

HI-DEF

INSPECTION SYSTEMS



RVI + FOSAR

Remote Visual Inspection,
Foreign Object Search & Retrieval



SENSOR[®]
NETWORKS, INC

Inspection, Testing & Asset-Integrity Solutions

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Version 3.1

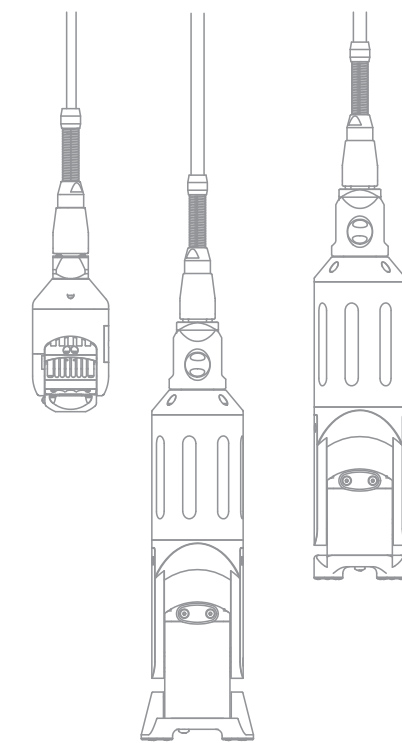
Insight Into Your Assets

What you don't know about your critical plant assets and infrastructure can develop into significant risks. Sensor Networks, Inc. delivers the visual inspection tools you need to see inside and inspect process and pressure components for cleanliness and mechanical damage; helping you assess conditions and retrieve loose parts.



Innovation

At Sensor Networks, we combine new technologies with novel approaches for monitoring asset integrity, giving you advanced tools to keep your systems operating safely, productively, and efficiently.



Expertise

Drawing on more than 100 years of combined experience in visual inspection across a range of industrial sectors, our team takes the guesswork out of applications engineering. Trust us to bring the best technologies and techniques to bear on your inspection challenges.

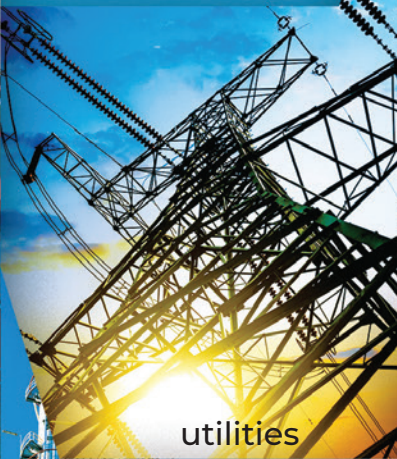


Reliability

More than thirty Fortune 500 companies already rely on our technology and team to gain better insight on their critical infrastructure.



process



utilities



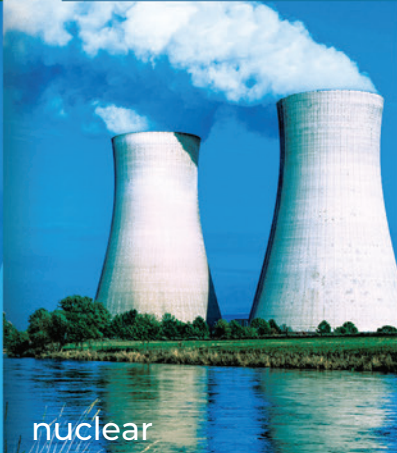
environmental



oil & gas



aerospace



nuclear

Table of Contents

- Introduction 2-3
- PTZ Systems 4
- About HDTV 5
- Hi-Def PTZ's 6-7
- Tech Exposed 8-9
- Retrieval Tools . . . 10-11
- Specs. Back Cover

Hi-Def Systems

Understanding HD

All Sensor Networks RVI tools are now Hi-Def



- Versatile lightweight solution for control room shelf
- Full-control user interface for Pan-Tilt-Zoom-Lighting
- All cable connections on rear panel
- UL-rated low-voltage power supply
- Magnetic swivel mount for monitor or recorder
- One power cord, no additional outlets needed

