OLYMPUS®

Your Vision, Our Future

Phased Array Probes and Wedges

- **Angle Beam Probes**
- **Immersion Probes**
- **Integrated Wedge**
- **Curved Array Probes**
- **Wedges**

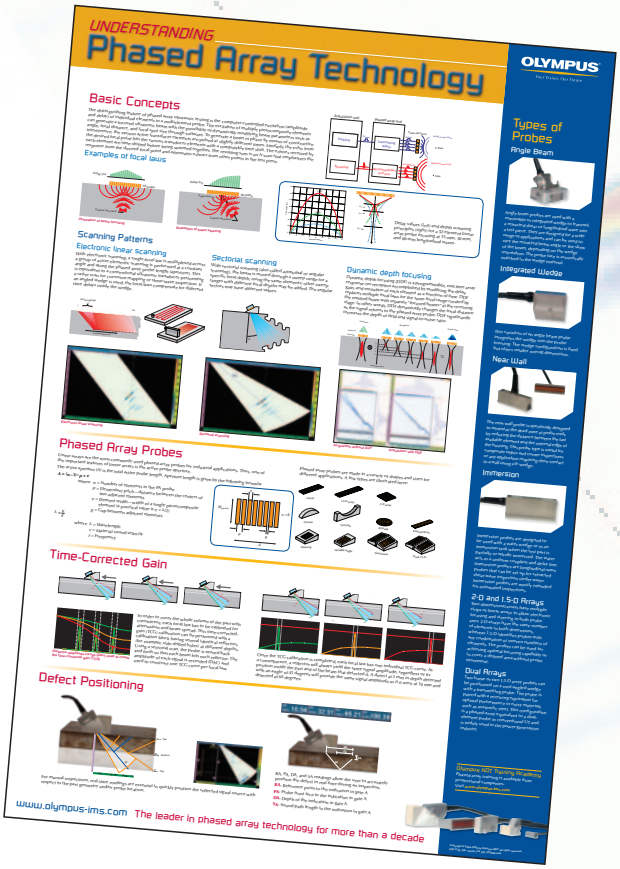
The Company

Olympus Corporation is an international company operating in industrial, medical, and consumer markets, specializing in optics, electronics and precision engineering. Olympus instruments contribute to the quality of products and add to the safety of infrastructures and facilities.

Olympus NDT is a world-leading manufacturer of innovative nondestructive testing instruments that are used in industrial and research applications ranging from aerospace, power generation, petrochemical, civil infrastructure, and automotive to consumer products. Leading-edge testing technologies include ultrasound, ultrasound phased array, eddy current, and eddy current array. Its products include flaw detectors, thickness gages, industrial NDT systems, automated systems, industrial scanners, pulser-receivers, probes, transducers, and various accessories. Olympus NDT is also a distributor of remote visual inspection instruments and high- speed video cameras in the Americas.

Olympus NDT is based in Waltham, Massachusetts, USA. The company has sales and service centers in all principal industrial locations worldwide. Visit www.olympus-ims.com *for applications and sales assistance.*

We invite you to browse this catalog to find out more about Olympus phased array probes and accessories and their applications.



In order to support the growing NDT community, Olympus has published the “Understanding Phased Array Technology” poster. This poster has been designed by field experts to present phased array inspection technology in a concise and clearly illustrated manner.

Get your free poster at www.olympus-ims.com.

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Introduction to Phased Array Technology

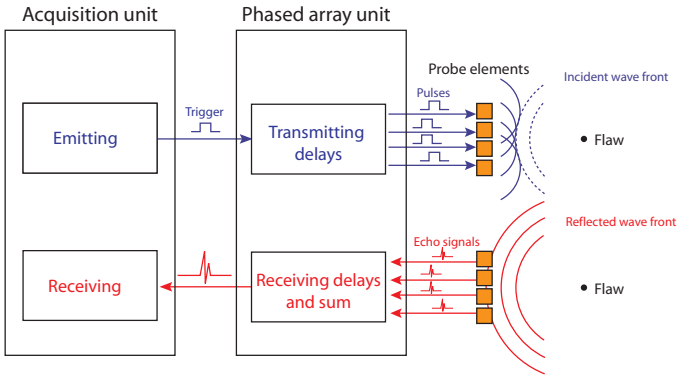
The distinguishing feature of phased array ultrasonic testing is the computer-controlled excitation (amplitude and delay) of individual elements in a multielement probe. The excitation of multiple piezocomposite elements generates a focused ultrasonic beam allowing the dynamic modification of beam parameters such as angle, focal distance, and focal spot size through software. To generate a beam in phase by means of constructive interference, the various active transducer elements are pulsed at slightly different times. Similarly, the echo from the desired focal point hits the various transducer elements with a computable time shift. The echoes received by each element are time-shifted before being summed together.
The resulting sum is an A-scan that emphasizes the response from the desired focal point and attenuates echoes from the other points in the test piece.

All Olympus phased array systems offer the following capabilities:

SOFTWARE CONTROL OF BEAM ANGLE, FOCAL DISTANCE, AND FOCAL SPOT SIZE

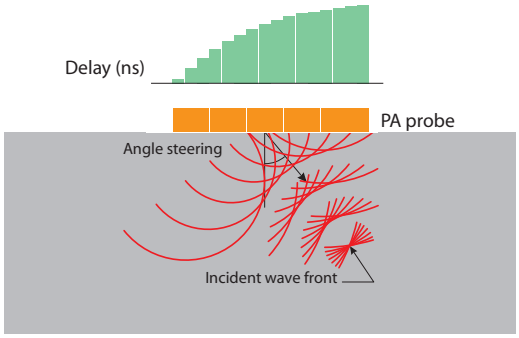
To generate a beam, the various probe elements are pulsed at slightly different times. By precisely controlling the delays between the probe elements, beams of various angles, focal distances, and focal spot sizes can be produced. The echo from the desired focal point hits the various probe elements with a computable time shift.

The signals received at each probe element are time-shifted before being summed together. The resulting sum is an A-scan emphasizing the response from the desired focal point and attenuating various other echoes from other points in the material.



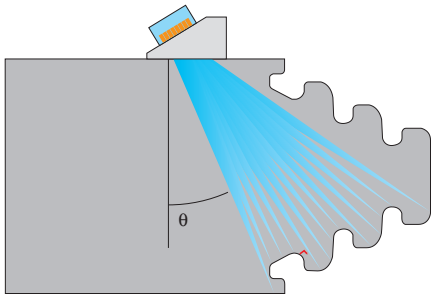
MULTIPLE-ANGLE INSPECTION WITH A SINGLE, SMALL, ELECTRONICALLY CONTROLLED, MULTIELEMENT PROBE

A conventional UT inspection requires a number of different transducers. A single phased array probe can be made to sequentially produce the various angles and focal points required by the application.



INSPECTION OF COMPLEX SHAPES

The capacity to produce at will, and under computer control, various beam angles and focal lengths is used to inspect parts with complex shapes such as turbine discs, turbine blade roots, reactor nozzles, and other complex shapes.



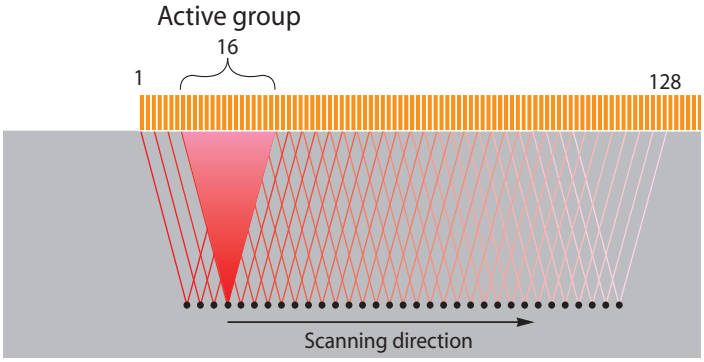
HIGH-SPEED SCANS WITH NO MOVING PARTS

While phased arrays imply handling the many signals from multielement probes, it is important to note that the resulting signal is a standard RF signal (or A-scan) comparable to that of any conventional system with a fixed-angle transducer.

This signal can be evaluated, processed, filtered, and imaged just as any A-scan from a conventional UT system. B-scans, C-scans, and D-scans built from the A-scan are also identical to that of a conventional system. The difference is that a multiple-angle inspection can be handled with a single transducer.

