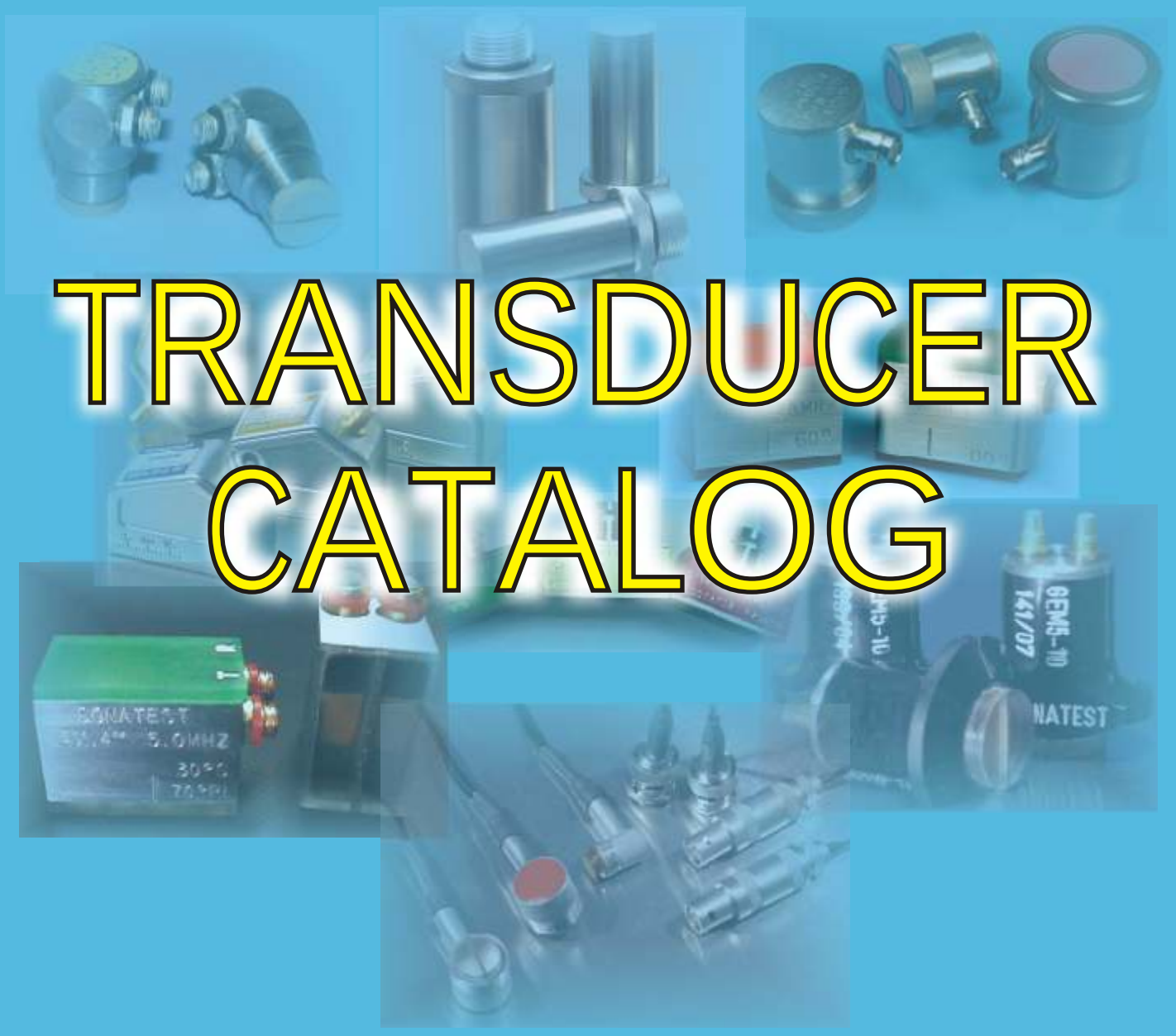
SONATEST

"Sound Solutions"



TRANSDUCER CATALOG

4734 Research Drive • San Antonio, Texas 78240
(210) 697-0335 • FAX (210) 697-0767
e-mail: sonatest@sbcglobal.net
www.sonatest.com

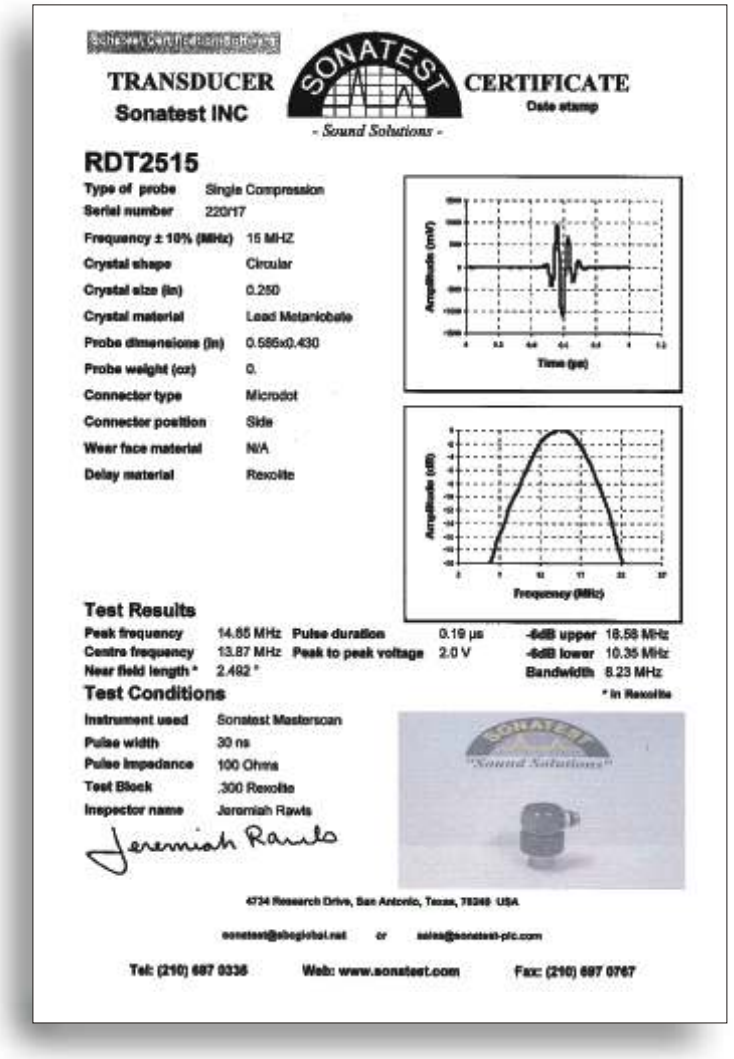
"Sound Solutions"

Sonatest has one over-riding and driving motivation – to design, manufacture and market the world's best NDT products. The pace of our own R&D investment has increased and we have formed strategic partnerships to provide our customers with an unmatched range of leading edge NDT instruments, transducers and systems. We are delighted to present our growing range of transducers over the next pages.

Sonatest Inc. manufactures a complete range of high performance, high technology ultrasonic transducers for general flaw detection and thickness measurement applications. Each transducer is made to exacting standards regarding acoustical, electronic and mechanical properties. Our transducers are tested thoroughly, typically at three stages of manufacture. The complete range of transducer types are available with a variety of connector styles, case configurations, frequencies and element sizes. This catalog lists our standard-build angle, frequency and diameter configurations only – other combinations are available on request.