Modular System



Integrated System

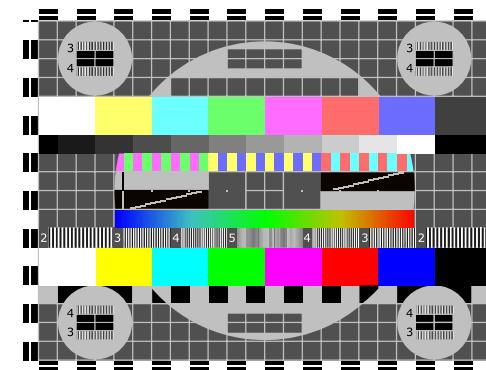
- Integrated one-hand carry solution
- Full-control user interface for Pan-Tilt-Zoom-Lighting
- Stores camera head for transport
- Stores and winds 150 feet (45m) of cable
- Swivel mount for monitor or recorder
- One power cord, no additional outlets needed

6:1 Pixel Improvement

345,600 pixels is typical of Standard Video vs. 2,073,600 for HDTV. That's a 6:1 ratio improvement just in pixel resolution not to mention HDTV's significantly improved color fidelity.

Resolution

High definition television offers a much higher resolution than standard definition video. While a typical analog broadcast in the U.S. contains a maximum of 525 horizontal lines of resolution, an HDTV signal supports over 1000 HTVL (1920 Horizontal pixels).



Video test-pattern charts like this one are used to assess the camera system's ability to accurately translate color.

Aspect Ratio

While previous broadcasts used a 4:3 ratio (4 units wide for every 3 units tall), HDTV uses a ratio of 16:9. This wider aspect ratio more closely emulates how humans see the world, making the image appear more realistic.

Color Rendition

HDTV systems provide precise and vivid representation of color. This is important for certain industrial inspections where subtle color variations become meaningful to the examination.

HDTV - 1080p (1920 x 1080)

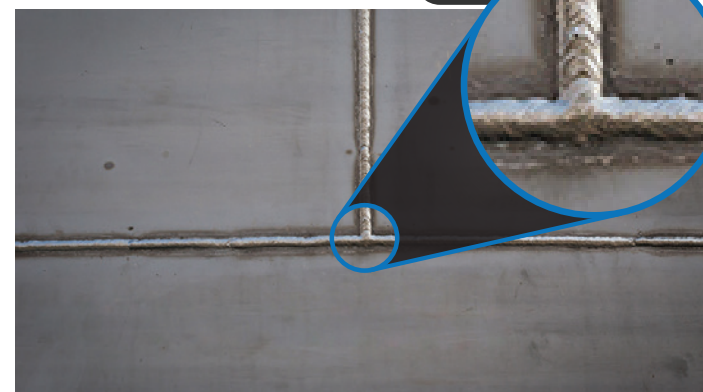
HDTV - 720p (1280 x 720)

NTSC DVD
(720 x 480)

This chart shows a simplified comparison of NTSC (Standard Video) in lower-left corner compared with medium resolution (720p) and high-res full HDTV (1080p).

