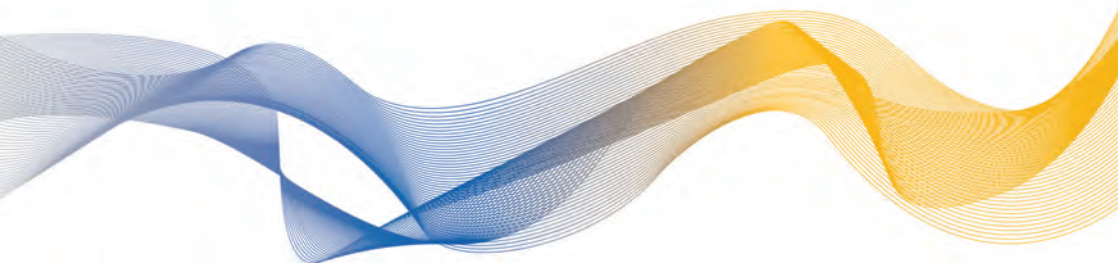


Bracelet

Operating & Maintenance Manual



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1. Basic Description



Figure 1 - Bracelet Scanner

The Bracelet is a lightweight, low-profile scanner for ultrasonic phased array inspection of circumferential welds in small bore pipework.

It can be configured to inspect pipes ranging from 0.5" to 12" nominal pipe size (NPS) with the standard range being 0.5" to 4". The innovative tool-free design allows for speedy set-ups between this range by adding or removing the belt links to resize the scanner.

The single-sided Bracelet configuration is suitable for pipe-to-fitting inspections, as well as straight welds. And the dual-sided configuration, with bridging plates and two phased array probes allows for complete weld inspection in one scan.

Comprising of a series of links to make a flexible belt, the Bracelet easily wraps around pipes and a strap secures the Bracelet to the pipe once the axial position is established. The ultrasonic probe and profiled wedge are fixed to one end of the Bracelet in an adjustable clasp.

An encoder unit is attached to the opposing end of the Bracelet with the encoder wheel running around the pipe surface. A bar attached to the end of the encoder module is used as a buckle for securing the strap.

The Bracelet can be rotated 360° around a pipe, past neighboring obstructions, when only half the pipe is accessible. Rubber tyres on the wheels provide axial grip to prevent unwanted slippage.

The Bracelet is compatible with a range of industry standard miniature phased array probes and instruments.

1.1 Single-sided inspection (1.5" to 4" NPS)

Figure 2 shows a configuration of the Bracelet used for pipes 1.5" to 4" NPS. Features of this configuration include:

- A former ring which is fitted inside the links
- An axially adjustable probe and wedge clasp
- A short strap
- Rubber coated wheels are used on every other link



Figure 2 - 1.5" to 4" NPS Inspection Configuration

1.2 Single-sided inspection (0.5" to 1.25" NPS)

Figure 3 shows a configuration of the Bracelet used for pipes 0.5" to 1.25" NPS. Features of this configuration include:

- A fixed probe and wedge attachment
- A long strap
- Rubber coated wheels are used on every link



Figure 3 - 0.5" to 1.25" NPS Inspection Configuration

1.3 Dual-sided inspection (1.5" to 4" NPS)

Figure 4 shows a configuration for a dual-sided Bracelet used for pipes 1.5" to 4" NPS. One half of the Bracelet is a standard single-sided Bracelet with the addition of bridge pieces connecting to the second half. The second half of the Bracelet is a standard single-sided unit with the exception of two additional wheeled links replacing the encoder module.