Transducer Analysis/Certification

Sample Certificate



TRANSDUCER CERTIFICATE

Sonatest INC

- Sound Solutions -

Date stamp

RDT2515

Type of probe	Single Compression
Serial number	220/17
Frequency ± 10% (MHz)	15 MHZ
Crystal shape	Circular
Crystal size (in)	0.250
Crystal material	Lead Metaniobate
Probe dimensions (in)	0.586x0.430
Probe weight (oz)	0.
Connector type	Microdot
Connector position	Side
Wear face material	N/A
Delay material	Rexolite

Amplitude (mV) — Time (ps)

Amplitude (dB) — Frequency (MHz)

Test Results

Peak frequency	14.85 MHz	Pulse duration	0.19 µs	-6dB upper	16.58 MHz
Centre frequency	13.87 MHz	Peak to peak voltage	2.0 V	-6dB lower	10.35 MHz
Near field length *	2.482 *			Bandwidth	6.23 MHz

* in Rexolite

Test Conditions

Instrument used	Sonatest Masterscan
Pulse width	30 ns
Pulse Impedance	100 Ohms
Test Block	.300 Rexolite
Inspector name	Jeromiah Rawls

Jeremiah Rawls

4724 Research Drive, San Antonio, Texas, 78240 USA

sonatest@sbcglobal.net or sales@sonatest-plc.com

Tel: (210) 697 9336 Web: www.sonatest.com Fax: (210) 697 9767

Custom and Specialty Transducers Are Available

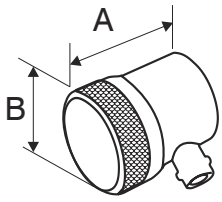
Index-Dimensions

Most transducers can be manufactured using piezo composite elements "*PLATINUM SERIES*."

To order place a "P" in front of order code.

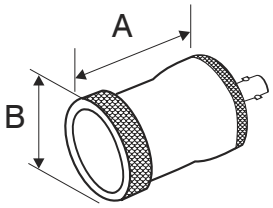
Single Contact Transducers (SLM)..... (page 4)

ELEMENT SIZE	A	B
.500" Dia.	1.250"	1.030"
.750" Dia.	1.4"	1.250"
1.00" Dia	1.475"	1.425"



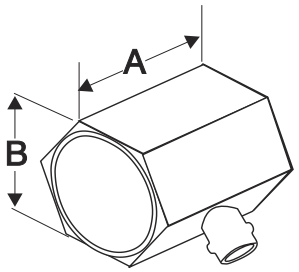
Single Contact Transducers (SLF) ..... (page 4)

ELEMENT SIZE	A	B
.500" Dia.	1.250"	1.180"
1.00" Dia	1.5"	1.580"



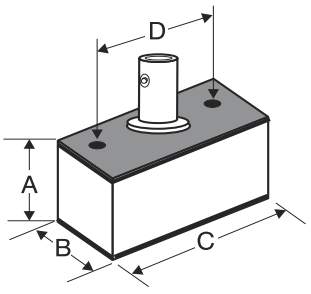
Fingertip Contact Transducers (FC)..... (page 5)

ELEMENT SIZE	A	B
.125" Dia	.600"	.250"
.250" Dia	.562"	.350"
.375" Dia	.725"	.500"
.500" Dia	.725"	.600"
1.0" Dia	.940"	1.140"



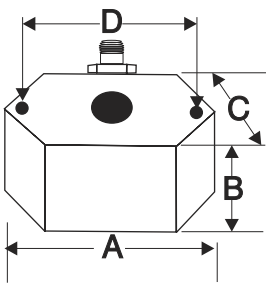
Standard Shear Wave Transducers (SS) (page5)

ELEMENT SIZE	A	B	C	D
.500" x .500"	.650"	.750"	1.125"	.810"
.500" x 1.0"	.650"	.750"	1.625"	1.312"
.625" x .625"	.650"	.850"	1.350"	1.0"
.625" x .750"	.650"	.850"	1.350"	1.0"
.750" x .750"	.650"	.910"	1.350"	1.0"



Miniature Shear Wave Transducers (MS) (page 6)

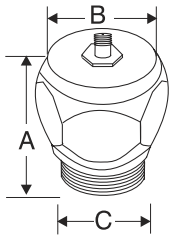
ELEMENT SIZE	A	B	C	D
.125"	.425"	.400"	.225"	.312"
.250"	.500"	.500"	.400"	.375"
.500"	.785"	.525"	.585"	.625"



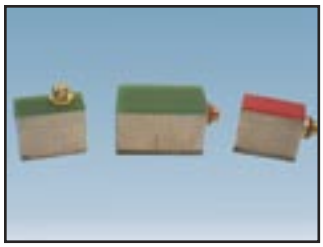
Quick Change Shear Wave Transducers (QC) .....(page 6)

ELEMENT SIZE	A	B	C	D
.250”	.450”	.400”	.375”	3/8” x 32
.375”	.700”	.510”	.500”	½” x 28
.500”	.700”	.600”	.625”	5/8” x 24

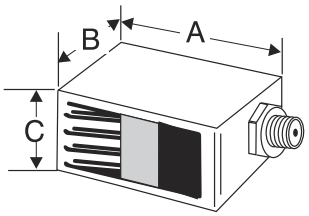
D: Thread Size



Miniature Angle Beam Potted Transducers (MAP) ..... (page 7)



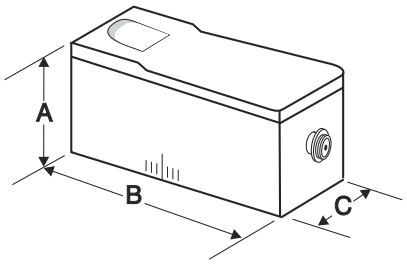
ELEMENT SIZE	A	B	C
.187”	.700”	.650”	.225”
.250”	.700”	.650”	.325”
.500”	.700”	.650”	.325”



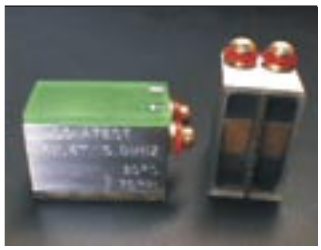
Mini Maps are also available.

Single Angle Transducers (SA) .....(page 7)

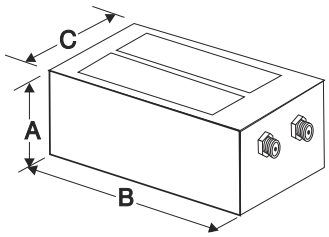
ELEMENT SIZE	A	B	C
.375” x .375”	.750”	1.00”	.600”
Other Sizes on Request			



Dual Shear Wave Transducers (CDA) ..... (page 8)



ELEMENT SIZE	A	B	C
.25 x .25”	.700”	.900”	.625”
.25 x .375”	.700”	.900”	.625”
.375 x .375”	.720”	1.100”	.900”



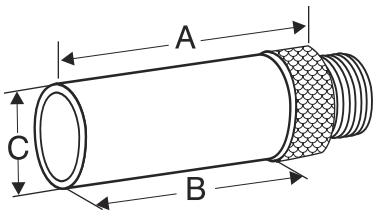
Various sizes available.

Immersion Transducers (IM) .....(page 8)

Standard Sizes

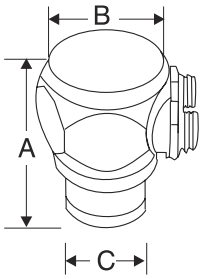
ELEMENT SIZE	A	B	C
.250	***Custom Built***		
.375”	1.750”	1.40”	.525
.500”	1.750”	1.40”	.625”
.750”	1.750”	1.00	1.00

Measurements Do Not Include Connectors
Custom Sizes Available



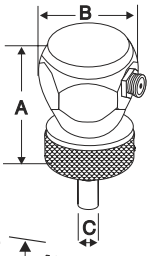
Dual Element Transducers (DE).....(page 9)

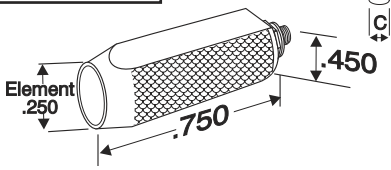
ACTIVE ELEMENT SIZE	A	B	C
1/4 DIA.	.925”	.500”	.410”
3/8 DIA.	.930”	.625”	.495”
1/2 DIA.	.930”	.750”	.620”
3/4DIA	.930”	1.00”	.875”



Delay Line Transducers (RDT) ..... page 10

ELEMENT SIZE	A	B	C
1/4 DIA.	.625”	.425	.125” -.25”
1/2 DIA.	.850”	.685”	.50”

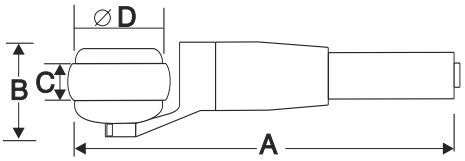




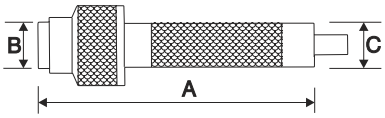
Fixed Delay Line Transducers (PD)

