



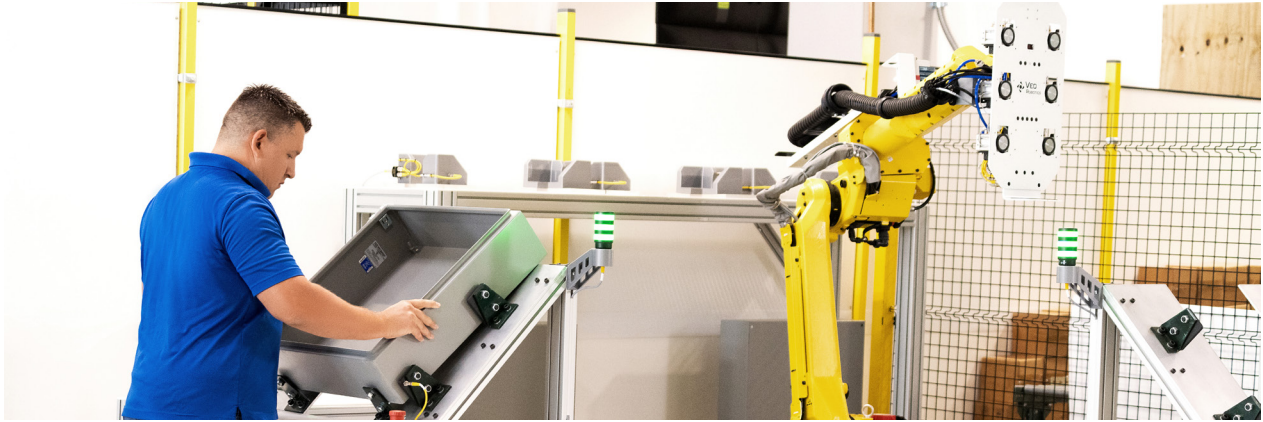
FreeMove[®]

Responsive Machines For Flexible Factories

 **VEO**
ROBOTICS
www.veobot.com • sales@veobot.com

Veo FreeMove®

3D Safeguarding For Human-Robot Collaboration



Applications that require the speed and strength of industrial robots increasingly also require human dexterity and versatility. FreeMove® from Veo Robotics is a comprehensive 3D safeguarding solution that reduces the cost and complexity of human-robot collaboration.

Veo FreeMove® is a 3D safety system for industrial workcells with human-robot collaboration. FreeMove® monitors workcells in 3D and implements dynamic Speed and Separation Monitoring (SSM) as defined by ISO 10218-2:2011 and ISO/TS 15066:2016, enabling safe interaction between humans and robots. FreeMove® is TÜV Rheinland certified to PLd, Category 3 as described in ISO 13849-1:2015.

The FreeMove® system includes 3D time-of-flight sensors (FreeMove Sensors®), custom computing platform (FreeMove Engine®) and a software suite for installation and configuration (FreeMove Studio®).

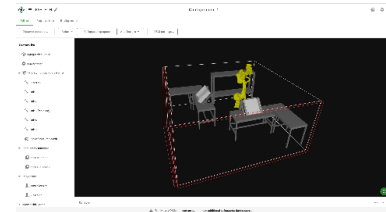
Using 3D image data from the FreeMove Sensors®, the FreeMove Engine® identifies places where a human could be. It calculates possible future robot positions and signals the robot to stop by sending safety outputs that indicate if the robot is closer to a human than the Protective Separation Distance (PSD). When the PSD violation is cleared, FreeMove® allows the robot to safely restart.

Key Features of FreeMove®

- Certified to PLd, Category 3 as described in ISO 13849-1:2015
- Implements Speed and Separation Monitoring (SSM) as defined in ISO 10218 and ISO/TS 15066
- Dynamically determines if the robot is closer to a human than the Protective Separation Distance (PSD) based on the 3D state of the safeguarded space
- Responds to a PSD violation by issuing a dual channel safety output signal to indicate whether the robot should stop
- Static Hazards feature can be used to safeguard additional non-robot hazards
- Tracked Objects and Dynamic Blanking Zones features can be used to blank large objects such as workpieces so they do not trigger PSD Violations

System Components

Powerful Software Running On Fail-Safe Hardware



FreeMove Sensors®

Wide FoV, long range 3D Time-of-Flight sensors (1 to 8) with dual imagers enabling per-pixel validation

FreeMove Engine®

High-performance industrial computer with dual motherboards checked by safety processor, which processes sensor data and interfaces with the robot and other hazards

FreeMove Studio®

A browser-based application which runs on a standard PC that allows configuration of FreeMove®

