



Krautkrämer ultrasonic transducers

For flaw detection and sizing

Quality at every step

For 70 years, Krautkrämer ultrasonic transducers have been synonymous with quality.

Our core ability is to match ultrasonic probes to the inspection applications of today, both simple and complex. This skill lets us design and manufacture fine-tuned quality probes that meet your customer-specific requirements.

We build quality into every step we perform—from start to finish:

- **Requirement analysis.** At the very beginning of our discussions with you, we draw on our experience manufacturing more than 1 million probes—including 14,000 probe variations—to build quality into our requirement analysis process.
- **Specifications.** To help ensure quality results, each product in our one-stop-shop adheres to our exacting specifications.
- **Simulation.** Early in the process, we use industry leading simulation technology software to help us determine what needs to be done to meet application requirements. We also understand the boundaries of simulation and how that impacts the build.
- **Feasibility studies.** We support challenging applications by conducting feasibility studies in our labs, which are located worldwide. Send us your samples and we can determine the best inspection method and technology.
- **Material selection and processing.** We use the highest standards when sourcing our raw materials, and our in-house manufacturing is fully controlled to ISO standards. Our ceramics shop in Shannon, Ireland, creates piezocomposite ceramics, an in-house offering unique to our business.
- **Prototyping.** With a strong understanding of your needs, we offer prototyping to further validate that the solution works.
- **Product validation.** With an emphasis on repeatability and process stability, our exacting build-and-test procedures and specifications are followed for every single build, meaning every step includes a quality inspection/test to meet required criteria. What's documented: Each probe has a unique serial number, and every validated manufacturing step is recorded before shipment. Finally, our database stores historical test data for every probe. We provide a certification of conformance, including probe waveform and frequency spectrum results with each probe.
- **Manufacturing.** With manufacturing available in both Europe and the USA, we can provide local variation and meet local norms. In fact, we can customize your transducer to meet your specific ultrasonic testing applications. Modifications can involve transducer case design, connector options, and element size and shape, including non-standard frequencies, sensitivity, bandwidth and focusing.
- **Delivery.** Our pledge is to provide you with exceptional product availability with our global distribution sites and customer care resources, to ensure that order status is communicated until your probe reaches your door.
- **Support.** We have expert resources available to help you with your ultrasonic inspection challenges including field application engineers and remote service technicians who can be reached through phone or email 24/7. Our probes are backed by a standard one year repair or replace warranty as a testament that we stand behind our products.

Krautkrämer ultrasonic transducers from Inspection Technologies deliver consistent readings. Our quality goes beyond standard, our pricing is competitive, and our products are delivered when and where you need them.

Now that's quality, every step of the way.

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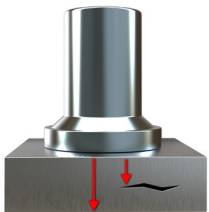
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Transducer selection criteria and performance

General information

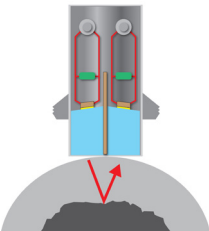
The ultrasonic transducers in this catalog are divided into two general categories, Contact and Immersion.

Transducers for the contact inspection method



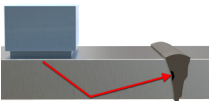
Straight beam—single element

- Parts with regular geometry and relatively smooth contact surface
- Flat or curved contact surface
- Flaw or backwall parallel to surface or detectable with beam normal to surface
- Preferred for penetration of thick sections
- Delay line types improve near surface resolution
- Requires couplant layer, typically a gel, oil, or paste
- Typically used for manual inspection



Straight beam—dual element (TR)

- Transmit and receive elements separated by crosstalk barrier
- Flaw or backwall parallel to surface or detectable with beam normal to surface
- Best for thin sections, near surface resolution
- Requires couplant layer, typically a gel, oil, or paste
- Typically used for manual inspection



Angle beam

- Element mounted on integral or replaceable wedge
- Uses refraction to transmit shear or longitudinal wave at a predetermined angle
- Most standard transducers generate shear waves by mode conversion
- Preferred for parts with inclined flaws, such as welds
- Available in both single and dual element types
- Requires couplant layer, typically a gel, oil, or paste
- Sometimes used in mechanized or automated testing

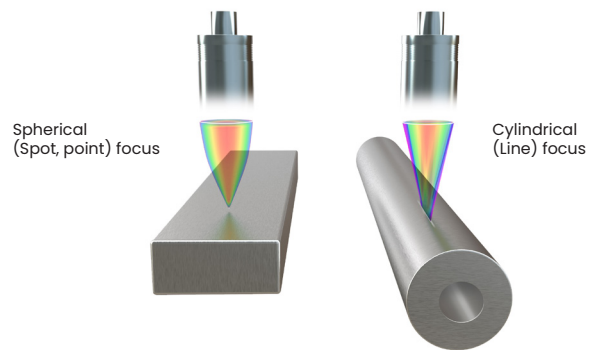
Transducers for the immersion method

Immersion transducers

- Acoustically matched for best efficiency in water
- Suitable for parts with irregular geometries
- Commonly used in mechanized or automated testing
- Best method for consistent coupling and reproducible results
- Large parts can be tested using probe holders, bubblers, or water jets
- Transducers can be focused to improve results

Focused immersion transducers

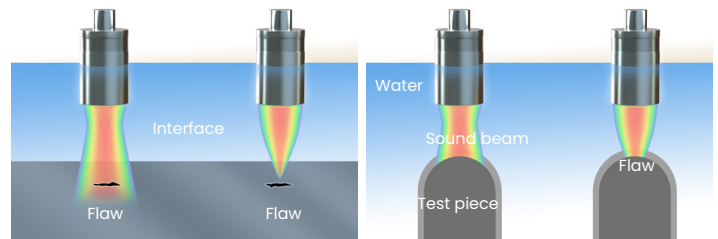
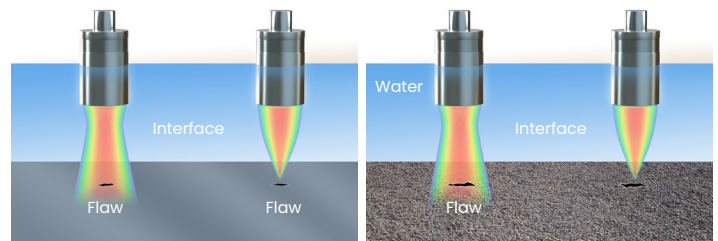
- Spherical focus forms a point or spot
- Cylindrical focus forms a line



Advantages of focusing

Increase sensitivity to small flaws

Improve signal-to-noise ratio



Improve near surface resolution

Correct for contoured surfaces

Transducer selection criteria— European standards

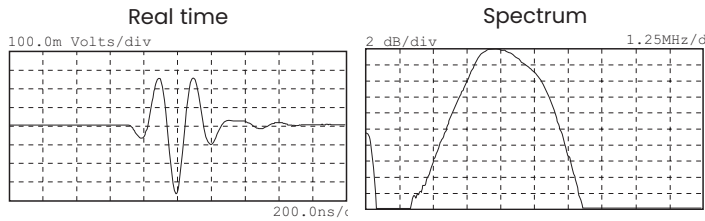
For transducers manufactured to European standards, technical and performance information is provided throughout this catalog based on the definitions below. A comprehensive data sheet is supplied with most flaw detection transducers at no charge.

| Description | Explanation |
|--------------------------------------|--|
| Element size D or a x b | Diameter D or length x width a x b of the transducer element. The size of the element strongly affects the shape of the transmitted sound field. Slight deviations, (e.g., imperfect shape or positions with reduced radiation due to poor bonding) cause considerable evaluation errors, even when calibrated to a reference flaw. |
| Nominal frequency f | The mean frequency of all probes of the same type. The frequency has a great influence on the evaluation of reflectors. Even the shape of the sound field and the reflection behaviour of angled reflectors are strongly dependent on the frequency. With increasing frequency, the echo height from non-vertically positioned reflectors to the sound beam decreases. This is why each probe is checked by our Quality Control to see if its frequency coincides with the nominal frequency, according to the identification label, within very narrow tolerances. This is entered into the probe data sheet. |
| Bandwidth B | <p>The range of frequencies in the echo pulse whose amplitude, at the most, is 6 dB less than the maximum amplitude.</p> $B = \frac{f_o - f_u}{f} \times 100\%$ <p>f_o = upper, f_u = lower frequency limit for a 6 dB drop in amplitude. With B = 100%, a 4 MHz, probe for example, has an f_o of 6 MHz and an f_u of 2 MHz. Large bandwidths mean shorter echo pulses, which mean high resolution and a good penetration power, because the lower frequencies of the pulse become less attenuated than the nominal frequency. At high attenuation, the frequency of reflected signals decreases, compared to the nominal frequency, as the distance increases. This must be taken into account with flaw evaluation. The bandwidth of each probe is therefore checked and must, within narrow tolerances, coincide with the mean value of all probes.</p> |
| Focal distance F | The distance of a small reflector from the probe producing the highest possible echo. Probes are focused in order to detect small reflectors and produce a high echo amplitude. Focusing is only possible within the near field of the probe. |
| Near field length N | <p>The near field length N is the focal distance of the unfocused probe which constitutes the sound pressure maximum at the largest distance from the probe. N is determined by D, c and f.</p> $\text{For } D \gg \lambda \text{ is: } N = \frac{D_{\text{eff}}^2}{4\lambda} = \frac{D_{\text{eff}}^2 \cdot f}{4c}$ <p>λ = wave length c = sound velocity D_{eff} = effective element diameter Focal point and near field length are the distances with the best sound concentration and reflector recognition. Therefore, when a probe is selected for a critical test, the flaw expectancy range must be in the focal area or near field length. The data in the tables refers to steel with the exception of immersion testing in water.</p> |
| Focal diameter FD₆ | <p>Diameter of the sound field in the focal distance or near field length with a 6 dB drop of the echo indication.</p> $\text{For } D \gg \lambda \text{ is: } FD_6 = \frac{F \cdot c}{f - D_{\text{eff}}} = \frac{1}{4} k \cdot D_{\text{eff}} \quad \text{with } k = \frac{F}{N}$ |
| Pulse shape | The presentation of signals, as they are at the instrument input coming from plane reflectors. |
| Spectrum | Display of all the frequencies in the echo pulse. The frequency amplitudes are shown over the frequency. |
| Beam angle β | The angle between the main beam and the normal axis of the test surface. |

Transducer selection criteria— North American standards

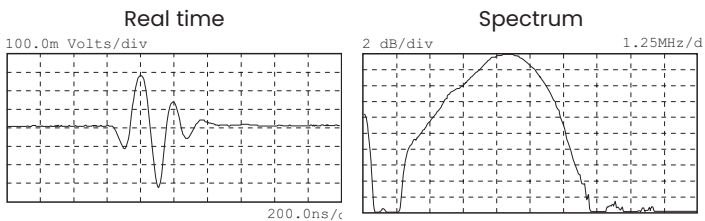
For transducers manufactured to North American standards, Baker Hughes Inspection Technologies offers three performance ranges: **Alpha**, **Benchmark**, and **Gamma Series**. Waveform and frequency certification, per ASTM E-1065, are supplied with all flaw detection transducers at no charge.

Alpha series features



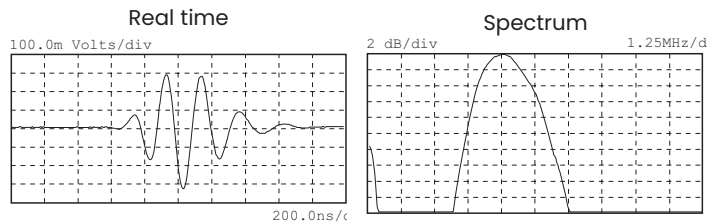
- Recommended for applications where resolution is the primary consideration.
- Suitable for applications such as thickness measurement and near-surface flaw detection.
- Very short pulse—mechanically damped to the limit of current technology.
- Gain is usually lower than that of the Gamma and Benchmark Series.
- Broadband—typical 6 dB bandwidths range from 50% to 100%.
- Typical Alpha waveforms (right) exhibit one to two full ring cycles, depending on frequency, size and other parameters.

Benchmark series features



- Proprietary **BENCHMARK COMPOSITE**[®] (piezocomposite) active elements.
- Penetration in attenuative materials is far superior to conventional transducers.
- High signal to noise on coarse grain metals, fiber reinforced composites, et al.
- Short pulse—resolution usually superior to Gamma Series.
- Gain is usually higher than that of the Gamma and Alpha Series.
- Very broadband—typical 6 dB bandwidths range from 60% to 120%.
- Low acoustic impedance element improves performance of angle beam, delay line, and immersion probes—excellent match to plastic and water.

Gamma series features



- General purpose transducers, recommended for the majority of applications.
- Medium pulse, medium damping—best combination of gain and resolution.
- Matching electrical network ensures maximum gain and optimum waveform for general use.
- Medium bandwidth—typical 6 dB bandwidths range from 30% to 50%.
- Typical Gamma waveform exhibits three to four full ring cycles, depending on frequency, size and other parameters.

Contact transducers

Straight beam contact transducers, protective face



Applications

- General purpose, larger parts with simple geometry
- Forgings, billets
- Plates, bars, square profiles
- Containers, machine components, shells
- Inspection at high temperature with delay line

Features and benefits

- European models have replaceable membrane:
 - Improves coupling on uneven or curved surface
 - Extends transducer life.
 - Suitable for DGS flaw sizing method
 - High temperature delay lines also available
 - Lemo 1 (B..S) or Lemo 00 (MB..S) connector, side mount standard, top mount optional
- North American models can be used with three types of protective face:
 - Membrane improves coupling on uneven or curved surface.
 - Wear cap extends transducer life indefinitely when replaced periodically.
 - High temperature delay line enables testing on surfaces up to 400°F (200°C).
 - BNC connector, side or top mount

Protective face transducers— European standards

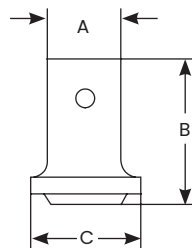
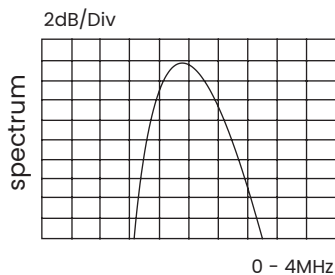
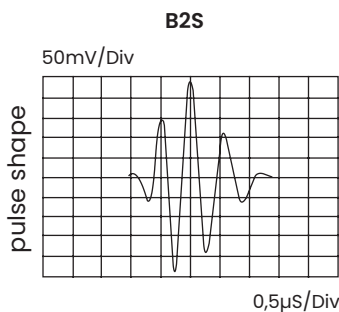
Types B..S and MB..S



B..S



MB..S



| Case type | A | | B | | C | |
|-----------|----|------|----|------|----|------|
| | mm | in | mm | in | mm | in |
| Type 2 | 30 | 1.18 | 59 | 2.32 | 45 | 1.69 |
| Type 3 | 20 | 0.79 | 43 | 1.77 | 25 | 0.98 |