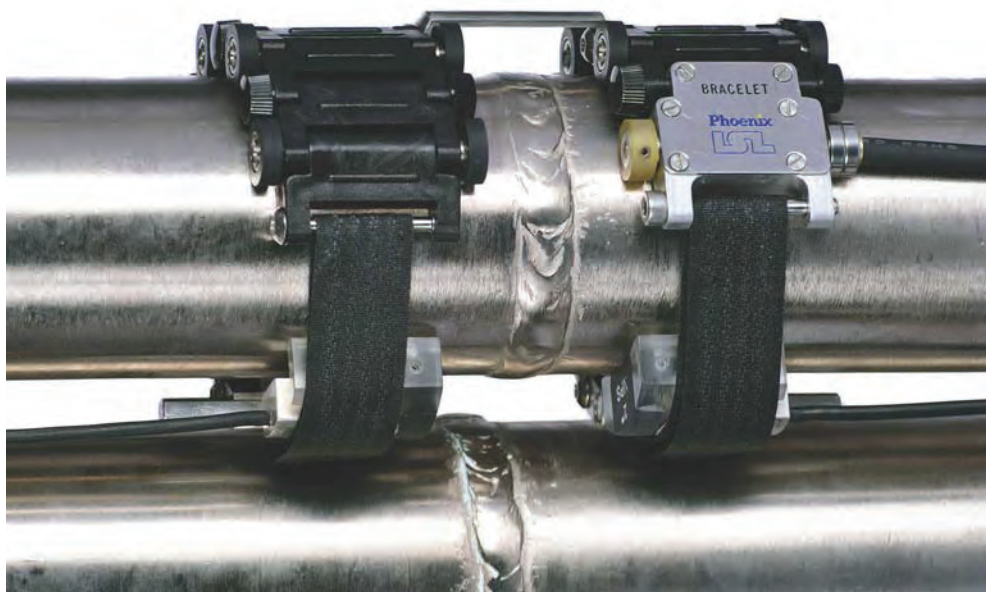


Figure 4 - Double Sided Inspection Configuration (1.5'' to 4'' NPS)

2. Components

2.1 Key Features

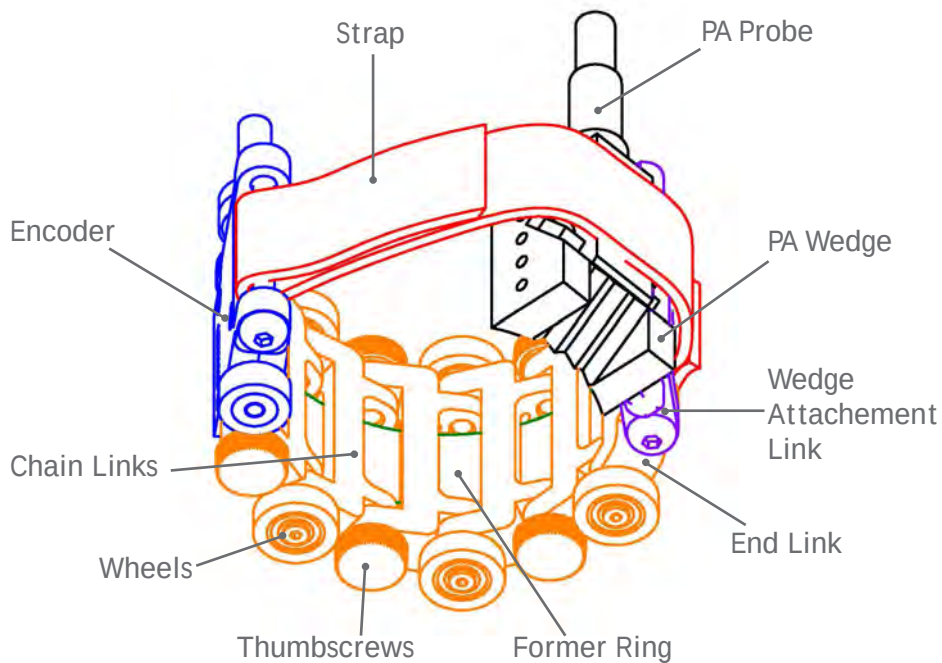


Figure 5 - Bracelet - Key Features

2.2 Encoder Module

A miniature encoder providing 38 quad counts/mm is housed inside a splash proof casing. The encoder is driven by a rubber wheel on one side of the case, and the flexible cable fits through a bearing on the opposite side. The encoder module has holes to mount it to the Bracelet chain and to fit a bar for the securing strap to loop around.



Figure 6 - Encoder Module

2.3 Links / Bracelet Chain

The Bracelet chain is made up of several links that are easily added or removed to suit the pipe size. The centre of the links are slotted, in which to fit a former. Links are secured together by fastening either wheel shafts or thumb screws into the outboard threaded holes of one link and locating into the inboard holes in the next link. For pipes 1.5" NPS and above, wheels are only fitted in every other link alternated with thumb screws.

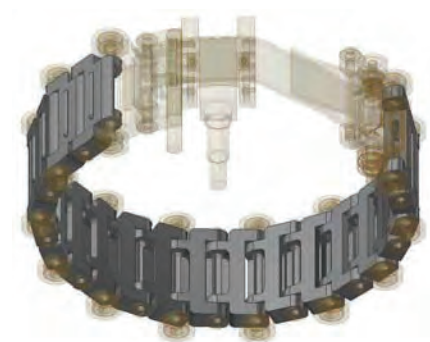


Figure 7 - Bracelet Links

2.4 Formers (1.5" to 4" NPS)

For pipes between 1.5" and 4" NPS a former ring is recommended for each Bracelet configuration, although not strictly necessary. The former fits inside the slots running through the centre of the links. Its primary use is to help guide the Bracelet around the pipe when mounting, in particular when other pipes or obstructions mean that access is only available on one side of the pipe.



