

Inertial-Stabilization Module

Low-Cost Line of Site Stabilization

Better Image Quality From Moving Platforms

The Inertial-Stabilization Module (ISM) is a modular sensor processing unit that adds stabilized line-of-site (LOS) pointing capability to Directed Perception pan-tilt units (PTU). The ISM enables stabilized pointing of video cameras, lasers, spotlights, antennas, and other payloads. It allows steady aiming during boat, vehicle, aircraft, or tower motion due to wind, waves or terrain. The ISM can dramatically improve image and communications link quality by automatically maintaining steady alignment.

A system consists of the ISM attached to a gyro-enabled pan-tilt unit and a host application connected via the serial interface. The ISM uses a "strapdown" design, with a full 3-axis gyro embedded in the pan-tilt unit for simplified integration and installation. Alternative gyros can be supported to meet specific application and cost/performance requirements.

Stabilization operates as an additional pan-tilt control mode and is compatible with existing pan-tilt control applications. When stabilization is turned off, the ISM passes pan-tilt commands directly to the attached pan-tilt unit. When stabilization mode is on, the ISM reads inputs from the gyro sensor and commands the pan-tilt to maintain the stabilized pan/tilt angle, compensating for vehicle or platform motion. The ISM allows real-time control of the pan-tilt during stabilization allowing video tracking, radar slew-to-queue, and operator joystick control.

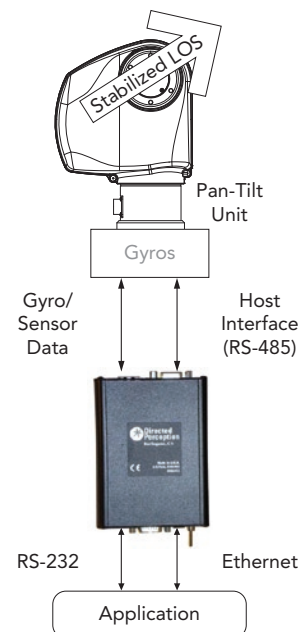
Breakthrough Cost/Performance

Until now, stabilized pointing platforms typically have been used in very specialized applications due to their high cost (hundreds of thousands of dollars) and lack of flexibility to accommodate different payloads. The ISM provides impressive performance at cost points that are an order of magnitude lower than previous systems, allowing stabilization to be used in a much broader range of applications. The stabilization provided by the ISM allows the use of higher zoom cameras and is critical for operation of automated video tracking and detection systems aboard moving platforms.



Open Architecture Simplifies Integration for OEMs

The ISM's open architecture and powerful feature set allows OEMs and integrators to quickly implement complex applications and products that include stabilized pointing of your payload. The ISM is tightly integrated and tested with Directed Perception Pan-tilt units to minimize development risk and time. The ISM offers a rich command set to support integration with operator consoles, radar inputs, video tracking systems, and more. This building-block approach allows OEMs and systems integrators to meet a wide range of application requirements at the lowest total system cost.



General Features

- Modular, compact, fully integrated
- Strapdown 3D gyro design
- Real-time control while stabilized (tracking, slew-to-queue)
- Compatible with most Directed Perception Pan-Tilts
- Simple setup and operation
- Stabilized Line-of-Site (LOS) Pointing
- Supports standard PTU and stabilized pointing commands

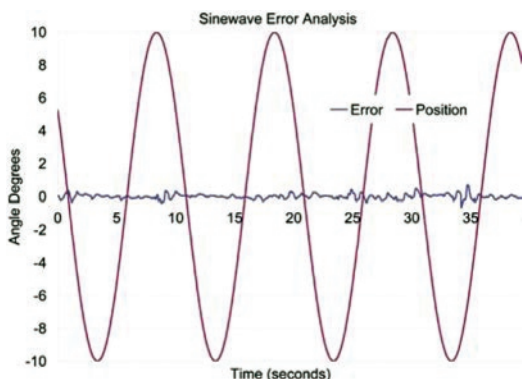
General Features

A built-in webserver and set of web pages are accessed via the Ethernet interface to configure the ISM stabilization functions. Commands are accepted over the ISM's Host interface (RS-232) using the supplied C API software. The ISM connects to the Pan-tilt unit (PTU) Host Interface (RS-485) and to a gyro sensor that provides platform motion data. Standard pan-tilt commands are passed directly through to the pan-tilt unit. Turning on stabilization mode causes the ISM to command the pan-tilt to maintain the current angle using gyro inputs and moving the pan-tilt to compensate for platform motion. Certain pan-tilt commands are accepted during stabilized mode and serve to offset or modify the current pointing angles being maintained by the ISM.

Performance

Stabilized pointing performance is characterized by (a) the error between actual and commanded pointing angle and (b) the range of platform motions over which the stabilization system will perform. Primary performance limitations stem from (1) gyro accuracy and (2) the ability of the pan-tilt to respond. The graph below shows the stabilized pointing error for a controlled sine-wave motion input. The error under this condition is $<0.25^\circ$. This error figure is dominated by the gyro sensor error.

Real-world platform motion is more complicated than a sine-wave. Actual system performance will depend on payload inertia and the actual platform motion frequencies. The ISM strapdown gyro design allows the system to reacquire the line-of-site after a momentary disturbance that goes beyond the capabilities of the pan-tilt to respond.



Stabilization

Type	2 Axis (3-axis strapdown gyro, no roll compensation)
Range	Full pan-tilt range of motion
Sine-wave Stability Error	$< 0.25^\circ$ sine-wave test (see graph)
Typical Stability Error	$< 1^\circ$ under real platform motion
Slew Rate	Up to pan-tilt maximum
External Control	Accepts pan-tilt commands while stabilized
Max Payload	Application dependent - up to pan-tilt maximum

Inertial-Stabilization Commands

Stabilize On/Off	Engage/disengage stabilization
Pan Absolute	Pan to given absolute position
Pan Relative	Pan to given offset position
Tilt Absolute	Tilt to given absolute position
Tilt Relative	Tilt to given offset position

Connections & Communications

Applications	Configuration (Ethernet), Application (RS-232)
Pan-Tilt/Gyro	Pan-Tilt Host (RS-485), gyro sensor (RS-232)

Mechanical & Environmental

Weight	Configuration (Ethernet), Application (RS-232)
Dimensions	3.23" x 1.3" x 4.7"
Operating Temperature (Pan Tilt)	See pan-tilt data
Operating Temperature (ISM)	0° to 70°C (-40° to $+85^\circ\text{C}$ option)
Non-operating Temperature	0°C to 70°C

Power Requirements

Input Voltage	9-35VDC
Power Consumption	1.5W, 51mA @ 30VDC (typical max)

System Requirements

Directed Perception pan-tilt with compatible gyro option

Specifications subject to change without notice.



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