European Style Transducers (Metric)

Roller Probes and Soft Tip Probes .....page 10

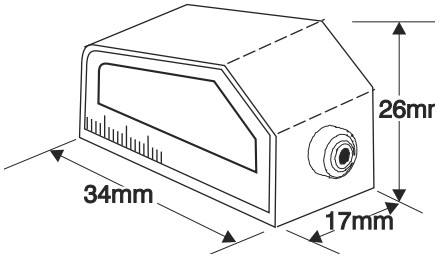


ELEMENT DIAMETER	A	B	C
5mm	30mm	9.8mm	7.6mm
10mm	36mm	20mm	7.6mm

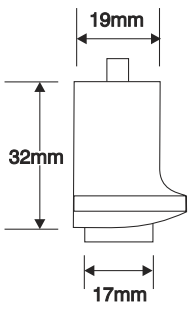


ELEMENT DIAMETER	A	B	C	D
9mm	113mm	36mm	10mm	25mm
15mm	75mm	100mm	------	------

Single Angle Transducers - Orion.....page 11



Twin Contact Transducers - Gemini .....page 11



Single Contact Transducers (SLM)

SONATEST *SLM* ceramic faced transducers are used for inspecting wrought metals, billets, bar forged, extruded parts and castings.

Features: Medium damped elements tuned for optimum performance. Hardened stainless steel wear ring to prolong transducer life.

Connectors: BNC (B) and LEMO 1 (L). Specify connector type by placing "B" or "L" after Part #.

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ
.500" Dia.	SLM501	SLM5025	SLM5050
.750"Dia.	SLM751	SLM7525	SLM7550
1.00"Dia	SLM101	SLM1025	SLM1050

Ordering Code Example: SLM7525B = SLM .750 X 2.25 MHZ BNC
SLM7525L = SLM .750 X 2.25 MHZ LEMO 1

Side or Top Mount Connectors Available.

Single Contact Transducers (SLF)

SONATEST *SLF* protected element transducers which may be fitted with a replacement membrane to improve contact on rough surface materials.

Elements with mid range frequencies produce excellent penetrating abilities. Housed in rugged steel case. Retaining ring allows versatility.

Features: Medium damped elements provide high gain with low noise. Each element is tuned for optimized performance.

Connectors: BNC

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ
.500" Dia.	SLF501	SLF5025	SLF5050
1.00"Dia.	SLF101	SLF1025	SLF1050

Ordering Code Example: SLF101 = SLF 1.00" 1.0 MHZ

Dual element also available.

High temp delay lines also available

Replaceable Membrane Pack of 10.
For ½" Dia. Transducer, Part # FD15
For 1.00" Dia. Transducer, Part # FD25

Fingertip Contact Transducers (FC)

SONATEST *FINGERTIP* transducers are constructed using the latest materials, such as piezo composite, lead metaniobate piezoelectric elements with a 70% bandwidth for good near surface resolution.

Features: Hexagonal shaped stainless steel housing provides for easy handling. 100% bandwidth available upon request. Hard ceramic faces for good wearability. Designate if damping required by placing "G" or "R" after part number.

Connectors: Microdot (Standard Side Mount) ***Top Mount available*** *-Place **"T"** after part #*

BNC available on larger sizes, (.500 or .750) - *FCSL (Slim Line)*

15 MHz & 20 MHz are available on some models.

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ	10.0 MHZ
.125"Dia	-	-	FC1250	FC1210
.125"Dia	-	-	FCSL1250	FCSL1210
.250"Dia	-	FC2525	FC2550	FC2510
.375"Dia.	-	FC3725	FC3750	FC3710
.500" Dia.	FC501	FC5025	FC5050	FC5010
.750"Dia.	FC751	FC7525	FC7550	-

Ordering Code Example: FC5025T = FC .500 X 2.25 MHZ Top Mount

Standard Shear Wave Transducers (SS)

SONATEST *STANDARD SHEAR WAVE* transducers are designed to be used with different angle beam wedges for general weld inspection & A.W.S. Structural Weld Code.

Features: Constructed in low noise plastic housing or stainless steel. Two types of damping available, High Gain (G) and Resolution (R).
Designate damping required by placing "G" or "R" after "SS" in part number.

Connectors: Standard connector BNC. ***Microdot available ,(place "M" after part number)***
For Stainless Steel, (place ***"STH"*** *after part number)*

Snail Wedges Available.
Ordering Code: SNW

High Temp Wedges also Available.

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ
.500" x .500"	SS50501	SS50502	SS50505
.500" x 1.00"	SS50101	SS50102	SS50105
.625" x .625"	SS62621	SS62622	SS62625
.750" x .625"	SS75621	SS75622	SS75625
.750" x .750"	SS75751	SS75752	SS75755

Ordering Code Example: SSG50502 = SS High Gain 1/2 X 1/2 2.25 MHZ
SSR50502m = SS Resolution 1/2 X 1/2 2.25 MHZ Microdot

"Standard Angle Beam Wedges"

ELEMENT SIZE	45 DEGREES STEEL	60 DEGREES STEEL	70 DEGREES STEEL
.500" x .500"	SW5045	SW5060	SW5070
.500" x 1.00"	SW5145	SW5160	SW5170
.625" x .625"	SW6245	SW6260	SW6270
.750" x .750"	SW7545	SW7560	SW7570

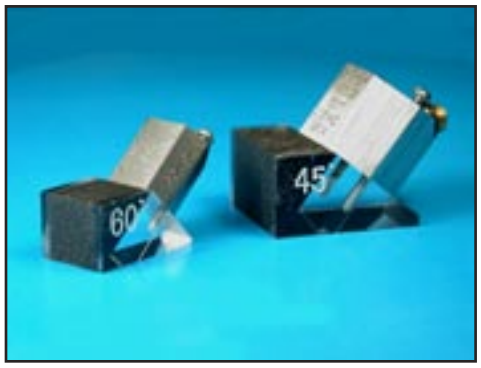
Ordering Code Example: SW5045 = SW 1/2 X 1/2, 45 Degree Steel.
Other Angles Available Upon Request

Miniature Shear Wave Transducers (MS)

SONATEST *MINIATURE SHEAR WAVE* transducers are designed for inspections that are inaccessible for larger units, curved surfaces or for reducing the "offset."

Features: Two types of damping are available, High Gain (G) to provide penetrating capability in a small unit, and (R) for near surface resolution and low signal to noise ratio. Designate damping required by placing "G" or "R" After "MS" in part number.

Connectors: Microdot.



Axial & Circumferential contouring available. (I.D. or O.D.)

High Temp Wedges also Available.

ELEMENT SIZE	2.25 MHZ	5.0 MHZ	10.0 MHZ
.250" Dia.	MS2525	MS2550	MS2510
.375" Dia.	MS3725	MS3750	MS3710
.500"Dia.	MS5025	MS5050	MS5010

Ordering Code Example: MSG2550 = MS .250 x 5.0 MHZ High Gain
MSR2550 = MS .250 x 5.0 MHZ Resolution

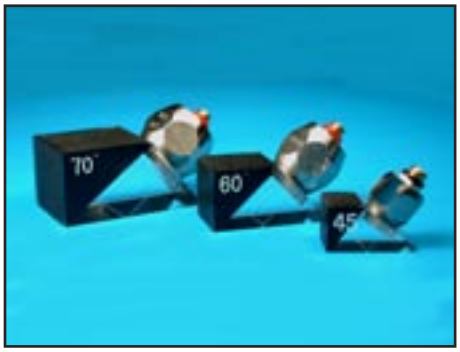
TRANSDUCER SIZE	45 DEGREE STEEL	60 DEGREE STEEL	70 DEGREE MHZ
.250"	MW2545	MW2560	MW2570
.375"	MW3745	MW3760	MW3770
.500"	MW5045	MW5060	MW5070

Other Angles Available Upon Request

Quick Change Shear Wave Transducers (QC)

SONATEST *QUICK CHANGE SHEAR WAVE* transducers are designed for use in inspections where different frequencies are required using the same wedge, or where different angles are required using the same frequency transducer. Ideal for limited access and curved surfaces.

Features: Two types of damping are available, High Gain (G) to provide penetrating capability in a small unit, and (R) for near surface resolution and low signal to noise ratio.
Designate damping required by placing "G" or "R" after part number.