Figure 8 - Former

2.5 Wedge attachments

2.5.1 Fixed Attachment (0.5" to 1.25" NPS)

For pipes 0.5" to 1.25" NPS the probe and wedge are attached to the links with a fixed wedge attachment bracket. The bracket is fixed to the end of the Bracelet chain with two screws and is attached to the probe wedge with two small countersunk screws. Several hole positions in the bracket and wedge allow the probe to be attached in different axial positions.

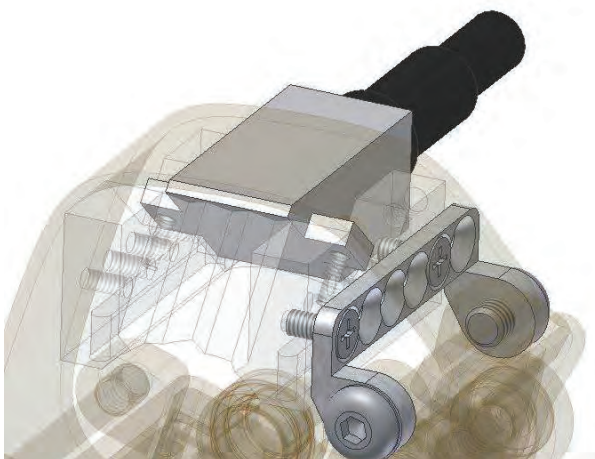


Figure 9 - Wedge Attachment - 0.5" to 1.25" NPS

2.5.2 Adjustable Clasp (1.5" to 2.5" NPS)

For pipes 1.5" to 2.5" NPS the probe and wedge are attached to the links with an adjustable clasp. The clasp is fixed to the end of the Bracelet chain with two screws. A bar attached to the wedge locates inside the groove in the clasp. The relative axial position of the wedge can be chosen and then secured in place with a central set screw.

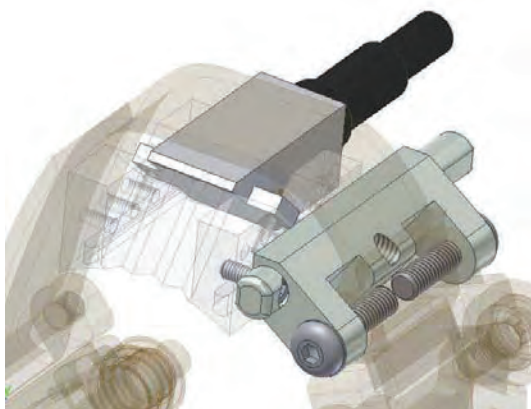


Figure 10 - Adjustable Wedge attachment for 1.5" to 2.5" NPS

2.5.3 Adjustable Clasp (3" to 4" NPS)

For pipes 3" to 4" NPS there is an adjustable clasp similar to the above 1.5" - 2.5" NPS clasp with a different wedge mounting angle.

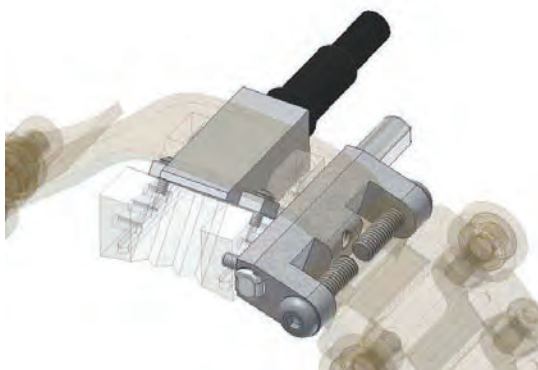


Figure 11 - Adjustable Wedge attachment for 3" to 4" NPS

2.6 Wedges

Figure 12 and figure 13 show two typical probe and wedge assemblies. Both wedges have similar Bracelet attachment hole positions. Each wedge has a contoured surface specific to the outer diameter of the pipe being inspected. Both wedge types include couplant irrigation channels for effective coupling.