Typical waveform and frequency spectrum

| Type | Order code | D | | f (MHz) | N | | Notes | Sketch |
|-------------|------------|----|------|---------|-----|-----|--------------------------------------|--------|
| | | mm | in | | mm | in | | |
| B 1 S | 0057744 | 24 | 0.94 | 1 | 23 | 0.9 | | Type 2 |
| B 1 S-ISO | 0500035 | 24 | 0.94 | 1 | 23 | 0.9 | ISO 22232-2 compliant | |
| B 2 S-ISO | 0500036 | 24 | 0.94 | 2 | 45 | 1.8 | ISO 22232-2 compliant | |
| B 2 S-O-ISO | 0500267 | 24 | 0.94 | 2 | 45 | 1.8 | ISO 22232-2 compliant, top connector | |
| B 4 S | 0057746 | 24 | 0.94 | 4 | 88 | 3.5 | | |
| B 4 S-ISO | 0500037 | 24 | 0.94 | 4 | 88 | 3.5 | ISO 22232-2 compliant | |
| B 4 S-O | 0057757 | 24 | 0.94 | 4 | 88 | 3.5 | Top connector | |
| B 4 S-O-ISO | 0500268 | 24 | 0.94 | 4 | 88 | 3.5 | ISO 22232-2 compliant, top connector | |
| B 5 S | 0057747 | 24 | 0.94 | 5 | 110 | 4.3 | | |
| MB 2 S | 0057748 | 10 | 0.39 | 2 | 8 | 0.3 | | Type 3 |
| MB 2 S-ISO | 0500038 | 10 | 0.39 | 2 | 8 | 0.3 | ISO 22232-2 compliant | |
| MB 4 S | 0057749 | 10 | 0.39 | 4 | 16 | 0.6 | | |
| MB 4 S-ISO | 0500039 | 10 | 0.39 | 4 | 16 | 0.6 | ISO 22232-2 compliant | |
| MB 5 S | 0057750 | 10 | 0.39 | 5 | 20 | 0.8 | | |

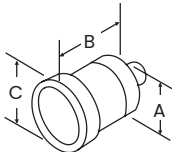
Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Accessories

| Description | Type | Remark |
|--------------------------------------|------------------------------------|---|
| Protective membrane (1 set = 10 pcs) | ES45 (0053756) ES24 (0053769) | for B..S; for MB..S; |
| Delay line or delay wedges | Special order | e.g., for testing at high temperatures. |
| Cables | PKLL2 (0050326) MPKL2 (0050486) | for B..S for MB..S |

Protective face transducers— North American standards



| Element Ø | | A | | B | | C | |
|-----------|------|------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 13 | 0.50 | 19.1 | 0.75 | 30.5 | 1.20 | 23.9 | 0.94 |
| 19 | 0.75 | 25.4 | 1.00 | 30.5 | 1.20 | 30.2 | 1.19 |
| 25 | 1.00 | 31.8 | 1.25 | 30.5 | 1.20 | 36.6 | 1.44 |

Protective face combination transducers—type PFCR (side mount BNC), PFCS (top mount BNC)

| Freq. (MHz) | Element Ø | | Order code | | Freq. (MHz) | Element Ø | | Order code | |
|-------------|-----------|------|-------------------|-------------------|-------------|-----------|------|-------------------|-------------------|
| | mm | in | Gamma series PFCR | Gamma series PFCS | | mm | in | Gamma series PFCR | Gamma series PFCS |
| 2.25 | 13 | 0.50 | 113-242-240 | | 5.0 | 13 | 0.50 | | 113-244-260 |
| | 25 | 1.00 | 113-262-240 | 113-262-260 | | 25 | 1.00 | 113-264-240 | |

Note: Protective face option kits sold separately. Custom configurations are available by special order.

Protective face option kits—PFCR/PFCS

| Kit styles | Order code | | |
|-------------------------------|----------------------|----------------|-----------------|
| | Transducer element Ø | | |
| | .5 in (13 mm) | .75 in (19 mm) | 1.00 in (25 mm) |
| PM | 118-450-120 | 118-450-140 | 118-450-160 |
| PWC | 118-450-220 | 118-450-240 | 118-450-260 |
| PHTD - 1.0 in (25.4 mm) delay | 118-450-320 | 118-450-340 | 118-450-360 |
| PHTD - 1.5 in (38.1 mm) delay | 118-450-420 | 118-450-440 | 118-450-460 |

Style PM Kit includes a knurled ring, gland nut, wrench, 12 membranes, and a 2 oz. bottle of couplant (transducer not included).

Style PWC Kit includes a knurled ring, three wear caps, and a 2 oz. bottle of couplant (transducer not included). This option may not be usable if near surface resolution is critical.

Style PHTD Kit includes a knurled ring, high temperature delay line, and a 2 oz. bottle of couplant (transducer not included).

| | Order code | | |
|--|----------------------|----------------|-----------------|
| | Transducer element Ø | | |
| | .5 in (13 mm) | .75 in (19 mm) | 1.00 in (25 mm) |
| Spare membranes pkg. of 12 pcs. | 118-220-020 | 118-220-021 | 118-220-022 |
| Spare wear caps pkg. of 12 pcs. | 118-240-123 | 118-240-122 | 118-240-121 |
| Hi-Temp. Delay Line* 1.0 in (25.4 mm) length | 118-440-027 | 118-440-031 | 118-440-035 |
| Hi-Temp. delay Line* 1.5 in (38.1 mm) length | 118-440-029 | 118-440-033 | 118-440-037 |
| BNC cable | 118-140-016 | | |
| Membrane, wear cap and delay line couplant | 118-300-740 | | |

* High temp (PHTD) delay line: maximum temperature 400°F (200°C), maximum contact time 10 seconds; cool to ambient before reuse.

Straight beam contact transducers, wear resistant



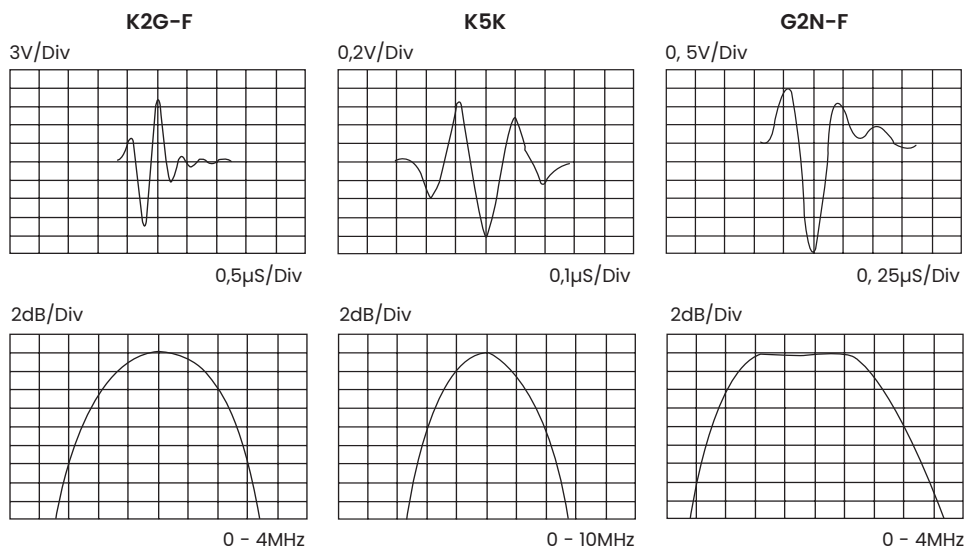
Applications

- General purpose, metal parts with simple geometry
- Manual inspection of plate, large forgings, billets, castings
- Smaller models for pipe and tube, tanks, bars, small forgings
- Lamination, delamination
- Bond testing
- Thick sections or difficult to penetrate materials

Features and benefits

- Permanent, abrasion—resistant wear plate
- Best match to metals
- Higher gain reserve than protective face models
- Fingertip models for access to tight spaces
- Comfortable grip
- European models have side mounted Lemo 00 connectors, side mounted Microdot on K..K and G..K types.
- North American models have BNC connectors (side or top mount), side mounted Microdot on F type.

Wear resistant transducers— European standards



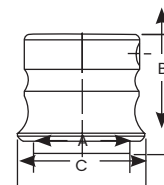
Typical waveform and frequency spectrum

| Type | Order code | D | | f (MHz) | N | | Notes | Sketch | |
|------------|------------|----|------|---------|----|-----|-----------------------|--------|-----------------------|
| | | mm | in | | mm | in | | | |
| K 1 G | 0058506 | 24 | 0.94 | 1 | 23 | 0.9 | Type 5 | | |
| K 2 G | 0058507 | 24 | 0.94 | 2 | 45 | 1.8 | | | |
| K 2 G-ISO | 0500071 | 24 | 0.94 | 2 | 45 | 1.8 | | | ISO 22232-2 compliant |
| K 4 G | 0058508 | 24 | 0.94 | 4 | 88 | 3.5 | | | |
| K 4 G-ISO | 0500072 | 24 | 0.94 | 4 | 88 | 3.5 | ISO 22232-2 compliant | | |
| K 2 N | 0058509 | 10 | 0.39 | 2 | 8 | 0.3 | Type 6 | | |
| K 4 N | 0058510 | 10 | 0.39 | 4 | 16 | 0.6 | | | |
| K 5 N | 0058511 | 10 | 0.39 | 5 | 20 | 0.8 | | | |
| K 5 K | 0052831 | 5 | 0.20 | 5 | 5 | 0.2 | Type 7 | | |
| K 5 K-ISO | 0500061 | 5 | 0.20 | 5 | 5 | 0.2 | | | ISO 22232-2 compliant |
| K 10 K | 0052832 | 5 | 0.20 | 10 | 10 | 0.4 | | | |
| K 10 K-ISO | 0500062 | 5 | 0.20 | 10 | 10 | 0.4 | | | ISO 22232-2 compliant |
| G 1 N | 0058500 | 24 | 0.94 | 1 | 23 | 0.9 | Type 5 | | |
| G 2 N | 0058501 | 24 | 0.94 | 2 | 45 | 1.8 | | | |
| G 2 KB | 0058503 | 10 | 0.39 | 2 | 8 | 0.3 | Type 6 | | |
| G 5 KB | 0058504 | 10 | 0.39 | 5 | 20 | 0.8 | | | |
| G 5 K | 0053057 | 5 | 0.20 | 5 | 5 | 0.2 | Type 7 | | |

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Types K..G, K..N, K..K, G..N, G..KB and G..K



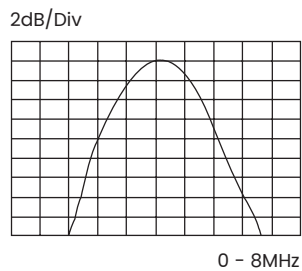
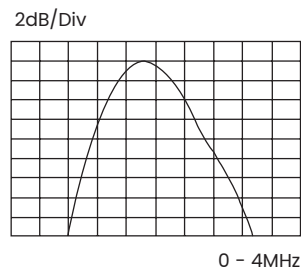
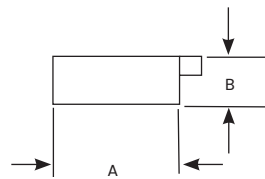
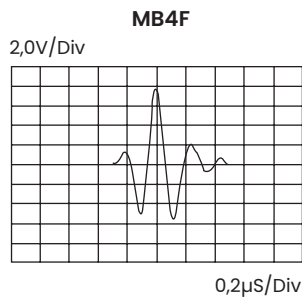
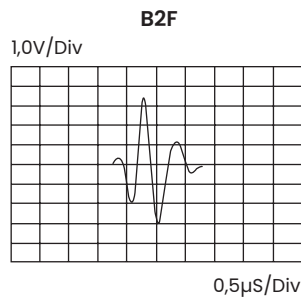
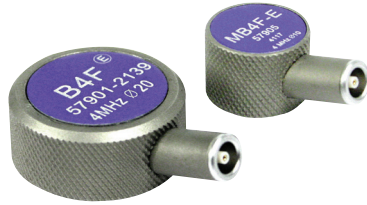
| Case type | A | | B | | C | |
|-----------|----|------|----|------|----|------|
| | mm | in | mm | in | mm | in |
| Type 5 | 30 | 1.18 | 37 | 1.46 | 40 | 1.57 |
| Type 6 | 15 | 0.59 | 31 | 1.22 | 26 | 1.02 |
| Type 7 | 10 | 0.39 | 17 | 0.67 | | |

Accessories

| Description | Type | Remark |
|-------------|-----------------|---------------------------------|
| Probe cable | MPKL2 (0050486) | for K..G, K..N, G..N, and G..KB |
| | MPKM2 (0052999) | for K..K and G..K |

Wear resistant transducers— European standards

Types B..F and MB..F



| Case type | A | | B | |
|-----------|----|------|----|------|
| | mm | in | mm | in |
| Type 8 | 31 | 1.22 | 16 | 0.63 |
| Type 9 | 19 | 0.75 | 16 | 0.63 |

Typical waveform and frequency spectrum

| Type | Order code | D | | f | N | | Notes | Sketch |
|-------------|------------|----|------|-------|----|-----|-----------------------|--------|
| | | mm | in | (MHz) | mm | in | | |
| B 1 F | 0057899 | 20 | 0.79 | 1 | 16 | 0.6 | | Type 8 |
| B 2 F | 0057900 | 20 | 0.79 | 2 | 31 | 1.2 | | |
| B 4 F | 0057901 | 20 | 0.79 | 4 | 62 | 2.4 | | |
| B 5 F | 0057902 | 20 | 0.79 | 5 | 76 | 3.0 | | |
| MB 2 F | 0057904 | 10 | 0.39 | 2 | 8 | 0.3 | | Type 9 |
| M B 4 F | 0057905 | 10 | 0.39 | 4 | 16 | 0.6 | | |
| M B 4 F-ISO | 0500073 | 10 | 0.39 | 4 | 16 | 0.6 | ISO 22232-2 compliant | |
| MB 5 F | 0057906 | 10 | 0.39 | 5 | 19 | 0.8 | | |
| MB 10 F | 0057903 | 10 | 0.39 | 10 | 32 | 1.4 | | |

Accessories

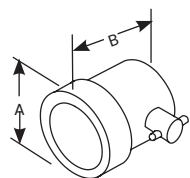
| Description | Type | Remark |
|-------------|--------------------|--------------------|
| Cable | MPKL2 (0050486) | for B..F and MB..F |

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Wear resistant transducers— North American standards

Type RHP



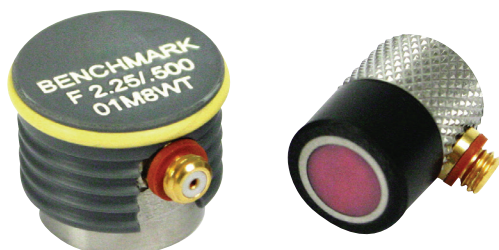
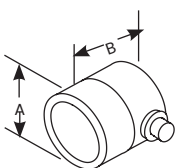
| Element Ø | | A | | B | |
|-----------|------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 13 | 0.50 | 29.2 | 1.15 | 38.1 | 1.50 |
| 25 | 0.75 | 35.6 | 1.40 | 38.1 | 1.50 |
| 19 | 1.00 | 41.9 | 1.65 | 38.1 | 1.50 |

Standard contact transducers—type RHP-CR (side mount BNC), RHP-CS (top mount BNC)

| Freq. (MHz) | Element Ø | | Order code | | | Freq. (MHz) | Element Ø | | Order code | | |
|-------------|-----------|------|----------------|----------------------------------|------------------------------|-------------|----------------|------|----------------|----------------------------------|------------------------------|
| | mm | in | Alpha series | Gamma series | Accessories | | mm | in | Alpha series | Gamma series | Accessories |
| 0.5 | 25 | 1.00 | | 113-260-043-CR | | 3.5 | 13 | 0.50 | | 113-243-043-CR | |
| 1.0 | 13 | 0.50 | | 113-241-043-CR | Cables BNC 118-140-016 | 5.0 | 13 | 0.50 | 113-144-043-CR | 113-244-043-CR | Cables BNC 118-140-016 |
| | 25 | 1.00 | | 113-261-043-CR | | | 113-244-123-CS | | | | |
| 2.25 | 13 | 0.50 | 113-142-043-CR | 113-242-043-CR 113-242-123-CS | LEMO-1 118-140-018 | 10.0 | 19 | 0.75 | | 113-254-043-CR | LEMO-1 118-140-018 |
| | 19 | 0.75 | 113-152-043-CR | 113-252-043-CR | | | 25 | 1.00 | 113-164-043-CR | 113-264-043-CR 113-264-123-CS | |
| | 25 | 1.00 | 113-162-043-CR | 113-262-043-CR 113-262-123-CS | | | 13 | 0.50 | | 113-246-043-CR | |

Custom configurations are available by special order.