Connectors: **Microdot or Mini Lemo**
Axial & Circumferential contouring available. (I.D. or O.D.)

High Temp Wedges also Available.

ELEMENT SIZE	2.25 MHZ	5.0 MHZ	10.0 MHZ
.250" Dia.	**QC2525**	**QC2550**	**QC2510**
.375" Dia.	**QC3725**	**QC3750**	**QC3710**
.500"Dia.	**QC5025**	**QC5050**	**QC5010**

Ordering Code Example: **QCR2510 = QC .250 x 10.0 MHZ** *Resolution*
QCG2510 = QC .250 x 10.0 MHZ *High Gain*

TRANSDUCER SIZE	45 DEGREE STEEL	60 DEGREE STEEL	70 DEGREE MHZ
.250"	**QW2545**	**QW2560**	**QW2570**
.375"	**QW3745**	**QW3760**	**QW3770**
.500"	**QW5045**	**QW5060**	**QW5070**

Other Angles Available Upon Request

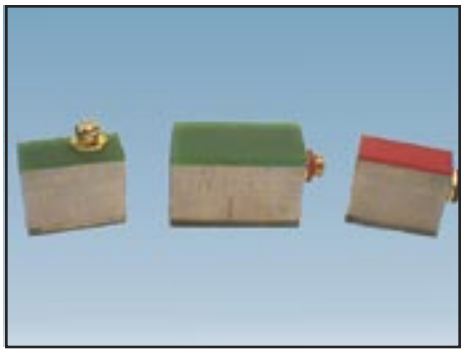
Miniature Angle Beam Potted Transducers (MAP)

SONATEST *MINIATURE ANGLE BEAM POTTED* transducers with fixed angle, are designed with stainless steel housing for durability. Standard angles are in steel, other nonstandard angles with specific materials can be produced.

Features: Two types of damping available: High Gain (G) and Near Surface Resolution (R). Designate type required by Placing "G" or "R" after MAP in part #. Designate connector position for top mount with T after part#.

Connectors: Microdot End Connector. Top mount available on request [T]

- ***Large Angle Potted (LAP) Transducers available on request.***
- ***Mini Maps also available.***



ELEMENT SIZE	2.25 MHZ			5.0 MHZ			10.0 MHZ		
	45°	60°	70°	45°	60°	70°	45°	60°	70°
.187"	MAP 182545	MAP 182560	MAP 182570	MAP 185045	MAP 185060	MAP 185070	MAP 181045	MAP 181060	MAP 181070
.250"	MAP 252545	MAP 252560	MAP 252570	MAP 255045	MAP 255060	MAP 255070	MAP 251045	MAP 251060	MAP 251070
.375"	MAP 372545	MAP 372560	MAP 372570	MAP 375045	MAP 375060	MAP 375070	MAP 371045	MAP 371060	MAP 371070
.500"	MAP 502545	MAP 502560	MAP 502570	MAP 505045	MAP 505060	MAP 505070	MAP 501045	MAP 501060	MAP 501070

Ordering Code Example:
MAP2525-60T = MAP 1/4" X 1/4" 2.25 MHZ, *60 Degree Top* connector.

Single Angle Transducers (SA)

SONATEST *SINGLE ANGLE* shear wave transducers for the inspection of weldments and components requiring inspection by transverse wave techniques.

Features: *Economic, potted, medium damped, elements tuned to provide optimum gain and resolution for general purpose use. Housed in a stainless steel case for durability, with indexed emission point marked on either side.*

Connectors: Subvis (S) or Microdot(D). Top(T) Mount Available-Place "T" after part # Rear(R) Mount Available-Place "R" after part #

ANGLE (Steel)	2.25 MHZ	5.0 MHZ
38	SA2-38	SA5-38
45	SA2-45	SA5-45
60	SA2-60	SA5-60
70	SA2-70	SA5-70

Ordering Code Example:
SA5-60MT = SA *5.0 MHZ, 60 Degree Microdot Top* connector.

Dual Shear Wave Transducers (CDA)

SONATEST *DUAL SHEAR WAVE* transducers are designed for inspections of welds and thin materials where near surface resolution is required. Also designed for the detection of IGSCC (Inter Granular Stress Corrosion Cracking.)

Features: Medium damped elements to provide optimum gain and excellent resolution with low signal to noise ratio. The 3/32 extended wedge allows for shaping of curvatures.

Connectors: Microdot Top [T] Rear [R]. Specify angle and connector position after part #.
Refracted longitudinal style also available. Place R/L after part# for longitudinal

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ	45 DEGREE	60 DEGREE	70 DEGREE
.25" X .25"	CDA251	CDA2525	CDA2550	ADD 45 TO PART#	ADD 60 TO PART#	ADD 70 TO PART#
.25" X .375"	CDA25371	CDA25372	CDA25375	ADD 45 TO PART#	ADD 60 TO PART#	ADD 70 TO PART#
.375" X .375"	CDA371	CDA3725	CDA3750	ADD 45 TO PART#	ADD 60 TO PART#	ADD 70 TO PART#

Other Angles and Focussing Available on Request

Ordering Code Example:
CDA2525-60T = CDA 1/4" X 1/4" 2.25 MHZ, *60 Degree Top* connector.

Immersion Transducers (IM)

SONATEST *IMMERSION* transducers are designed for inspection of components in immersion tanks or using bubbler systems.

Features: Constructed in stainless steel housing with a standard UHF connector. Three different lens configurations available: Flat, Spherical Focus, and Cylindrical Focus. Three different types of damping also available: High gain (G), Resolution (R), and High Resolution (HR).

*** Specify *Damping* required *after "IM"* in part #.**
*** Specify *Lens configuration, or Focal Length* required when placing order.**
*** Higher frequencies available upon request.**

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ	10.0 MHZ	15.0 MHZ
.250"Dia	_	IM2525	IM2550	IM2510	IM2515
.375"Dia.	_	IM3725	IM3750	IM3710	_
500" Dia.	IM501	IM5025	IM5050	IM5010	_
.750"Dia.	IM751	IM7525	IM7550	IM7510	_
1.00"Dia.	IM101	IM1025	IM1050	_	_

Ordering Code Examples:
IMR7550 = IM .750" 5.0 MHZ Resolution
IMHR2510 = IM .250" 10.0 MHZ High Resolution
IMG7525= IM .750" 2.25 MHZ High Gain

Dual Element Transducers (DE)

SONATEST *DUAL ELEMENT* transducers are designed for detecting near surface resolution and for the detection of corrosion and pitting. They are also designed for thickness measurement.

Features: Two types of Dual Element transducers are offered: One with microdot connectors and another with integral cable with BNC connectors. Both are constructed in stainless steel housing. Both have extended shoe for shaping to curved surfaces. Both types of Dual Element transducers are available to work with conventional thickness gages upon request.

Connectors: Standard Side Mount Microdot Top Mount Available- Place "T" After Part #.

DUAL ELEMENT MICRODOT

Different shoe materials available.

ACTIVE ELEMENT SIZE	1.0 MHZ	MICRODOT 2.25 MHZ	5.0 MHZ	10.0 MHZ
1/4 DIA.	DEM251	DEM2525	DEM2550	DEM2510
3/8 DIA.	DEM371	DEM3725	DEM3750	DEM3710
1/2 DIA.	DEM501	DEM5025	DEM5050	DEM5010
3/4DIA.	DEM751	DEM7525	DEM7550	-

Ordering Code Example: **DEM5025T= DEM1/2" 2.25 MHZ *TOP MOUNT***
DEM5025 = DEM1/2" 2.25 MHZ *SIDE MOUNT*

DUAL ELEMENT INTEGRAL CABLE (POTTED)

ACTIVE ELEMENT SIZE	1.0 MHZ	MICRODOT 2.25 MHZ	5.0 MHZ	10.0 MHZ
1/4 DIA.	DEI251	DEI2525	DEI2550	DEI2510
3/8 DIA.	DEI371	DEI3725	DEI3750	DEI3710
1/2 DIA.	DEI501	DEI5025	DEI5050	DEI5010
3/4DIA.	DEI751	DEI7525	DEI7550	-

Ordering Code Example:
DEI5025T= DEI 1/2" 2.25 MHZ *TOP MOUNT INTEGRAL CABLE*

Thickness Gage Transducers (SG Series) Standard and High Temperature are available.