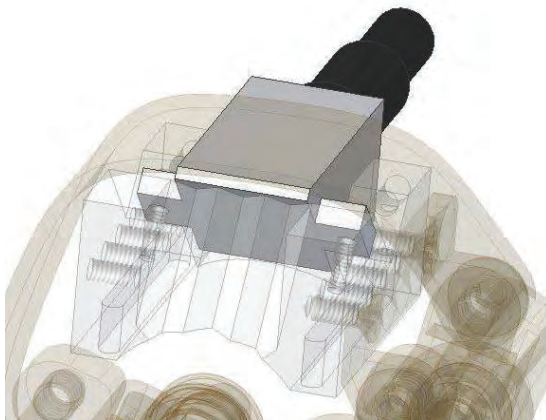


Figure 12 - Probe and Wedge 1

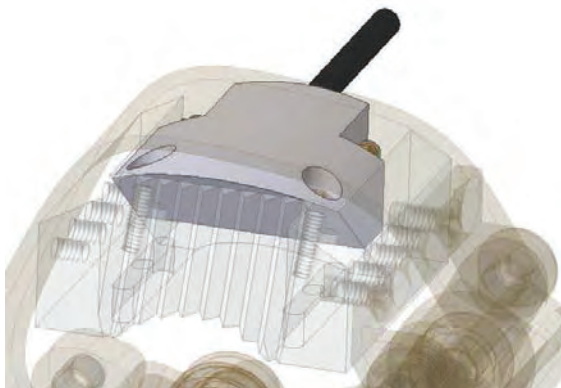


Figure 13 - Probe and Wedge 2

2.7 Hook and Loop Strap

Figure 14 and 15 show the long hook and loop strap with buckle for pipes 0.5" to 1.25" NPS and the short hook and loop strap for pipes 1.5" to 4" NPS respectively.



Figure 14 - Long Strap for 0.5" to 1.25" NPS



Figure 15 - Short Strap for 1.5" to 4" NPS

2.8 Dual-Sided Bracelet Bridges

Figure 16 shows the bridge pieces used in the dual-sided Bracelet configuration. The bridges fit between the two chains and are orientated with the arched side over the weld cap. They are secured at each end with a cap head screw through the tapped hole in the side of the link.

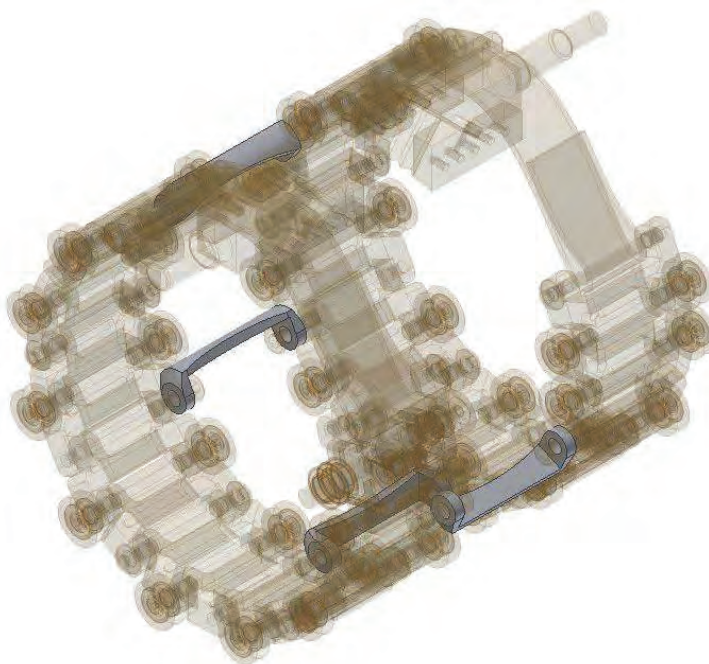


Figure 16 - Bracelet Bridges

2.9 Couplant Tubing

Figure 17 shows the couplant tubing fitted in line with the probe cable. From the pump the main feed is divided by a Y split connector which attaches to the two barbed connectors on the wedge. Couplant passes through the wedge irrigation channel to the pipe surface.