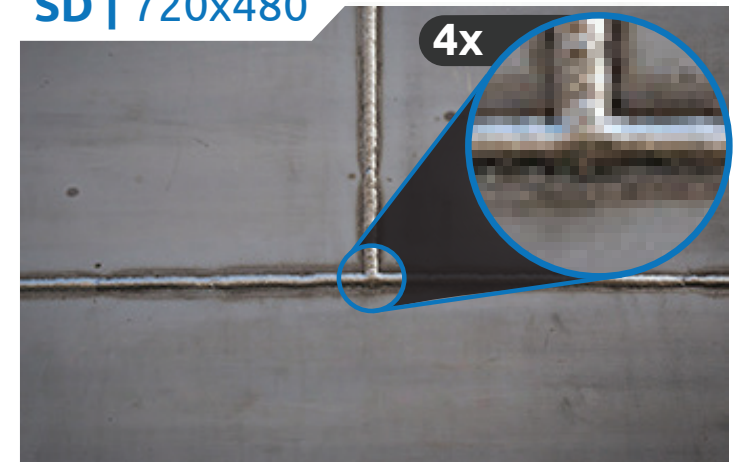
HD | 1920x1080

4x



SD | 720x480

4x

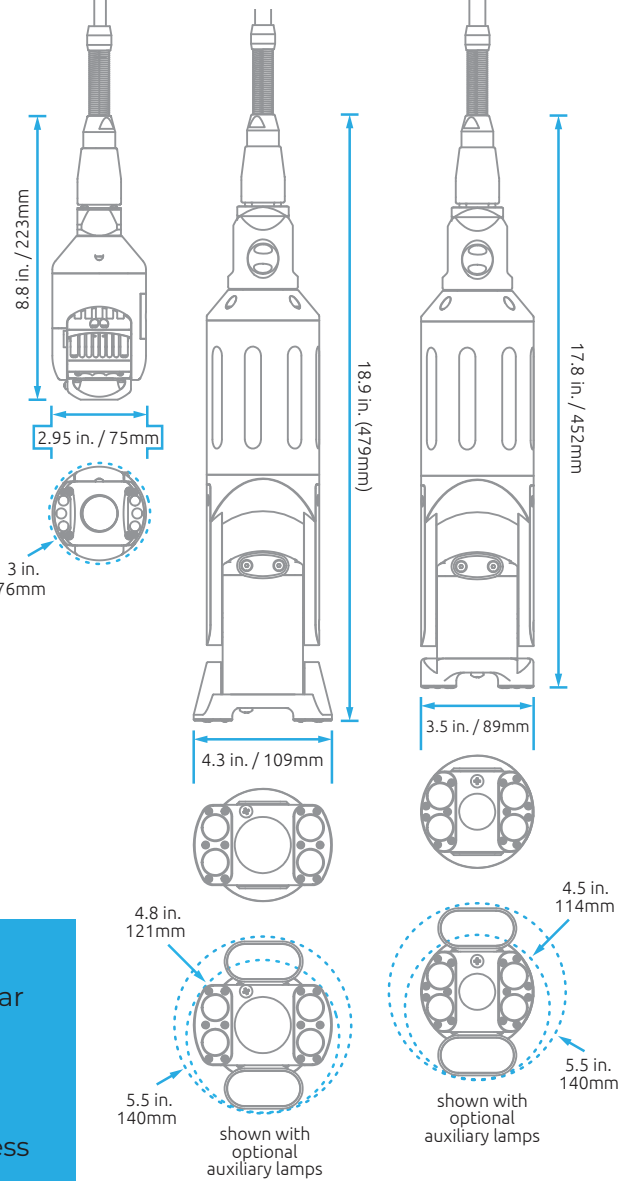


Hi-Def PTZx

PTZx includes everything you need to perform tank, vessel or large-area inspections of piping and facility infrastructure. Even with 100 feet of cable, cable reel, monitor and digital recorder, this system weighs under 30 lbs. (14 kg) and can be carried with one hand. The result of decades of RVI experience, PTZx is rugged, reliable, waterproof and easy-to-use.