**** Specials available for through lagging measurement, specify length, call for pricing.***

Delay Line Transducers (RDT)
Fixed Delay Line Transducers (PD)

SONATEST *DELAY LINE* transducers provide excellent near surface resolution and are primarily used for thickness gaging or flaw detection in thin materials.

Features: An economical and versatile delay line with a knurled retaining ring for easy replacement of the delay tip.

Connectors: Standard Side Mount Microdot. Top Mount Available-Place "T" after part #

DELAY LINE OPTIONS: *Standard sizes depends on element diameter however special sizes, high temperature or conical shaped delay lines are also available.*

ELEMENT SIZE	1.0 MHZ	2.25 MHZ	5.0 MHZ	10.0 MHZ	15.0 MHZ	20.0 MHZ
1/8			RDT1250	RDT1210	RDT1215	RDT1220
1/4		RDT2525	RDT2550	RDT2510	RDT2515	RDT2520
1/2	RDT501	RDT5025	RDT5050	RDT5010		

Ordering Code Example: **RDT 2510T = RDT 1/4" 10 MHZ Top Mount.**

ELEMENT SIZE	10.0 MHZ	15.0 MHZ
1/4	PD2510	PD2515

Side or Top Mount

European Style Transducers (Metric)

Dry Contact Transducers
Roller Probes and Soft Tip Probes

SONATEST *DRY CONTACT TRANSDUCERS* are for testing highly attenuative materials such as composites, rubber, wood, ceramics, friction material and in particular, the inspection of bonded materials. Operates in through transmission or from one side only. A range of holders are available for these transducers.

Roller Transducers

For use in automated testing or where large areas require hand scanning techniques to be applied. Renewable tyres prolong the life of the transducers. Miniature BNC connectors are fitted as standard.

Freq	Element Diameter	
MHz	9	15
0.5	RP25HS-2	----------
1.25	RP25HS-1	RP75HS-1

Replacement tyres also available:
PT25 for RP25HS • PT75 for RP75NS

Soft Tip Transducers

Ideally suited to test specimens with complicated geometry or for investigating suspect or damaged areas. Replaceable soft tips provide long life for these transducers. Available in two sizes and frequencies, fitted with subvis connectors as standard. *(Microdot Available)*

Freq	Element Diameter	
MHz	5	10
0.5	STP5-2	STP10-2
1.25	STP5-1	STP10-1

Replacement tips also available:
RST/5 for STP5 • RST/10 for STP10

Single Angle Transducers - Orion

SONATEST *ORION* series are high quality angle transducers for testing critical welds, forgings and other components. The Orion series is high damped, with high output and excellent signal to noise ratio, specially designed to produce the best possible near surface resolution without losing resolution in depth. A circular element with matching layer provides maximum signal to noise ratio or gain reserve. Theses transducers comply with the highest specifications using round crystals to avoid side lobes.

Connectors: Available with Lemo 00(Z) or Subvis(S) or Microdot connectors, Top(T) or Rear(R) mounted.

***Features*:** Housed in a stainless steel case with forward emission point to give close access to the weld cap, allows more weld area to be inspected. The casing is scaled in millimeters from the front of the transducer. The stainless steel case is ergonomically designed for ease of handling and comfortable fatigue-free scanning. A center link mark for length measurement of defects provides consistency and accuracy when sizing defects. Each transducer is individually serial numbered. Specifically designed shoe and excellent damping gives very low internal noise. A wide frequency bandwidth provides a narrow pulse width and excellent resolution.

ORDER CODE	ANGLE STEEL	FREQUENCY MHz
ORION 2-38	38	2.0
ORION 2-45	45	2.0
ORION 2-60	60	2.0
ORION 2-70	70	2.0
ORION 4-38	38	4.0
ORION 4-38	45	4.0
ORION 4-60	60	4.0
ORION 4-70	70	4.0

Ordering Example: **Specify Orion transducer code followed by connector and entry code.**
e.g. ORION4-38ZT = Orion 4MHz, 38 degrees, Lemo 00, Top entry

Twin Contact Transducers - Gemini

SONATEST *TWIN* or ***DUAL*** element contact transducers are useful for corrosion inspection, thickness measurement and location of defects near to the surface. Available in two options standard or short focused (F) for measurement of thin materials.

Connectors: Supplied with the option of three types of connectors, Subvis(S), Microdot(D) and Lemo 00(Z) all top mounted.

Features:
Housed in an ergonomic case to provide user with fatigue free scanning. The flat front face allows close access to corners. The Gemini is available in three frequencies 2.0MHz, 4.0MHz and 5.0MHz. The 2.0MHz and the 5.0MHz are available in high temperature (HT).

Order Code	Frequency MHz	Crystal Size	Info
GEM2-10	2	2 X 8 X 4	60 Deg C
GEM4-10	4	2 X 8 X 4	60 Deg C
GEM5-10	5	2 X 8 X 4	60 Deg C
GEM5-10F	5	2 X 8 X 4	Focussed
GEM2-10HT	2	2 X 8 X 4	250Deg C
GEM5-10HT	5	2 X 8 X 4	250 Deg C

Ordering Example: **Specify transducer code, followed by connector code:**
e.g. GEM5-10Z = Gemini 5MHz Lemo 00

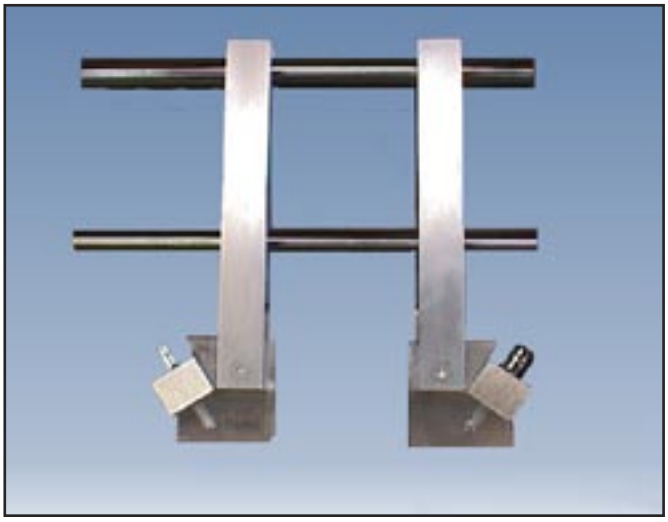
Sonatest Inc. manufactures a variety of special transducers and accessories.

*** *MAGNETIC* - Fixed locations or Bolt Measurement.**

*** *PAINT BRUSH - IMMERSION* for large scanning.**

CYLINDER BORE

MULTI ELEMENT ARRAY TRANSDUCERS



SPECIAL JIGS

AEROSPACE SPECIALS

FEATURES OF A TRANSDUCER

FREQUENCY

Frequency selection involves a trade-off between penetration, small flaw detectability and sensitivity. Lowering frequencies increase penetration and raising the frequency increases the ability to detect small flaws. By increasing the bandwidth of a transducer, penetration can usually be increased without sacrificing resolution. Generally, flaws as small as one-half wavelength can be reliably detected.

ELEMENT SIZE

The best aim is to select the smallest element size that is consistent with the frequency/beam spread characteristics that are compatible with your scan rate requirements. In flat faced transducers, element size indicates the width of material that can be inspected with one pass. In focused immersion transducers, the element size will be relative to the 'depth of field' of the focused unit. In low frequency transducers a very small element diameter will cause excessive beam divergence. In any given element size, these effects of divergence can be lessened by increasing the frequency.

BANDWIDTH

Performing over a large frequency range, broadband highly damped (shock wave) transducers are responsive to frequencies extending above and below their nominal values. Their advantage lies in the inspection of materials which have large acoustical absorption or scattering effects, or wherever high resolution flaw testing is a prime consideration. Generally used for high resolution thickness gauging of thin materials while utilizing contact, delay-line and immersion testing techniques, broad-band transducers afford maximum resolution in detecting flaws near the front and far surfaces of test materials.

