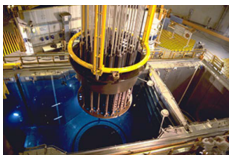
NEWTON

Powerful Tools for Nuclear Energy

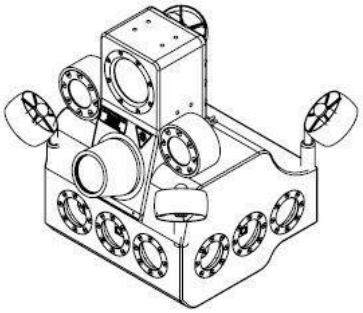
Specifications for the SW1000 Underwater Drone Mounted with the Newton NM200EVT-1

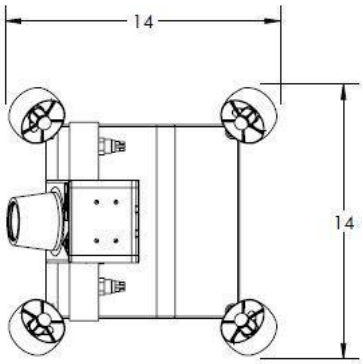


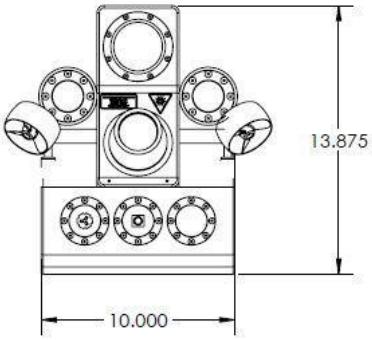
Technical Specifications

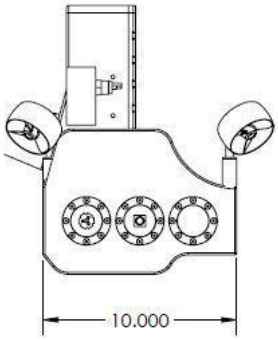
Item	SW1000 Drone	Control Unit
Height	13.875 in. (352.425mm)	14.75 in. (374.65 mm)
Width	10 in. (254 mm)	26.75 in. (679.45 mm)
Length	10 in. (254 mm)	27.50 in. (698.5 mm)
Weight (in air)	84.5 lbs. (38.3 kg)	24 lbs. (10.9 kg)
Weight (in water)	Neutrally Buoyant	---
Construction	Hard Anodized Aluminum	Metal electronics rack suspended on eight shock absorbers within a molded, high-impact, airline-transportable case
LED ring arrays	Adjustable Output High Intensity LED	---
Windows	Nuclear Rated Glass	---
Output ports	---	Ethernet, USB, DVI, VGA & HDMI
Operating temperature	40° to 120° F (5° to 49° C)	40° to 110° F (5° to 43° C)
Storage temperature	0° to 125° F (-18° to 52° C)	0° to 125° F (-18° to 52° C)
Power input voltage/current	Powered by the Control unit	100/240 VAC 50/60 cycle @ 15 Amps
Data storage	---	Internal solid state drive & USB stick data
Maximum scanner-to-target distance	1 Meter (36")	---
Minimum scanner-to-target distance	150mm (6")	---
Watertight depth rating	50 Meters (164 ft)	---

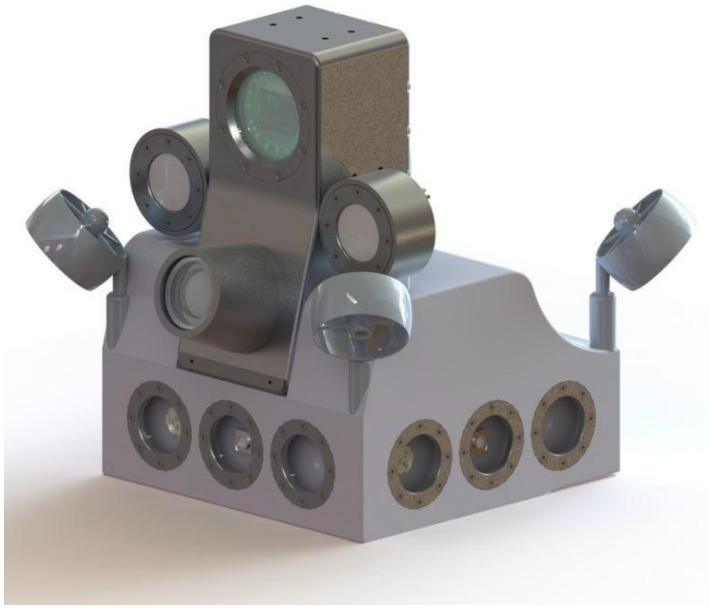
For information on Newton Labs underwater products, please contact:
sales@newtonlabs.com











SW1000 Underwater Drone

The SW1000 console includes control box, with monitor and keyboard. For transport, the monitor and keyboard are securely stowed within the electronics rack.