Hi-Def 3.0 Hi-Def 4.3 Hi-Def 3.5



Three interchangeable camera heads

digital video recorder & monitor

- 7 in (178mm) FHD display
- Records 1080p video in ProRes® or DNx format
- 64 GB SD card
- Microphone

control unit

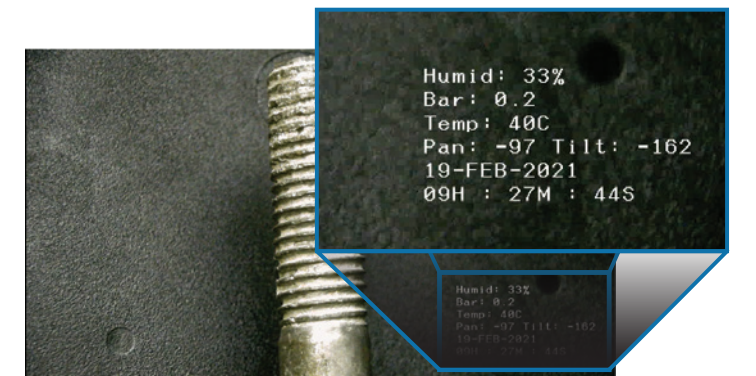
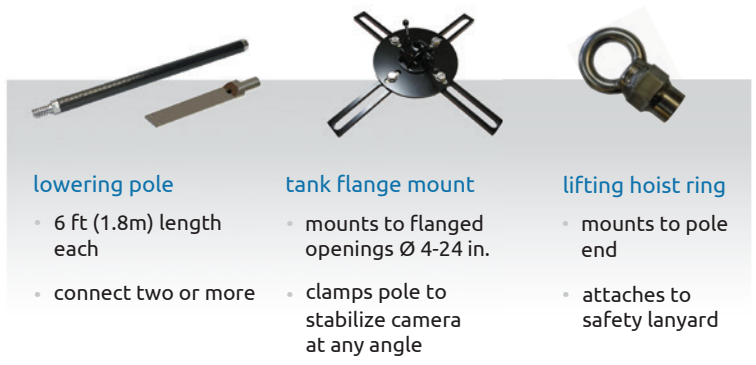
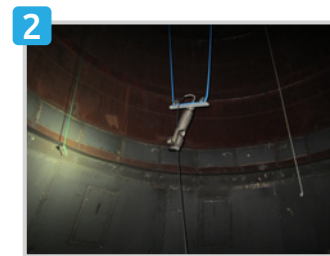
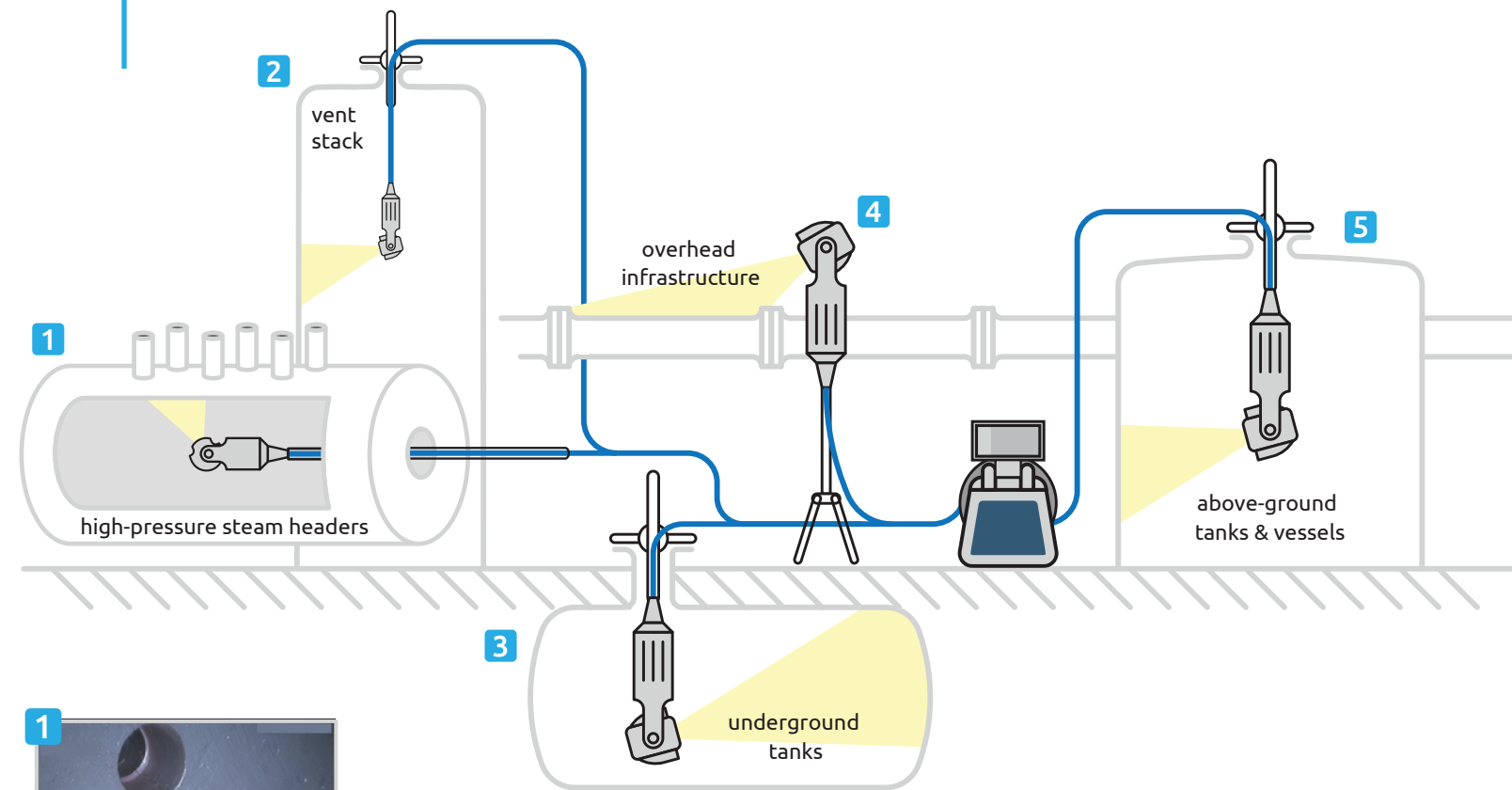
- 150 ft (45m) reel or modular
- Adjustable zoom lens
- Auto/manual focus
- Adjustable light intensity
- Adjustable video brightness
- Camera position memory
- Image control