Broadband highly damped transducers exhibit critically damped pulse characteristics which are essential for error-free thickness gauging and High resolution flaw detection. Narrowband, moderately damped, transducers provide maximum material penetration and sensitivity. Recommended for the majority of flaw detection applications these transducers are ideal where known frequency specifications exist. Since the sensitivity bandwidth is limited in a narrowband transducer, it has greater output at the centre frequency. Narrowband transducers generally contain tuning networks as an integral part of the transducer assembly and this optimizes the transducer frequency characteristics of the flaw detector, maximizing bandwidth sensitivity. Sonatest narrowband transducers are tuned to within ± 10% of the nominal frequency.

LENS CONFIGURATION

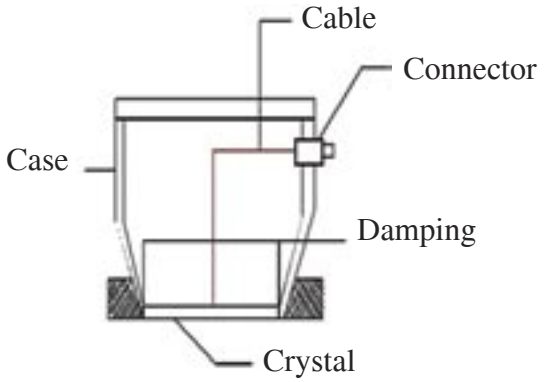
To give optimum and reliable performance on a range of testing materials under a range temperatures, Sonatest, Inc. provide transducer lens configurations. Contact transducers have flat aluminium oxide wear surfaces to enable resistance to abrasion. Some models feature removable membranes to increase coupling on rough surfaces. The epoxy covering on angle beam transducers allows an improved acoustical match into the lucite wedge for added sensitivity. Delay line transducers have either fixed or removable delay tips made of polystyrene or special high temperature resistant materials that retard wear. To match surface curvatures and maximize test reliability, the surface of these delay tips may be contoured. In immersion testing the transducer lens configuration determines whether the beam will focus to a single spot or line configuration in the test material. Choosing an optimal focal length and shape (line or spot) while considering their relationship to element size and 'depth of field' is crucial to proper immersion transducer selection.

TYPES OF TRANSDUCERS

SINGLE COMPRESSION TRANSDUCERS

Single element or straight beam transducers are used to measure thickness and to detect flaws on plates, bars, forgings, castings and extrusions. During testing they are applied directly to the flat surfaces of the test material or object. Transducers with smaller diameters can be applied to test slightly curved materials.

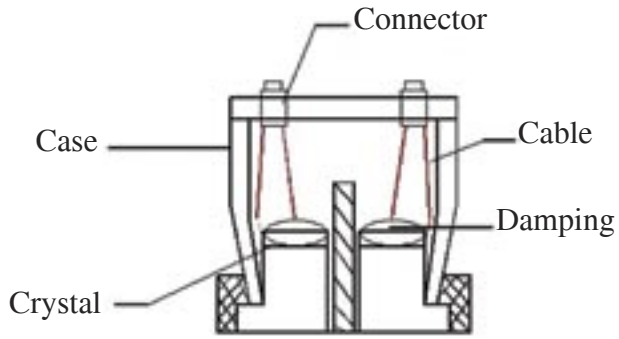
Single element contact transducers work by emitting compression (longitudinal) waves into the test material. Due to the fact that this type of transducer comes into direct contact with test materials when being used, the wear plates are constructed with highly durable material.



TWIN COMPRESSION TRANSDUCERS

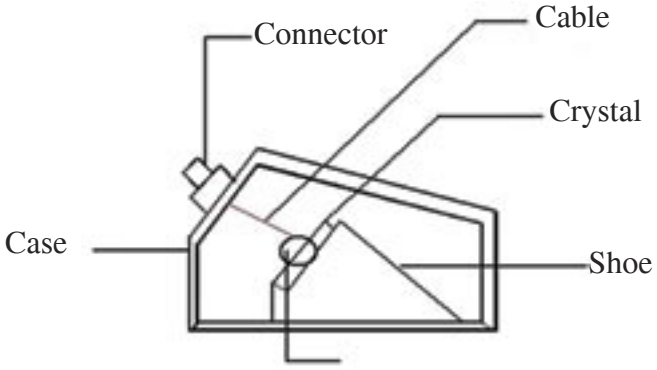
Dual element contact (pitch-catch) transducers measure thickness and detect flaws and corrosion in thin materials, especially where near surface resolution is required. They focus very close to the front surface, making them ideal for pitting and corrosion tests, braze inspection and lamination evaluation. This focusing effect of the dual transducer makes it ideal for pipes and other curved surfaces.

Dual element transducers utilise separate transmitting and receiving elements, mounted on delay lines that are usually cut at an angle. This configuration improves near surface resolution by eliminating recovery problems. In addition, the "crossed beam" design provides a pseudofocus that makes duals more sensitive to echoes from irregular reflectors such as corrosion and pitting. One consequence of the dual element design is a sharply defined distances-amplitude curve. In general a decrease in the roof angle to an increase in the transducer element size will result in longer pseudo-focal distance and an increase in useful range.



ANGLE BEAM TRANSDUCERS

Angle beam transducers allow the soundbeam to be introduced into the test material at an angle. Plastic wedges of controlled geometry are attached to the transducer active element in order to establish the desired angle. Sonatest wedges are precision engineered to produce a refracted shear wave within the test object at specific angles, as indicated on the wedge or transducer housing. The refracted beam angle should be selected to ensure that the sound beam angle will be, as much as possible, perpendicular to the plane of expected flaws.



In some cases, the geometry of the test object will dictate the selection of beam angle. With regard to frequency however, the same general rule applies—which is to select/the lowest frequency which provides adequate flaw sensitivity Both material noise and attenuation are minimised at lower frequencies.

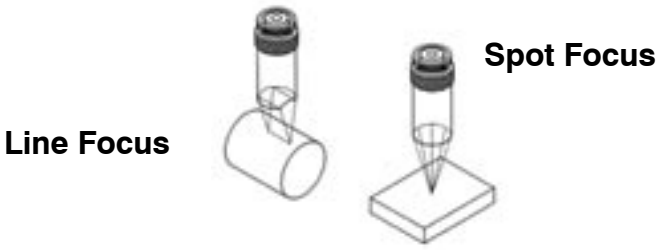
IMMERSION TRANSDUCERS

Immersion transducers are usually used for mechanised or automatic systems and, in principle, operate the same way as normal contact compression transducers.

Most applications take place in immersion tanks filled with water, where the test object is placed on a turntable or roller system so that the object is moved at a constant speed past the probe. This technique offers the best coupling conditions to provide reproducible results.

Compared to contact transducers where all the parameters are defined “as in steel”, immersion transducer parameters are defined in water. Since the speed of sound in steel is approx. .232 **in/μs** and in water is .058 **in/μs**. This gives a ratio of 4 to 1, which means it takes the same time to travel through .39 in. of water as it does to travel through 1.57 in of steel.

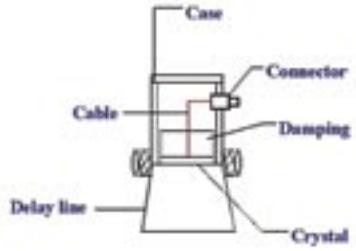
Focusing Types



Immersion transducers are available as flat faced or focussed. There are two types of focussing - spherical and line. Spherical, spot or point focussing gives a reduced but concentrated beam width, which provides the best possible flaw detection capability, but takes longer to scan because of the reduced beam width. Line focussed probes give larger beam width in one axis with a concentrated reduced beam in the other axis. The working range of the focussed probes is much less than the flat-faced probes and in fact the focal length occurs within the near field length.

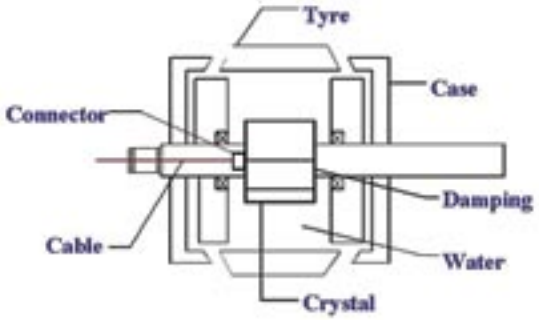
DELAY LINE TRANSDUCERS

Delay line transducers transmit and receive sound waves with one element, coupled to the surface as with compression transducers. The crystal held off from the test piece surface by a delay block. This permits inspection very close to the test piece surface.



