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RobotEye Vision REV25-ST
3-Axis High Performance Stabilized Vision System

Product Datasheet

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The RobotEye Vision REV25-ST is a 3-axis high performance stabilized vision system combining the REV25's unprecedented motion bandwidth with an extremely low latency stabilization control loop. RobotEye Stabilized Vision systems are conceptually similar to conventional stabilized 3-axis stabilized gimbals systems in that they both effect the stabilized pointing of cameras about three axes, but that is where the similarity ends.
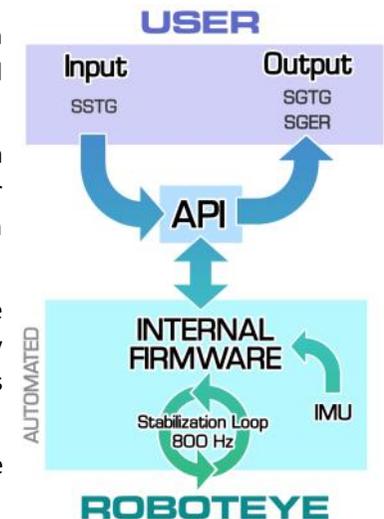
RobotEye Vision systems deliver ground breaking capabilities in camera pointing with dramatic implications for many existing directable camera applications while also enabling new applications not previously possible. The REV25-ST couples the unique ability of RobotEye Vision system's to steer the view of cameras at incredible speed and precision with extremely low latency firmware level stabilization that operates independently of motion commanded by the host.

As with other RobotEye Vision system's the REV25-ST system aperture can be controlled in a variety of ways to accomplish a wide range of tasks. The REV25-ST allows stabilization to be enabled or disabled as required during operation. Stabilization operates in firmware in a layer underneath highly dynamic motion commanded by the host through the RobotEye API. Due to the extreme stabilization bandwidth delivered by the REV25-ST, regardless of demands placed on the system by higher level behaviours stabilization of the system aperture continues uninterrupted.

With the REV25-ST, Ocular Robotics has delivered a stabilized camera system unmatched in performance in its class. Key features particular to the REV25-ST are:

- *3-axis stabilization* - Not only is stabilization about three axes rare in a form factor comparable to the REV25-ST, the REV25-ST delivers stabilized motion about yaw, pitch and roll$_1$ at the high levels of performance characteristic of RobotEye Vision systems.

- *Operate in a Global Coordinate Frame* - When stabilization is active on the REV25-ST, pointing commands are issued as roll-pitch-yaw Tait-Bryan angles in a North-East-Down reference frame. The REV25-ST has ample motion bandwidth to simultaneously stabilize and execute complex behaviours such as, track, even multiple objects or build maps. The ability to issue the motion commands needed to execute these behaviours in the global coordinate frame and recover information about the current orientation of the system aperture in the same global frame is invaluable for users and application developers.

- *Bounded IMU Drift* - The AHRS used in the REV25-ST uses Magnetometers and MEMS Accelerometers in addition to MEMS Gyroscopes. This additional information enables our stabilization system to bound drift in all three rotational axes, as compared to the 2-axis bounding possible with Gyro/Accelerometer systems, or the unbounded drift from a Gyro-only system.

- *Camera Choice Flexibility* - As with the REV25 Vision system the REV25-ST also allows complete freedom to attach any C-mount camera to the REV25-ST that is needed for your application. Whether your camera is the size of a brick or a matchbox, 50 grams or 5 kilograms there is no difference in the pointing dynamics attainable with RobotEye Vision systems. Ocular Robotics is able to install a wide selection of cameras from the Allied Vision Technologies range or the user is free to install and use their own camera of choice.

1. Roll is delivered as an image rotation correction parameter

RobotEye Vision REV25-ST Specifications

Mechanical		Electrical	
Maximum Aperture Rate	10,000°/s*	Communication	Ethernet
Maximum Aperture Acceleration	100,000°/s^2	Supply Voltage	24VDC
Azimuth Axis Resolution	0.010°	Power Consumption — Typical (average)	< 40W
Elevation Axis Resolution	0.010°	— Maximum (transient)	200W
Azimuth Range	360° Continuous		
Elevation Range	70° (±35°)	Optical	
Accuracy	0.05°	Optical Field of View (diagonal)^	40°
Weight (Unit/System)	1.6kg/2.5kg	Optical Port	C-mount
Inertial**		Software	
Stabilization Update Frequency	800 Hz	RobotEye C++ Development Library	Windows/Linux
Maximum Angular Rate	±2000 °/s		
Static Accuracy (pitch/roll)	0.5 °	Environmental	
Static Accuracy (heading)	2.0 °	Operating Temperature Range^^	-20°C - +70°C
Angular Resolution	< 0.05 °	IP Class Rating^^^	65
Repeatability***	< 0.2 °		

* At the maximum acceleration rate of 100,000°/s^2 more than a full rotation is required to reach 10,000°/s aperture slew rate.