Multiplexing also allows motionless scanning: a focused beam is created using a few of the many elements of a long phased-array probe. The beam is then shifted (or multiplexed) to the other elements to perform a high-speed scan of the part with no probe movement along that axis. More than one scan may be performed with various inspection angles.

The principle can be applied to flat parts using a linear phased array probe or to tubes and rods using a circular phased array probe.



High-speed linear scan: Olympus phased array systems can also be used to inspect flat surfaces such as steel plates. Compared to a wide, single-element transducer—often referred to as a "paint brush"—phased array technology offers a much higher sensitivity due to the use of a small focused beam.

DEFECT POSITIONING

For manual inspections, real-time readings are essential to quickly position the reflected signal source with respect to the part's geometry and/or probe location.

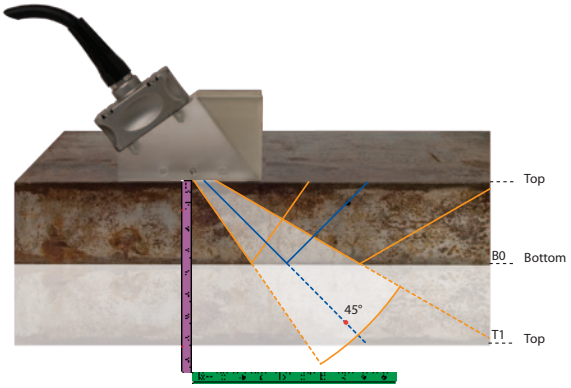
RA, PA, DA, and SA readings allow the user to accurately position the defect in real time during an inspection.

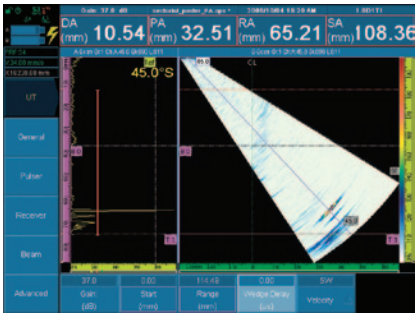
RA: Reference point to the indication in gate A

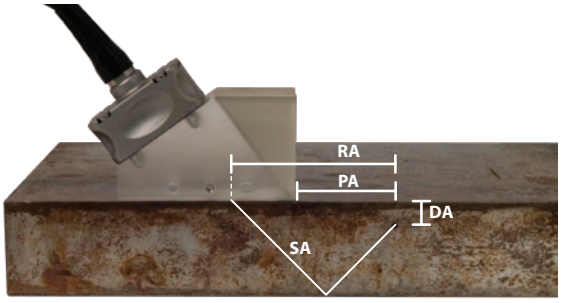
PA: Probe front face to the indication in gate A

DA: Depth of the indication in gate A

SA: Sound path length to the indication in gate A





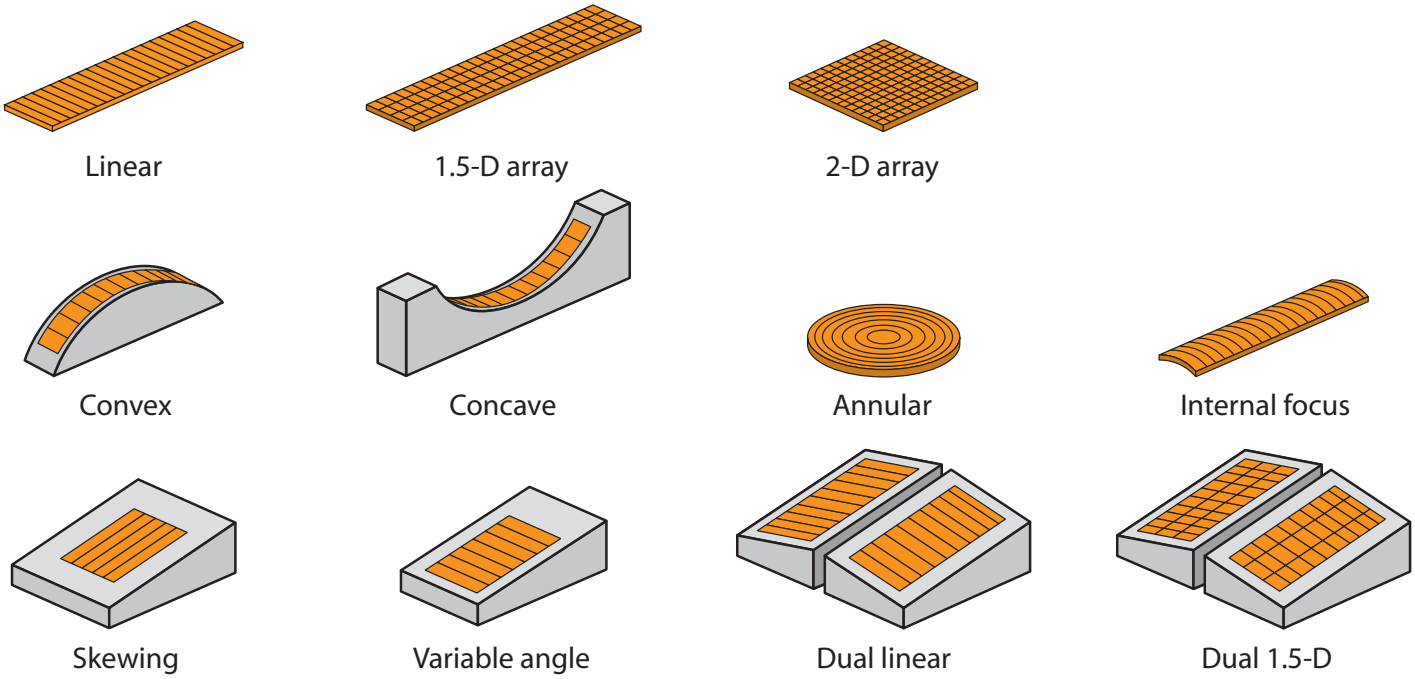


DA (mm)	PA (mm)	RA (mm)	SA (mm)
10.54	32.51	65.21	108.36

PHASED ARRAY PROBES

Phased array probes are made in a variety of shapes and sizes for different applications. A few types are illustrated here.

Typical array probes have a frequency ranging from 1 MHz to 17 MHz and have between 10 and 128 elements. Olympus offers a wide variety of probes using piezocomposite technology for all types of inspections. This catalog shows Olympus standard phased array probes, which are divided into three types: angle beam probes, integrated wedge probes, and immersion probes.



Other types of probes can be designed to suit the needs of your application.

Linear arrays are the most commonly used phased array probes for industrial applications. One of the important features that defines phased array probes is the active probe aperture.

The *active aperture (A)* is the total active probe length. Aperture length is calculated by the following formula:

$$A = n \bullet p$$

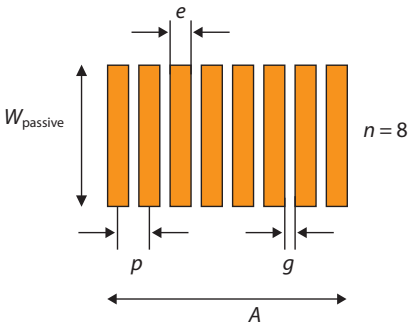
where n = number of elements in the PA probe

p = elementary pitch—distance between the centers of two adjacent elements

A more precise way of finding the active aperture is calculated by this formula:

$$A = (n-1) \bullet p + e$$

where e = element width—width of a single piezocomposite element (a practical value is $e < \lambda/2$)



The *near-field (N)* value gives the maximum depth of usable focus for a given array. This value is given by the following formula:

$$N = \frac{D^2 f}{4c}$$

where D = element diameter

f = frequency

c = material velocity

- To calculate the near-field value in the active (primary) axis of a phased array probe: $D = n' \bullet p$, where n' is number of elements per group in the focal law.
- To calculate the near-field value in the passive (secondary) axis of a phased array probe: $D = Wpassive$, which is often called elevation.

Ordering Information

NUMBERING SYSTEM USED TO ORDER STANDARD PHASED ARRAY PROBES

GLOSSARY USED TO ORDER PHASED ARRAY PROBES (Typical options shown)

Frequency

1.5 = 1.5 MHz
2.25 = 2.25 MHz
3.5 = 3.5 MHz
5 = 5 MHz
7.5 = 7.5 MHz
10 = 10 MHz

Array type

L = linear
A = annular
M = matrix probe (1.5D, 2D)
CV (ROC) = convex in azimuth
CC (ROC) = concave in azimuth
CCEV (ROC) = elevation focused

Number of elements

Example:

16 = 16 elements

Active Aperture

Active aperture in mm.
Refer to page vi for details.

