



# D40 CAMERA

## SOLUTIONS: Visual Inspection

- 200 MegaRad radiation tolerance
- 600+ TVL video resolution, easily meets VT-1 and EVT-1
- Compact 1.58" diameter form factor
- Wide range of view heads for various applications
- Designed for maintainability – “plug and play” factory-tuned replacement tube

### Powerful Inspection Tool

The D40 offers the perfect mix of high resolution, small size, and high radiation tolerance. Due to its compact diameter of just 1.58", the camera is perfectly suited for inspection of confined areas and in reactor components. Its modular design and range of attachments makes it the ideal “utility camera”, in which a single camera system can be reconfigured to support all types of plant operations and maintenance. This flexibility offers users the highest level of economy, and best value for their investment. The D40 is also offered as an integrated system solution, complete with camera, processing system and user interface. Details on each of the D40 attachments and accessories are provided on the following pages.

### Split-Head Design

The D40 is the modern embodiment of the traditional split-head camera. To maximize its radiation tolerance, only non-browning optics and minimal electronics are located inside the camera itself. The majority of the camera system components are housed in the topside Camera Control Unit (CCU).



### D40 Applications

- IVVI inspection of BWR reactor internals
- PWR MRP Reactor Vessel inspections
- Fuel and insert serial number ID verification
- Control rod blade inspection, while within loaded reactor core
- Inspection of irradiated fuel cladding
- Below-core plate FOSAR operations
- Spent fuel cask loading operations
- D&D activity surveillance
- Hot cell surveillance

### State-of-the-Art Capabilities

In addition to its wide range of standard functions, the D40 incorporates several superior capabilities:

- Smooth 2x analog zoom
- Auto Exposure function, for automatic image quality enhancement
- Stabilized radial viewing
- Ease of maintenance

These capabilities make D40 operation extremely easy and convenient, when compared to that of traditional radiation-tolerant cameras.

### High Quality & Reliability

The D40 is designed and manufactured to stringent quality standards. All stages of the production cycle, through final factory acceptance testing of the finished products, are performed under the tight parameters of Diakont's ISO 9001-certified Quality Management System. High camera reliability is achieved through solid design, and incorporation of the highest-quality components. Diakont routinely performs radiation tests of components and completed camera systems in order to validate performance to specifications.

**17mm Lens L40-17S**

- Radiation tolerant non-browning glass
- Standard viewing angle
- High sharpness image
- Ideal for close inspection
- Allows to work with radial view head

**6mm Lens L40-6S**

- Radiation tolerant non-browning glass
- Wide viewing angle
- Increased depth of field
- No "fish eye" effect
- Ideal for general inspection and surveillance

**5x Zoom Lens Head H40-ZS**

- Radiation tolerant non-browning glass
- 5x optical zoom
- Macro focusing capability
- Stainless steel housing

**Frontal Head (No Lights) H40-00S**

- Radiation tolerant non-browning glass or acrylic window
- 40.5 mm – diameter
- Installed on camera housing
- Used with either 6 mm or 17 mm lens
- External scene lighting is required

**Frontal Head with LED Lights - for 17mm Lens H40-01S**

- Radiation tolerant non-browning glass or acrylic window
- Adjustable LED lights (brightness)
- 40.5 mm – diameter
- Installed on camera housing
- Used together with 17 mm lens.

**Frontal Head with LED Lights - for 6mm Lens H40-02S**

- Radiation tolerant non-browning glass or acrylic window
- Adjustable LED lights (brightness)
- 40.5 mm – diameter
- Installed on camera housing
- Used together with 6 mm lens



**Frontal Head w/ Extra LED Lights - for 6mm Lens H40-03S**

- Radiation tolerant non-browning glass or acrylic window
- Adjustable LED lights (brightness)
- 65 mm – diameter
- Installed on camera housing
- Used together with 6 mm lens

**Radial Head with Far and Near Field Lights H40-05S**

- Radiation tolerant non-browning glass windows
- Adjustable LED lights (brightness)
- 40.5 mm – diameter
- Installed on camera housing
- Used together with 17 mm lens

**Radial Head with Near Field Lights H40-06S**

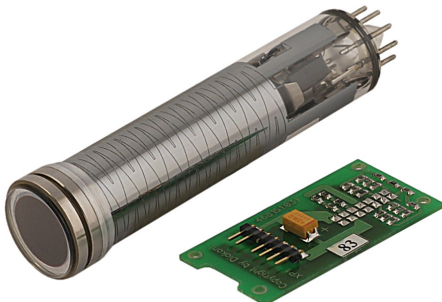
- Radiation tolerant non-browning glass
- Adjustable LED lights (brightness)
- 40.5 mm – diameter
- Installed on camera housing