Technical Details

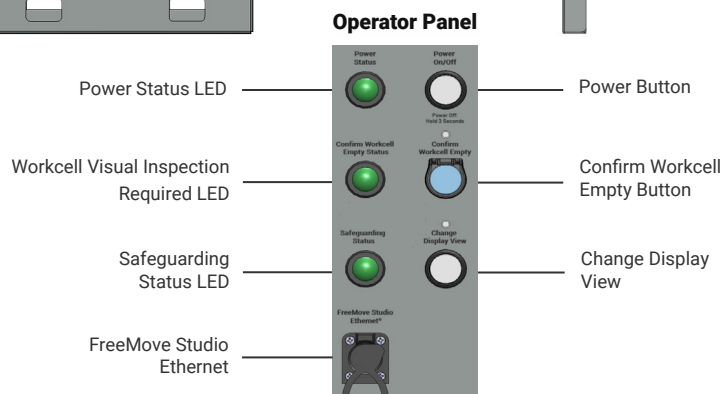
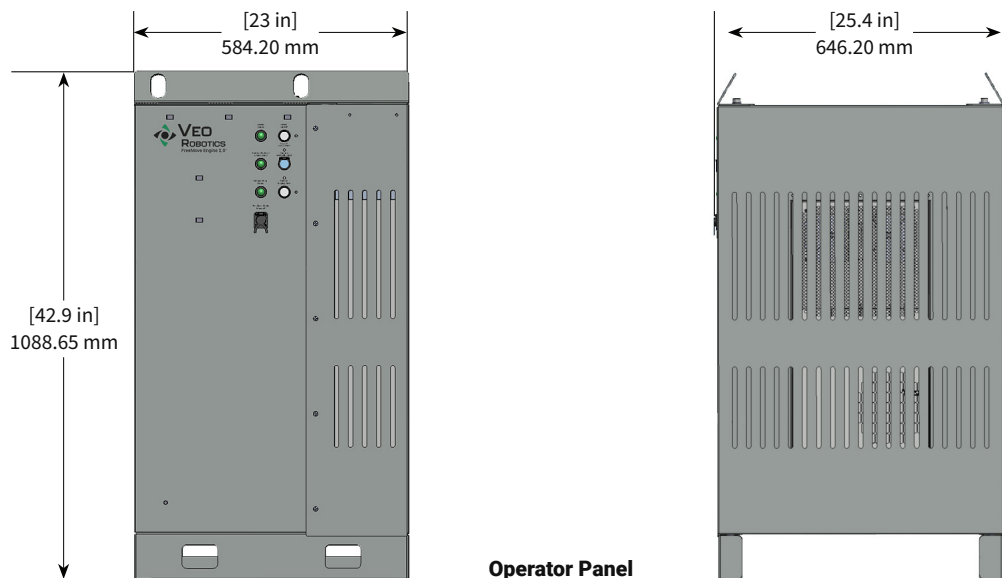
FreeMove® Specifications

Detection method	FreeMove Sensors® use active infrared (IR) Time-of-Flight technology (850 nm)
Safeguarding method	Real-time dynamic Speed & Separation Monitoring
Resolution	25 mm (0.98 in)
Response time	100 ms
Object size at which FreeMove® issues a stop signal to the robot	> 15000 cm ³ (5,905.51 in ³) when detected within the PSD of the robot
PL (Performance Level)	d
Category	3
Power consumption	~1,600 W for an 8 sensor system
Power requirements	Single phase, 200-240 VAC, 50-60 Hz, 20A mains power
Operating temperature	0°C to +45°C (32°F to 113°F)
Humidity	0 to 95% relative humidity, non-condensing
Storage temperature	-20°C to + 70°C (-4°F to +158°F)
Enclosure protection	IP54 (Engine), IP65 (Sensors)