Type F



| Element Ø | | A | | B | |
|-----------|-------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | 0.25 | 12.7 | 0.50 | 16.8 | 0.66 |
| 10 | 0.375 | 16.0 | 0.63 | 16.8 | 0.66 |
| 13 | 0.50 | 19.1 | 0.75 | 16.8 | 0.66 |

Fingertip contact transducers—type F

| Freq. (MHz) | Element Ø | | Order code | | | | Freq. (MHz) | Element Ø | | Order code | | | |
|-------------|-----------|-------|------------------|--------------|--------------|-----------------------|-------------|-----------|-------|------------------|--------------|--------------|-----------------------|
| | mm | in | Benchmark series | Alpha series | Gamma series | Accessories | | mm | in | Benchmark series | Alpha series | Gamma series | Accessories |
| 2.25 | 6 | 0.250 | 113-822-000 | 113-122-000 | 113-222-000 | Cables | 5.0 | 6 | 0.250 | 113-824-000 | 113-124-000 | 113-224-000 | Cables |
| | 10 | 0.375 | 113-832-000 | | 113-232-000 | | | 10 | 0.375 | 113-834-000 | 113-134-000 | 113-234-000 | |
| | 13 | 0.500 | 113-842-000 | 113-142-000 | 113-242-000 | BNC 118-140-012 | | 13 | 0.500 | 113-844-000 | 113-144-000 | 113-244-000 | BNC 118-140-012 |
| | | | | | | LEMO-1 118-140-022 | 10.0 | 6 | 0.250 | | 113-126-000 | 113-226-000 | |
| | | | | | | | | 10 | 0.375 | | | 113-236-000 | LEMO-1 118-140-022 |
| | | | | | | | 13 | 0.500 | | | 113-246-000 | | |

Custom configurations are available by special order.

Straight beam contact transducers, delay line



Applications

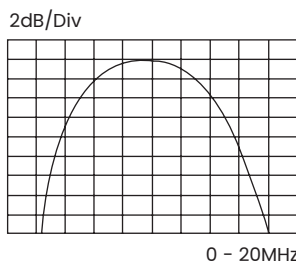
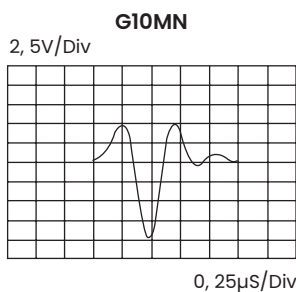
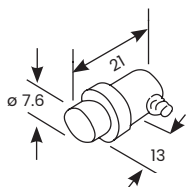
- Thickness measurement
- Near surface flaw detection
- Inspection of thin sections
- Curved parts, tubing, pipe
- Composites and plastics
- Turbine blades

Features and benefits

- Excellent near surface resolution.
- Replaceable delay line—long life and versatility.
- Higher frequencies improve resolution and small flaw detectability.
- All models have side mounted Microdot connector.

Delay line transducers— European standards

Type G..MN



Typical waveform and frequency spectrum

| Type | Order code | D mm | in | f (MHz) | N mm | in | Sketch |
|--------|------------|---------|------|------------|---------|-----|---------|
| G 5 MN | 0053046 | 5 | 0.20 | 5 | 5 | 0.2 | Type 14 |

Custom configurations are available by special order.

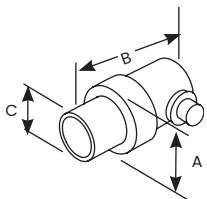
Accessories

| Description | Type | Remark |
|------------------------------|------------------------------------|---|
| Cable | MPKM2 (0052999) | |
| Delay Line (exchangeable) | CLFV1 (0054258) CLFV3 (0054262) | 0.37 in (9.5 mm) for G.MN 0.49 in (12.5 mm) for G.MN |

Delay line transducers— North American standards

Types DFR and K-PEN

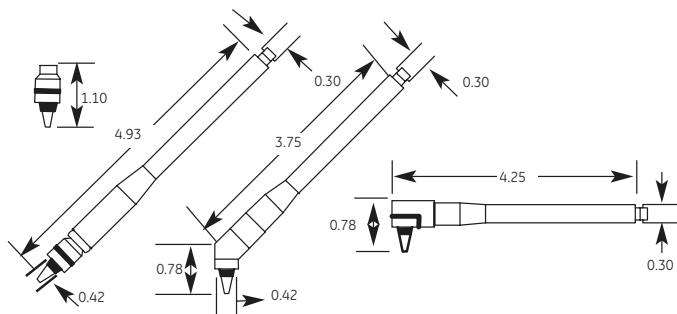
Removable delay line—type DFR



| Element Ø | | A | | B | | C | |
|-----------|---------------|-------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 3 or 6 | 0.125 or 0.25 | 13 | 0.51 | 21.3 | 0.84 | 7.6 | 0.30 |
| 13 | 0.50 | 22.4 | 0.88 | 35.1 | 1.38 | 15.2 | 0.60 |
| Mini-DFR | | | | | | | |
| 3 | 0.125 | 10.41 | 0.41 | 19.6 | 0.77 | 4.8 | 0.19 |

K-PEN replaceable delay line pencil probe

- Focused, high resolution pencil probe
- Interchangeable delay lines, two tip diameters
- Extremely small contact area
- Tightly curved surfaces, such as turbine blades
- Wall thickness measurement from the bottom of an external pit
- Straight, right angle and 45° handles
- Straight model has removable handle



| Freq. (MHz) | Order code | | | | | |
|-------------|----------------|-------------|-------------------|----------------------------------|----------------------------------|-------------|
| | Straight K-PEN | 45° K-PEN | Right angle K-PEN | .065 in (1.7 mm) Tip delay 10-PK | .090 in (2.3 mm) Tip delay 10-PK | BNC cable |
| 7.5 | 389-042-200 | | 389-042-870 | | | |
| 20.0 | 389-030-290 | 389-041-270 | 389-040-660 | 387-003-109 | 387-003-110 | 118-140-012 |



| Freq. (MHz) | Element Ø | | Alpha series | Order code | | Accessories |
|---------------|-----------|-------|--------------|-------------------------------------|-------------------------------------|-------------------------|
| | mm | in | | Delay line 10-PK .38 in (9.5 mm) Lg | Delay line 10-PK .5 in (12.7 mm) Lg | |
| 2.25 | 6 | 0.250 | 113-122-660 | 118-440-050 | 118-440-051 | Cables |
| 3.5 | 6 | 0.250 | 113-123-660 | 118-440-050 | 118-440-051 | BNC |
| 5.0 | 6 | 0.250 | 113-124-660 | 118-440-050 | 118-440-051 | 118-140-012 |
| | 13 | 0.500 | 113-144-660 | | 118-440-052 | |
| 10.0 | 6 | 0.250 | 113-126-660 | 118-440-050 | 118-440-051 | LEMO-1 |
| 15.0 | 6 | 0.250 | 113-127-660 | 118-440-050 | 118-440-051 | 118-140-022 |
| 22.0 | 3 | 0.125 | 113-118-660 | 118-440-050 | 118-440-051 | Delay line couplant |
| Mini-DFR 20.0 | 3 | 0.125 | 113-518-650 | 118-440-502 | | 118-300-740 |
| | | | | | | Spring loaded VEE block |
| | | | | | | 118-480-007 |

*118-480-007 fits .125 in (3 mm) and .25 in (6 mm) units only with exception of Mini DFR. Custom configurations are available by special order.



Straight-beam contact transducers, dual element



Applications

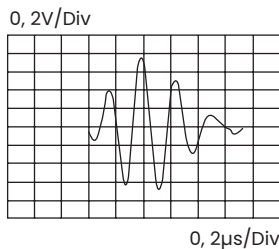
- Remaining wall thickness, corrosion, erosion
- Near surface flaw detection
- Small parts—screws, bolts, pins
- Cladding and weld overlay
- Bond testing
- Railroad wheels
- Core flaws in shafts, bars, billets
- Coarse grain materials

Features and benefits

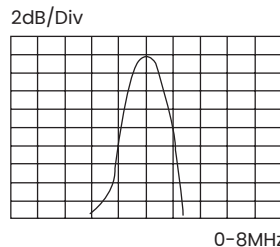
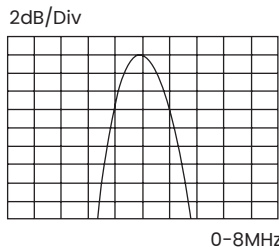
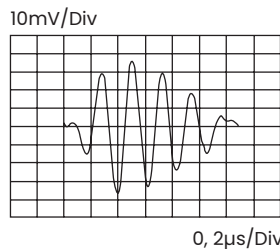
- Excellent near surface resolution
- Improved coupling on curved and rough surfaces
- Reduce noise caused by scattering
- Can be contoured for curved parts
- European models have side mounted Lemo 00 connectors, side mounted Microdot SEB..KF types
- North American models have fixed BNC cable (ADP) or side mounted MMD (FDU)

Dual element contact transducers— European standards

MSEB4



SEB4KFB

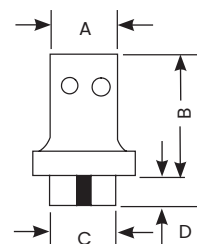


Typical waveform and frequency spectrum

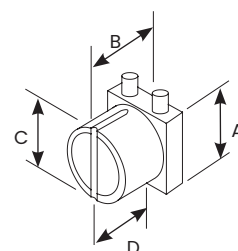
Types SEB and MSEB



Types 15 and 16



Types 17 and 18



| Case type | A | | B | | C | | D | |
|-----------|----|------|----|------|------|------|-----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 15 | 30 | 1.18 | 65 | 2.56 | 28.5 | 1.12 | 10 | 0.39 |
| Type 16 | 20 | 0.79 | 45 | 1.77 | 16.5 | 0.65 | 5 | 0.20 |
| Type 17 | 14 | 0.55 | 17 | 0.67 | 13 | 0.51 | 6.4 | 0.25 |
| Type 18 | 14 | 0.55 | 17 | 0.67 | 7.5 | 0.30 | 6.4 | 0.25 |

Accessories

| Description | Type | Remark |
|-------------|---------------|------------------|
| Cable | SEKG2 (53887) | for SEB., MSEB., |
| | SEKM2 (53001) | for SEB..KF |

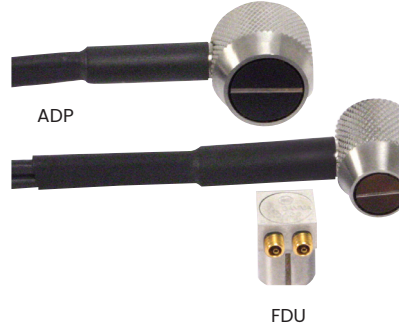
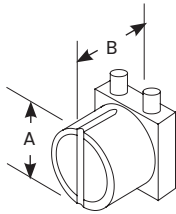
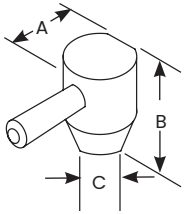
| Type | Order code | a x b | | f (MHz) | F | | Notes | Sketch |
|---------------|------------|----------|-----------|---------|----|------|--|---------|
| | | mm | in | | mm | in | | |
| SEB 1 | 0057466 | 21 / 2 ø | 0.83 | 1 | 20 | 0.8 | | Type 15 |
| SEB 1-ISO | 0500176 | 21 / 2 ø | 0.83 | 1 | 20 | 0.8 | ISO 22232-2 compliant | |
| SEB 2 | 0057467 | 7 x 18 | .28 x .71 | 2 | 15 | 0.6 | | |
| SEB 2-ISO | 0500063 | 7 x 18 | .28 x .71 | 2 | 15 | 0.6 | ISO 22232-2 compliant | |
| SEB 2-0° | 0057468 | 7 x 18 | .28 x .71 | 2 | 30 | 1.2 | Elements at 0° included angle | |
| SEB 2-EN-0° | 0500065 | 7 x 18 | .28 x .71 | 2 | 30 | 1.2 | Elements at 0° included angle ISO 22232-2 compliant | |
| SEB 4 | 0057469 | 6 x 20 | .24 x .79 | 4 | 12 | 0.5 | | |
| SEB 4-ISO | 0500064 | 6 x 20 | .24 x .79 | 4 | 12 | 0.5 | ISO 22232-2 compliant | |
| SEB 4-0° | 0057470 | 6 x 20 | .24 x .79 | 4 | 25 | 1.0 | Elements at 0° included angle | |
| SEB 4-ISO-0° | 0500066 | 6 x 20 | .24 x .79 | 4 | 25 | 1.0 | Elements at 0° included angle ISO 22232-2 compliant | |
| MSEB 2 | 0057461 | 11 / 2 ø | 0.43 | 2 | 8 | 0.3 | | Type 16 |
| MSEB 2-ISO | 0500067 | 11 / 2 ø | 0.43 | 2 | 8 | 0.3 | ISO 22232-2 compliant | |
| MSEB 4 | 0057462 | 3.5 x 10 | .14 x .39 | 4 | 10 | 0.4 | | |
| MSEB 4-ISO | 0500068 | 3.5 x 10 | .14 x .39 | 4 | 10 | 0.4 | ISO 22232-2 compliant | |
| MSEB 4-0° | 0057463 | 3.5 x 10 | .14 x .39 | 4 | 18 | 0.7 | Elements at 0° included angle | |
| MSEB 5 | 0057464 | 9 / 2 ø | 0.35 | 5 | 10 | 0.4 | Typical bandwidth 100% | |
| SEB 2 KF5 | 0056464 | 8 / 2 ø | 0.31 | 2 | 6 | 0.24 | | Type 17 |
| SEB 4 KF8 | 0056465 | 8 / 2 ø | 0.31 | 4 | 6 | 0.24 | | |
| SEB 4 KF8-ISO | 0500069 | 8 / 2 ø | 0.31 | 4 | 6 | 0.24 | ISO 22232-2 compliant | |
| SEB 5 KF3 | 0056466 | 8 / 2 ø | 0.31 | 5 | 3 | 0.12 | | Type 18 |
| SEB10 KF3 | 0056867 | 5 / 2 ø | 0.20 | 10 | 3 | 0.12 | | |
| SEB10 KF3-ISO | 0500070 | 5 / 2 ø | 0.20 | 10 | 3 | 0.12 | ISO 22232-2 compliant | |

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Dual element contact transducers— North American standards

Types ADP and FDU



ADP

| Element Ø | | A | | B | | C | |
|-----------|-------|------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 6 | 0.25 | 12.7 | 0.50 | 16.3 | 0.64 | 9.1 | 0.36 |
| 10 | 0.375 | 16.0 | 0.63 | 16.3 | 0.64 | 11.9 | 0.47 |
| 13 | 0.50 | 19.1 | 0.75 | 17.3 | 0.68 | 15.2 | 0.60 |

FDU

| Element Ø | | A | | B | |
|-----------|-------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | 0.25 | 9.7 | 0.38 | 12.7 | 0.50 |
| 10 | 0.375 | 12.7 | 0.50 | 12.7 | 0.50 |

Dual element transducers—types ADP and FDU

| Freq. (MHz) | Element Ø | | Order code | |
|-------------|-----------|-------|-------------|-------------|
| | mm | in | ADP dual | FDU Dual† |
| 2.25 | 6 | 0.250 | 113-222-700 | |
| | 10 | 0.375 | 113-232-700 | 113-232-680 |
| 5.0 | 6 | 0.250 | 113-224-700 | 113-224-680 |
| | 10 | 0.375 | 113-234-700 | 113-234-680 |
| | 13 | 0.500 | 113-244-700 | |
| 7.5 | 8 | 0.300 | 113-135-700 | |

† Standard MMD to BNC dual cable (118-140-014) sold separately. Custom configurations are available by special order.