**Rotation Unit R40S**

- 40.5 mm diameter; 166 mm (w/o connectors) length
- 360° - rotation angle
- 7 degrees/sec – rotation speed
- Installed between camera and cable
- Ideal for pipe inspection or deployment into tight spaces
- Used together with 17 mm lens

**Pre-Tuned Replacement Camera Tube**

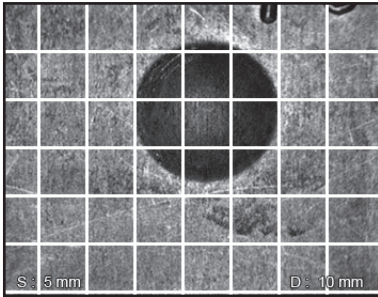
D40 replacement camera tubes and tuning boards are paired at the factory and pre-tuned prior to shipping. This feature supports “plug and play” tube replacement, eliminating labor-intensive field tuning requirements, and ultimately saving hours of camera tuning per tube changeout.

**Ultra-Rad Tube**

For applications with extremely high gamma fields, the D40 is available with an ultra-rad tube with a dose rate of  $3 \times 10^6$  Rads/hr. These applications include control blade inspections, irradiated fuel assembly inspections, in-air reactor vessel and internals inspections and more.

### Measurement Module

An On-Screen Display (OSD) measurement module is available for the D40 that provides distance to target measurements. The OSD module also provides a scaled grid on the screen allowing operators to measure the size of viewed objects. In addition, the OSD module allows operators to annotate screen-captured images providing a permanent record for future evaluation and analysis.



### Remote Operation

The D40 has an optional hand-held remote control console that can be plugged into the CCU for remote operation. This accessory is ideal for operators that rack mount the CCU and don't want to stand next to the rack to control the camera functions.

The D40 system is also capable of remote operation via serial or other network interface for operation outside of containment.



### Camera Head Sleeve With Rope Attachment

Diakont offers rugged axial and radial head sleeves with a rope attachment groove to facilitate "puppeteering" during reactor inspections.



### D40 Console System

Diakont's D40 console system incorporates the best-in-class D40 rad hardened camera along with a rack-mounted camera control unit, a monitor, a digital video recorder (DVR), a microphone, and a handheld remote controller, all integrated into a rugged enclosure. By combining the D40 camera with all of the equipment required to successfully complete visual inspections, the D40 console offers a turnkey solution that is ready to use "out of the box."



## Technical specifications

Parameters	L40-6S lens			L40-17S Lens				Zoom Lens
Head	H40-00S	H40-02S	H40-03S	H40-00S	H40-01S	H40-05S	H40-06S	H40-ZS
Analog Zoom <sub>1</sub>	2x	2x	2x	2x	2x	2x	2x	10x (5x2)
Sensitivity	32 lux			16 lux				24 lux
View Angle (Air)	82°			34°				5° -43°
View Angle (Water)	59°			26°				4° -32°
Iris Range	2.8-16			1.4-16				2.2-16
Focusing Distance (air)	50mm+	50mm+	50mm+	50mm+	50mm+	12mm+	12mm+	50mm+
Operating Distance in Air <sub>2</sub>	45mm ∞	45mm ∞	45mm ∞	45mm ∞	45mm ∞	10mm ∞	10mm ∞	-
Operating Distance in Water <sub>2</sub>	60mm ∞	60mm ∞	60mm ∞	60mm ∞	60mm ∞	13mm ∞	13mm ∞	-
Operating Distance of Lights in Air <sub>3</sub>	N/A	50 – 500mm	150 – 3000mm	N/A	35 – 3000mm	35 – 1000mm	35 – 500mm	-
Operating Distance of Lights in Water <sub>3</sub>	N/A	10 – 350mm	150 – 1000mm	N/A	35 – 1000mm	35 – 400mm	35 – 200mm	-
Cable Length	Standard length - 30m, option - up to 100m							
Diameter with Head	40.5mm	40.5mm	65mm	40.5mm	40.5mm	40.5mm	40.5mm	74.5mm
Length with Head <sub>4</sub>	246mm	245mm	250mm	246mm	246mm	297mm (487mm <sub>5</sub> )	343mm (533mm <sub>5</sub> )	371mm
Camera Weight with Installed Head	1kg	1kg	1.2kg	1kg	1kg	1.3kg	1.5kg	2.7kg
Max. Temp. (air)	55°							50°
Max. Temp. (water)	65°							50°