Elevation

Elevation in mm
Example:

10 = 10 mm

Probe type

A = angle beam with external wedge
NW = near-wall
PWZ = weld inspection angle beam
W = angle beam with integrated wedge
I = immersion
DGS = DGS inspection/Atlas (AVG probe)
AWS = AWS inspection

Casing type

Casing type for a given probe type

Cable type

P = PVC outer
M = metal armor outer

Cable length

Cable length in m

2.5 = 2.5 m
5 = 5 m
10 = 10 m

Connector type

OM = OmniScan® connector
HY = Hypertronics™ connector
OL = OmniScan Connector with conventional UT channel on element 1 (LEMO® 00 connector)

ROC: radius of curvature (mm)

Phased array probes application matrix

Probe model	Composite	Weld	Immersion	Small footprint	Deep penetration	General purpose	Typical application use		Scan type	Additional information
							Manual	Automated		
A00				✓			✓		Sectorial	Developed for scribe mark applications
A0		✓		✓		✓	✓		Sectorial	Small access, reduced footprint
A1		✓		✓		✓		✓	Sectorial	Replaced by A10 for weld applications
A2		✓				✓		✓	Sectorial and Linear	Replaced by A12 for weld applications
A3		✓			✓			✓	Sectorial	
A4		✓			✓			✓	Sectorial	
A5		✓			✓			✓	Sectorial	
A10		✓		✓		✓		✓	Sectorial	
A11		✓				✓		✓	Sectorial	Developed for OmniScan 32:128 shear wave and L-wave manual S-scan crack sizing applications
A12		✓				✓		✓	Sectorial and Linear	Primary probe for carbon steel weld inspection for thickness up to 50 mm (16:128) and 70 mm (32:128)
A14		✓				✓		✓	Sectorial and Linear	
AWS		✓					✓		Sectorial	AWS weld inspection
NW1	✓							✓	Linear	Designed for near-wall and close access applications
NW2	✓							✓	Linear	
NW3	✓							✓	Linear	
PWZ1		✓						✓	Sectorial and Linear	Primary probe for carbon steel weld inspection for thickness over 50 mm (16:128)
PWZ3		✓						✓	Sectorial	
DGS1		✓				✓	✓		Sectorial	DGS applications
I1			✓					✓	Sectorial and Linear	
I2			✓					✓	Sectorial and Linear	
I3			✓					✓	Sectorial and Linear	

This table is only a general application guideline. Please consult your Olympus sales representative prior to ordering.

Angle Beam Probes

General purpose

5L16-A10

5L32-A11

5L64-A12

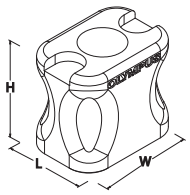
Advantages

- Probes are designed to have a low-profile probe/wedge combination for easier access in restricted areas.
- Wave layers with acoustic adaptation to Rexolite®
- Captive anchoring screws are provided with the probe.
- A wide selection of wedges is available to suit any angle beam application.

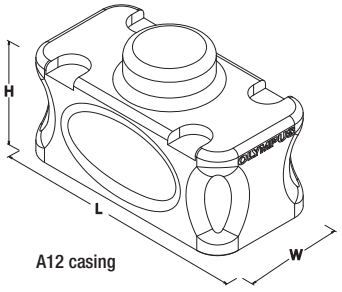
Typical applications

A10, A11, AND A12 PROBES

- Manual or automated inspection of 6.35 mm to 38 mm (0.25 in. to 1.5 in.) thick welds
- Detection of flaws and sizing
- Inspections of castings, forgings, pipes, tubes, and machined and structural components for cracks and welding defects



A10 casing



A12 casing

Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	External dimensions mm (in.)		
						L	W	H
5L16-A1	5.0	16	0.60	9.6	10.0	17 (0.67)	29 (1.16)	25 (0.98)
10L32-A1	10.0	32	0.31	9.9	7.0	17 (0.67)	29 (1.16)	25 (0.98)
5L64-A2	5.0	64	0.60	38.4	10.0	53 (2.09)	29 (1.16)	35 (1.38)
10L64-A2	10.0	64	0.60	38.4	7.0	53 (2.09)	29 (1.16)	35 (1.38)
5L16-A10	5.0	16	0.60	9.6	10.0	16 (0.62)	23 (0.89)	20 (0.79)
10L32-A10	10.0	32	0.31	9.9	7.0	16 (0.62)	23 (0.89)	20 (0.79)
5L32-A11	5.0	32	0.60	19.2	10.0	25 (0.99)	23 (0.89)	20 (0.79)
5L64-A12	5.0	64	0.60	38.4	10.0	45 (1.76)	23 (0.89)	20 (0.79)
5L60-A14	5.0	60	1.0	60.0	10.0	68 (2.68)	23 (0.89)	20 (0.79)
7.5L60-A14	7.5	60	1.0	60.0	10.0	68 (2.68)	23 (0.89)	20 (0.79)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

Angle Beam Probes

Deep penetration applications

A3 A4 A5

Advantages

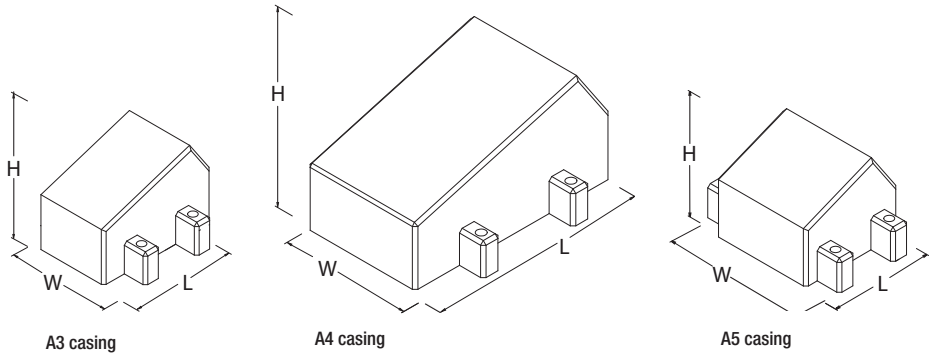
- Wave layers with acoustic adaptation to Rexolite®
- Captive anchoring screws are provided with the probe.
- A wide selection of wedges is available to suit any angle beam application.

Typical applications

A3, A4, AND A5 PROBES

Deep penetration applications

- Thick plates and welds
- Forging
- Noisy or granular material



A3 casing A4 casing A5 casing

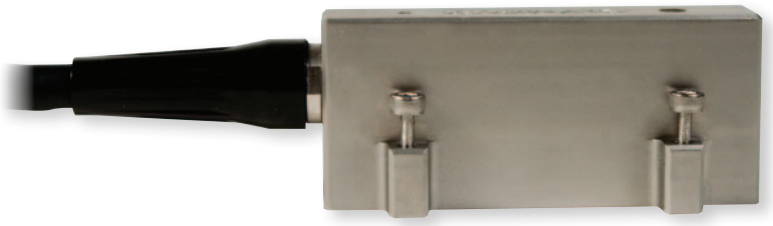
Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	External dimensions mm (in.)		
						L	W	H
3.5L16-A3	3.5	16	1.60	25.6	16.0	36 (1.41)	36 (1.41)	25 (0.98)
5L16-A3	5.0	16	1.20	19.2	12.0	36 (1.41)	36 (1.41)	25 (0.98)
1.5L16-A4	1.5	16	2.80	44.8	26.0	57 (2.25)	46 (1.80)	30 (1.19)
2.25L16-A4	2.25	16	2.00	32.0	20.0	57 (2.25)	46 (1.80)	30 (1.19)
2.25L32-A5	2.25	32	0.75	24.0	24.0	29 (1.15)	43 (1.67)	24 (0.96)
5L32-A5	5.0	32	0.60	19.2	20.0	29 (1.15)	43 (1.67)	24 (0.96)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