Angle beam transducers— large sizes



Applications

- General weld inspection, larger objects, thicker sections
- Pipes, tanks, pressure vessels
- Axles, forgings, castings
- Bridges and other structures
- Railroad wheels and rail

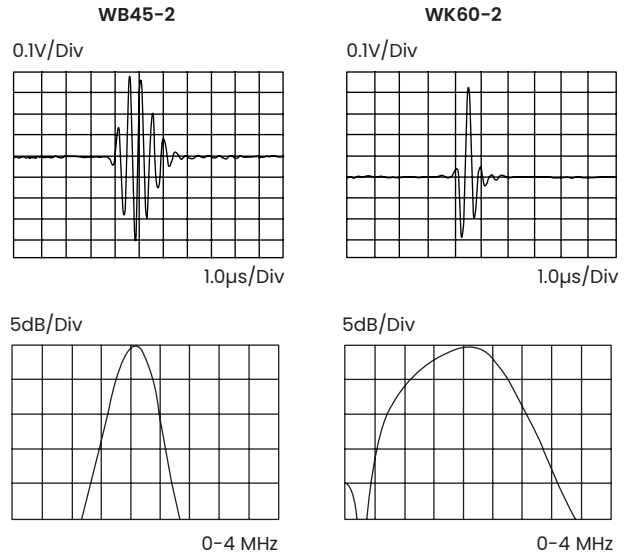
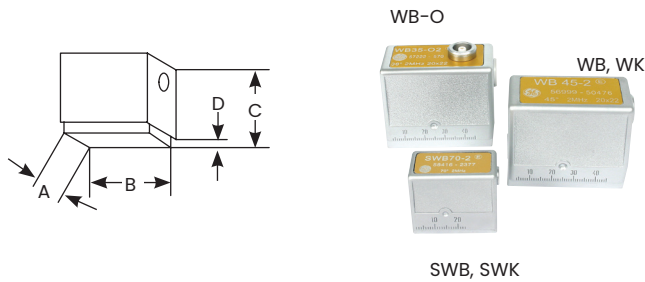
Features and Benefits

- European models have integral wedge
 - Maximum precision and repeatability for DGS flaw sizing method
 - Durable, ergonomically designed die cast housing
 - Replacement soles (sold separately) for extended service life
 - Lemo 1 connector on WB and WK types, side mount standard, top mount optional
 - Lemo 00 connector on SWB and SWK types, side mount
- North American models have interchangeable wedges (sold separately)
 - Maximum versatility and service life
 - Custom wedge angles and curvatures can be special ordered
 - AWS models available for AWS Structural Welding Code D1.1
 - High temperature wedges available for testing to 200°C (400°F)
 - BNC connector, top mount

Large angle beam transducers— European standards

Types WB/WK and SWB/SWK

Types WB/WK and SWB/SWK



Typical waveform and frequency spectrum

| Case type | A | | B | | C | | D | |
|-----------|------|------|------|------|----|------|----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 20 | 21.5 | 0.85 | 37 | 1.46 | 31 | 1.22 | 3 | 0.12 |
| Type 21 | 29 | 1.14 | 53.5 | 2.11 | 45 | 1.77 | 5 | 0.20 |

| Type | Order code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch |
|-------------|------------|---------|-------------|---------|-----------|----|-----|-----------------------|---------|
| | | mm | in | | | mm | in | | |
| WB 45-1 | 0056993 | 20 x 22 | 0.79 x 0.87 | 1 | 45 | 45 | 1.8 | | Type 21 |
| WB 45-1-ISO | 0500207 | 20 x 22 | 0.79 x 0.87 | 1 | 45 | 45 | 1.8 | ISO 22232-2 compliant | |
| WB 60-1 | 0056994 | 20 x 22 | 0.79 x 0.87 | 1 | 60 | 45 | 1.8 | | |
| WB 70-1 | 0056995 | 20 x 22 | 0.79 x 0.87 | 1 | 70 | 45 | 1.8 | | |
| WB 70-1-ISO | 0500209 | 20 x 22 | 0.79 x 0.87 | 1 | 70 | 45 | 1.8 | ISO 22232-2 compliant | |
| WB 35-2 | 0056998 | 20 x 22 | 0.79 x 0.87 | 2 | 38 | 90 | 3.5 | | |
| WB 35-2-ISO | 0500054 | 20 x 22 | 0.79 x 0.87 | 2 | 38 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 35-O2 | 0057222 | 20 x 22 | 0.79 x 0.87 | 2 | 38 | 90 | 3.5 | Top connector | |
| WB 45-2 | 0056999 | 20 x 22 | 0.79 x 0.87 | 2 | 45 | 90 | 3.5 | | |
| WB 45-2-ISO | 0500055 | 20 x 22 | 0.79 x 0.87 | 2 | 45 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 45-O2 | 0057223 | 20 x 22 | 0.79 x 0.87 | 2 | 45 | 90 | 3.5 | Top connector | |
| WB 45-O2ISO | 0500059 | 20 x 22 | 0.79 x 0.87 | 2 | 45 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 60-2 | 0057000 | 20 x 22 | 0.79 x 0.87 | 2 | 60 | 90 | 3.5 | | |
| WB 60-2-ISO | 0500056 | 20 x 22 | 0.79 x 0.87 | 2 | 60 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 60-O2 | 0057224 | 20 x 22 | 0.79 x 0.87 | 2 | 60 | 90 | 3.5 | Top connector | |
| WB 60-O2ISO | 0500060 | 20 x 22 | 0.79 x 0.87 | 2 | 60 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 70-2 | 0057001 | 20 x 22 | 0.79 x 0.87 | 2 | 70 | 90 | 3.5 | | |
| WB 70-2-ISO | 0500057 | 20 x 22 | 0.79 x 0.87 | 2 | 70 | 90 | 3.5 | ISO 22232-2 compliant | |
| WB 70-O2 | 0057225 | 20 x 22 | 0.79 x 0.87 | 2 | 70 | 90 | 3.5 | Top connector | |
| WB 90-2 | 0057003 | 20 x 22 | 0.79 x 0.87 | 2 | 90 | 90 | 3.5 | | |

Large angle beam transducers— European standards

| Type | Order code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch |
|-------------|------------|---------|-------------|---------|-----------|-----|-----|------------------------|---------|
| | | mm | in | | | mm | in | | |
| WB 35-4 | 0057004 | 20 x 22 | 0.79 x 0.87 | 4 | 38 | 180 | 7.1 | Top connector | Type 21 |
| WB 45-4 | 0057005 | 20 x 22 | 0.79 x 0.87 | 4 | 45 | 180 | 7.1 | | |
| WB 45-4-ISO | 0500200 | 20 x 22 | 0.79 x 0.87 | 4 | 45 | 180 | 7.1 | ISO 22232-2 compliant | |
| WB 60-4 | 0057006 | 20 x 22 | 0.79 x 0.87 | 4 | 60 | 180 | 7.1 | | |
| WB 60-4-ISO | 0500201 | 20 x 22 | 0.79 x 0.87 | 4 | 60 | 180 | 7.1 | ISO 22232-2 compliant | |
| WB 70-4 | 0057007 | 20 x 22 | 0.79 x 0.87 | 4 | 70 | 180 | 7.1 | | |
| WB 70-4-ISO | 0500202 | 20 x 22 | 0.79 x 0.87 | 4 | 70 | 180 | 7.1 | ISO 22232-2 compliant | |
| SWB 45-2 | 0058414 | 14 x 14 | 0.55 x 0.55 | 2 | 45 | 39 | 1.5 | | Type 20 |
| SWB 60-2 | 0058415 | 14 x 14 | 0.55 x 0.55 | 2 | 60 | 39 | 1.5 | | |
| SWB 70-2 | 0058416 | 14 x 14 | 0.55 x 0.55 | 2 | 70 | 39 | 1.5 | | |
| SWB 45-5 | 0058420 | 14 x 14 | 0.55 x 0.55 | 5 | 45 | 98 | 3.9 | | Type 20 |
| SWB 60-5 | 0058421 | 14 x 14 | 0.55 x 0.55 | 5 | 60 | 98 | 3.9 | | |
| SWB 70-5 | 0058422 | 14 x 14 | 0.55 x 0.55 | 5 | 70 | 98 | 3.9 | | |
| WK 45-2 | 0057011 | 20 x 22 | 0.79 x 0.87 | 2 | 45 | 90 | 3.5 | Piezocomposite element | Type 21 |
| WK 60-2 | 0057012 | 20 x 22 | 0.79 x 0.87 | 2 | 60 | 90 | 3.5 | | |
| WK 70-2 | 0057013 | 20 x 22 | 0.79 x 0.87 | 2 | 70 | 90 | 3.5 | | |
| SWK 45-2 | 0058843 | 14 x 14 | 0.55 x 0.55 | 2 | 45 | 39 | 1.5 | Piezocomposite element | Type 20 |
| SWK 60-2 | 0058844 | 14 x 14 | 0.55 x 0.55 | 2 | 60 | 39 | 1.5 | | |
| SWK 70-2 | 0058845 | 14 x 14 | 0.55 x 0.55 | 2 | 70 | 39 | 1.5 | | |

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Accessories

| Description | Type | Remark |
|--------------------------------|-----------------|-----------------|
| Cable | PKLL2 (0050326) | for WB., WK.. |
| | MPKL2 (0050486) | for SWB., SWK.. |
| Spare sole (1 set = 10 pcs) | WP(E) (0057276) | for WB., WK.. |
| | SWP (0058514) | for SWB., SWK |

Angle beam transducers— small sizes



Applications

- General weld inspection, smaller objects, thinner sections
- Tubes, pipes, pressure vessels, containers
- Pumps, valve housings
- Turbine blades, shafts
- Wheel rims

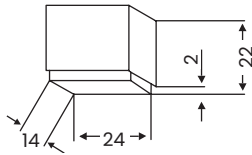
Features and benefits

- European models have integral wedge
 - Maximum precision and repeatability for DGS flaw sizing method
 - Durable, ergonomically-designed die cast housing
 - Replacement soles (sold separately) for extended service life
 - Lemo 00 connector on MWB and MWK types, side mount standard, top mount optional
- North American models have interchangeable wedges (sold separately)
 - Maximum versatility and service life
 - Custom wedge angles and curvatures can be special ordered
 - Both quick change and screw mounted styles available
 - Microdot connector on MSW-QC and MSWS types, MMD on SMSWS

Small angle beam transducers— European standards

Type MWB/MWK

Type 23

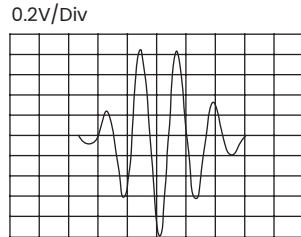


MWB-O



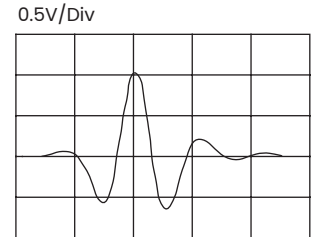
MWB, MWK

MWB45-4

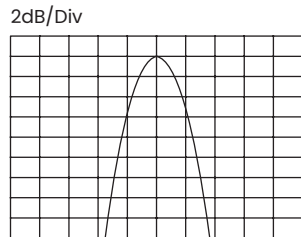


0, 2 μ s/Div

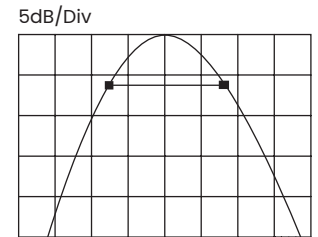
MWK45-4



0, 2 μ s/Div



0-8 MHz



0-8 MHz

Typical waveform and frequency spectrum

| Type | Order code | a x b mm | in | f (MHz) | β (Steel) | N mm | in | Notes | Sketch |
|--------------|------------|-------------|-------------|------------|--------------------|---------|-----|-----------------------|---------|
| MWB 35-2 | 0056920 | 8 x 9 | 0.31 x 0.35 | 2 | 38 | 15 | 0.6 | | Type 23 |
| MWB 35-2ISO | 0500040 | 8 x 9 | 0.31 x 0.35 | 2 | 38 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 35-O2 | 0057204 | 8 x 9 | 0.31 x 0.35 | 2 | 38 | 15 | 0.6 | Top connector | |
| MWB 35-O2ISO | 0500044 | 8 x 9 | 0.31 x 0.35 | 2 | 38 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 45-2 | 0056921 | 8 x 9 | 0.31 x 0.35 | 2 | 45 | 15 | 0.6 | | |
| MWB 45-2ISO | 0500041 | 8 x 9 | 0.31 x 0.35 | 2 | 45 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 45-O2 | 0057205 | 8 x 9 | 0.31 x 0.35 | 2 | 45 | 15 | 0.6 | Top connector | |
| MWB 45-O2ISO | 0500045 | 8 x 9 | 0.31 x 0.35 | 2 | 45 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 60-2 | 0056922 | 8 x 9 | 0.31 x 0.35 | 2 | 60 | 15 | 0.6 | | |
| MWB 60-2ISO | 0500042 | 8 x 9 | 0.31 x 0.35 | 2 | 60 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 60-O2 | 0057206 | 8 x 9 | 0.31 x 0.35 | 2 | 60 | 15 | 0.6 | Top connector | |
| MWB 60-O2ISO | 0500046 | 8 x 9 | 0.31 x 0.35 | 2 | 60 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 70-2 | 0056923 | 8 x 9 | 0.31 x 0.35 | 2 | 70 | 15 | 0.6 | | |
| MWB 70-2ISO | 0500043 | 8 x 9 | 0.31 x 0.35 | 2 | 70 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 70-O2 | 0057207 | 8 x 9 | 0.31 x 0.35 | 2 | 70 | 15 | 0.6 | Top connector | |
| MWB 70-O2ISO | 0500234 | 8 x 9 | 0.31 x 0.35 | 2 | 70 | 15 | 0.6 | ISO 22232-2 compliant | |
| MWB 80-2 | 0056924 | 8 x 9 | 0.31 x 0.35 | 2 | 77 | 15 | 0.6 | | |
| MWB 90-2 | 0056925 | 8 x 9 | 0.31 x 0.35 | 2 | 90 | 15 | 0.6 | Surface wave | |

Small angle beam transducers— European standards

| Type | Order code | a x b | | f (MHz) | β (Steel) | N | | Notes | Sketch |
|--------------|------------|-------|-------------|---------|-----------|----|-----|-----------------------|------------------------|
| | | mm | in | | | mm | in | | |
| MWB 35-4 | 0056926 | 8 x 9 | 0.31 x 0.35 | 4 | 38 | 30 | 1.2 | | Type 23 |
| MWB 35-4ISO | 0500047 | 8 x 9 | 0.31 x 0.35 | 4 | 38 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 35-O4 | 0057210 | 8 x 9 | 0.31 x 0.35 | 4 | 38 | 30 | 1.2 | Top connector | |
| MWB 35-O4ISO | 0500235 | 8 x 9 | 0.31 x 0.35 | 4 | 38 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 45-4 | 0056927 | 8 x 9 | 0.31 x 0.35 | 4 | 45 | 30 | 1.2 | | |
| MWB 45-4ISO | 0500048 | 8 x 9 | 0.31 x 0.35 | 4 | 45 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 45-O4 | 0057211 | 8 x 9 | 0.31 x 0.35 | 4 | 45 | 30 | 1.2 | Top connector | |
| MWB 45-O4ISO | 0500236 | 8 x 9 | 0.31 x 0.35 | 4 | 45 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 60-4 | 0056928 | 8 x 9 | 0.31 x 0.35 | 4 | 60 | 30 | 1.2 | | |
| MWB 60-4ISO | 0500049 | 8 x 9 | 0.31 x 0.35 | 4 | 60 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 60-O4 | 0057212 | 8 x 9 | 0.31 x 0.35 | 4 | 60 | 30 | 1.2 | Top connector | |
| MWB 60-O4ISO | 0500237 | 8 x 9 | 0.31 x 0.35 | 4 | 60 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 70-4 | 0056929 | 8 x 9 | 0.31 x 0.35 | 4 | 70 | 30 | 1.2 | | |
| MWB 70-4ISO | 0500050 | 8 x 9 | 0.31 x 0.35 | 4 | 70 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 70-O4 | 0057213 | 8 x 9 | 0.31 x 0.35 | 4 | 70 | 30 | 1.2 | Top connector | |
| MWB 70-O4ISO | 0500238 | 8 x 9 | 0.31 x 0.35 | 4 | 70 | 30 | 1.2 | ISO 22232-2 compliant | |
| MWB 80-4 | 0056930 | 8 x 9 | 0.31 x 0.35 | 4 | 7 | 30 | 1.2 | | |
| MWB 90-4 | 0056931 | 8 x 9 | 0.31 x 0.35 | 4 | 90 | 30 | 1.2 | Surface wave | |
| MWK 45-2 | 0067488 | 8 x 9 | 0.31 x 0.35 | 2 | 45 | 15 | 0.6 | | Piezocomposite element |
| MWK 60-2 | 0067489 | 8 x 9 | 0.31 x 0.35 | 2 | 60 | 15 | 0.6 | | |
| MWK 70-2 | 0067490 | 8 x 9 | 0.31 x 0.35 | 2 | 70 | 15 | 0.6 | | |
| MWK 45-4 | 0058938 | 8 x 9 | 0.31 x 0.35 | 4 | 45 | 30 | 1.2 | | |
| MWK 60-4 | 0058939 | 8 x 9 | 0.31 x 0.35 | 4 | 60 | 30 | 1.2 | | |
| MWK 70-4 | 0058940 | 8 x 9 | 0.31 x 0.35 | 4 | 70 | 30 | 1.2 | | |

