J-Systems
Industrial IP Video Solutions

APPLICATION WHITE PAPER

Some Considerations When Selecting a Pan-Tilt Positioner

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Selecting the right pan-tilt positioner for your application involves evaluating multiple factors such as

- **Weight Carrying Capacity**
- **Price**
- **Voltage & Power Requirements**
- **Accuracy (Relative vs Absolute Positioning)**
- **Protocol & Communications**
- **Reliability**
- **After Sale Manufacturer's Support**

Most importantly are the project requirements that will dictate the specific type of positioner that will be required. The selection process can get complicated, and it is important to work with a supplier that is willing and able to address questions from a supportive approach.

This White Paper has been authored to help choose the most suitable pan-tilt positioner while achieving the best value-proposition.

Let's get started.

CARRYING CAPACITY:

It is extremely important to fully understand the mechanical load (physical size and weight) that will be attached to the top plate or side arm of the pan-tilt positioner. Generally, the carrying capacity is more critical for the tilt (elevation) axis than the pan (azimuth) axis. The tilt axis is required to lift the load from a potentially tilted down position.

Most, but not all, pan-tilt positioners specify a weight carrying capacity such as 10 lbs. over-the-top. This generally means the pan-tilt positioner can lift a 10 ft-lb load. This can be thought of as a 10 lb. weight mounted above the center line of the tilt axis by 1 ft. If your load has a large surface area like a dish antenna, you must also take wind loading in to account when you calculate the load capacity.

The physical size of the load is also important as it may need to be mounted on the top plate in such a way that it can be tilted over without running into a stationary object such as a mounting platform for the pan-tilt positioner.

In every instance, if it is not clear how to size the load in relation to the pan-tilt positioner, this is when assistance should be requested. Nothing can damage a pan-tilt positioner quicker than having it overloaded or when the load runs into a stationary object like a wall. A stalled DC drive motor will draw maximum stall current and could eventually burn out if the controller does not protect against this.

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PRICE:

Please keep in mind that "low price" does not always provide the best "value". A low-cost pan-tilt positioner that fails after 2-3 months, or even a year, may end up costing more to replace than the original price paid.

Remember, "value" can be defined as "…the importance, worth, or usefulness of something…". This definition implies that something which works as it is intended to, over a long period of time, has "value". This analogy applies to selecting the right pan-tilt positioner that offers the best "value" for the long term.

This point will be discussed more when we talk about reliability.

VOLTAGE & POWER REQUIREMENTS:

There are a variety of pan-tilt positioners which run on 220VAC, 115VAC, 24VAC, 24VDC and 12VDC. Depending on the application and the location, some type of power source might already exist that needs to be utilized. This can range from a solar power battery system to 12VDC vehicle power.

In general, 12VDC is the easiest source voltage to generate and the most flexible to convert to other voltages as required. In some cases, PoE (power over Ethernet) is another possible power source allowing for a single cable to carry both power and data.

ACCURACY:

For many applications accuracy may not be critical when using a camera to view a large area with a wide-angle lens, i.e. moving the pan-tilt positioner from one preset to another. However, when a large focal length lens (100mm and up) is involved more accurate repeatability between presets is necessary.

Accuracy generally refers to the precision a device can achieve for a position. As an example, 90, 90.1, or 90.01 degrees all represent different levels of precision. The direction with the most decimal places is considered more accurate while the one with no decimal places displayed is the least accurate. Accuracy and repeatability are directly related to the type of position feedback device built into the positioner.

There are many types of position feedback techniques in use today including 5K analog potentiometers, PWM magnetic encoder and optical encoders. There is both a cost and operational consideration for each type. Potentiometers are low cost and low accuracy while optical encoders tend to be more precise and considerably more expensive.

So, the question that needs to be answered is what is required for the application? If the requirement involves simply looking at camera views to gain situational awareness, potentiometers should be adequate. If there is a need for precise, preset repeatability of +/- 0.01 degrees, PWM encoders would be a good choice. If the goal is to aim a radar dish or directional beam antenna, the use of optical encoders would be the best choice.