Angle Beam Probes

Weld inspection

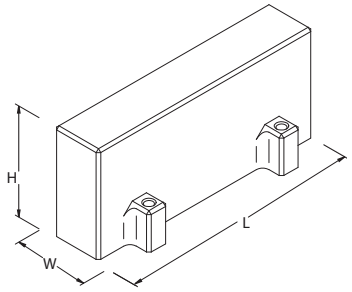


7.5L60-PWZ1

SPWZ1-N55S-IHC

Advantages

- Low-profile housing
- Front-exit cable to avoid interference with the scanner probe holder
- Fits special PipeWIZARD® wedges designed for automated inspections of girth welds (sophisticated irrigation channels, locking carbide wear pins)
- Can be ordered with CE-certified Hypertronics™ connector
- Suitable for manual and automated inspections



PWZ1 casing

Typical applications

- Automated inspection of girth welds with PipeWIZARD systems
- Manual or automated inspection of thick welds
- Detection of flaws and sizing
- Inspection of castings, forgings, pipes, tubes, and machined and structural components for cracks and welding defects

Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	External dimensions mm (in.)		
						L	W	H
5L60-PWZ1	5.0	60	1.0	60.0	10.0	68 (2.68)	26 (1.02)	30 (1.18)
7.5L60-PWZ1	7.5	60	1.0	60.0	10.0	68 (2.68)	26 (1.02)	30 (1.18)
5L48-PWZ2	5.0	48	1.0	48.0	10.0	56 (2.20)	26 (1.02)	30 (1.18)
5L32-PWZ3	5.0	32	1.0	32.0	10.0	40 (1.58)	26 (1.02)	30 (1.18)
7.5L32-PWZ3	7.5	32	1.0	32.0	10.0	40 (1.58)	26 (1.02)	30 (1.18)
10L32-PWZ3	10.0	32	1.0	32.0	10.0	40 (1.58)	26 (1.02)	30 (1.18)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.
When ordered as part of the PipeWIZARD systems, these probes require CE Hypertronics™ connectors and a 0.6 m (2 ft) cable.

Angle Beam Probes

Small-footprint and near-wall probes

10L16-A00

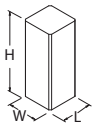
10L16-A00 with SA00-N60S wedge

5L10-A0-TOP

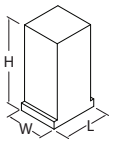
5L64-NW1

Advantages of small-footprint probes

- Access to confined areas (A00 probe has an 8 × 8 mm footprint)
- Cable connector can come out from either the side or the top (A0 only).
- Special-design small-footprint wedge
- 10L16-A00 is used for aerospace scribe-mark applications.



A00 casing

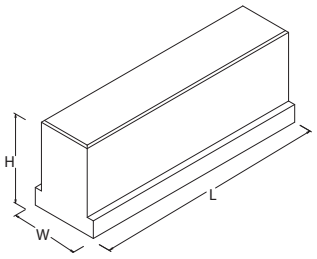


A0 casing

Dimensions are without the strain relief.

Advantages of near-wall probes

- Shortened dead zone at both ends (1.5 mm between center of first or last element and housing edge)
- Well suited for composite channel inspections
- Used for C-scan inspections of composites (delamination, disbonding, and porosity)



NW1 casing

Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	External dimensions mm (in.)		
						L	W	H
Small-footprint probes								
10L16-A00	10.0	16	0.31	5.0	5.0	8 (0.31)	8 (0.31)	23 (0.90)
5L10-A0-SIDE	5.0	10	0.60	6.0	6.0	13 (0.50)	10 (0.40)	23 (0.90)
5L10-A0-TOP	5.0	10	0.60	6.0	6.0	13 (0.50)	10 (0.40)	23 (0.90)
10L10-A0-SIDE	10.0	10	0.60	6.0	6.0	13 (0.50)	10 (0.40)	23 (0.90)
10L10-A0-TOP	10.0	10	0.60	6.0	6.0	13 (0.50)	10 (0.40)	23 (0.90)
Near-wall probes								
3.5L64-NW1	3.5	64	1.0	64.0	7.0	66 (2.60)	19 (0.75)	25 (0.98)
5L64-NW1	5.0	64	1.0	64.0	7.0	66 (2.60)	19 (0.75)	25 (0.98)
3.5L24-NW2	3.5	24	1.0	24.0	7.0	22 (0.85)	19 (0.75)	30 (1.18)
5L24-NW2	5.0	24	1.0	24.0	7.0	22 (0.85)	19 (0.75)	30 (1.18)
3.5L128-NW3	3.5	128	1.0	128.0	7.0	130 (5.12)	21 (0.83)	35 (1.38)
5L128-NW3	5.0	128	1.0	128.0	7.0	130 (5.12)	21 (0.83)	35 (1.38)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

Immersion Probes

10L128-I2

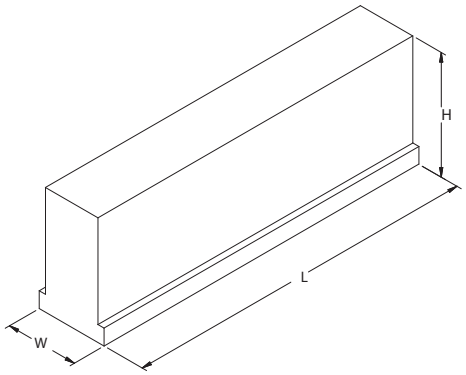
Immersion probes are designed to be used with a water wedge or in an immersion tank when the test part is partially or wholly immersed. They are longitudinal wave probes that can be set up for refracted shear-wave inspections using a Rexolite wedge.

Advantages

- Acoustic impedance matches water
- Design allows fitting on water wedges for easier coupling on many surfaces and an adjustable water path (when the part to be inspected cannot be immersed in a tank).
- Linear scanning allows coverage of 30 mm to 90 mm in one line, with very high accuracy.
- Corrosion-resistant stainless steel case
- Waterproof guaranteed up to 1 m (3.28 ft) under water

Typical applications

- Inspection of thin plate or tubing (steel, aluminum, or other)
- Composite inspection for delamination, disbonding, etc.
- Inline thickness gaging
- Automated scanning



I3 casing

Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	External dimensions mm (in.)		
						L	W	H
5L64-I1	5.0	64	0.60	38.4	10.0	50 (1.97)	19 (0.75)	25 (0.98)
10L64-I1	10.0	64	0.50	32.0	7.0	50 (1.97)	19 (0.75)	25 (0.98)
5L128-I2	5.0	128	0.60	76.8	10.0	83 (3.27)	21 (0.83)	35 (1.38)
10L128-I2	10.0	128	0.50	64.0	7.0	83 (3.27)	21 (0.83)	35 (1.38)
2.25L128-I3	2.25	128	0.75	96.0	12.0	102 (4.02)	21 (0.83)	35 (1.38)
5L128-I3	5.0	128	0.75	96.0	10.0	102 (4.02)	21 (0.83)	35 (1.38)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

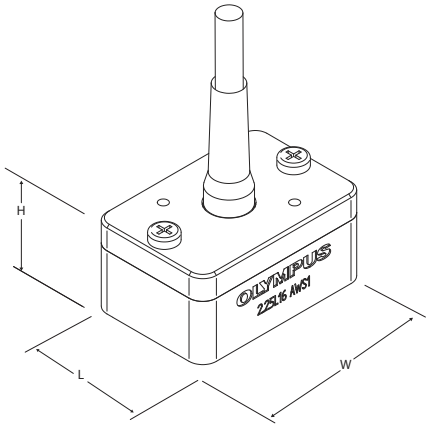
Integrated Wedge and Code Compliant Probes

4L16-DGS1

2.25L16-AWS1

Advantages

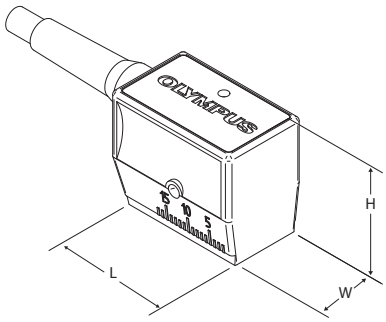
- Probe and wedge in the same housing
- The lowest-profile probe-and-wedge combination for contact angle beam inspection
- Coupling always good between probe and wedge interfaces, no need for couplant between the probe and wedge
- Very small assembly for easy access in restricted areas
- Inspections of 30° to 70° in steel, SW or LW
- Easy to handle
- Probes with an internal wedge can be specially ordered to fit a specific curvature radius.