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Accessories

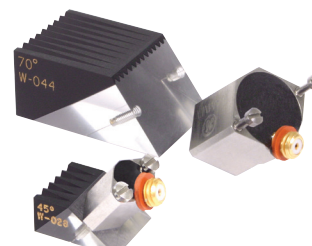
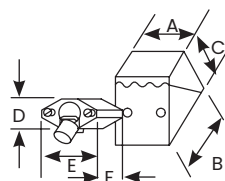
| Description | Type | Remark |
|-----------------------------|------------------|-----------------|
| Cable | MPKL2 (0050486) | for MWB., MWK.. |
| Spare sole (1 set = 10 pcs) | MWP(E) (0057277) | for MWB., MWK.. |

Small angle beam transducers— North American standards

Type MSWS

| Replaceable wedge .25 in (6 mm) | | | | | | | | | | | | |
|---------------------------------|------|------|------|------|-----|------|-----|-----|------|------|-----|------|
| Wedge angle | A | | B | | C | | D | | E | | F | |
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 11.9 | 0.47 | 15.2 | 0.60 | 7.6 | 0.30 | 7.9 | .31 | 12.2 | 0.48 | 8.6 | 0.34 |
| 60° | 11.9 | 0.47 | 16.5 | 0.65 | 8.9 | 0.35 | 7.9 | .31 | 12.2 | 0.48 | 8.6 | 0.34 |
| 70° | 11.9 | 0.47 | 17.8 | 0.70 | 9.7 | 0.38 | 7.9 | .31 | 12.2 | 0.48 | 8.6 | 0.34 |
| 90° | 11.9 | 0.47 | 22.9 | 0.90 | 9.7 | 0.38 | 7.9 | .31 | 12.2 | 0.48 | 8.6 | 0.34 |

| Replaceable wedge .50 in (13 mm) | | | | | | | | | | | | |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Wedge angle | A | | B | | C | | D | | E | | F | |
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 18.5 | 0.73 | 24.4 | 0.96 | 10.7 | 0.42 | 14.2 | 0.56 | 18.5 | 0.73 | 12.7 | 0.50 |
| 60° | 18.5 | 0.73 | 27.4 | 1.08 | 12.7 | 0.50 | 14.2 | 0.56 | 18.5 | 0.73 | 12.7 | 0.50 |
| 70° | 18.5 | 0.73 | 29.5 | 1.16 | 13.7 | 0.54 | 14.2 | 0.56 | 18.5 | 0.73 | 12.7 | 0.50 |
| 90° | 18.5 | 0.73 | 39.6 | 1.56 | 14.7 | 0.58 | 14.2 | 0.56 | 18.5 | 0.73 | 12.7 | 0.50 |

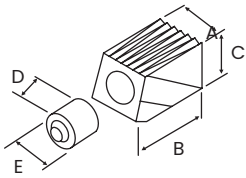


Miniature angle beam transducers—type MSWS (Captive screw mount)

| Freq. (MHz) | Element Ø | | Order code | | | Freq. (MHz) | Element Ø | | Order code | | | |
|-------------|-----------|-------|--------------|----------------|-------------|-------------|-----------|-------------|--------------|----------------|-------------|-------------|
| | | | Gamma series | Standard wedge | Accessories | | | | Gamma series | Standard wedge | Accessories | |
| 2.25 | 6 | 0.250 | 113-222-580 | 118-340-028 | 45° | 5.0 | 6 | 0.250 | 113-224-580 | 118-340-028 | 45° | 118-140-012 |
| | | | | 118-340-030 | 60° | | | | | 118-340-030 | 60° | |
| | | | | 118-340-032 | 70° | | | | | 118-340-032 | 70° | |
| | | | | 118-340-034 | 80° | | | | | 118-340-034 | 80° | |
| | 13 | 0.500 | 113-242-580 | 118-340-036 | 90° | 10.0 | 6 | 0.250 | 113-226-580 | 118-340-036 | 90° | 118-300-740 |
| | | | | 118-340-040 | 45° | | | | | 118-340-028 | 45° | |
| | | | | 118-340-042 | 60° | | | | | 118-340-030 | 60° | |
| | | | | 118-340-044 | 70° | | | | | 118-340-032 | 70° | |
| | | | | 118-340-046 | 80° | | | 118-340-034 | 80° | | | |
| | | | | 118-340-048 | 90° | | | 118-340-036 | 90° | | | |

Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Type MSW-QC



| Replaceable wedge 6 mm (.25 in) | | | | | | | | | | | |
|---------------------------------|------|------|------|------|------|------|------|------|------|------|----------|
| Wedge angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | in |
| 45° | 11.4 | 0.45 | 19.1 | 0.75 | 9.4 | 0.37 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 60° | 11.4 | 0.45 | 21.3 | 0.84 | 11.2 | 0.44 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 70° | 11.4 | 0.45 | 25.4 | 1.00 | 12.7 | 0.50 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |
| 90° | 11.4 | 0.45 | 24.1 | 0.95 | 12.7 | 0.50 | 14.1 | 0.56 | 10.7 | 0.42 | 3/8 - 32 |

| Replaceable wedge 10 mm (.375 in) | | | | | | | | | | | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|----------|
| Wedge angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | in |
| 45° | 14.0 | 0.55 | 22.6 | 0.89 | 11.9 | 0.47 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 60° | 14.0 | 0.55 | 26.4 | 1.04 | 14.0 | 0.55 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 70° | 14.0 | 0.55 | 30.2 | 1.19 | 14.7 | 0.58 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |
| 90° | 14.0 | 0.55 | 29.2 | 1.15 | 15.5 | 0.61 | 14.7 | 0.58 | 14.0 | 0.55 | 1/2 - 28 |

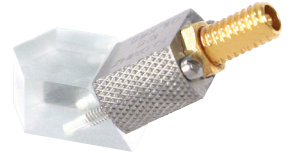
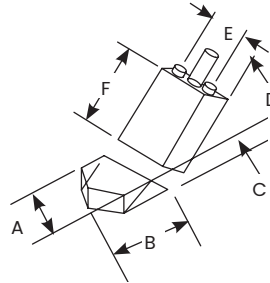
| Replaceable wedge 13 mm (.50 in) | | | | | | | | | | | |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|----------|
| Wedge angle | A | | B | | C | | D | | E | | Thread |
| | mm | in | mm | in | mm | in | mm | in | mm | in | in |
| 45° | 17.8 | 0.70 | 26.7 | 1.05 | 14.0 | 0.55 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 60° | 17.8 | 0.70 | 31.5 | 1.24 | 16.3 | 0.64 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 70° | 17.8 | 0.70 | 35.8 | 1.41 | 17.3 | 0.68 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |
| 90° | 17.8 | 0.70 | 35.3 | 1.39 | 18.5 | 0.73 | 16.5 | 0.65 | 17.8 | 0.70 | 5/8 - 24 |

Miniature angle beam transducers—type MSW-QC (Quick change)

| Freq. (MHz) | Element Ø | | Order code | | | | | Freq. (MHz) | Element Ø | | Order code | | | | | | | | |
|-------------|-----------|-------|--------------|------------------|--------------|---|---|-------------|-------------|-------------|--------------|------------------|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | | | Gamma series | Benchmark series | Alpha series | Standard wedge | Accessories | | | | Gamma series | Benchmark series | Alpha series | Standard wedge | Accessories | | | | |
| 1.5 | 10 | 0.375 | 113-231-590 | 113-231-596 | | | 118-340-220 30° 118-340-221 45° 118-340-222 60° 118-340-223 70° 118-340-224 90° | 6 | 0.250 | 113-224-590 | 113-224-591 | 113-124-591 | | | 118-340-200 30° | 118-340-201 45° | 118-340-202 60° | 118-340-203 70° | 118-340-204 90° |
| | | | | | | | | | | | | | | | 118-340-220 30° | | | | |
| | | | | | | | | | | | | | | | 118-340-221 45° | | | | |
| | 13 | 0.500 | 113-241-595 | 113-241-596 | | | 118-340-210 30° 118-340-211 45° 118-340-212 60° 118-340-213 70° 118-340-214 90° | 13 | 0.500 | 113-244-590 | 113-244-591 | 113-144-591 | | | 118-340-210 30° | 118-340-211 45° | 118-340-212 60° | 118-340-213 70° | 118-340-214 90° |
| | | | | | | | | | | | | | | | 118-340-210 30° | | | | |
| | | | | | | | | | | | | | | | 118-340-211 45° | | | | |
| 2.25 | 10 | 0.375 | 113-232-590 | 113-232-591 | 113-132-591 | 118-340-200 30° 118-340-201 45° 118-340-202 60° 118-340-203 70° 118-340-204 90° | 6 | 0.250 | 113-222-590 | 113-222-591 | 113-122-591 | | | 118-340-200 30° | 118-340-201 45° | 118-340-202 60° | 118-340-203 70° | 118-340-204 90° | |
| | | | | | | | | | | | | | | 118-340-220 30° | | | | | |
| | | | | | | | | | | | | | | 118-340-221 45° | | | | | |
| | 13 | 0.500 | 113-242-590 | 113-242-591 | 113-142-591 | 118-340-210 30° 118-340-211 45° 118-340-212 60° 118-340-213 70° 118-340-214 90° | 13 | 0.500 | 113-242-590 | 113-242-591 | 113-142-591 | | | 118-340-210 30° | 118-340-211 45° | 118-340-212 60° | 118-340-213 70° | 118-340-214 90° | |
| | | | | | | | | | | | | | | 118-340-210 30° | | | | | |
| | | | | | | | | | | | | | | 118-340-211 45° | | | | | |
| 3.5 | 10 | 0.375 | 113-233-590 | 113-233-591 | 113-133-591 | 118-340-200 30° 118-340-201 45° 118-340-202 60° 118-340-203 70° 118-340-204 90° | 6 | 0.250 | 113-223-590 | 113-223-591 | 113-123-591 | | | 118-340-200 30° | 118-340-201 45° | 118-340-202 60° | 118-340-203 70° | 118-340-204 90° | |
| | | | | | | | | | | | | | | 118-340-220 30° | | | | | |
| | | | | | | | | | | | | | | 118-340-221 45° | | | | | |
| | 13 | 0.500 | 113-243-590 | 113-243-591 | 113-143-591 | 118-340-210 30° 118-340-211 45° 118-340-212 60° 118-340-213 70° 118-340-214 90° | 13 | 0.500 | 113-243-590 | 113-243-591 | 113-143-591 | | | 118-340-210 30° | 118-340-211 45° | 118-340-212 60° | 118-340-213 70° | 118-340-214 90° | |
| | | | | | | | | | | | | | | 118-340-210 30° | | | | | |
| | | | | | | | | | | | | | | 118-340-211 45° | | | | | |

Small angle beam transducers— North American standards

| Angle | A | | B | | C | | D | | E | | F | |
|-------|-----|------|------|------|-----|------|-----|------|-----|------|-----|------|
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| 45° | 7.9 | 0.31 | 6.4 | 0.25 | 5.3 | 0.21 | 4.8 | 0.19 | 5.8 | 0.23 | 7.1 | 0.28 |
| 60° | 7.9 | 0.31 | 10.7 | 0.42 | 5.3 | 0.21 | 4.8 | 0.19 | 5.8 | 0.23 | 7.1 | 0.28 |
| 70° | 7.9 | 0.31 | 10.7 | 0.42 | 5.3 | 0.21 | 4.8 | 0.19 | 5.8 | 0.23 | 7.1 | 0.28 |
| 90° | 7.9 | 0.31 | 18.3 | 0.72 | 8.6 | 0.34 | 4.8 | 0.19 | 5.8 | 0.23 | 7.1 | 0.28 |



Subminiature angle beam type SMSWS (Screw mount)

| Freq. (MHz) | Element Ø | | Order code | | |
|-------------|-----------|-------|--------------|-----------------|----------------------------------|
| | mm | in | Gamma series | Standard wedge | Accessories |
| 5.0 | 3 | 0.125 | 113-214-585 | 118-340-120 45° | Cable BNC 118-140-047 |
| | | | | 118-340-121 60° | |
| | | | | 118-340-122 70° | |
| | | | | 118-340-123 90° | |
| 10.0 | 3 | 0.125 | 113-216-585 | 118-340-120 45° | Wedge couplant 118-300-740 |
| | | | | 118-340-121 60° | |
| | | | | 118-340-122 70° | |
| | | | | 118-340-123 90° | |

Note: Standard wedge angles are specified for carbon steel. Custom configurations are available by special order.