applications

Nuclear Power: Reactor pressure vessel and cooling pumps, steam generator channel head, nozzle welds, fuel pool, fuel assembly, spent fuel, IWE/IWL exams.

Fossil Power: FAC & MIC inspections, baffle plates, HP steam headers, tank and vessels.

Refining & Petrochemical: Tray-towers, refractory- and glass-lined vessels, tanks, pipe racks, heat exchanger internals, baffle plates.

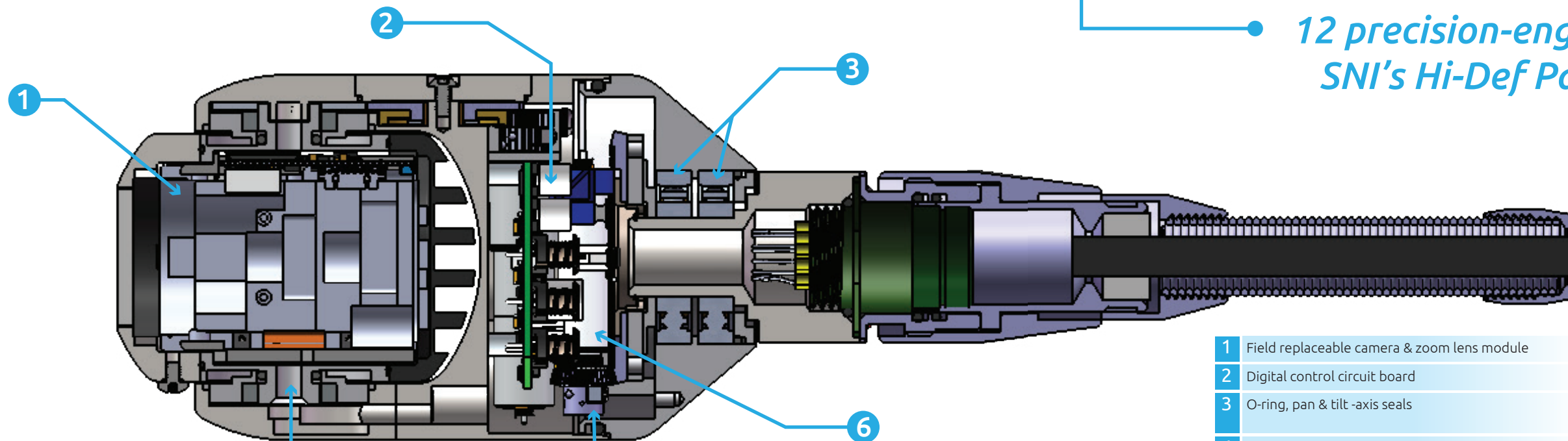


PTZx text overlay with data

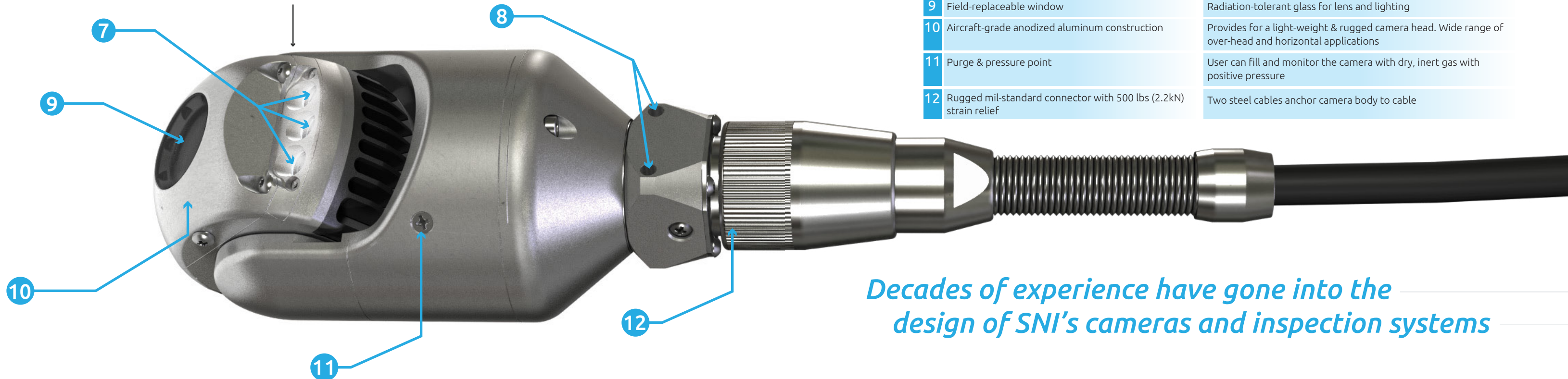
Hi-Def PTZTMX

TECHNOLOGY EXPOSED

12 precision-engineered reasons to specify SNI's Hi-Def Pan-Tilt-Zoom product line



2.95in (75mm) Ø head
shown 1:1 scale
(can pan & tilt in a 3 in. ID cylinder)