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Powerful Tools for Nuclear Energy

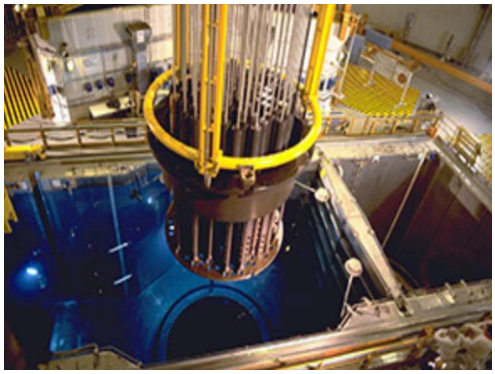
Nuclear Underwater Laser Scanner

With Enhanced Visual Inspection Capabilities Model NM200EVT-1

NM200EVT-1 Measurement Head

The award-winning* NM200EVT-1 Nuclear Underwater Laser Scanner is a landmark technology by Newton Labs that delivers precise dimensional measurements in nuclear underwater environments in both BWR and PWR vessels; Combined with the Visual Inspection requirements of BWRVIP-03 and MRP 227. The scanner has a demonstrated underwater accuracy of 0.003" (0.076mm) or better, while the Visual Inspection resolution meets or exceeds the requirements of BWRVIP-03, MRP227, and ASME XI.

The NM200EVT-1 system combines rugged, industrial-grade hardware and electronics with sophisticated, Newton-developed software that compensates for the disruption of refraction, turbulence, heat and radioactivity typical of the in-vessel environment.



The Newton NM200EVT-1 underwater scanner with its EVT-1 high resolution capability is very useful for EVT-1, VT-1 and VT-3 inspections of reactor internals. Not only does it perform the MRP 227 inspections but unlike simple camera systems it then has the capability to make a CAD model of any defects found for later analysis.

NM200EVT-1 Control Console, screen and key-board with trackball.

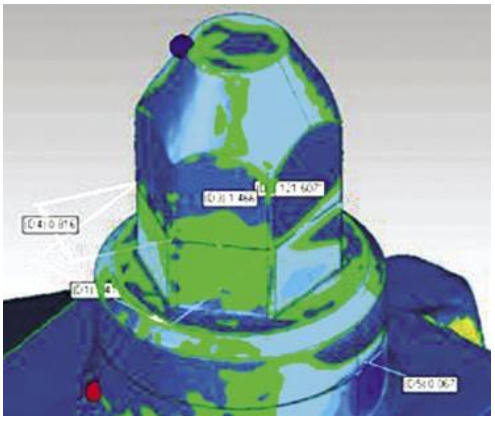
- The NM200EVT-1 scans by laser triangulation. The laser line sweeps the target surface and the high resolution camera, centered on the target, captures and records any deformation of the line as a point cloud, enabling ultimately 3D CAD model.

- The NM200EVT-1 is able to scan a target as close as 6 in. (150 mm) and out to a distance of 3 ft. (0.9 M) for a scan coverage area of 1.6 ft. x 2.2 ft. (500 mm x 680 mm).

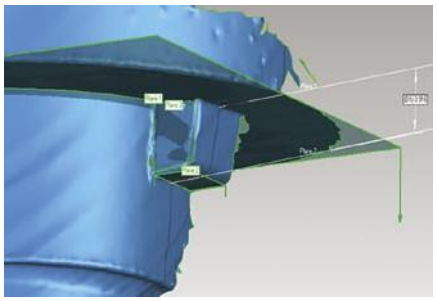
- The NM200EVT-1 is designed to scan and capture much larger underwater target areas by combining several point clouds together to form larger composites.

- In the visual observation mode, the LED ring array on the head illuminates the area and the camera transmits a very high resolution color image to the control console screen for visual inspection and to assist the operator for optimum positioning and on-site analysis.

- NM200EVT-1 scanner deployment can be deployed by pole mounting, an articulated arm, an ROV, or other robots. The scanner operates in both air as well as underwater.

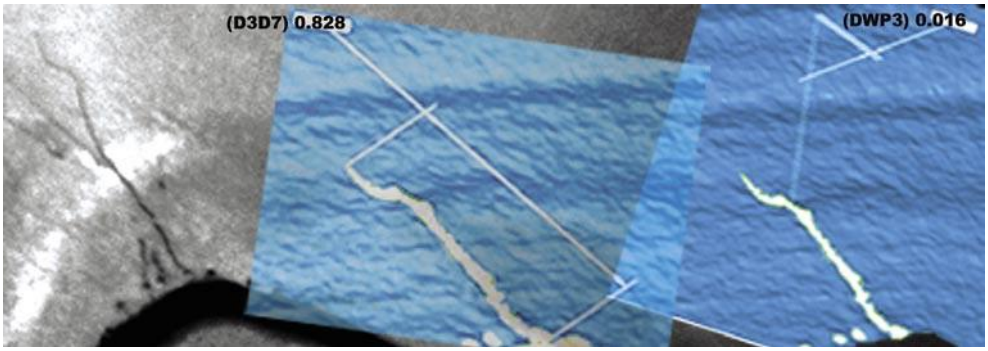


CAD model of a bracket bolt rendered in 3-D software from point clouds of consecutive scans at different positions. Greenish areas indicate corrosion.