FreeMove Engine®

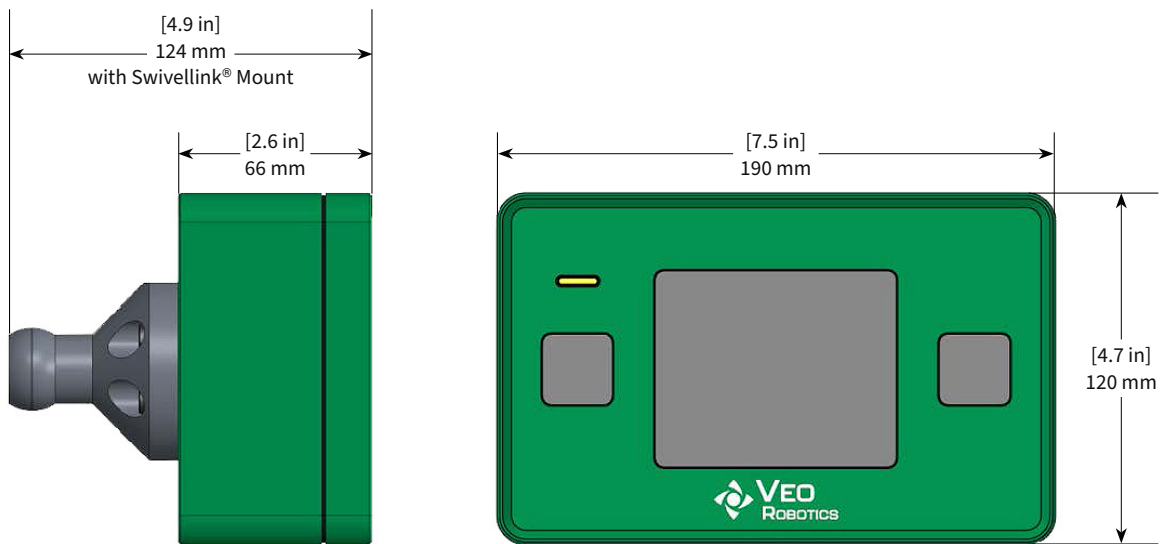
Number of sensors	Up to 8 sensors depending on the workcell geometry
Dimensions	584.2 mm (23.0 in) wide, 646.2 mm (25.4 in) deep, and 1088.7 mm (42.9 in) tall *
Weight	128 kg (282 lbs) *
Ingress Protection Code	IP54
Mounting requirement	To be installed on a flat surface (mounting holes for additional security included) Clearance of 150 mm (6 in) of free space required around the vent cover of the FreeMove Engine® to ensure adequate ventilation for engine cooling
Connectors	8 connectors for FreeMove Sensor® Cables 3 connectors for FreeMove® Robot I/O Cables 2 connectors for Remote Safety inputs 3 connections for FreeMove Engine® Synchronization triggering 1 HDMI port to support 3D visualization on a monitor 3 Ethernet ports (include adaptors for FreeMove Engine's® sealed Ethernet and HDMI ports)
Cables	FreeMove Sensor® Cable available in lengths of 10 m (32.81 ft), 15 m (49.21 ft), 20 m (65.62 ft), and 25 m (82.02 ft) FreeMove® supports use of Ethernet cables up to 30 m (98.43 ft) and HDMI cables up to 5 m (65.62 ft) in length. Longer cable lengths will require the use of a powered repeater.
Operator panel	LED status: Safeguarding and configuration



*Weight measures are approximate

FreeMove Sensors

Sensing technology	Provides 3D range data to the FreeMove Engine® using active infrared (IR) Time-of-Flight technology (850 nm wavelength)
Field of View (FOV)	67° x 57°
Sensing range	0.5 m to 8.0 m (1.6 ft to 26.25 ft)
Dimensions	190 mm (7.48 in) wide, 120 mm (4.72 in) tall, and 66 mm (2.6 in) deep
Weight	1.63 kg (3.59 lbs) *
Ingress Protection Code	IP65
Power	Sensors are powered through FreeMove Engine®
Mounting height	3 m to 5 m (9.84 ft to 16.4 ft) depending on the workcell architecture
Mounting requirement	Comes with mounting hole pattern that can be used with the included Swivellink mounts, or with custom mounting hardware
Connectors	1 connector that mates with the FreeMove Sensor® Cables to connect with the FreeMove Engine®
Status lights	LED status: powered, initializing, fault, updating, ready, active
Sensitivity	Performance is affected by direct sunlight, specularly reflective materials or external sensors operating at a 850 nm wavelength



*The weight measures are approximate. Actual weight may vary slightly.

FreeMove Studio®

Modes	Configuration and troubleshooting
Operating system supported	Windows 10 or Linux equivalent to Ubuntu 16.04 or later
Browser supported	Google Chrome 32+ or Microsoft Edge 23+
RAM requirement	8 GB
Processor	Intel i7 processor or equivalent running at 3 GHz or faster

Supported Robots & Controllers

Robots supported	<p>FreeMove® supports most common articulated industrial robot configurations:</p> <ul style="list-style-type: none"> • Up to 6 active, revolute joints • Open chain kinematics and parallel 4-bar kinematics • One passive prismatic joint, such as a balancer spring <p>Note: FreeMove® does not support SCARA robots, Cartesian robots, or Delta robots</p>
Robot Controllers supported	<p>ABB: IRC5</p> <p>FANUC: R30iB, R30iB+</p> <p>KUKA: KRC4</p> <p>Yaskawa: DX200, YRC1000</p>

Certifications

- Functional safety: PLd, Category 3 per ISO 13849-1:2015
- Approbations: UL 508:2018



Contact

To learn more about how FreeMove can help you simplify your workcell design and more effectively safeguard your applications, contact Veo Robotics at sales@veobot.com.

411 Waverley Oaks Road, Suite 107
 Waltham, MA 02452
 617-651-5733



About

Veo Robotics was founded in 2016 and has raised over \$40 million in venture capital funding from investors such as AI Capital Partners, Google Ventures, Lux Capital Management, Siemens Next47, Nikon-SBI Innovation Fund, SBI AI & Blockchain Fund, and Baidu Ventures. Veo Robotics has also partnered with robot manufacturers FANUC, Yaskawa, ABB, and KUKA.