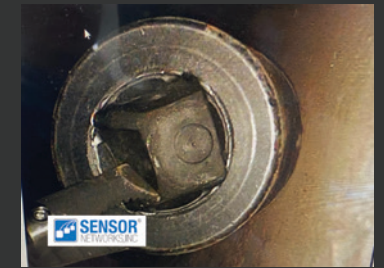


- | | | |
|----|--|---|
| 1 | Field replaceable camera & zoom lens module | User can easily replace the camera module due to radiation failure |
| 2 | Digital control circuit board | Tested & improved radiation tolerance |
| 3 | O-ring, pan & tilt -axis seals | Reliable, time-tested, design allows for use at up to 100 ft. (30m) submerged in water |
| 4 | Rotary sensors on tilt and pan axis | Monitor, recorder, or frame grabber displays pan & tilt position |
| 5 | Miniature slip clutches | Clutch-protected drivetrain protects motors for manual positioning |
| 6 | High-energy, rare-earth magnet DC motors/gearboxes | Enables a small, compact and rugged pan & tilt gimbal |
| 7 | Broad-spectrum white LED lighting | Wide-angle and narrow-angle lighting for close and far viewing |
| 8 | M6-Threaded mounting points | Easily attach the PTZ head to tooling or robotic end-effectors |
| 9 | Field-replaceable window | Radiation-tolerant glass for lens and lighting |
| 10 | Aircraft-grade anodized aluminum construction | Provides for a light-weight & rugged camera head. Wide range of over-head and horizontal applications |
| 11 | Purge & pressure point | User can fill and monitor the camera with dry, inert gas with positive pressure |
| 12 | Rugged mil-standard connector with 500 lbs (2.2kN) strain relief | Two steel cables anchor camera body to cable |

Decades of experience have gone into the design of SNI's cameras and inspection systems

loose parts retrieval tooling

JAWS 2.0 (left) and RGT (right) through 1.5D elbows in 4" and 6" (100 & 150 mm), respectively



Large 1 in. drive impact socket retrieval with RGT

fits through 1.5 in. (38mm) Ø access

3.2 in. (81mm) max. jaw opening

JAWS 2.0 with camera and illumination (actual size)

fits through 1.0 in. (25mm) Ø access

3.2 in. (81mm) max. jaw opening

RGT (actual size)

jaws

left to right: serrated jaws, long serrated jaws, curved serrated jaws, fork & tine, needle nose, magnet, snare, hook, sampling cups



RGT controls



JAWS 2.0 controls

delivery devices

adjustable elbow

rubber flex joint

spring flex joint

6 in. (152mm) extension

3/8 in. (9mm) diameter flex rod, 5 ft (1.5cm) long

5/16 in. (8mm) diameter flex rod, 5 ft (1.5cm) long

1/4 in. (6mm) diameter flex rod, 5 ft (1.5cm) long

3/16 in. (5mm) diameter flex rod, 5 ft (1.5cm) long

lowering ring

maneuvering ring

T-handle for rotational control

JAWS 2.0 basic kit **blue items included**
14×22×8 in, 12 lb (5.5kg)



JAWS 2.0 ultimate kit **all contents**
15½×25×8½ in, 19 lb (8.6kg)



kits:

standard components: JAWS 2.0 HD grabber • JAWS 2.0 HD display/controller • AC adapter/charger • operator manual • 50 ft (15m) power/video cable • 50 ft (15m) power/video extension cable

Jaw Sets: short serrated jaws • fork and tine • flat serrated jaws • sampling cups • curved serrated jaws • tool adapter • needle-nose jaws

tools: snares: sm & lg • magnets: sm & lg (w/case) • hooks: sm, med, lg, xl (four) hooks: sm, med, lg, xl

Diameter/Length	6 in. (15cm)	12 in. (30cm)	16 in. (40cm)	5ft (1.5m)
Ø3/16 in. (5mm)			1	10
Ø1/4 in. (6mm)			1	10
Ø5/16 in. (8mm)	1	1	1	10
Ø3/8 in. (9mm)			1	10

accessories: tee handle • adjustable elbow • rubber and spring flex joints • hoist lifting ring