Angle beam transducers, dual element



Applications

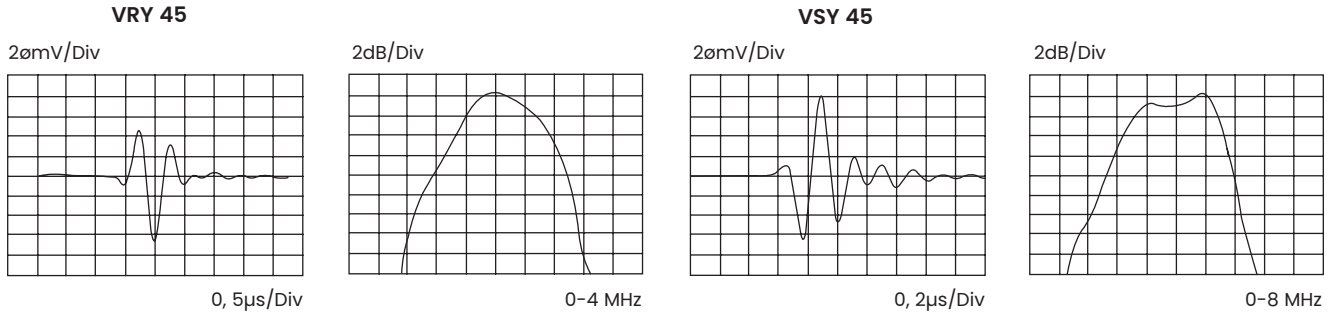
- VS shear wave type
 - Detection of small, near surface flaws
 - Thin-walled tubes and containers
 - Rings
- VRY and VSY longitudinal wave types
 - Coarse grain weld inspection
 - Attenuative materials
 - Austenitic welds
 - “Creeping wave” applications with 70° models

Features and Benefits

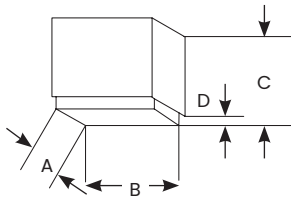
- Excellent near surface resolution
- Reduce noise caused by scattering
- Durable, ergonomically-designed die cast housing
- Types VS and VSY have side mounted Microdot connectors
- Type VRY has Lemo 00 connectors

Angle beam transducers, dual element

Types VS, VRY and VSY



Typical waveform and frequency spectrum



| Case type | A | | B | | C | | D | |
|-----------|----|------|------|------|----|------|----|------|
| | mm | in | mm | in | mm | in | mm | in |
| Type 30 | 14 | 0.55 | 24 | 0.94 | 22 | 0.87 | 2 | 0.08 |
| Type 31 | 29 | 1.14 | 53.5 | 2.1 | 45 | 1.77 | 5 | 0.20 |
| Type 32 | 15 | 0.59 | 30 | 1.8 | 27 | 1.06 | | |

| Type | Order code | a x b | | f (MHz) | β (Steel) | F | | Notes | Sketch |
|-----------|------------|----------|-------------|---------|-----------|----|-----|---|---------|
| | | mm | in | | | mm | in | | |
| VS 45 | 0057660 | 3.5 x 10 | 0.14 x 0.39 | 4 | 45 | 10 | 0.4 | ISO 22232-2 compliant | Type 30 |
| VS 45-ISO | 0500194 | 3.5 x 10 | 0.14 x 0.39 | 4 | 45 | 10 | 0.4 | | |
| VS 60 | 0057661 | 3.5 x 10 | 0.14 x 0.39 | 4 | 60 | 10 | 0.4 | | |
| VS 60-ISO | 0500195 | 3.5 x 10 | 0.14 x 0.39 | 4 | 60 | 10 | 0.4 | | |
| VS 70 | 0057662 | 3.5 x 10 | 0.14 x 0.39 | 4 | 70 | 10 | 0.4 | | |
| VS 70-ISO | 0500196 | 3.5 x 10 | 0.14 x 0.39 | 4 | 70 | 10 | 0.4 | ISO 22232-2 compliant | |
| VRY 45 | 0057663 | 10 x 22 | 0.39 x 0.87 | 1.8 | 45 | 40 | 1.6 | VRY and VSY angles are longitudinal (compression) wave suitable for testing coarse grain materials. | Type 31 |
| VRY 60 | 0057664 | 10 x 22 | 0.39 x 0.87 | 1.8 | 60 | 35 | 1.4 | | |
| VRY 70 | 0057665 | 10 x 22 | 0.39 x 0.87 | 1.8 | 70 | 35 | 1.4 | | |
| VSY 45-2 | 0067154 | 5 x 10 | 0.20 x 0.39 | 2 | 45 | 16 | 0.6 | 70° models suitable for creeping wave excitation in mild steel. | Type 32 |
| VSY 60-2 | 0067155 | 5 x 10 | 0.20 x 0.40 | 2 | 60 | 16 | 0.6 | | |
| VSY 70-2 | 0067156 | 5 x 10 | 0.20 x 0.41 | 2 | 70 | 16 | 0.6 | | |
| VSY 45-4 | 0054577 | 5 x 10 | 0.20 x 0.42 | 4 | 45 | 20 | 0.8 | | |
| VSY 60-4 | 0054578 | 5 x 10 | 0.20 x 0.43 | 4 | 60 | 20 | 0.8 | | |
| VSY 70-4 | 0054579 | 5 x 10 | 0.20 x 0.44 | 4 | 70 | 20 | 0.8 | | |

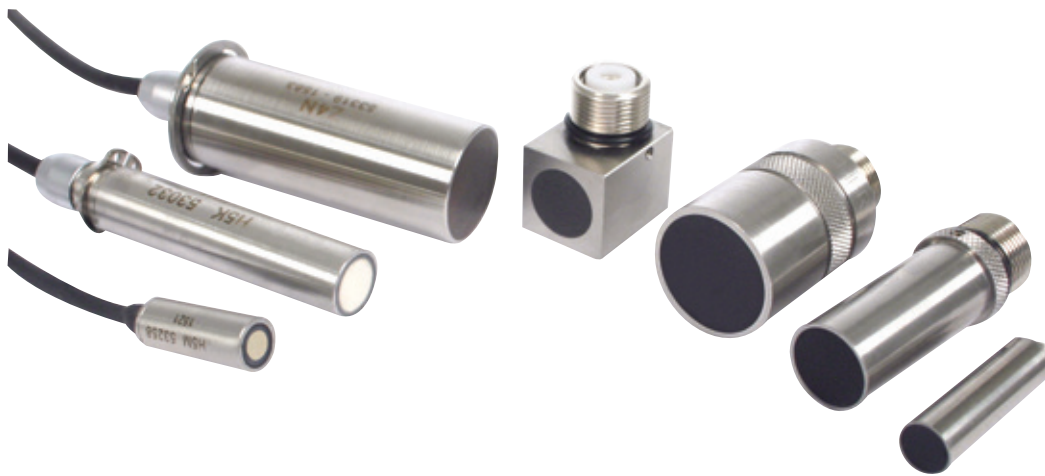
Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Accessories

| Description | Type | Remark |
|-------------|-----------------|---------|
| Cable | SEKM2 (0053001) | for VS |
| | SEKL2 (0050710) | for VRY |
| | SEKN2 (0053775) | for VSY |

Immersion transducers



Applications

- Parts with irregular or complex geometry, such as gears and valves
- Automated or mechanized scanning
- Applications requiring very high near surface resolution or detection of very small flaws
- Scanning pipes, tubes and tanks
- Plates, billets and bars
- Disks, axles and shafts

Features and benefits

- Acoustically matched for best efficiency in water
- Can be focused to a point (spherical) or to a line (cylindrical) for improved resolution, sensitivity and signal-to-noise ratio (refer to Selection Criteria on pages 5-7)
- European models have fixed cable with LEMO-1 connector.
- North American models have waterproof UHF connector, except IPS type, which has non-waterproof Microdot.

Minimum and maximum standard focal lengths (Longer or shorter focal lengths may be available by special order)

| Element diameter: mm (in) | | | | | | | | | | | | | | | | | |
|---------------------------|-----|-----|------|-----|------|-----|------|-----|------|----|-----|-----|-----|-----|-----|----|-----|
| Frequency (MHz) | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | |
| 1.0 | N | 109 | 4.3 | 67 | 2.7 | 61 | 2.4 | 28 | 1.1 | | | | | | | | |
| | Min | 50 | 2 | 40 | 1.5 | 40 | 1.5 | 25 | 1 | | | | | | | | |
| | Max | 75 | 3 | 50 | 2 | 50 | 2 | 25 | 1 | | | | | | | | |
| 2.0 | N | | | 135 | 5.3 | | | | | 34 | 1.3 | | | | | | |
| | Min | | | 40 | 1.5 | | | | | 20 | 0.8 | | | | | | |
| | Max | | | 100 | 4 | | | | | 25 | 1 | | | | | | |
| 2.25 | N | 245 | 9.6 | | | 138 | 5.4 | 61 | 2.4 | | | 34 | 1.4 | 16 | 0.6 | | |
| | Min | 50 | 2 | | | 40 | 1.5 | 25 | 1 | | | 20 | 0.8 | 13 | 0.5 | | |
| | Max | 150 | 6 | | | 100 | 4 | 50 | 2 | | | 25 | 1 | 13 | 0.5 | | |
| 3.5 | N | 381 | 15 | | | 215 | 8.4 | 94 | 3.7 | | | 53 | 2.1 | 24 | 0.9 | | |
| | Min | 50 | 2 | | | 40 | 1.5 | 25 | 1 | | | 20 | 0.8 | 13 | 0.5 | | |
| | Max | 200 | 8 | | | 150 | 6 | 60 | 2.5 | | | 40 | 1.5 | 17 | 0.7 | | |
| 4.0 | N | | | 270 | 10.7 | | | | | 67 | 2.6 | | | | | | |
| | Min | | | 40 | 1.5 | | | | | 20 | 0.8 | | | | | | |
| | Max | | | 200 | 8 | | | | | 50 | 2 | | | | | | |
| 5.0 | N | 544 | 21.4 | 337 | 13.4 | 307 | 12.0 | 137 | 5.4 | 84 | 3.3 | 76 | 3.0 | 35 | 1.3 | 21 | 0.9 |
| | Min | 50 | 2 | 40 | 1.5 | 40 | 1.5 | 25 | 1 | 20 | 0.8 | 20 | 0.8 | 13 | 0.5 | 10 | 0.4 |
| | Max | 200 | 8 | 200 | 8 | 200 | 8 | 100 | 4 | 60 | 2.4 | 50 | 2 | 25 | 1.0 | 15 | 0.6 |
| 10.0 | N | | | | | 615 | 24.1 | 272 | 10.7 | | | 152 | 6.0 | 69 | 2.7 | 42 | 1.7 |
| | Min | | | | | 40 | 1.5 | 25 | 1 | | | 20 | 0.8 | 13 | 0.5 | 10 | 0.4 |
| | Max | | | | | 200 | 8 | 150 | 6 | | | 100 | 4 | 50 | 2 | 30 | 1.2 |
| 15.0 | N | | | | | | | 406 | 16 | | | 228 | 9.0 | 104 | 4.0 | | |
| | Min | | | | | | | 25 | | | | 20 | 0.8 | 13 | 0.5 | | |
| | Max | | | | | | | 150 | 6 | | | 150 | 6 | 60 | 2.5 | | |

Notes:

N = Near field length in water

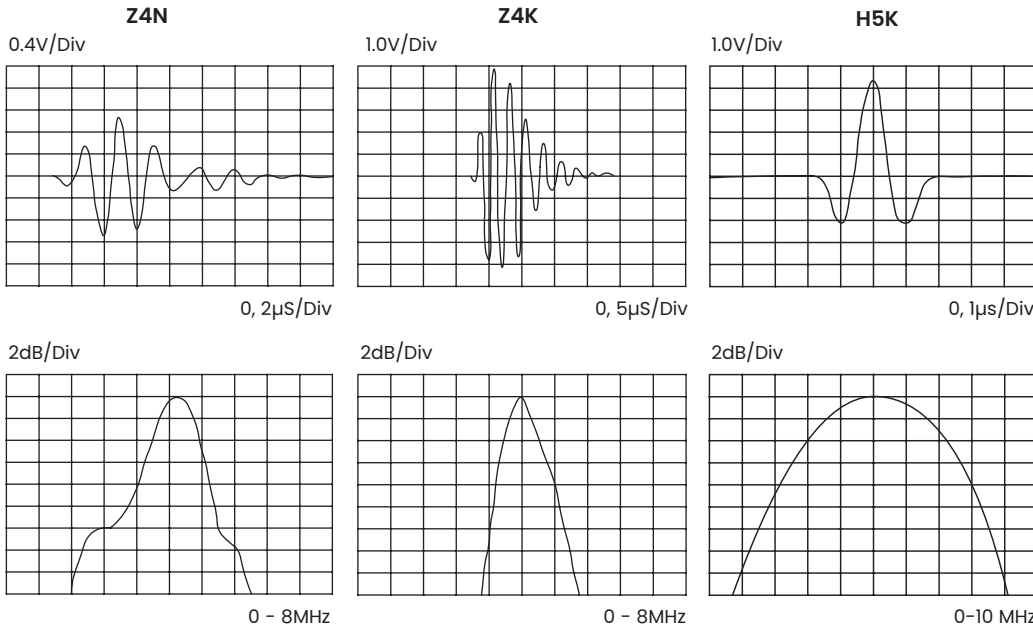
Min = Minimum recommended focal length in water

Max = Maximum recommended focal length in water

Distances in steel are approximately 1/4 the distances given for water. Longer or shorter focal lengths may be available by special order.

Immersion transducers—European standards

Types Z, H and L



Typical waveform and frequency spectrum



Z..N, H..N and L..N

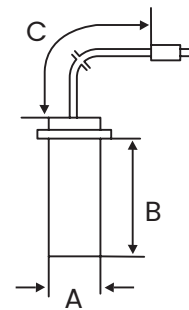


Z..K, H..K and L..K



Z..M, H..M and L..M

| Type | Order code | D | f | N | Notes | Sketch | | |
|--------|------------|----|------|-------|-------|--------|---|---------|
| | | mm | in | (MHz) | mm | in | | |
| Z 2 N | 0053318 | 20 | 0.79 | 2 | 127 | 5.0 | High sensitivity (gain reserve) for testing small to mid-size objects. | Type 33 |
| Z 4 N | 0053319 | 20 | 0.79 | 4 | 254 | 10.0 | | |
| Z 5 N | 0054705 | 20 | 0.79 | 5 | 318 | 12.5 | | |
| Z 4 K | 0053342 | 10 | 0.39 | 4 | 64 | 2.5 | Shock wave transducers especially suitable for thickness measurement or other applications requiring high resolution. | Type 34 |
| Z 5 K | 0053732 | 10 | 0.39 | 5 | 80 | 3.1 | | |
| Z 10 K | 0054704 | 10 | 0.39 | 10 | 160 | 6.3 | | |
| H 2 K | 0053300 | 10 | 0.39 | 2 | 32 | 1.3 | Shock wave transducers especially suitable for thickness measurement or other applications requiring high resolution. | Type 34 |
| H 5 K | 0053032 | 10 | 0.39 | 5 | 80 | 3.1 | | |
| H 10 M | 0053041 | 5 | 0.20 | 10 | 40 | 1.6 | | Type 35 |



| Case type | A | | B | | C | |
|-----------|-----|------|----|------|-----|------|
| | mm | in | mm | in | m | feet |
| Type 33 | 24 | 0.94 | 60 | 2.36 | 2.5 | 8.2 |
| Type 34 | 13 | 0.51 | 60 | 2.36 | 2.5 | 8.2 |
| Type 35 | 9.5 | 0.37 | 25 | 0.98 | 1.5 | 3.9 |

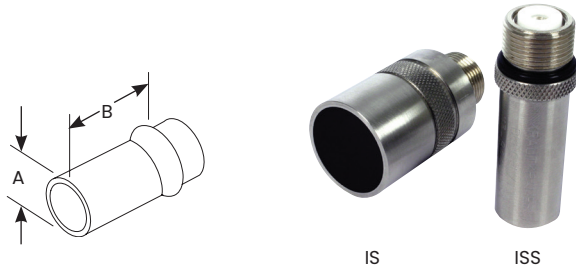
Also available with spherical (point) and cylindrical (line) focusing. Specify focal length. For available focal lengths, refer to the table at beginning of the Immersion Transducers section.

Custom configurations are available by special order.

For explanations to the table data, refer to selection criteria on pages 5 through 7.

Immersion transducers— North American standards

Types ISS and IS



| Element Ø | | A | | B | |
|-----------|-------|------|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | 0.25 | 16 | 0.63 | 39.4 | 1.55 |
| 10 | 0.375 | 16 | 0.63 | 39.4 | 1.55 |
| 13 | 0.50 | 16 | 0.63 | 39.4 | 1.55 |
| 19 | 0.75 | 25.4 | 1.00 | 45.0 | 1.77 |
| 25 | 1.0 | 31.8 | 1.25 | 46.2 | 1.82 |

Immersion transducers—types ISS and IS

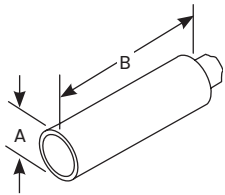
| Freq. (MHz) | Element Ø | | *Focus | Order code | | | Freq. (MHz) | Element Ø | | *Focus | Order code | | |
|-------------|-----------|-------|--------|--------------|--------------|----------------------------|-------------|-----------|-------|-------------|---|---|----------------------------|
| | mm | in | | Alpha series | Gamma series | Benchmark series | | mm | in | | Alpha series | Gamma series | Benchmark series |
| 1.0 | 25 | 1.00 | N | | | 113-861-380 | 5.0 | 6 | 0.250 | N | | 113-224-300 | 113-824-300 |
| | | | | | | | | 10 | 0.375 | N | 113-134-300 | 113-234-300 | 113-834-300 |
| 2.25 | 13 | 0.500 | S N | 113-142-300 | 113-242-300 | 113-842-280 113-842-300 | 10.0 | 13 | 0.500 | S C N | 113-144-280 113-144-290 113-144-300 | 113-244-280 113-244-290 113-244-300 | 113-844-290 113-844-300 |
| | | | | | | | | 19 | 0.750 | S C N | 113-154-360 113-154-370 | 113-254-380 | 113-854-370 113-854-380 |
| | | | | | | | | 25 | 1.00 | S | 113-164-360 | | |
| | | | | | | | | 6 | 0.250 | S C N | 113-126-280 113-126-290 113-126-300 | 113-226-300 | |
| 3.5 | 13 | 0.500 | N | | 113-243-300 | 113-843-300 | 15.0 | 10 | 0.375 | S N | 113-136-280 | 113-236-300 | |
| | | | | | | | | 13 | 0.500 | S C N | 113-146-280 113-146-290 113-146-300 | 113-246-280 113-246-290 113-246-300 | |
| 3.5 | 19 | 0.750 | S N | | 113-253-380 | 113-853-360 | 15.0 | 19 | 0.750 | S | | 113-256-360 | |
| | | | | | | | | 6 | 0.250 | S | 113-127-280 | | |
| 3.5 | 6 | 0.250 | S | | | | 15.0 | 6 | 0.250 | 1.5 in S | 113-127-302 (TTC-100) | | |
| | | | | | | | | 10 | 0.375 | S | 113-137-280 | | |
| | | | | | | | | 13 | 0.500 | S | 113-147-280 | | |

Note: Waterproof cables are in the accessories section.