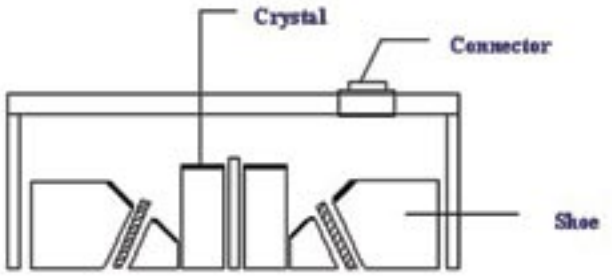
WHEEL TRANSDUCERS

Wheel transducers operate in a similar fashion to delay line models. They are typically used in applications where a large area must be scanned and/or where the test piece material is sensitive to conventional ultrasonic couplants.



CUSTOM TRANSDUCERS

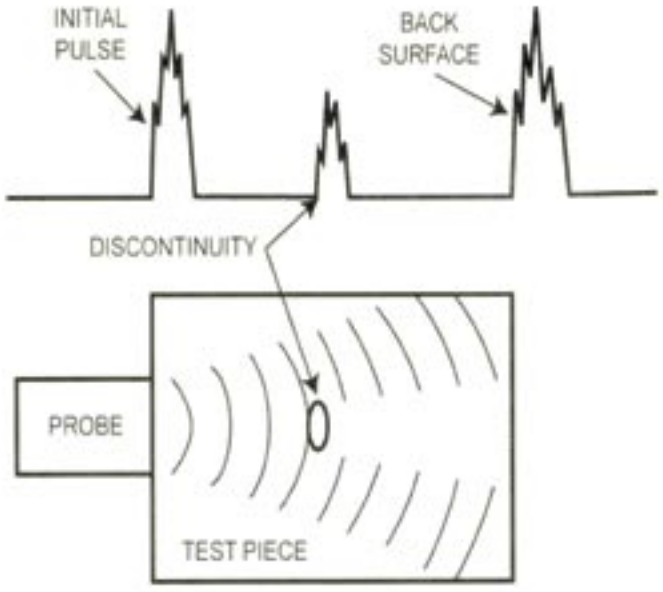
Custom transducers are often required for specialist applications. These often contain a number of elements for specific locations and angles. An example of this is the probe used to test railway tracks that incorporates both forward and backward facing twin element arrangements either side of a conventional twin crystal arrangement. Complex transducers such as this are designed in-house for a variety of specific applications.



FUNDAMENTALS OF ULTRASOUND

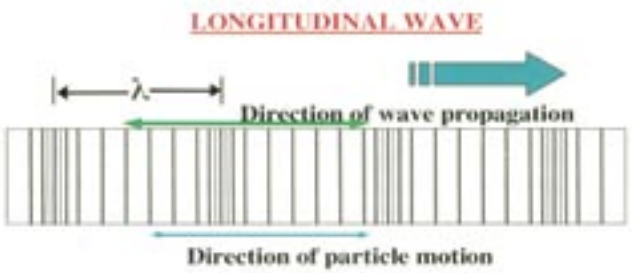
High frequency sound waves are introduced into the test material from a transducer, that is usually coupled to the test part by water or another suitable liquid based coupling method. The transducer converts the electrical impulses of the instrument into high frequency sound energy. A short burst of ultrasonic energy is introduced into the test material and some or all of the energy is reflected by discontinuities. Some may also be reflected by the far surface of the test part.

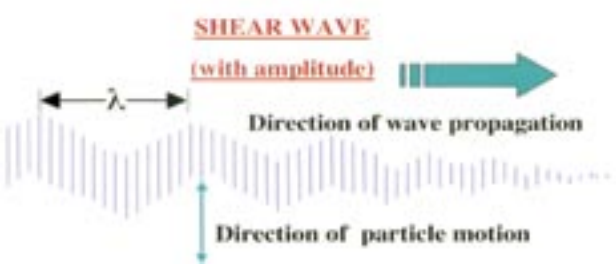
The reflection of sound energy is a function of the ratio between the acoustic impedance of the discontinuity and the base material. The acoustic impedance of a given material is the product of the density and velocity of sound in the material. The greater the impedance ratio, the more sound energy will be reflected. The principle of ultrasonic testing is illustrated in Fig.1. Here it shows the ultrasonic energy in the test piece and the resulting instrument display.



Basic Ultrasonic Testing

Fig.1





Wave Modes

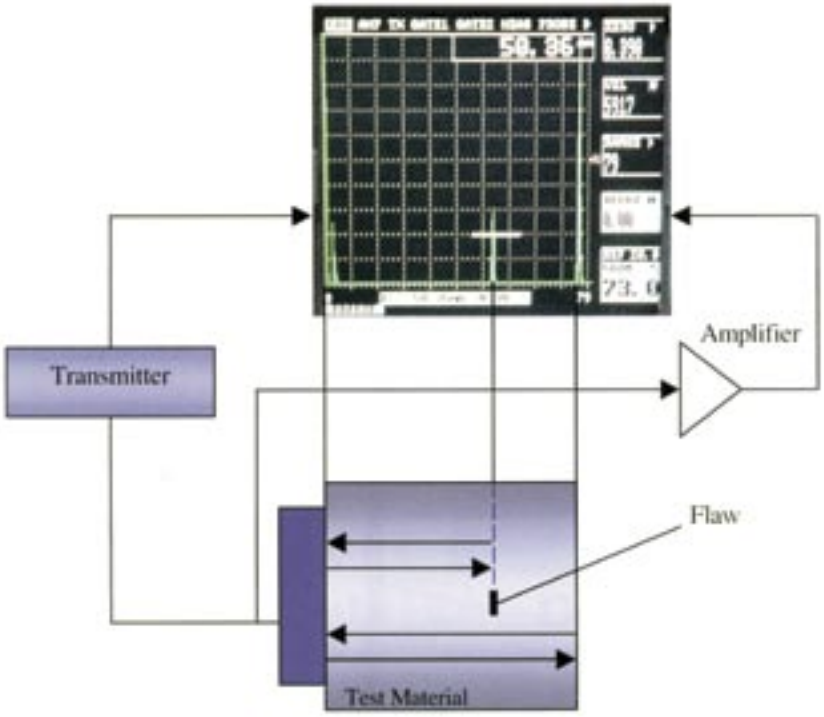
Longitudinal waves consist of particles vibrating along the direction of travel of the wave. Such waves may be propagated in solids, liquids and gasses.

In solid materials it is also possible for the particle movement to be at right angles to the direction of travel of the wave. These are known as Shear Waves.

λ = Wave length
c = Sound velocity
f = Frequency (MHz)

Technical Implementation

Short electrical pulses (typically 50-500 volts) are generated and used to drive a piezoelectric transducer. The resulting pulse of ultrasound travels through the test piece and may be reflected back to the transducer, producing an electrical signal. This can be amplified and displayed on an oscilloscope (or analyzed electronically).



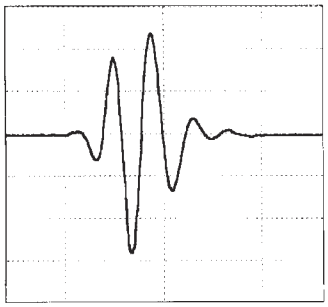
Ultrasonic Pulses

A piezoelectric element (crystal) is used to transform electrical energy into mechanical vibrations and vice versa. Due to mechanical damping of the transducer element a damped oscillation is produced-the ultrasonic pulse. In turn, when the transducer element receives an ultrasonic pulse, it converts it into an electronic RF pulse. The frequency of the pulse is determined by the element thickness, whereas the pulse length and frequency spectrum (bandwidth) is determined by the element damping.

$$B_6 = \frac{f_u - f_1}{f_m}$$

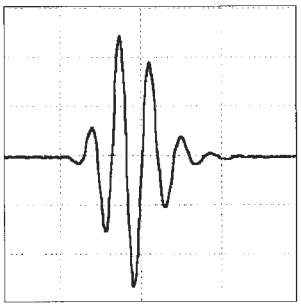
B_6 = bandwidth
f_u = upper frequency
f_1 = lower frequency
f_m = centre frequency

HIGH DAMPING

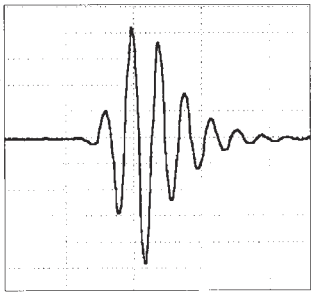


High damping generates a short pulse, which results in a wide frequency spectrum (large bandwith). Such devices demonstrate high resolution

MEDIUM DAMPING



LOW DAMPING



Low damping results in long pulse duration with distinctive frequency and narrow spectrum (small bandwidth).