Note1: 15-72 mm zoom lens: 5x – optical zoom, 2x – analog zoom. Total – 10x

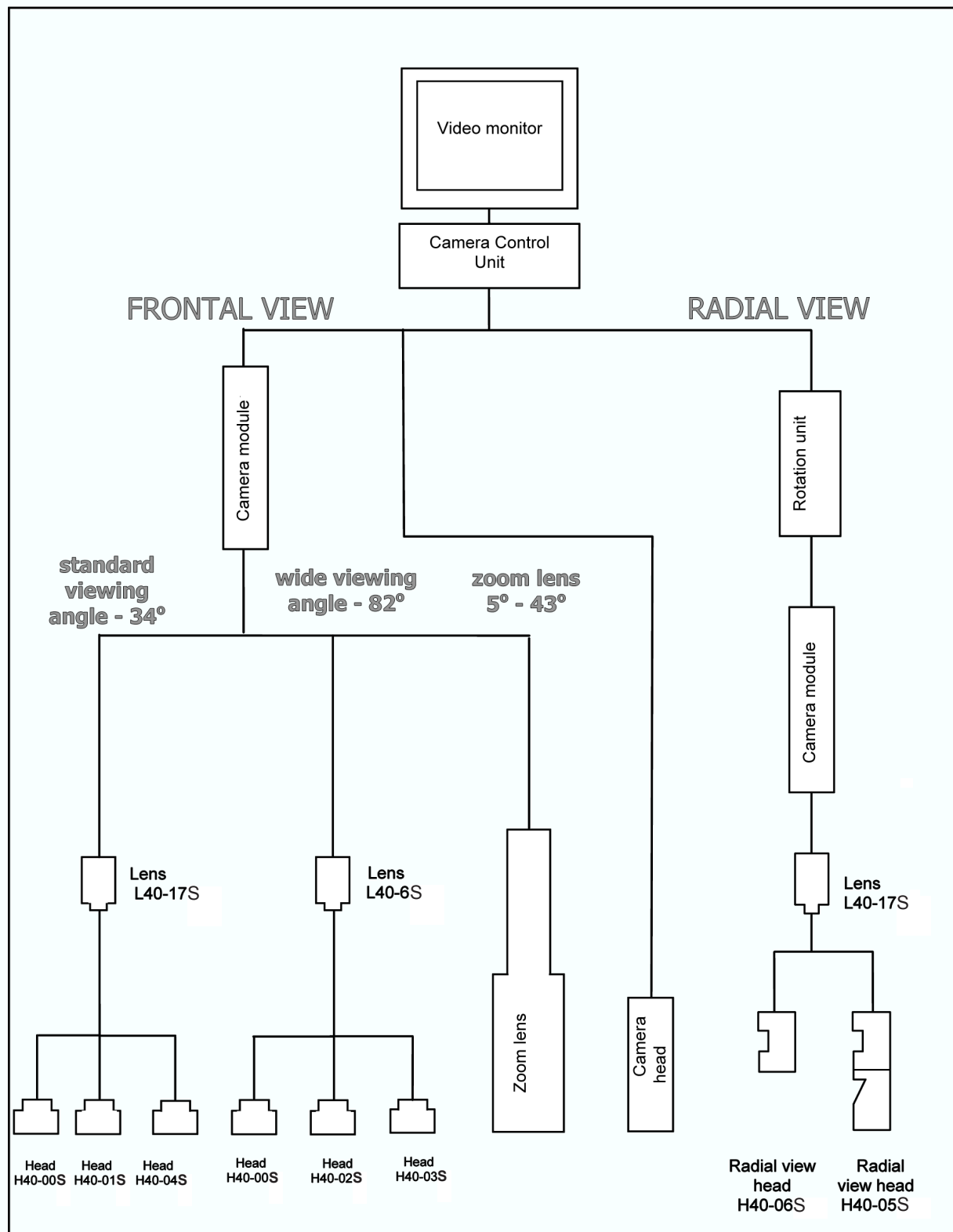
Note2: Image will be out of focus if the camera is closer to the viewing object than the minimum distance

Note3: Lights will provide uniform lighting on the viewing object between the distance range

Note4: Without cable connector. Length of cable connector: 131 mm

Note5: Length with rotation unit without cable connector. Rotation angle of the rotation unit - 360° (continuous rotation), rotation speed – 7 degrees/s





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