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Custom configurations are available by special order.

Immersion transducers— North American standards

Type IPS



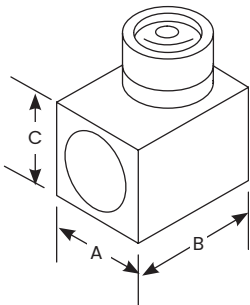
| Element Ø | | A | | B | |
|-----------|------|-----|------|------|------|
| mm | in | mm | in | mm | in |
| 6 | .250 | 9.7 | 0.38 | 36.8 | 1.45 |

Immersion transducers—type IPS

| Freq. (MHz) | Element Ø | | *Focus | Order code | | | Freq. (MHz) | Element Ø | | *Focus | Order code | | |
|-------------|-----------|------|--------|--------------|--------------|---|-------------|-----------|------|--------|--------------|--------------|---|
| | mm | in | | Alpha series | Gamma series | Accessories | | mm | in | | Alpha series | Gamma series | Accessories |
| 5.0 | 6 | 0.25 | S | 113-124-320 | 113-224-340 | Cable BNC 118-140-012 Non- waterproof | 10.0 | 6 | 0.25 | S | 113-126-320 | 113-226-330 | Cable BNC 118-140-012 Non- waterproof |
| | | | N | 113-124-340 | | | | | | C | 113-126-340 | | |
| | | | N | 113-126-340 | | | | | | | | | |

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Custom configurations are available by special order.

Type IR



| Element Ø | | A | | B | | C | |
|-----------|-------|------|------|------|------|------|------|
| mm | in | mm | in | mm | in | mm | in |
| 6 | 0.250 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |
| 10 | 0.375 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |
| 13 | 0.500 | 19.1 | 0.75 | 23.9 | 0.94 | 19.1 | 0.75 |

Immersion transducers—type IR

| Freq. (MHz) | Element Ø | | *Focus | Order code | | Freq. (MHz) | Element Ø | | *Focus | Order code | |
|-------------|-----------|------|--------|--------------|--------------|-------------|-----------|------|--------|--------------|--------------|
| | mm | in | | Alpha series | Gamma series | | mm | in | | Alpha series | Gamma series |
| 2.25 | 13 | 0.50 | C | 113-242-410 | | 5.0 | 6 | 0.25 | N | 113-124-420 | 113-224-420 |
| | | | | | | | 13 | 0.50 | N | 113-144-420 | |

* Focus: S = Spherical, C = Cylindrical, N = Non-focus. Focal length must be specified. For available focal lengths, refer to the table at the beginning of the Immersion Transducers section. Waterproof cables can be found in the Transducers Accessories Section. Custom configurations are available by special order.

Transducers for specific applications

Baker Hughes Inspection Technologies' Application Centers provide a broad spectrum of services to users of nondestructive testing applications. Our mission is to bring together worldwide knowledge and experience across multiple industries and modalities to help customers quickly solve their inspection application problems.

With an unsurpassed track record, our highly skilled engineers, technicians and specialists are a key asset for our customers. Their experience is broad, encompassing many NDT modalities and many industry segments—from the development of a radiographic solution to inspect aerospace

parts on the manufacturing floor to the design of customized ultrasound transducers for field inspection in the power, oil, gas and automotive industries.

New materials, manufacturing processes, and joining technologies often require customized ultrasonic transducers and accessories, designed specifically for the particular application. We offer a wide range of special application transducers, some of which are shown on these pages. Our special transducer teams are ready to address new application problems quickly and effectively.

Special application transducers

Roller (Wheel) transducers

Ultrasonic roller transducers and systems for the inspection of overlapped and butt laser welds or brazed joints and welds on tailored blanks with dry coupling.



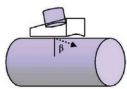
Low frequency transducers

Ultrasonic transducers for the inspection of coarse materials such as concrete, refractory bricks, stones, and wood.



Axle transducers

Ultrasonic transducers for the inspection of railway axles and wheel sets.



Transducer holders

Ultrasonic transducer holders for special fixtures for the inspection of gas bottles and tubes.



Transverse (Shear) wave straight beam transducers

Normal incidence transverse wave transducers typically used for characterization of materials.



Spot weld transducers

Ultrasonic transducers with a flexible acoustic interface for inspection of resistance welded spot welds on automotive bodies.



MIG/MAG transducers

Ultrasonic transducers for the inspection of MIG and MAG welds using the ultrasonic transmission technique.



Tube testing transducers

Ultrasonic transducers for the inspection of tubes and hollow railway axles and wheel sets.



High temperature transducers

Ultrasonic transducers for inspection at higher temperatures with heat resistant delays.



High frequency immersion transducers

Very high resolution immersion transducers, 25 MHz to 50 MHz.



RL transducers

Refracted longitudinal wave angle beam transducers, single and dual element, for inspection of coarse grain materials such as austenitic steel pipe welds.



Boreside arrays

Multi-element ultrasonic transducers, with water feed, for the inspection of tubing from the ID.



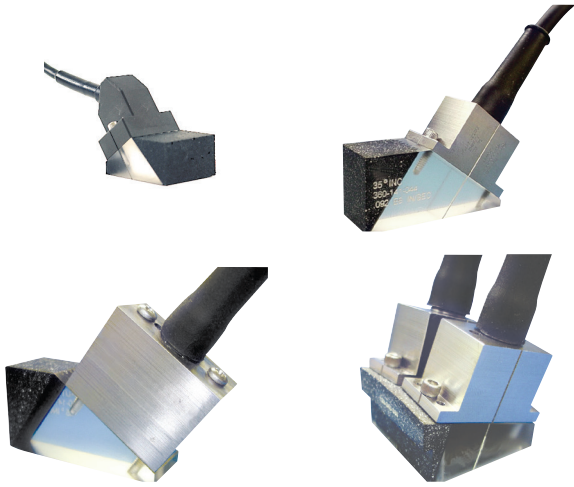
ZIP probes

"Zero Interface" delay line transducers for manual inspection of composite materials.

Phased array transducers

Baker Hughes Inspection Technologies manufactures a wide variety of phased array transducers for use with Mentor UT and other instruments. Phased array transducers with the Dialog feature recognize physical connection and automatically download transducer information to Mentor UT.

Small and mid-sized phased arrays for general angle and straight beam applications



Applications

- Power: General weld inspection, austenitic welds, pressure vessels and piping, turbine blades, rotors
- Oil and Gas: Pipeline girth welds, tanks, general weld inspection
- Aerospace: Weld inspection, landing gear
- Automotive: Axles, shafts, spindles, brake discs, wheels
- General: Welds, forgings, castings, tubular goods, bridges and structures

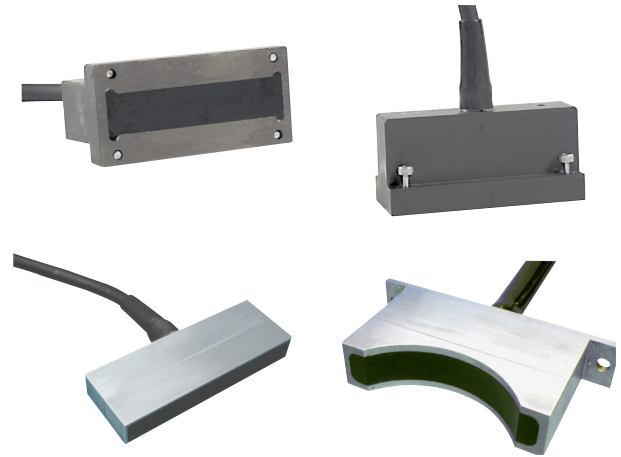
Features and benefits

- Electronic control of beam angle, focus, and scanning index
- Eliminate multiple inspections with fixed angle and fixed focus probes.
- Inspect hard to access areas from a single contact point.
- Replaceable angle beam wedges and 0° delay lines, flat or curved
- Probes with internal wedges and delay lines are also available.

Typical specifications (Others available upon request)

| Frequency (MHz) | Element count | Pitch mm (in) | Elevation mm (in) |
|-----------------|-----------------|----------------------------|------------------------|
| 1.0 | 16, 32, 64, 128 | 1 to 3 (0.04 to 0.12) | 10 to 25 (0.4 to 1.0) |
| 1.5 | 16, 32, 64, 128 | 0.75 to 3 (0.03 to 0.12) | 10 to 25 (0.4 to 1.0) |
| 2.25 | 16, 32, 64, 128 | 0.5 to 2 (0.02 to 0.08) | 6 to 20 (0.25 to 0.8) |
| 3.5 | 16, 32, 64, 128 | 0.5 to 2 (0.02 to 0.08) | 6 to 20 (0.25 to 0.8) |
| 5.0 | 16, 32, 64, 128 | 0.25 to 1.5 (0.01 to 0.06) | 6 to 20 (0.25 to 0.8) |
| 7.5 | 16, 32, 64, 128 | 0.25 to 1 (0.01 to 0.04) | 6 to 16 (0.25 to 0.63) |

Phased array for scanning and wide area coverage, immersion or delay line



Applications

- Power Generation: Pressure vessels, piping
- Oil and Gas: Piping, tanks
- Aerospace: Composite delamination and disbond, weld inspection, landing gear
- Transportation: Composite delamination and disbond, plates
- General: Large area scanning, plate, bar, tubular goods, in-line thickness measurement

Features and benefits

- Electronic control of beam angle, focus, and scanning index
- Reduce set-up and scan times.
- Increase sensitivity and signal-to-noise ratio with electronic focusing.
- Reduce or eliminate mechanical and manual manipulation.
- Use immersion method or with replaceable delay line.

Typical specifications (Others available upon request)

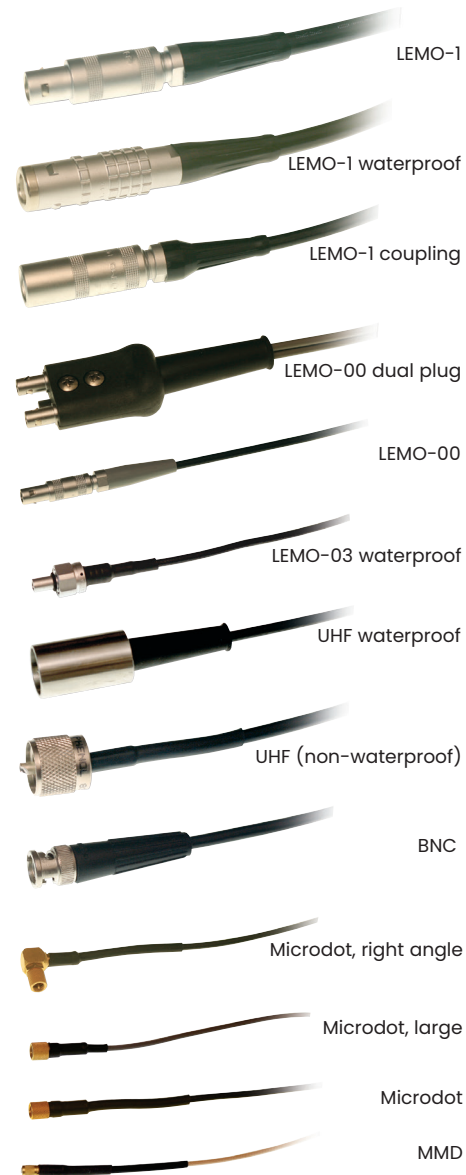
| Frequency (MHz) | Element Count | Pitch/mm (in) | Elevation/mm (in) |
|-----------------|---------------|----------------------------|------------------------|
| 1.0 | 32, 64, 128 | 1 to 3 (0.04 to 0.12) | 10 to 25 (0.4 to 1.0) |
| 1.5 | 32, 64, 128 | 0.75 to 3 (0.03 to 0.12) | 10 to 25 (0.4 to 1.0) |
| 2.25 | 32, 64, 128 | 0.5 to 2 (0.02 to 0.08) | 6 to 20 (0.25 to 0.8) |
| 3.5 | 32, 64, 128 | 0.5 to 2 (0.02 to 0.08) | 6 to 20 (0.25 to 0.8) |
| 5.0 | 32, 64, 128 | 0.25 to 1.5 (0.01 to 0.06) | 6 to 20 (0.25 to 0.8) |
| 7.5 | 32, 64, 128 | 0.25 to 1 (0.01 to 0.04) | 6 to 16 (0.25 to 0.63) |
| 10.0 | 32, 64, 128 | 0.25 to 1 (0.01 to 0.04) | 6 to 13 (0.25 to 0.5) |

Transducer accessories

Cables and adapters

Plug type

| Cable type | Order code | Length m (ft) | Impedance (ohms) | Transducer | Instrument |
|--------------|-------------|---------------|------------------|-----------------------------------|------------|
| CL 331 | 0058160 | 2 (6.5) | 50 | Microdot | LEMO-00 |
| MPKLL 2 | 0058791 | 2 (6.5) | 50 | LEMO-00 | LEMO-00 |
| MPKL 2 | 0050486 | 2 (6.5) | 50 | LEMO-00 | LEMO-1 |
| MPKM 2 | 0052999 | 2 (6.5) | 50 | Microdot | LEMO-1 |
| PKP 2 | 0066709 | 2 (6.5) | 75 | LEMO-03 Waterproof | LEMO-1 |
| PKI 2 | 0057694 | 2 (6.5) | 75 | UHF Waterproof | LEMO-1 |
| PKLL 2 | 0050326 | 2 (6.5) | 75 | LEMO-1 | LEMO-1 |
| PKTL 2 | 0052642 | 2 (6.5) | 50 | LEMO-1 Waterproof | LEMO-1 |
| SEKG 2 | 0053887 | 2 (6.5) | 50 | LEMO-00 Dual Plug | 2x LEMO-1 |
| SEKL 2 | 0050710 | 2 (6.5) | 50 | 2x LEMO-00 | 2x LEMO-1 |
| SEKM 2 | 0053001 | 2 (6.5) | 50 | 2x Microdot | 2x LEMO-1 |
| SEKN 2 | 0053775 | 2 (6.5) | 50 | 1x Microdot 1x Microdot, Large | 2x LEMO-1 |
| VKLL 5 | 0050484 | 5 (16.4) | 75 | LEMO-1 Coupling | LEMO-1 |
| MD-BNC | 118-140-012 | 1.8 (6) | 50 | Microdot | BNC |
| MD-BNC 12 | 118-140-011 | 3.6 (12) | 50 | Microdot | BNC |
| MMD-BNC | 118-140-047 | 1.8 (6) | 50 | MMD | BNC |
| MD/RA-BNC | 118-140-033 | 1.8 (6) | 50 | Right Angle Microdot | BNC |
| BNC-BNC | 118-140-016 | 1.8 (6) | 50 | BNC | BNC |
| BNC-BNC 12 | 118-140-021 | 3.6 (12) | 50 | BNC | BNC |
| UHF-BNC | 118-140-027 | 1.8 (6) | 50 | UHF Non-waterproof | BNC |
| L1-BNC | 118-140-018 | 1.8 (6) | 50 | LEMO-1 | BNC |
| UHF/WP-BNC | 118-140-013 | 1.8 (6) | 75 | UHF Waterproof | BNC |
| Dual MMD-BNC | 118-140-014 | 1.8 (6) | 50 | 2x MMD | 2x BNC |
| Dual MD-BNC | 118-140-024 | 1.8 (6) | 50 | 2x Microdot | 2x BNC |



| Adaptor type | Order code | Transducer | Instrument |
|------------------------|-------------|---------------------|-----------------------|
| PKLB1 | 0053013 | BNC Socket | LEMO-1 Plug |
| PKBL1 | 0053014 | LEMO-1 Socket | BNC Plug |
| STUHF-RA (Right angle) | 118-560-032 | UHF Plug Waterproof | UHF Socket Waterproof |
| DM-BNC dual | 118-560-045 | D-Meter Plug | 2x BNC |