Another consideration is Relative vs Absolute positioning. In simple terms, relative positioning simply implies if the device is moved 45 degrees in one direction, it has moved 45 degrees from where it started with no relationship to magnetic north. Conversely, absolute positioning implies movement in relation to magnetic north. The most common and least expensive method is relative positioning. It should be noted that if a pan-tilt positioner is mounted to orient with zero or 360 degrees as North, it can function as a pseudo absolute positioner.

Further, be aware that some positioners, depending upon their position feedback devices, will re-calibrate themselves every time the power is cycled. In some cases, this is of no importance to the end user, but in many cases (especially remote operations when power is turned on and off), this may be very undesirable.

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PROTOCOL & COMMUNICATIONS:

This relates directly to the method used to control the positioner's pan and tilt. The simplest method involves using a wired RS-485 or Pelco D capable joystick.

Some IP cameras output RS-485 Pelco D protocol which allows the end user the ability to control the positioner from inside the camera's web interface.

In some cases, a USB joystick can be connected to your NVR (network video recording) software. This requires the positioner to be ONVIF compatible (Open Network Video Interface Forum). This also implies that the positioner must be an IP based controller which can be controlled across an IP network such as the Internet.

ONVIF is the industry standard method for integration between IP-based physical security devices and NVR platforms. Choosing a pan-tilt-positioner that is ONVIF compliant means that a fixed box camera will appear as a unified pan-tilt enabled camera.

3rd party control of a pan-tilt-positioner platform is very important consideration. If there is a need to control the positioner from custom designed software, having access to a clearly documented REST API is critical. A good example of this is with thermal imager cameras and industrial monitoring applications utilizing custom software.

RELIABILITY:

This is a critical aspect when selecting a new positioner and helps to establish true "value".

Reliability relates to how long a positioner will operate without any type of scheduled maintenance or failure. This success is directly related to the materials used in both the positioner, gears, and electronics.

Selecting a positioner for an outside application must be done carefully. Many PTZ dome cameras, as an example, require heating and cooling to survive both very cold and hot temperatures. This not only requires more power at your location but presents an additional reliability risk. This simply means that when the heating or cooling systems fails inside the PTZ dome, the life of the camera and positioning elements are at risk of failure near term. It is prudent to choose a positioner that does not require any heating or cooling and can function for years in -30C to +60C temperatures in all types of weather.

Gears are a known failure point in many positioners. Many low-cost foreign made positioners use cheap, molded plastic gears. Even the slightest mechanical overload on a plastic gear train can result in catastrophic gear teeth failures. Units that use pre-hardened stainless steel or steel gears have a much better chance of surviving in rugged environments.

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One example system we supplied was for a wireless, remote weather station in the Canadian Rockies – only accessible by helicopter. The positioner held a camera to both monitor weather as well as avalanche potentials (at the top of the tower in the below image). At this location, the ambient temperatures regularly reached -40F in the winter. The device has worked successfully with no failures for over 10 years.

JPTH-13MPoE Positioner on Top of a Weather Instrumentation Tower in the Canadian Rockies - Canada

AFTER SALE SUPPORT:

If you purchase a quality positioner that offers a history of high reliability in the field, after sale support and factory service may never be required. However, if you purchase a low-cost bargain positioner, it's important to recognize that after sale support may be lacking or non-existent. In a similar manner, repair service and/or spare parts may also be an issue or unavailable.

An imported positioner may cost less up front but may ultimately prove to be a very poor "value" after the sale for all the reasons noted.

SUMMARY:

While this White Paper has not covered every aspect of the selection process for a hardened, outdoor positioner, we hope it has provided some insight into helping you ask the right questions.

J-Systems, Inc. has been designing, building, and supporting hardened, all-weather positioner for the past 15 years. These positioners have been deployed to frigid mountain tops, ships, vehicle mounted surveillance systems and many other harsh duty applications.

Please feel free to give us a call with your next positioner application; we believe you will be happy you did.

Thank you,

J-Systems Team

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PS – Here's a few more questions you need to consider when selecting your Pan / Tilt positioner.

- What materials are used to manufacture the positioner?
- Is Loctite used to secure all hardware during manufacture?
- What type of motors are used (servo, DC brushed, AC etc)?
- Does the positioner remember its position after a power failure?
- What level of maintenance is required and how often?
- Is the unit sealed to IP68 standards?
- Warranty period?
- Physical size of the positioner?

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