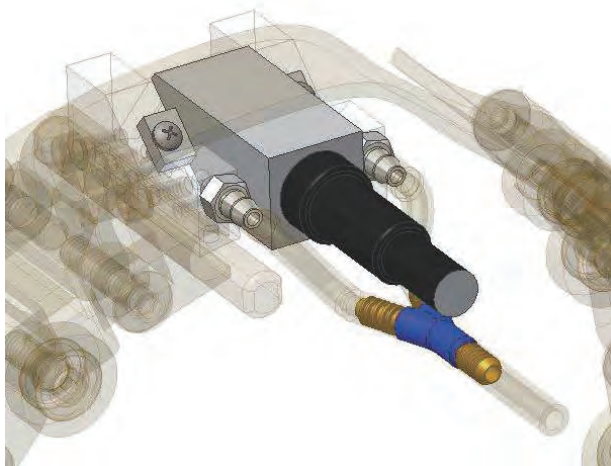


Figure 17 - Couplant Tubing

3. Bracelet Configurations

3.1 0.5" NPS

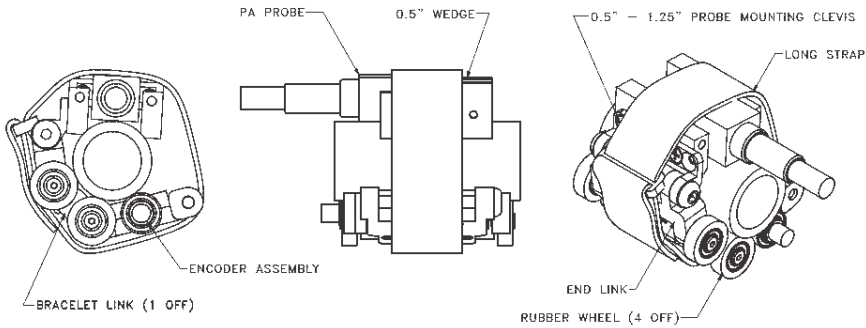


Figure 18 - Configuration for 0.5" NPS

3.2 0.75" NPS

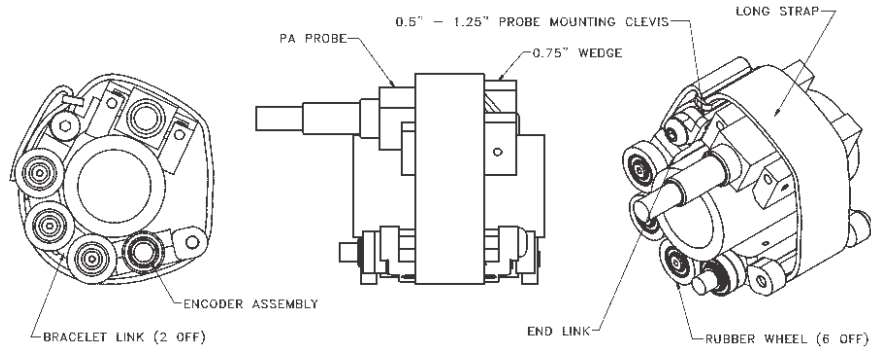


Figure 19 - Configuration for 0.75" NPS

3.3 1" NPS

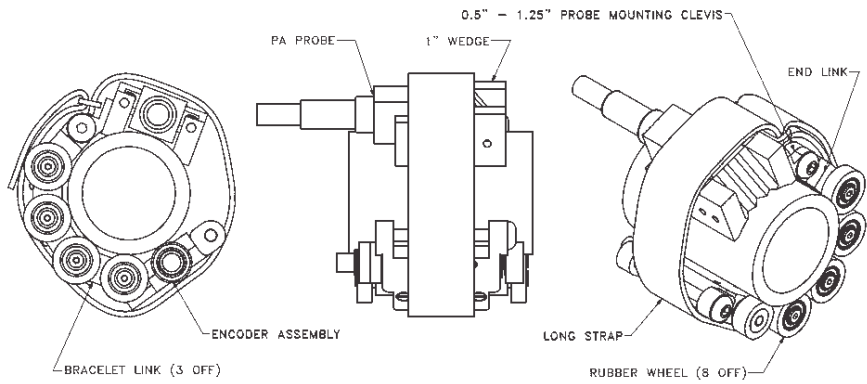


Figure 20 - Configuration for 1" NPS

3.4 1.25" NPS

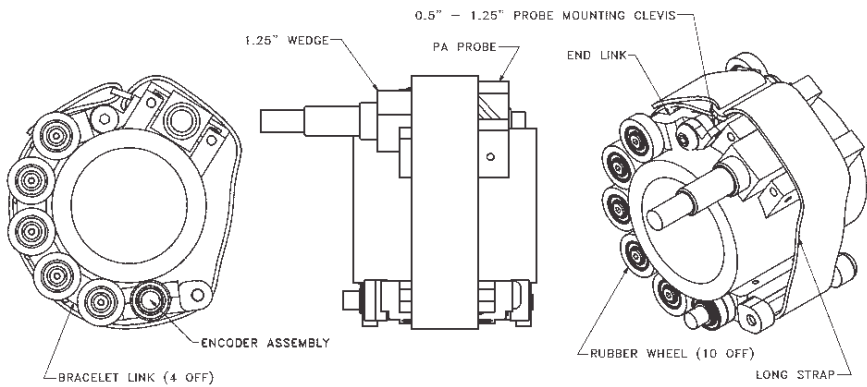


Figure 21 - Configuration for 1.25" NPS

3.5 1.5" NPS

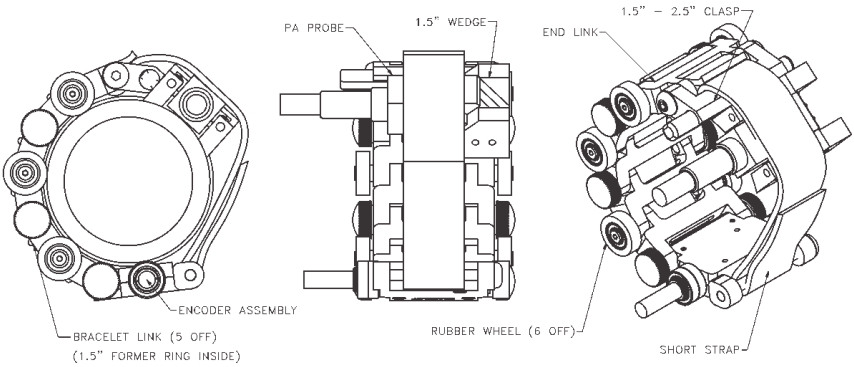


Figure 22 - Configuration for 1.5" NPS

3.6 2" NPS

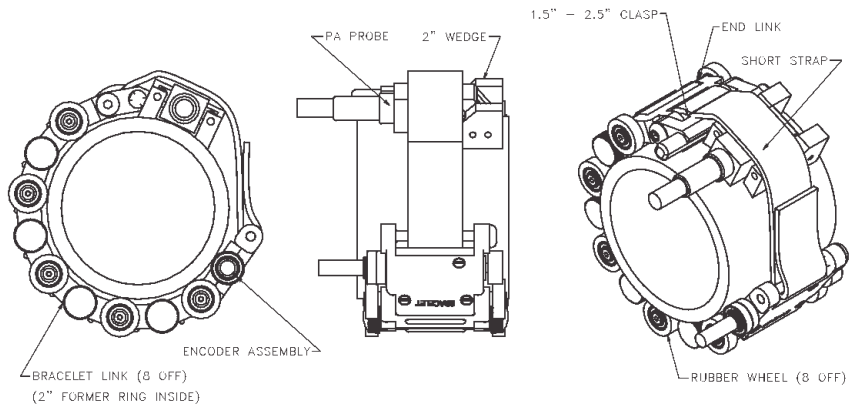


Figure 23 - Configuration for 2" NPS

3.7 2.5" NPS

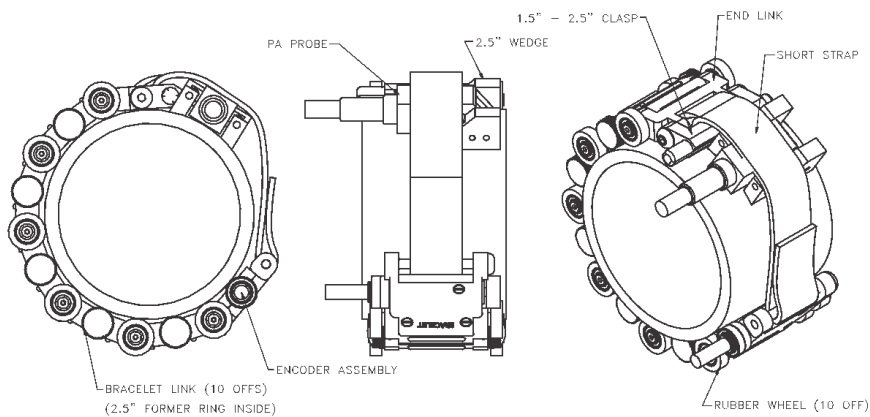


Figure 24 - Configuration for 2.5" NPS

3.8 3" NPS

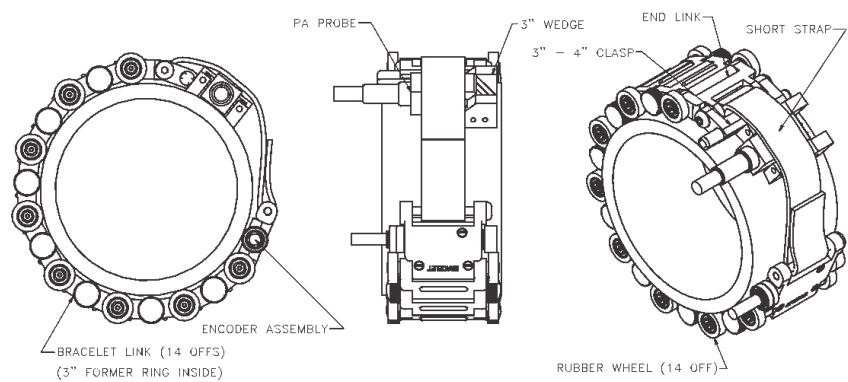


Figure 25 - Configuration for 3" NPS

3.9 3.5" NPS

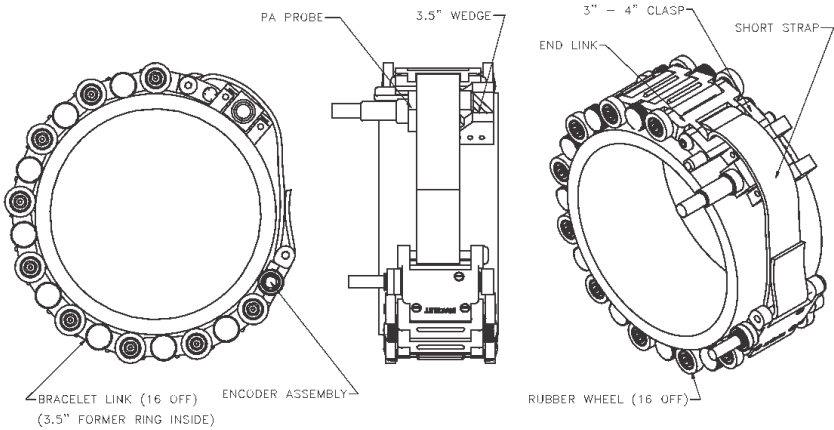