An NM200EVT-1 measured the position of this BWR jet pump main wedge to establish a base line for any movement in future cycles. **

* This technology enabled Exelon Nuclear to wins a Nuclear Energy Institute 2012 Top Industry Practice (TIP) Award from the for "Laser Scanning Within a BWR Vessel."



This image from a standard IVVI video shows a crack in a BWR steam dryer door. The NM200EVT-1 scans (in blue) of the same crack and processed with 3-D software, precisely captures the width at all points along the length (shown in inches).

Background of Newton Labs

Newton Labs is a Seattle area-based privately held developer and manufacturer of machine vision and robotic systems. Newton's powerful, easy to use, and industrially rugged systems provide solutions for wide ranging applications in many sectors, including aerospace, automotive, bottling, electronics, medical, packaging, and nuclear, among others. In 20 years Newton has deployed more than 30,000 machine vision and automation systems worldwide, many that are first-of-a-kind.

(Left) The PT200UW Pan-Tilt Arm enables precise and rapid positioning of a NM200EVT-1 scanner with a pole, ROV or robot in order to capture dimensional measurements from multiple angles of a target within a BWR or PWR vessel.

*NM200EVT-1 Scanning Technical Specifications & System Performance**

Item	Control Unit	Measurement Head
Height	14.75 in. (374.65 mm)	4.250 in. (107,950 mm)
Width	26.75 in. (679.45 mm	4.625 in. (117,475 mm)
Length	27.50 in. (698.5 mm)	9.375 in. (238,125 mm)
Weight	56 lbs. (38.3 kg)	[Air - 8 lbs. (3.6 k)] [Water - 2 lbs. (1 k)]
Construction	Metal electronics rack suspended on eight shock absorbers within a molded, high-impact, airline-transportable case	Machined from solid billet of 6061-T6 aluminum stock
Power/Data Umbilical Cable	Gel-filled with LLDPE polyurethane jacket and a rated yield point of 80 lb/ft (11 Kg/M) - 150 ft. (45,7 m) standard (other lengths available)	
Cable weight	23.6 lbs. (10.7 kg)	---
Laser power	---	40 mW
Video camera	---	Very High Resolution Color
LED ring array	---	8,320 lumens
Data storage	Internal solid state & USB stick data	---
Output format	.ply point cloud file	---
Data file size	Approximately 100 MB per scan	---
Maximum scanner-to-target distance	---	35.0 in. (900 mm)
Minimum scanner-to-target distance	---	6.0 in. (150 mm)
Maximum Resolution accuracy (after processing with 3-D software)	---	+/-0.0004 in. (0.01 mm)*
Scan range	---	6.0 in. (150 mm) to 35 in. (900 mm)
Watertight depth rating	---	320 ft. (100m)

Depth of Field Distance *(Distance to object)*	Field of View *Height---------- Width*		Raw Accuracy *(Single Point Cloud point, rms)*	Approximate CAD Model Accuracy***
6 in. (150 mm)	6 in. (150 mm)	7.5 in. (190 mm)	+/-.002 in. (0.05 mm)	+/-.0004 in. (0.01 mm)*
12 in. (300 mm)	10 in. (250 mm)	13 in. (330 mm)	+/-.004 in. (0.10 mm)	+/-.0008 in. (0.02 mm)
18 in. (450 mm)	14 in. (350 mm)	18.5 in. (470 mm)	+/-.008 in. (0.20 mm)	+/-.0012 in. (0.03 mm)
24 in. (600 mm)	18 in. (450 mm)	24 in. (600 mm)	+/-.014 in. (0.35 mm)	+/-.0025 in. (0.06 mm)
36 in. (900 mm)	25.5 in. (650 mm)	35 in. (880 mm)	+/-.028 in. (0.70 mm)	+/-.0060 in. (0.15 mm)

NM200EVT-1 Enhanced Vision Inspection Properties

Depth of Field Distance *(Distance to object)*	Field of View *Height---------- Width*	
6 in. (150 mm)	6 in. (150 mm)	7.5 in. (190 mm)
12 in. (300 mm)	10 in. (250 mm)	13 in. (330 mm)
18 in. (450 mm)	14 in. (350 mm)	18.5 in. (470 mm)
24 in. (600 mm)	18 in. (450 mm)	24 in. (600 mm)
36 in. (900 mm)	25.5 in. (650 mm)	35 in. (880 mm)

NM200EVT-1 Enhanced Visual Inspection Resolution

Meets or exceeds the visual resolution requirements of BWRVIP-03, MRP227, and ASME XI

****After 3rd-party 3-D software processing*

*All NM200EVT-1 accuracy is related to the field of view, distance from the object to be measured and can vary by the parameters of the object. Consult Newton for the specific accuracy that can be obtained for your proposed object.

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