready to mount? Do I need to worry about any cable lengths?**

Answer: We can provide an interface plate that will connect to the gimbal base and to the bolt pattern on the optical bench.

Using our electronics at the gimbal, cable lengths are not an issue until you reach the limit of your serial communications link.

**8. What is the allowed range of motion in Azimuth and Elevation?**

Answer: The standard range of motion is as follows:

AZ: +/-150 degrees, EL: +95, -30 degrees

The bolt pattern between the payload shelf and the elevation shaft is designed to allow the customer to change the orientation of the payload shelf in order to change the range of motion in elevation.

The limit switches are easily adjusted at the factory. Because of the yoke configuration, the range of elevation motion is usually limited by interference between the payload and the yoke. We work with all of our customers to maximize the range of motion and can configure the gimbal in the factory to ensure that the payload does not hit the yoke.

**9. What if I need continuous rotation in Azimuth?**

Answer: The Worm Drive version of the Model 30 can be modified for continuous rotation by adding slip rings in the azimuth housing and changing the controller configuration. Please note that continuous rotation systems require an export license.

**10. I need to center my payload on the intersection of the Azimuth and Elevation axes. Can this be done on a Model-30?**

Answer: Yes. The gimbal is designed so that the payload can be centered on both axes. The size of the payload will determine what the range of motion in elevation is possible once the payload is properly centered.

**11. My application requires a joystick interface. How would that work?**

Answer: Our servo board set on the Roto-Lok<sup>®</sup> version supports an “Industrial Mouse” type joystick as a stand-alone control wired directly to the gimbal. It does not directly support a PC style joystick, but you can write your own software to interface a PC joystick through a computer using the current control boards and the protocol information in the User’s Manual.

The loop controller used on the Worm Drive also supports a joystick interface, which is configured as analog inputs to the elevation and azimuth controllers.

You can write your own software to interface a PC joystick through a computer using the current controller and the protocol information in the User's Manual.

**12. Is there any particular limitation with the RS-232 cable? We assume the connection can be run up to 5 meters.**

Answer: The standard rules for cable distance on RS-232 communications apply. A five-meter cable should not be a problem. Depending upon the baud rate and number of commands being sent, some customers have had problems with time lags due to the volume of data being transmitted.

**13. Once I select RS-422 or RS-232, can it be changed back to the other if I change computers?**

Answer: Where there is a need to switch between the communications formats, we would recommend that the gimbal be delivered with RS-232 communications. The customer can purchase commercially available converters that can be installed on their incoming data line to convert from RS-422 to RS-232 when necessary.

**14. Does the Model 30 come with an Ethernet interface?**

Answer: No. We don't support Ethernet communications.

**15. Do you have experience relating to your pan & tilt units installed on a ship or in a coastal environment?**

Answer: We have designed the Model 30 to be suitable for a variety of environments. The following features are included in the standard gimbal:

1. White powder coating
2. Weatherproof connectors for power and data wiring
3. Gaskets and/or seals at all openings
4. The gimbals are sealed to the IP65 standard

**16. Are the gimbals submersible? Do they meet the requirements for explosion-proof operation?**

Answer: The answer to both questions is no – for off-the-shelf versions of the Model 30. We would be happy to look at specific application requirements and develop a customized solution.

**17. Can you ship the Model 30 anywhere in the world? Is an export license required?**

Answer: We can ship to any country that is not the subject of a trade embargo by the United States Government. Under most circumstances, no export licenses are required for Model 30 gimbals, but we are required to keep records of the end users and end-user applications for gimbals shipped to foreign countries. We cannot ship to persons or entities that have been denied export privileges by the

United States Government. An export license is required for continuous rotation gimbals. For these products we will require end-user documentation prior to offering a proposal.