Figure 26 - Configuration for 3.5" NPS

3.10 4" NPS

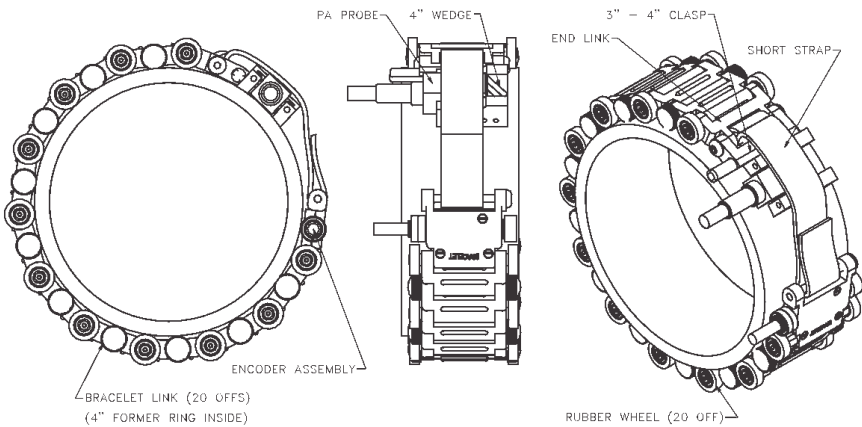


Figure 27 - Configuration for 4" NPS

4. Adjustments

4.1 Adding / Removing a Link

A link can be added by loosening the wheels or the thumb screws allowing the links to be separated. The links are secured together by fastening the wheel shafts or thumb screws into the threaded holes and locating with the holes in the next link.

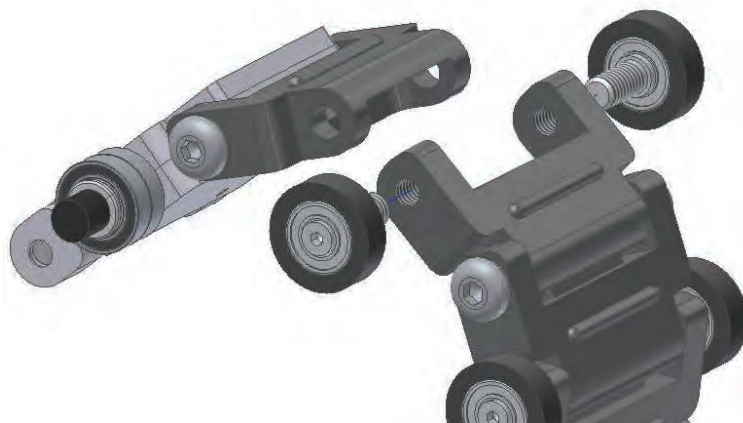


Figure 28 - Adding/Removing a Link

4.2 Attaching the Strap

4.2.1 Strap for 0.5" to 1.25" NPS

Figure 29 shows the long hook and loop strap with a buckle for inspecting pipes 0.5" to 1.25" NPS. The strap is attached to the wedge bracket with the two button head screws that fit through the loop in the end of the strap. The strap is then wrapped around the entire scanner, through the buckle and fastened down onto itself.



Figure 29 - Long Strap for 0.5" to 1.25" NPS

4.2.2 Strap for 1.5" to 4" NPS

A short hook and loop strap is used when inspecting pipes 1.5" to 4" NPS. The strap attaches to the wedge clasp with two screws that fit through the loop in the end of the strap. The strap is pulled over the probe, looped back around the encoder bar and fastened down (figure 30).



Figure 30 - Short Strap for 1.5" to 4" NPS

4.3 Fitting a Former

The former is fitted before attaching the encoder module, as shown in figure 31. Having selected the correct former size for the pipe to be inspected, it slides inside the slotted holes through the centre of the links. Ensure the former is pushed all the way through the links.



Figure 31 - Fitting a former

4.4 Attaching the Encoder

The encoder module is attached by fastening two thumb screws into the threaded holes on the last link and locating with the holes in the encoder body as shown in figure 32.