AWS1 casing

Typical applications

- Manual weld inspection of 6.35 mm to 19 mm (0.25 in. to 0.75 in.) thick surfaces (butt joints, corner joints, tee joints), using 40° to 70° simultaneously
- Manual inspection of stress-corrosion cracking
- AWS and DGS code compliant applications



DGS casing

Probe specifications and dimensions

Part number	Frequency (MHz)	Number of elements	Pitch (mm)	Active aperture (mm)	Elevation (mm)	Nominal refracted beam angle in steel	Integrated Wedge	External dimensions mm (in.)		
								L	W	H
2L8-DGS1	2.0	8	1.0	8.0	9.0	58° SW	Yes	27 (1.07)	17 (0.66)	22 (0.88)
4L16-DGS1	4.0	16	0.5	8.0	9.0	58° SW	Yes	27 (1.07)	17 (0.66)	22 (0.88)
2.25L16-45SW1	2.25	16	0.75	12.0	12.0	45° SW	Yes	30 (1.18)	15 (0.59)	31 (1.22)
2.25L16-45LW1	2.25	16	0.75	12.0	12.0	45° LW	Yes	30 (1.18)	15 (0.59)	31 (1.22)
5L16-45SW1	5.0	16	0.60	9.6	10.0	45° SW	Yes	30 (1.18)	15 (0.59)	31 (1.22)
5L16-45LW1	5.0	16	0.60	9.6	10.0	45° LW	Yes	30 (1.18)	15 (0.59)	31 (1.22)
2.25L16-AWS1	2.25	16	1.0	16.0	16.0	N/A	No	25 (1.0)	38 (1.48)	18 (0.70)

These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

Curved Array Probes

3.5CC25-R4

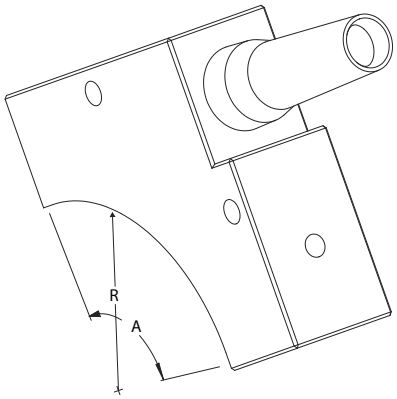
3.5CC50-R5

Advantages

- Acoustic impedance matches water.
- High circumferential resolution around the radius
- Corrosion-resistant stainless steel case
- Waterproof guaranteed up to 1 m (3.28 ft) underwater
- Compatible with adjustable immersion wedges (shown on page 19)

Typical applications

- Inspection of carbon fiber reinforced polymers (CFRP) corners
- Composite inspection for delamination



R casing

Probe specifications and dimensions

Part number	Casing type	Frequency (MHz)	Number of element	Pitch (mm)	Elevation (mm)	Radius (mm) (R)	Angle (°) (A)	Inspection type
3.5CC10.2-16-R1	R1	3.5	16	1.0	5.0	10.2	90	ID
5CC10.2-16-R1	R1	5.0	16	1.0	5.0	10.2	90	ID
3.5CC25-32-R4	R4	3.5	32	1.32	6.0	25.0	90	ID, OD
5CC25-32-R4	R4	5.0	32	1.32	6.0	25.0	90	ID, OD
3.5CC50-64-R5	R5	3.5	64	1.65	6.0	50.0	121	OD
5CC50-64-R5	R5	5.0	64	1.65	6.0	50.0	121	OD

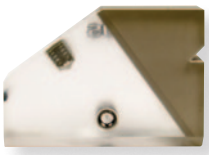
These probes come standard with an OmniScan® connector and a 2.5 m (8.2 ft) cable or can be specially fitted with other connectors and cable lengths.

Wedges for Angle Beam Probes

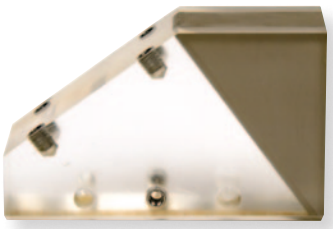
SA2-0L

SA00-N60S

SA10-N55S



SA11-N55S



SA12-N55S

Advantages

- Available in standard refracted angles of 0°, 45°, 55°, and 60° in steel for angle-beam inspections from 30° to 70°, SW or LW
- Stainless steel screw receptacles provide a firm anchoring of probes to wedges.
- Lateral electronic scanning replaces the hand-skewing movement (with lateral wedges).
- The IHC wedge option can be ordered to improve the quality of the inspection: irrigation, mounting holes for the wedge holder to work with any Olympus scanner, and carbide pins to increase wear resistance.
- Wedges are designed to perform manual or automated scans.
- Custom wedges with specific refracted angles can be ordered; wedge shape and contour can also be customized.

NUMBERING SYSTEM USED TO ORDER WEDGES FOR ANGLE BEAM PROBES

SA1-N60S-IHC-AOD8

- SA1 — Wedge type
- N — Probe mounting
- 60 — Refracted angle in steel
- S — Wave type
- IHC — Options
- AOD — Curvature type
- 8 — Pipe diameter

GLOSSARY USED TO ORDER WEDGES

Wedge type

SA00 = wedge for angle beam probe type A00
SA0 = wedge for angle beam probe type A0
SA1 = wedge for angle beam probe type A1
SA2 = wedge for angle beam probe type A2
SA3 = wedge for angle beam probe type A3
SA4 = wedge for angle beam probe type A4
SA5 = wedge for angle beam probe type A5
SA10 = wedge for angle beam probe type A10
SA11 = wedge for angle beam probe type A11
SA12 = wedge for angle beam probe type A12
SNW1 = wedge for near-wall probe type NW1
SPWZ1 = wedge for PipeWIZARD probe type PWZ1
SPWZ3 = wedge for PipeWIZARD probe type PWZ3

Probe mounting

N = normal
L = lateral (90° skew)

Refracted angle in steel

0 = 0°
45 = 45°
55 = 55°
60 = 60°

Wave type

S = shear wave
L = longitudinal wave

Options

IHC = Irrigation, scanner attachment points, and carbide wear pins
IHC-C = Irrigation, scanner attachment points, and composite wear pins
WP5 = Water pocket 0.005 in.

Curvature type

AOD = Axial outside diameter (circumferential scan)
COD = Circumferential outside diameter (axial scan)

Pipe diameter

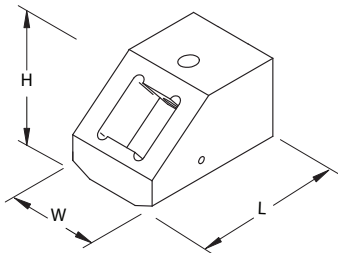
Measured external pipe diameter in in.