** See full details in REV25-ST user manual

*** Extended temperature calibration IMU option available for calibrated operation across –40°C to 85°C range

^ See details under Imaging Options in following pages

^^ Does not include temperature rating of the camera used with the system

^^^ IP Rating valid only when supplied in an enclosure as shown in the adjacent image and both supplied power & optionally supplied weatherproof Ethernet cable connectors are fitted

Specifications are subject to change without notice

Software

RobotEye C++ Development Library — The REV25-ST ships with a fully documented C++ class library for both Windows and Linux that can be used to simply and quickly interface to the REV25-ST stabilized vision system enabling rapid development of applications that control the higher level behaviour of an REV25-ST. These user applications are able to run while the underlying stabilization behaviour continues uninterrupted. The library provides access to the entire range of REV25-ST features and its reference manual is available from the Downloads page of the Ocular Robotics website.

The RobotEye C++ Development Library and the REV25-ST support both stabilized and standard RobotEye operation and the RE25-ST is able to switch between these modes at any time. The points below concentrate on the core stabilization specific commands. For information on standard mode commands refer to the RobotEye Development Library Reference Manual.

- *StartStabilization/StopStabilization* - These two commands provide the method to go into and out of stabilized mode. When in stabilized mode motion commands are issued in a World (North, East, Down) reference frame while in standard mode motion commands are issued in the RobotEye frame.

- *SetStabilizedTarget* - This command gives effect to any motion required relative to the current stabilized aperture orientation at any time. While the underlying stabilization framework is tasked with holding the system aperture at some orientation in the world frame regardless of how the RobotEye body itself is moving, the *SetStabilizedTarget* command allows the system aperture to be pointed relative to the current stabilized direction. From this command the familiar high performance RobotEye behaviours like tracking, multi target tracking, mapping etc. can be overlayed on the REV25-ST's core stabilization behaviour.

- *GetStabilizedTarget* - Like the standard *GetApertureAngles* command, this command recovers the aperture direction at any time. The difference between the two however is that *GetStabilizationTarget* reports the aperture angle in the world frame while the standard *GetApertureAngles* command reports in the RobotEye body frame. This command plays a critical role in tracking, image registration and similar operations.

Control & Communication

The REV25-ST requires a 24VDC power connection, a 100 Megabit Ethernet connection for control and a suitable connection for the chosen camera. Communication with and control of the REV25-ST is achieved via the system's Ethernet port. Full control over the motion of the system aperture and system feedback including current aperture orientation is enabled through the RobotEye C++ Development Library. The connection to the camera is typically made to the computer which is controlling the REV25-ST so that application software can efficiently coordinate the behaviour of the REV25-ST and the camera.

Robustness

The RobotEye Vision REV25-ST has been designed to operate in the harshest environments. RobotEye systems have a natural immunity to shock and vibration transmitted through the platform to which they are attached making them ideal for extended service on ground, surface and air vehicles and other mobile equipment. This is achieved because the moving components in RobotEye systems are lightweight and supported at their periphery. In contrast to pan-tilt and gimbals systems have relatively large masses supported on shafts which under shock and vibration drive large forces back through the drive train shortening their serviceable lifetime. Other factors contributing to reliability of the REV25-ST include:

- The absence of any slip rings in the system which is due to the fact that all electronics including the camera remain completely stationary during operation eliminating the need to pass electrical signals through rotating joints.

- The camera, motors and all electronics are located below the blue mounting flange as seen in the image on the adjacent page in a single enclosure or internal to the platform on which the REV25-ST is mounted simplifying environmental protection.

Imaging Options

As with the REV25 vision system the REV25-ST offers the freedom to use any C-mount camera of your choice. The REV25-ST is offered with an option for wide or narrow field optics which enable the user to select the optical arrangement that best suits their chosen camera and their application. The adjacent table gives approximate fields of view for both wide field and narrow field optics when combined with common 4:3 aspect ratio CCD sizes.

The RobotEye Vision REV25-ST's field of view specification assumes a camera with a 2/3" CCD. The table below shows approximate diagonal fields of view for cameras with different (4:3 aspect ratio) CCD's

CCD Size	Diagonal Field of View	
	Narrow Field Optics	Wide Field Optics
1/4"	10°	15°
1/3"	15°	22°
1/2"	19°	29°
2/3"	27°	40°

System Customization

Supply to OEM's and integrators is an important part of the Ocular Robotics business and as such customization of our standard offering to meet the needs of particular applications or operating environments is central to our operations. Whether it is tailoring for operation in a particular service environment, enhancing performance specifications, altering the optical path characteristics or a complete ground up design for a particular application, all of these things can be achieved while retaining the trademark dynamic performance and other benefits of the RobotEye technology. Please contact Ocular Robotics for more information.

Standard System Components

- RobotEye Vision REV25-ST stabilized camera pointing head
- RobotEye control system boards
- Interconnecting cables
- 5 metre power cable

Optional System Components

- Choose from a range of AVT camera options, mounted and integrated into the REV25 system, see the Ocular Robotics website for details.
- Extended temperature range IMU calibration
- System enclosure with RobotEye head, IMU, control system and cables installed
- 10 metre weatherproof Ethernet cable

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