Couplants

General purpose couplants

| Couplant type | Container size | Description | Order Code | Features |
|---------------|----------------------------------|---------------------|------------|--|
| ZGT | 5 bottles 250 ml (8.5 fl oz.) | General purpose | 0054558 | <ul style="list-style-type: none">• Medium viscosity paste• Water resistant, non-corrosive• Temperature range -22°F to 480°F (-30°C to 250°C)• Safety data sheet per 91/155/EEC |
| | 100 g Tube (3.5 oz.) | Multigrade couplant | 0050472 | |

Specialty couplants

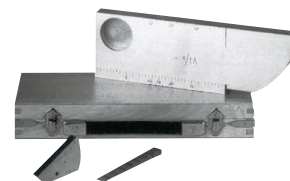
| Couplant type | Container size | Description | Order Code | Features |
|---------------|----------------------|---------------------------------|------------|--|
| ZGM | 100 g Tube (3.5 oz.) | High temperature coupling paste | 0056567 | <ul style="list-style-type: none">• High viscosity paste• Solid filler melts at elevated temperature• Specially formulated for thickness measurement on hot parts• Temperature range 390°F to 1100°F (200°C to 600°C) |

Calibration blocks

Calibration blocks provide known targets that produce echo indications that are used for instrument setup, transducer evaluation, and reference for evaluating flaw size.

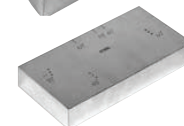
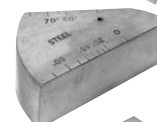
Calibration blocks—European standards

| Block type (Steel) | Order code | Description |
|--------------------------|------------|--|
| K1 ISO 12223 | 0059108 | <ul style="list-style-type: none"> • Large angle beam calibration block, 100 mm radius • Calibrate range with an angle beam transducer • Measure beam index point and refracted angle |
| K2 ISO 27963/ISO 7963 | 0050434 | <ul style="list-style-type: none"> • Small angle beam calibration block, 25 and 50 mm radii • Calibrate range with an angle beam transducer • Measure beam index point and refracted angle |
| VW | 0050441 | <ul style="list-style-type: none"> • Step block for calibrating thickness range • Eight .039 in (1 mm) steps, .039 in (1 mm) through .315 in (8 mm) |
| N30 | 0058474 | <ul style="list-style-type: none"> • Ultrasonic reference standard • Connect directly to flaw detector • Produces multiple echoes at precise intervals in steel • Check instrument gain over long time periods |



Calibration blocks—North American standards

| Block type (Steel) | Order code | Description |
|-----------------------|-------------|---|
| IIW Type 1 | 118-540-270 | <ul style="list-style-type: none"> • Large angle beam calibration block • 4.0 in (101.6 mm) radius for angle beam range calibration • Measure beam index point and refracted angle • Also used to check resolution and sensitivity |
| IIW Type 2 | 118-540-280 | <ul style="list-style-type: none"> • Same as IIW Type 1 with 2 in (50.8 mm) and 4 in (101.6 mm) radii for range calibration • Side drilled holes also added for resolution check |
| DSC | 118-540-300 | <ul style="list-style-type: none"> • Small block for angle beam distance and sensitivity calibration • 1.0 in (25.4 mm) radius opposite a 3.0 in (76.2 mm) radius • 0.375 in (9.5 mm) slot in the 3.0 in (76.2 mm) radius • Also used to check beam index point and refracted angle |
| Angle Beam, Miniature | 118-540-260 | <ul style="list-style-type: none"> • Substitute for DSC block • 1.0 in (25.4 mm) radius opposite a 2.0 in (50.8 mm) radius • Side drilled hole to check beam index point and refracted angle |
| AWS Resolution | 118-540-350 | <ul style="list-style-type: none"> • Evaluate angle beam transducer resolution capability • Three sets of side drilled holes for 45°, 60° and 70° angles • Three 0.062 in (1.6 mm) diameter holes in each set of holes |
| NAVSHIPS Test Block | 118-540-370 | <ul style="list-style-type: none"> • For NAVSHIPS specification 0900-006-3010, Section 6 • Distance amplitude correction, sensitivity, and flaw depth |
| 4-Step Block | 118-540-320 | <ul style="list-style-type: none"> • Step block for calibrating thickness range • Steps .250, .500, .750, 1.00 in (6.35, 12.70, 19.05, 25.40 mm) |
| 5-Step Block | 118-540-310 | <ul style="list-style-type: none"> • Step block for calibrating thickness range • Steps .100, .200, .300, .400, .500 in (2.54, 5.08, 7.62, 10.06, 12.70 mm) |



Transducer certification

European standards

Each delivered probe is subjected to a very strict quality test that makes certain all probes of the same type identically evaluate flaws. The corresponding probe data sheet contains proof of the data reliability. We store the data of every numbered probe for a number of years, enabling probe certificates (PZ) to also be produced at a later date.

| Certificate | Order code | Description |
|-------------|------------|--|
| PZ-E | 0057682 | Waveform and frequency spectrum for standard catalog flaw transducers, including amplitude, frequency, bandwidth, and pulse duration |
| PZ-EN | 0059969 | Detailed certificate of calibration according to standard EN 12668-2, "Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes", ratified by European Committee for Standardization (CEN) |

North American standards

| Certificate | Order code | Description |
|------------------------|-------------|--|
| Waveform/ Frequency | 113-900-911 | Waveform and frequency spectrum for standard catalog flaw transducers, including amplitude, frequency, bandwidth, and pulse duration |
| Beam Profile | 113-900-913 | Plot is made by moving the transducer across a ball or rod reflector in an immersion tank. The beam profile gives the relative intensity and width of the sound beam at a given distance from the transducer face. |

Tables and formulas

dB vs. Amplitude ratio chart

| dB | Ratio | dB | Ratio | dB | Ratio | dB | Ratio |
|----|--------|----|--------|----|--------|----|-----------|
| 0 | 1.00:1 | 5 | 1.78:1 | 11 | 3.55:1 | 17 | 7.08:1 |
| .5 | 1.06:1 | 6 | 2.00:1 | 12 | 3.98:1 | 18 | 7.94:1 |
| 1 | 1.12:1 | 7 | 2.24:1 | 13 | 4.47:1 | 19 | 8.91:1 |
| 2 | 1.26:1 | 8 | 2.51:1 | 14 | 5.01:1 | 20 | 10.00:1 |
| 3 | 1.41:1 | 9 | 2.82:1 | 15 | 5.62:1 | 40 | 100.00:1 |
| 4 | 1.58:1 | 10 | 3.16:1 | 16 | 6.31:1 | 60 | 1000.00:1 |

Near field length (N) in water

Element diameter

| Frequency (MHz) | Element diameter | | | | | | | |
|-----------------|------------------|--------|---------|---------|---------|---------|--------|---------|
| | mm 25.4 | in 1.0 | mm 19.1 | in 0.75 | mm 12.7 | in 0.50 | mm 6.3 | in 0.25 |
| 1.0 | 109.2 | 4.3 | 61 | 2.4 | 27.2 | 1.07 | 6.8 | 0.27 |
| 2.25 | 243.8 | 9.6 | 137.1 | 5.4 | 61.0 | 2.4 | 15.3 | 0.60 |
| 5.0 | 543.5 | 21.4 | 304.8 | 12.0 | 137.1 | 5.4 | 33.0 | 1.3 |
| 10.0 | 1092.2 | 43 | 609.6 | 24 | 271.8 | 10.7 | 68.6 | 2.7 |

To find approx. length in steel, divide the above values by 4.

Velocity and acoustic impedance of common materials

| Material | Longitudinal velocity | | Shear velocity | | Acoustic impedance MRayl |
|----------------|------------------------|------|------------------------|------|-----------------------------|
| | in/s x 10 ⁶ | km/s | in/s x 10 ⁶ | km/s | |
| Air | 0.013 | .33 | - | - | .0004 |
| Aluminum | 0.25 | 6.3 | 0.12 | 3.1 | 17.0 |
| Aluminum oxide | 0.39 | 9.9 | 0.23 | 5.8 | 32.0 |
| Beryllium | 0.51 | 12.9 | 0.35 | 8.9 | 23.0 |
| Boron carbide | 0.43 | 11.0 | - | - | 26.4 |
| Brass | 0.17 | 4.3 | 0.08 | 2.0 | 36.7 |
| Cadmium | 0.11 | 2.8 | 0.059 | 1.5 | 24.0 |
| Copper | 0.18 | 4.7 | 0.089 | 2.3 | 41.6 |
| Glass (Crown) | 0.21 | 5.3 | 0.12 | 3.0 | 18.9 |
| Glycerin | 0.075 | 1.9 | - | - | 2.42 |
| Gold | 0.13 | 3.2 | 0.047 | 1.2 | 62.6 |
| Ice | 0.16 | 4.0 | 0.08 | 2.0 | 3.5 |
| Inconel | 0.22 | 5.7 | 0.12 | 3.0 | 47.2 |
| Iron | 0.23 | 5.9 | 0.13 | 3.2 | 45.4 |
| Iron (Cast) | 0.18 | 4.6 | 0.10 | 2.6 | 33.2 |
| Lead | 0.085 | 2.2 | 0.03 | 0.7 | 24.6 |
| Magnesium | 0.23 | 5.8 | 0.12 | 3.0 | 10.0 |
| Mercury | 0.057 | 1.4 | - | - | 19.6 |
| Molybdenum | 0.25 | 6.3 | 0.13 | 3.4 | 64.2 |
| Monel | 0.21 | 5.4 | 0.11 | 2.7 | 47.6 |
| Neoprene | 0.063 | 1.6 | - | - | 2.1 |

| Material | Longitudinal velocity | | Shear velocity | | Acoustic impedance MRayl |
|------------------|------------------------|------|------------------------|------|-----------------------------|
| | in/s x 10 ⁶ | km/s | in/s x 10 ⁶ | km/s | |
| Nickel | 0.22 | 5.6 | 0.12 | 3.0 | 49.5 |
| Nylon, 6-6 | 0.10 | 2.6 | 0.043 | 1.1 | 2.9 |
| Oil (SAE 30) | 0.067 | 1.7 | - | - | 1.5 |
| Platinum | 0.13 | 3.3 | 0.067 | 1.7 | 69.8 |
| Plexiglass | 0.11 | 2.7 | 0.043 | 1.1 | 3.1 |
| Polythylene | 0.07 | 1.9 | 0.02 | 0.5 | 1.7 |
| Polystyrene | 0.093 | 2.4 | 0.04 | 1.1 | 2.5 |
| Polyurethane | 0.070 | 1.9 | - | - | 1.9 |
| Quartz | 0.23 | 5.8 | 0.087 | 2.2 | 15.2 |
| Rubber, butyl | 0.07 | 1.8 | - | - | 2.0 |
| Silver | 0.14 | 3.6 | 0.06 | 1.6 | 38.0 |
| Steel, mild | 0.23 | 5.9 | 0.13 | 3.2 | 46.0 |
| Steel, stainless | 0.23 | 5.8 | 0.12 | 3.1 | 45.4 |
| PTFE | 0.06 | 1.4 | - | - | 3.0 |
| Tin | 0.13 | 3.3 | 0.07 | 1.7 | 24.2 |
| Titanium | 0.24 | 6.1 | 0.12 | 3.1 | 27.3 |
| Tungsten | 0.20 | 5.2 | 0.11 | 2.9 | 101.0 |
| Uranium | 0.13 | 3.4 | 0.08 | 2.0 | 63.0 |
| Water | 0.0584 | 1.48 | - | - | 1.48 |
| Zinc | 0.17 | 4.2 | 0.09 | 2.4 | 29.6 |

Useful formulas

| | |
|-------------------------------|--|
| Near field length | $D^2F/4C$ or $D^2/4\lambda$ |
| Beam spread | $\text{SIN}_\gamma C/DF \times 1.22$ or $1.22\lambda/D$ |
| Snell's law | $\text{SIN}\alpha / \text{SIN}\beta = C_1/C_2$ |
| Skip distance | $2T \times \text{TAN}\beta$ |
| V-Path | $2T/\text{COS}\beta$ |
| Surface distance (Projected) | $\text{S.P.} \times \text{SIN}\beta$ |
| Depth (1st Leg) | $\text{S.P.} \times \text{COS}\beta$ |
| Depth (2nd Leg) | $2T - (\text{S.P.} \times \text{COS}\beta)$ |
| Depth (3rd Leg) | $(\text{S.P.} \times \text{COS}\beta) - 2T$ |
| Wavelength | C/F |
| Frequency | C/λ |
| Acoustic impedance | $Z = C \times d$ |
| % of Reflected sound pressure | $R_p = (Z_2 - Z_1)/(Z_2 + Z_1)$ |
| Coefficient of transmission | $T_p = 2Z_2/(Z_2 + Z_1)$ |
| Total beam width | $TBW = (\text{Depth} - N) (2\text{TAN}_\gamma) + T \times \text{Element diameter}$ |

| | |
|--------------------------------|--|
| Transit time | $TT = 2T/C$ |
| Center frequency | $F_c = (F_1 + F_2)/2$ |
| % Bandwidth | $(F_1 - F_2)/F_c \times 100\%$ |
| Q factor | $F_c/(F_1 - F_2)$ |
| Distance | Speed x time |
| RPM | Speed/circumference |
| Maximum scanning speed (x, y) | (Min. flaw length + EBW) x PRR |
| Maximum scanning speed (polar) | RPM x Diameter x Clock interval (ft per min.) |
| dB Difference | $20 \text{ Log } (A1/A2)$ |
| dB Ratio | $\text{Inv log dB}/20$ |
| Water equivalent = (Steel) | $WE = F(\text{water}) \times (C(\text{water}))/C(\text{steel})$ (F = Focal length) |
| MAXR | $\text{SIN}-1 (ID/OD)$ |
| Focal length | $R = F(n - 1)/n$ |
| Cylinder offset technique | Offset (X) = Outside radius x SIN α |

Symbol key

| |
|---------------------------------|
| λ = Wavelength |
| D = Probe diameter |
| F = Probe frequency |
| C = Acoustic velocity |
| d = Density |
| α = Incident angle |
| β = Refracted angle |
| T = Part thickness |
| S.P. = Sound path |
| N = Near field |
| γ = Divergence 1/2 angle |

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Baker Hughes sensing and inspection technologies provides technology-driven inspection solutions that deliver productivity, quality and safety. We design, manufacture and service ultrasonic, remote visual and radiographic equipment to inspect, monitor and test materials and equipment without disassembling, deforming or damaging them.

We offer specialized products and services that will help improve productivity in a wide range of industries including aerospace, power generation, oil and gas, automotive and metals.



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Remote visual



Radiography



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Hardness testing



Software

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We have 11 application centers strategically sited around the world which provide our customers with personalized problem solving and custom transducer designs for the toughest applications. We offer advice and assistance to many different industry segments.

- Highly skilled, experienced and dedicated team
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