Wedge specifications and dimensions

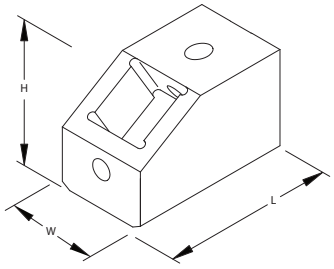
Part number	Probe type	Nominal refracted beam angle (in steel)	Sweep (°)	Probe orientation	Wedge dimensions (mm)			
					L	W	W*	H
SA00-0L	A00	0° LW	N/A	Normal	16	12	N/A	12
SA00-N45S	A00	45° SW	30 to 60	Normal	21	12	N/A	13
SA00-N60S	A00	60° SW	45 to 70	Normal	21	14	N/A	13
SA0-0L	A0	0° LW	N/A	Normal	23	12	N/A	11
SA0-N45S	A0	45° SW	30 to 60	Normal	32	18	N/A	20
SA0-N45L	A0	45° LW	30 to 60	Normal	28	11	N/A	25
SA0-N60S	A0	60° SW	45 to 70	Normal	32	18	N/A	21
SA1-0L	A1	0° LW	N/A	Normal	29	30	10	20
SA1-N60S	A1	60° SW	30 to 70	Normal	30	30	40	16
SA1-N60L	A1	60° LW	45 to 70	Normal	28	30	40	21
SA1-L45S	A1	45° SW	–30 to 30	Lateral	45	35	45	27
SA1-L45L	A1	45° LW	–30 to 30	Lateral	45	35	45	42
SA2-0L	A2	0° LW	N/A	Normal	65	30	40	20
SA2-N60L	A2	60° LW	30 to 70	Normal	79	30	40	50
SA2-N55S	A2	55° SW	30 to 70	Normal	69	30	40	43
SA3-0L	A3	0° LW	N/A	Normal	38	37	50	20
SA3-N45S	A3	45° SW	30 to 60	Normal	55	37	50	30
SA3-N45L	A3	45° LW	30 to 60	Normal	55	37	50	49
SA3-N60S	A3	60° SW	45 to 70	Normal	58	37	50	32
SA3-N60L	A3	60° LW	45 to 70	Normal	53	37	50	40
SA4-0L	A4	0° LW	N/A	Normal	59	47	55	20
SA4-N45S	A4	45° SW	30 to 60	Normal	90	47	55	51
SA4-N45L	A4	45° LW	30 to 60	Normal	88	47	55	85
SA4-N60S	A4	60° SW	45 to 70	Normal	86	47	55	45
SA4-N60L	A4	60° LW	45 to 70	Normal	83	47	55	68
SA5-0L	A5	0° LW	N/A	Normal	38	45	55	20
SA5-N45S	A5	45° SW	30 to 60	Normal	57	47	55	37
SA5-N60S	A5	60° SW	45 to 70	Normal	46	43	55	25
SA5-N60L	A5	60° LW	45 to 70	Normal	39	50	55	41
SA10-0L	A10	0° LW	–30 to 30	Normal	25	23	40	20
SA10-N55S	A10	55° SW	30 to 70	Normal	23	23	40	14
SA10-N60L	A10	60° LW	30 to 70	Normal	26	23	40	30
SA11-0L	A11	0° LW	–30 to 30	Normal	35	23	40	23
SA11-N55S	A11	55° SW	30 to 70	Normal	41	23	40	29
SA11-N60L	A11	60° LW	30 to 70	Normal	66	23	40	41
SA12-0L	A12	0° LW	–30 to 30	Normal	62	23	40	53
SA12-N55S	A12	55° SW	30 to 70	Normal	58	23	40	23
SA12-N60L	A12	60° LW	30 to 70	Normal	26	23	40	30
SAWS1-N60S	AWS1	60° SW	45 to 70	Normal	45	38	N/A	30
SAWS1-0L	AWS1	0° LW	-30 to 30	Normal	38	38	N/A	40
SNW1-0L	NW1	0° LW	N/A	Normal	66	32	32	22
SNW1-0L-WP5	NW1	0° LW	N/A	Normal	66	32	32	22

Part number	Probe type	Nominal refracted beam angle (in steel)	Sweep (°)	Probe orientation	Wedge dimensions (mm)			
					L	W	W*	H
SNW1-0L-IHC-C	NW1	0° LW	N/A	Normal	66	32	32	22
SNW2-0L	NW2	0° LW	N/A	Normal	26	32	32	22
SNW2-0L-WP5	NW2	0° LW	N/A	Normal	26	32	32	22
SNW3-0L	NW3	0° LW	N/A	Normal	130	32	32	22
SNW3-0L-WP5	NW3	0° LW	N/A	Normal	130	32	32	22
SPWZ1-0L	PWZ1	0° LW	N/A	Normal	75	30	40	20
SPWZ1-N55S REV-C	PWZ1	55° SW	30 to 70	Normal	87	30	40	45
SPWZ3-0L	PWZ3	0° LW	N/A	Normal	40	30	40	20
SPWZ3-N55S	PWZ3	55° SW	30 to 70	Normal	65	30	40	38
SPWZ3-N60L	PWZ3	60° LW	45 to 70	Normal	64	30	40	35

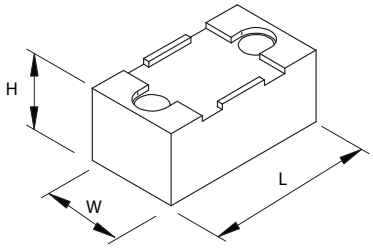
*: Width with IHC wedge option



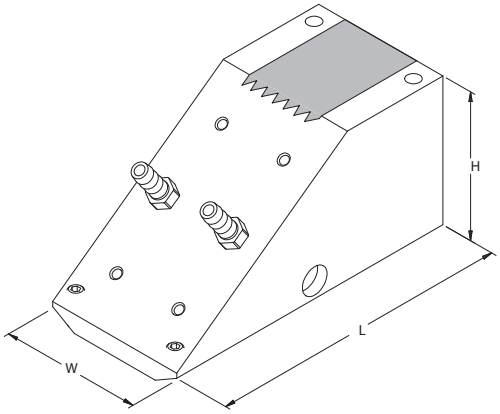
SA00-N60S



SA0-N45S

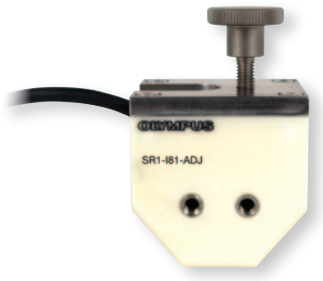


SA0-0L



SPWZ1-N55S-IHC

Immersion Corner Wedges for Curved Array Probes



SR1-I81-ADJ

SR4-IE90-ADJ

Advantages

- Available in specific radius and angle and also with adjustable radius to fit on various components to be inspected
- Wedges are designed to perform manual scans.
- Designed to be used with the Mini-Wheel encoder

NUMBERING SYSTEM USED TO ORDER WEDGES FOR CURVED ARRAY PROBES

SR1-I90-0.125

- Wedge type
- Inspection type
- Angle of inspected part
- Radius

GLOSSARY USED TO ORDER WEDGES

Wedge type
SR1 = wedge for curved probe type R1
SR4 = wedge for curved probe type R4
SR5 = wedge for curved probe type R5

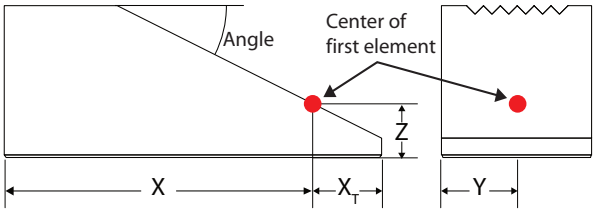
Inspection type
I = internal
E = external

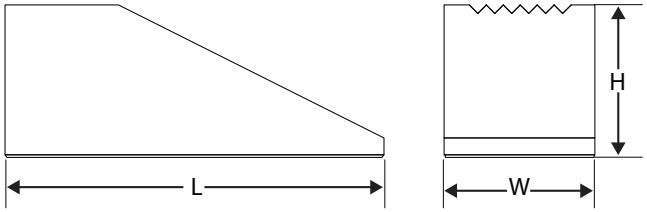
Angle of inspected part (°)
81 = 81°
90 = 90°
98 = 98°
Custom angles can be ordered.

Radius
Radius in in.
ADJ = adjustable radius

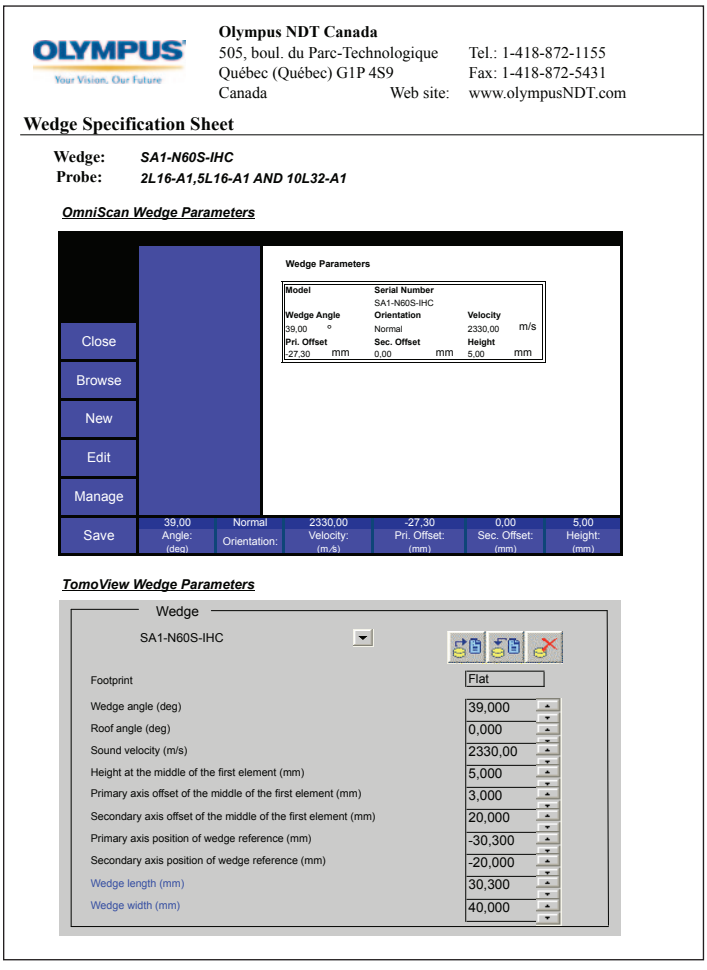
Part number	Probe type	Angle of the inspected part (°)	Radius range (mm)	Inspection type
SR1-I81-ADJ	R1	81	4 to 14	ID
SR1-I90-ADJ	R1	90	3 to 14	ID
SR1-I98-ADJ	R1	98	3 to 13	ID
SR4-IE90-ADJ	R4	90	3 to 20	OD/ID

Wedge Offset Parameters





A Wedge Specification Sheet is provided with every wedge. This sheet presents the wedge offset parameters of a phased array probe's first element for both OmniScan® and TomoView™ software. It is important to note that the values given are only applicable for the wedge and probe combinations listed.