Soundfield

The sound field (or beam shape) is defined by the diameter and frequency of the crystal together with the sound velocity in the test piece. The sound pressure drops to 50% (-6dB) of the centre line, defining the diameter of the sound field. Maximum sensitivity is achieved at the near field length where the beam is at its narrowest. In the far field, the beam diameter is seen to increase in accordance with the divergence angle.

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

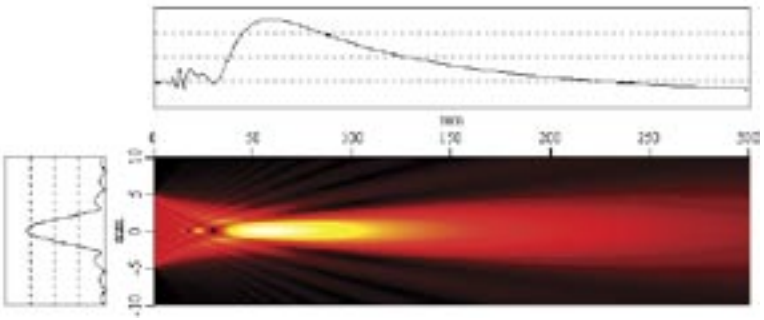
$$\sin \theta_6 = \frac{0.51c}{Df}$$

D = Crystal diameter

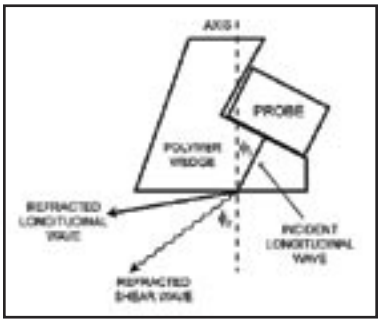
f = Frequency (MHz)

C = Sound Velocity

θ_6 = Divergence angle to 6dB drop (degrees)



Typical angle probe arrangement



Reflection and Refraction

If ultrasound hits an interface at an angle other than 90°, reflection, refraction and mode conversion occur according to Snell's Law. As the velocity of longitudinal waves is greater than the velocity of shear waves in a given material, the angles of reflection and refraction of longitudinal waves are greater than those of shear waves. Ultrasound incident at 90° onto an interface between two dissimilar materials will be partly reflected back from the interface. The amplitudes of the transmitted and reflected components are defined by the acoustic impedance mismatch between the two materials.

$$Z = pc$$

$$T = \frac{2Z_2}{Z_2 + Z_1}$$

$$R = \frac{Z_2 - Z_1}{Z_2 + Z_1}$$

Z = Acoustic impedance

P = Density

Subscript 1 = material 1

2 = material 2

$$\frac{Sin\,\theta_i}{C_i} = \frac{Sin\theta_r}{C_r}$$

The incident angle necessary to produce a desired refracted wave can be calculated from Snell's Law.

θ_i = incident angle of the transducer wedge

θ_r = desired refracted angle

C_i = sound velocity of the wedge

C_r = sound velocity of a shear wave in the test material

VELOCITY & ACOUSTIC IMPEDANCE TABLE

MATERIAL	LONGITUDINAL VELOCITY in/μs	SHEAR VELOCITY in/μs	ACOUSTIC IMPEDANCE
Air	.013	-	0.0004
Aluminium	.249	0.123	17.0
Berylium	.508	.350	23.0
Brass	.168	.79	31.0
Copper	.183	.089	41.6
Glass	.233	.135	11.4
Glycerin	.078	-	24.6
Gold	.128	.047	62.6
Inconel	.229	.119	47.2
Iron	.232	.127	45.4
Iron (cast)	.189	.094	33.2
Lead	.085	.028	24.6
Magnesium	.248	.130	10.0
Molybdenum	.248	.132	63.1
Monel	.237	.107	47.6
Nickel	.222	.117	49.5
Platinum	.156	.066	69.8
Plexiglass	.107	.056	3.1
Polyethylene	.069	.020	1.7
Polyurethane	.07	-	1.9
Quartz	.226	.087	5.2
Rubber, Butyl	.072	-	2.0
Silver	.142	.063	38.0
Steel, mild	.232	.128	46.0
Steel, stainless	.226	.122	45.4
Teflon	.059	-	3.0
Tin	.131	.066	24.2
Titanium	.239	.122	27.3
Tungsten	.204	.113	101.0
Uranium	.133	.066	63.0
Water	.058	-	1.48
Zinc	.164	.095	29.6

Please Note: Some of these values are approximations. Material velocities do change.
Conversion Factor: 1 m/s = 3.937 x 10^{-5} in/μs

CALIBRATION BLOCKS

All Calibration Blocks Available in Metric or Imperial
(Some Calibration Blocks shown in Metric others in Imperial sizes.)

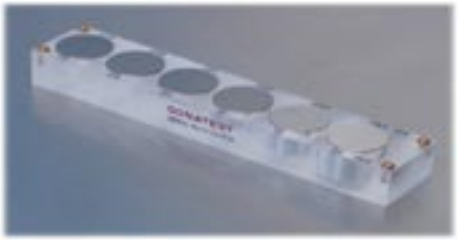
Calibration Block 1 (EN12223) A steel block for the calibration of ultrasonic flaw detection and inspection equipment used in material testing. Used for the calibration of shear and longitudinal transducers, determination of shear wave emission point, refracted angle. Also for measurement of sensitivity and resolution. Type I and Type II available.
Product Code V1.

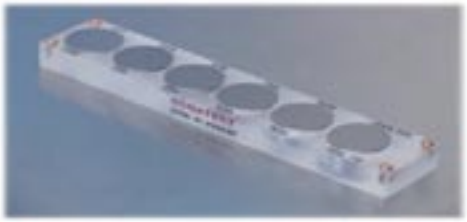
Calibration Block 2 (EN27963) For the ultrasonic examination of welds. To check angle transducers for beam angle and index point. Available in 12.5mm and 20mm thickness.
Product Code V2

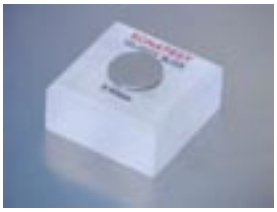
Sonatest Universal CBU Calibration Block. For calibration of small shear wave and longitudinal transducers, determination of shear wave emission point, refracted angle and measurement of sensitivity and depth resolution. 2.0 in. (50 mm) radius.
Product Code CBU

Steel Step Wedge
1mm to 8mm in 1mm steps. Each step is 20mm x 20mm. Used for checking the sensitivity of twin transducers on thin sections when using a flaw detector.
Product Code VW
Standard 4 & 5 step wedges available .100 .500 (Imperial)

Steel Pipe Wedge
Made from 2in (50mm) diameter pipe with thickness steps of 10, 8, 6, 4 and 2mm or imperial sizes. This pipe wedge simulates steam boiler tubes in power stations and is used to calibrate flaw detectors for thin tube inspection. *Product Code PW*







Calibration Step Wedge Imperial Series of steel discs set into a perspex block for calibration and linearity checking of thickness meters and flaw detectors. Wedge thicknesses 0.05, 0.1, 0.2, 0.3, 0.4, 0.6 in..
Product Code CBI

Velocity Block. Equivalent to a 1μs thickness of a known velocity in steel. The block is mounted on perspex. Used to check the velocity of other materials with thickness meters.
Product Code CBV

Calibration Step Wedge Metric Series of steel discs set into a perspex block for calibration and linearity checking of thickness meters and flaw detectors. Wedge thicknesses 1.5, 2.5, 5.0, 10.0, 15.0, 20.0 mm.
Product Code CBM

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