misc.: hex keys • screws • quiver

Maneuvering ring not included in either kit

Hi-Def 3.0

Hi-Def 3.5

Hi-Def 4.3

video	optical / digital zoom	10x / 12x	10x / 12x	30x / 12x
	effective imager pixels	2.13 mega-pixels	2.13 mega-pixels	2.13 mega-pixels
	sensitivity	0.5 lux	0.5 lux	0.5 lux
	horizontal FOV (wide - tele)	W 54° / T 4.9°	W 54° / T 4.9°	W 59° / T 2.1°
	brightness adjustment	±7 step	±7 step	±7 step
	minimum focus distance	W 0.01m / T 1.0m	W 0.01m / T 1.0m	W 0.01m / T 1.2m
lighting	type	integral, long-life LED lamps		
	lumens (adjustable)	1500	2000	2000
	auxillary lighting	N/A	1,000 lumens x2	1,000 lumens x2
mechanical	minimum access hole	3.0 in. (76 mm)	3.6 in. (90 mm)	4.4 in. (110 mm)
	head weight	2.4 lbs. (1.1 kg)	6 lbs. (2.7 kg)	6 lbs. (2.7 kg)
	material	anodized aluminum	anodized & nickle-plated aluminum	
	temperature range (in degrees)	14 to 120°F (-10 to 49°C)		
	pressure rating	44 PSI (3 bar), 100 ft (30 M) of water		
	internal purge & pressurization	inert or dry air up to 10 psi (0.7 bar)		
	pan range (degrees)	±180	360 continuous	360 continuous
	tilt range (degrees)	±135	±135	±122
	radiation life expectancy	50,000 RAD average total dose†		
	system	weight with 100' cable	25 lbs. (11.4 kg)	29 lbs. (13.2 kg)
# boxes		one with two handles		
cable length		50 ft - 500 ft (15 - 150 M)		
control units options		modular (desktop) or cable reel with slip-rings		
power requirement		110-240 VAC; 4 A; 50/60 Hz		
outputs		2 HDMI, 12 VDC accessory power		
other		text overlay with keyboard	time & date, pan & tilt, zoom, temperature, pressure, & humidity (internal), image title	
	single-button home position	saved pan, tilt, & zoom positions		

JAWS 2.0™

tool head	construction	aluminum, stainless steel	
	diameter	1.4 in.(34 mm)	
	access required	1.5 in.(38 mm)	
	length	7.1 in.(180 mm)	
	push point connector	10 mm quick-disconnect	
	weight	0.7 lbs. (0.3 kg)	
	jaw opening	3.2 in.(81 mm)	
	jaw clamping force	25 lbs. at tip	
	end-effectors	see chart*	
	Radiation Life Expectancy	30,000 Rad Avg. Total Dose†	
	cable	cable material	TPE
		cable dia.	¼ in.(6 mm)
cable length		50 ft(15 m) with extensions	

display/controller	type	12V NiMH
	size	9.0×5.5×2.4 in.
camera	weight	3.1 lbs. (1.4 kg)
	features	HD color 5 in. display, HDMI video output, battery gage, grip strength indicator
	camera	1/3 in. color CMOS (1920×1080 pixels)
lighting	viewing angle	88° hor., 63° vert., 140° diag.
	lighting	2 long-life LEDs, total 150 lumens

RGT

tool head	construction	stainless steel
	diameter	0.82 in. (21 mm)
	access required	1.0 in. (25 mm)
	length	11.3 in. (287 mm)
	push point connector	10 mm quick-disconnect
	weight	0.7 lbs. (0.32 kg)
cable	jaw opening	3.2 in. (81 mm)
	jaw clamping force	25 lbs. at tip
	end effectors (3)	curved serrated, flat serrated, fork and tine
power supply	cable material	polyurethane
	cable dia.	3/16 in.(4.5 mm)
	cable length	50 ft (15 m) with extensions

* Basic kit comes standard with one serrated jaw. Options include a curved serrated, fork & tine, needle-nose pliers, sampling cups, hooks and manual tool adapter.
† Camera replacement module available

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JAWS 2.0 design is protected by U.S. patent #10,981,280 B2

type	Lithium-Ion rechargeable
size	7.0×4.8×2.7 in.
weight	1 lb. (0.5 kg)
features	battery gage