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Web site: www.olympusNDT.com

Wedge Specification Sheet

Wedge: *SA1-N60S-IHC*
Probe: *2L16-A1,5L16-A1 AND 10L32-A1*

OmniScan Wedge Parameters

TomoView Wedge Parameters

Note that if the word "reverse" appears on the header of the Wedge Specification Sheet, it means that the probe is mounted backwards on the wedge.

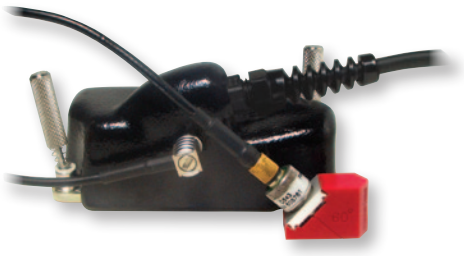
Wedge parameters with OmniScan	
X	Primary offset
Y	Secondary offset (0 when probe is centered)
Z	Height

Wedge parameters with TomoView	
X_T	Primary axis offset of the middle of the first element (mm)
Y	Secondary axis offset of the middle of the first element (mm) (measured from the side of the wedge)
Z	Height at the middle of the first element (mm)

HOW TO FIND THE WEDGE PARAMETERS

1. Find the appropriate wedge in either the OmniScan or TomoView Wedge Database. Parameters are automatically set once the wedge model is chosen.
2. If the wedge is not already in the database, you may download the latest database update from the Service & Support section of www.olympus-ims.com.
3. Enter the parameters manually using the values provided on the Wedge Specification Sheet accompanying the wedge.
4. Call your local sales representative.

Probe Options



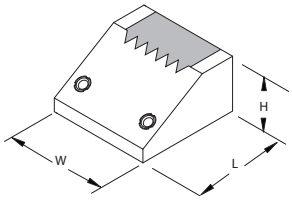
OL OMNISCAN CONNECTOR

- Additional conventional UT channel (LEMO 00 connector) directly on the OmniScan Connector of the phased array probe
- Allows simultaneous or alternate use of phased array and pulse-echo using a single setup.
- To order this option, for the Instrument Connector code of the extension cable part number, replace **OM** with **OL**.

METAL ARMOR OUTER

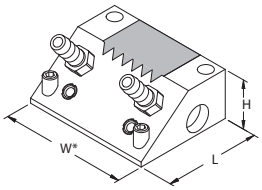
- Offers mechanical protection against cut, wear, and harsh environments
- Available for most standard probes and extension cables

Wedge Options



BASIC

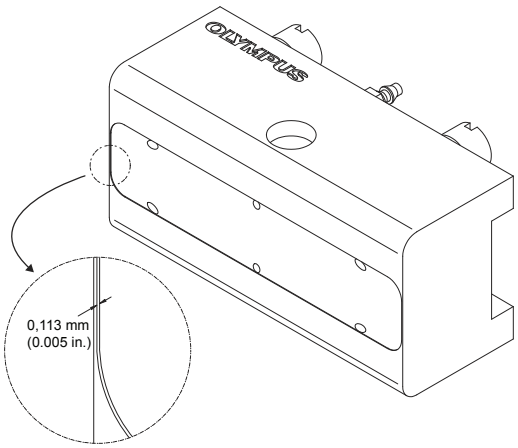
Designed for manual inspection using gel couplant or water (not fed from an irrigation system).



New removable IHC ring for SA10, SA11, and SA12 wedges offers great flexibility.

IHC (IRRIGATION, HOLES, AND CARBIDES)

Same as Basic but with irrigation, scanner yoke attachment points, and four adjustable carbide wear pins.



WP

The “water pocket” option adds a shallow cavity at the base of the wedge to improve the quality of coupling by restricting the flow of couplant. WP option offers irrigation and scanner yoke attachment points. This option is only available for SNW wedges.

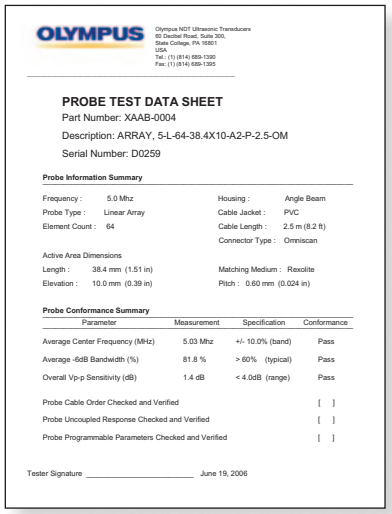
Testing and Documentation

All Olympus phased array probes are rigorously tested to ensure conformance to the highest standards. An extensive database, containing characterization records for each probe sold, is maintained by Olympus. This information can be accessed to compare probe properties.

If you have any special testing requirements, please contact Olympus.

Standard Test Form

A Probe Test Data Sheet is supplied with the purchase of any probe. This form presents the following information:



OLYMPUS

Olympus NDT Ultrasonic Transducers
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State College, PA 16801
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Tel.: (1) (814) 689-1390
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PROBE TEST DATA SHEET

Part Number: XAAB-0004

Description: ARRAY, 5-L-64-38.4X10-A2-P-2.5-OM

Serial Number: D0259

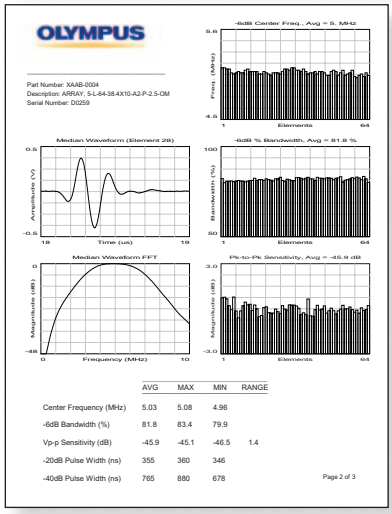
Probe Information Summary

Frequency :	5.0 Mhz	Housing :	Angle Beam
Probe Type :	Linear Array	Cable Jacket :	PVC
Element Count :	64	Cable Length :	2.5 m (8.2 ft)
		Connector Type :	Omniscan
Active Area Dimensions			
Length :	38.4 mm (1.51 in)	Matching Medium :	Rexolite
Elevation :	10.0 mm (0.39 in)	Pitch :	0.60 mm (0.024 in)

Probe Conformance Summary

Parameter	Measurement	Specification	Conformance
Average Center Frequency (MHz)	5.03 Mhz	+/- 10.0% (band)	Pass
Average -6dB Bandwidth (%)	81.8 %	> 60% (typical)	Pass
Overall Vp-p Sensitivity (dB)	1.4 dB	< 4.0dB (range)	Pass
Probe Cable Order Checked and Verified			[ ]
Probe Uncoupled Response Checked and Verified			[ ]
Probe Programmable Parameters Checked and Verified			[ ]

Tester Signature _____ June 19, 2006



OLYMPUS

Part Number: XAAB-0004
Description: ARRAY, 5-L-64-38.4X10-A2-P-2.5-OM
Serial Number: D0259

-6dB Center Freq., Avg = 5. MHz

Median Waveform (Element 28)

-6dB % Bandwidth, Avg = 81.8 %

Median Waveform FFT

Pk-to-Pk Sensitivity, Avg = -45.9 dB

	AVG	MAX	MIN	RANGE
Center Frequency (MHz)	5.03	5.08	4.96	
-6dB Bandwidth (%)	81.8	83.4	79.9	
Vp-p Sensitivity (dB)	-45.9	-45.1	-46.5	1.4
-20dB Pulse Width (ns)	355	360	346	
-40dB Pulse Width (ns)	765	880	678	

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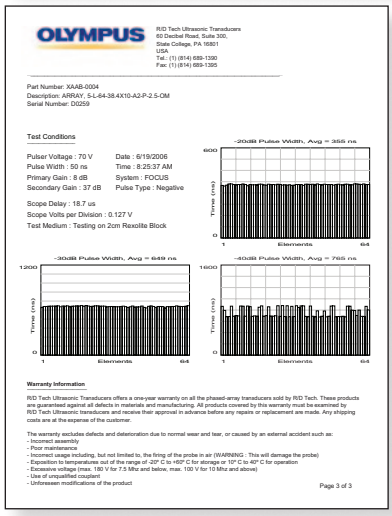

OLYMPUS

R/D Tech Ultrasonic Transducers
60 Dechtel Road, Suite 300,
State College, PA 16801
USA
Tel.: (1) (814) 689-1390
Fax: (1) (814) 689-1395

Part Number: XAAB-0004
Description: ARRAY, 5-L-64-38.4X10-A2-P-2.5-OM
Serial Number: D0259

Test Conditions

Pulser Voltage : 70 V
Pulse Width : 50 ns
Primary Gain : 8 dB
Secondary Gain : 37 dB
Date : 6/19/2006
Time : 8:25:37 AM
System : FOCUS
Pulse Type : Negative

Scope Delay : 18.7 us
Scope Volts per Division : 0.127 V
Test Medium : Testing on 2cm Rexolite Block

-20dB Pulse Width, Avg = 355 ns

-30dB Pulse Width, Avg = 649 ns

-40dB Pulse Width, Avg = 765 ns

Warranty Information

R/D Tech Ultrasonic Transducers offers a one-year warranty on all the phased-array transducers sold by R/D Tech. These products are guaranteed against all defects in materials and manufacturing. All products covered by this warranty must be examined by R/D Tech Ultrasonic transducers and receive their approval in advance before any repairs or replacement are made. Any shipping costs are at the expense of the customer.

The warranty excludes defects and deterioration due to normal wear and tear, or caused by an external accident such as:
- Incorrect assembly
- Poor maintenance
- Incorrect usage including, but not limited to, the firing of the probe in air (WARNING : This will damage the probe)
- Exposition to temperatures out of the range of -20° C to +60° C for storage or 10° C to 40° C for operation
- Excessive voltage (max. 180 V for 7.5 Mhz and below, max. 100 V for 10 Mhz and above)
- Use of unqualified couplant
- Unforeseen modifications of the product

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MEDIAN WAVEFORM

The median waveform graph displays a median pulse-echo response (typical) from the test target. Half of the return pulses from the probe elements will have a peak-peak voltage greater than (or equal to) this median element, and the other half will have a smaller value. Return pulse duration is shown on the horizontal axis (in microseconds) and amplitude is shown on the vertical axis (in V). The number of the median element is shown above the graph (in parentheses).

MEDIAN WAVEFORM FFT

The median waveform FFT graph shows the calculated spectrum for the median waveform (see above) over a range of zero MHz to twice the probe's nominal frequency.

–6 DB CENTER FREQUENCY

The –6 dB center frequency bar graph displays a calculated center-frequency value for each of the probe's elements. This value is calculated by using the halfway point (in frequency) of an imaginary line intersecting a given element's spectrum (FFT) data at the –6 db level. The average value of all the probe's elements is displayed at the top of the graph.

–6 DB PERCENT BANDWIDTH

The –6 dB percent bandwidth bar graph displays a calculated percent bandwidth value for each of the probe's elements. This value is determined by using the length (in frequency) of an imaginary line intersecting a given element's spectrum (FFT) data at the –6 db level and calculated as a percentage of the center frequency. The average value of all the probe's elements is displayed at the top of the graph.

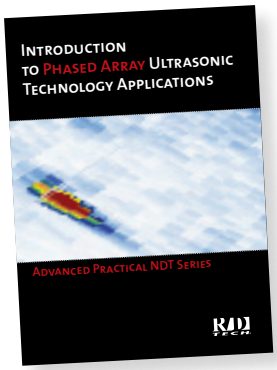
PEAK-TO-PEAK SENSITIVITY

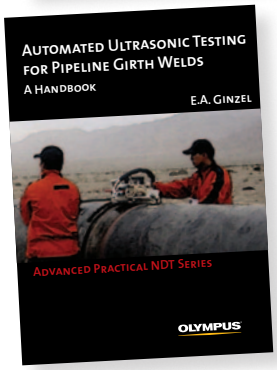
The peak-to-peak sensitivity bar graph displays a value for each of the probe's elements, representing the sensitivity of the probe. This value is calculated by using the magnitude of the excitation (test) pulse sent to each element and the peak-to-peak voltage measurement of that element's pulse-echo return (from the test target). The reported value is –20 multiplied by the log of the ratio of these two magnitudes. The average value of all the probe's elements is displayed at the top of the graph.

PULSE WIDTH

The various pulse-width bar graphs display values representing the axial resolution of the elements' pulse-echo returns at various levels, such as –20 dB, –30 dB and –40 dB. These values are calculated by measuring the return pulse's width (in nanoseconds) at the desired level. Axial resolution is an important measure of the ability to distinguish individual pulse returns from one another during a normal transducer operation. The average value of all the probe's elements is displayed at the top of the graph.

Books and Training





ADVANCES IN PHASED ARRAY ULTRASONIC TECHNOLOGY APPLICATIONS

Over the last few years, phased array ultrasonic technology has entered many new markets and industries. It is now routinely used for pipeline inspections, general weld integrity, in-service crack sizing, and aerospace fuselage inspections. These recent applications have brought phased array technology to new and improved levels across the industrial spectrum. *Advances in Phased Array Ultrasonic Technology Applications* covers the latest developments in phased array technology as well as its implementation worldwide.

INTRODUCTION TO PHASED ARRAY ULTRASONIC TECHNOLOGY APPLICATIONS

This guideline is Olympus's first step to help fill the lack of information between conventional UT and phased array technologies. The guideline is focused on terminology, principles, useful formulas, tables, and charts. This guideline provides an overview of phased array ultrasonic technology, including examples of industrial applications. The guideline is an introduction to phased array ultrasonic technology applications, not a training manual.

Note that this book is also available in Japanese.

AUTOMATED ULTRASONIC TESTING FOR PIPELINE GIRTH WELDS

NDT expert E. A. Ginzel's 366-page book, *Automated Ultrasonic Testing for Pipeline Girth Welds,* provides an overview of the principles behind automated ultrasonic testing (AUT) of girth welds and explains the many parameters that influence the results of these inspections. Ginzel discusses some of the more experimental aspects of the process, including sizing and acceptance criteria. In addition, he examines the basic AUT concepts as applied by the major players in the industry, and considers future enhancements.

Training

Olympus has recently developed its unique Training Academy, which is a partnership with major training companies in an effort to offer comprehensive courses in phased array technology and applications. Courses range from a two-day "Introduction to Phased Array" program to an in-depth, two-week "Level II Phased Array" course. In both cases, students experience practical training utilizing the portable OmniScan® phased array unit. Courses lead either to recognized certification or to certificates of attendance.

Courses are currently being offered at the training facilities of participating companies as well as at customer-determined locations worldwide. Customized courses can also be arranged. Check the latest course schedule at **www.olympus-ims.com**.

Olympus NDT training partners

- Davis NDE (USA)
- DgzfP (Germany)
- Eclipse Scientific Products (Canada)
- Lavender International (UK)
- TEST NDT (USA)
- Vinçotte Academy (Belgium)

How to Order

For pricing or for further information, consult the ordering information outlined on page vii and call your local sales representative.

To quickly locate your local sales representative, go to **www.olympus-ims.com**.

Disclaimer

This document was prepared with particular attention to usage to ensure the accuracy of the information contained therein. It corresponds to the version of the products manufactured prior to the printing date. There may, however, be some differences between the catalog and the products if the products have been modified thereafter.

The information contained in this document (including photographs, drawings, descriptions, and technical data) is subject to change without notice.

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