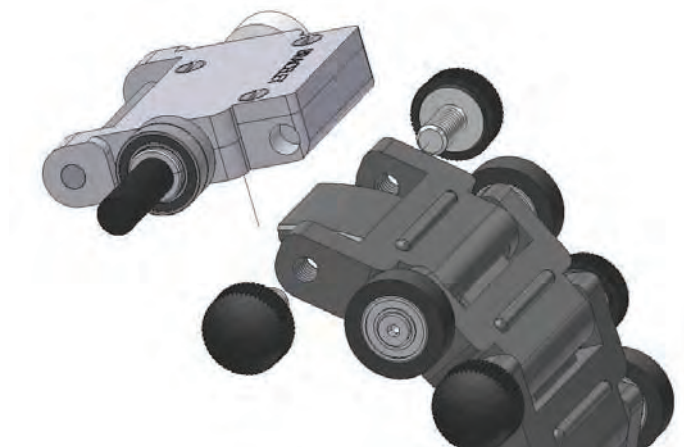


Figure 32 - Encoder Attachment

4.5 Setting the Wedge Position

The axial position of the wedge is adjustable to allow for setting of the distance from the front of the probe to the weld centreline independent of the Bracelet position. The wedge is mounted on a slide that fits into the groove in the clasp on the end of the Bracelet. The position of the probe and wedge is adjusted by releasing the set screw that clamps it in place and setting it to the desired axial position. Once in place the set screw should be re-tightened to secure it in place ready for scanning.

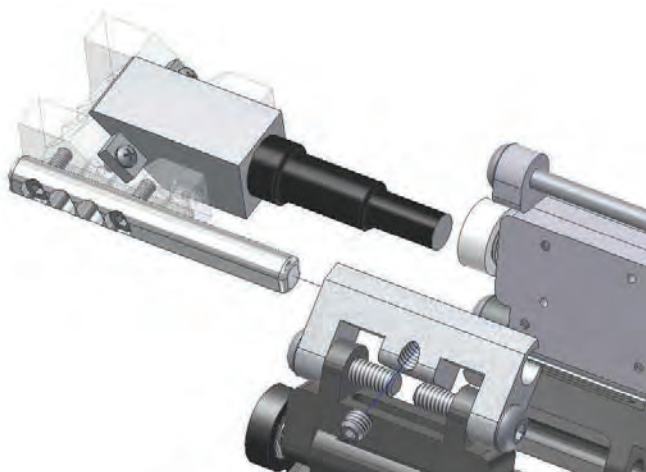


Figure 33 - Setting the Wedge Position

5. Operation

5.1 Attaching the Scanner

If full access to the pipe is available then the Bracelet should be handled and mounted as shown in the pictures in figure 34. Wrap the scanner around the pipe and secure into position with the strap.

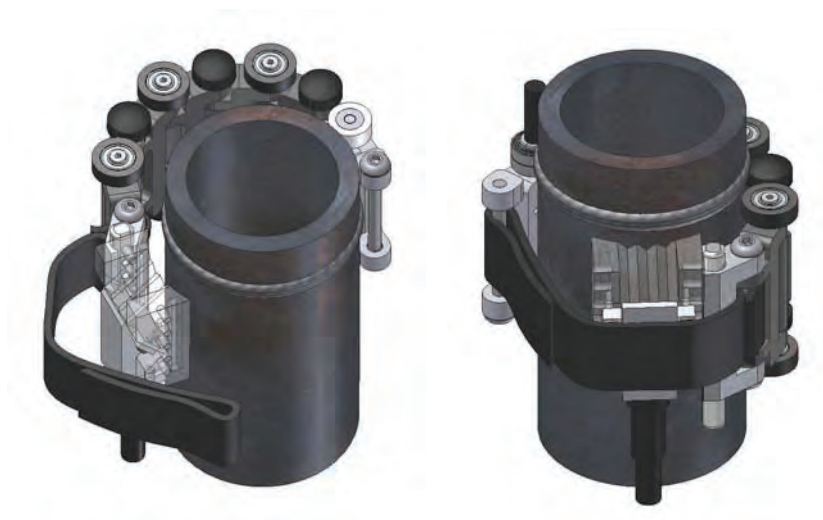


Figure 34 - Attaching the Scanner

If the scanner needs to be fitted from one side due to an obstruction then this can be achieved by feeding the Bracelet around the pipe. Care should be taken at all times not to bend any of the links backwards beyond 180° to avoid damage to the former.

5.2 Scan Direction

It is recommended that the preferred Bracelet scan direction is driving the encoder towards the wedge, dragging the probe as the 'tail' of the scanner. This prevents the wedge from digging in to the surface and potentially lifting off.

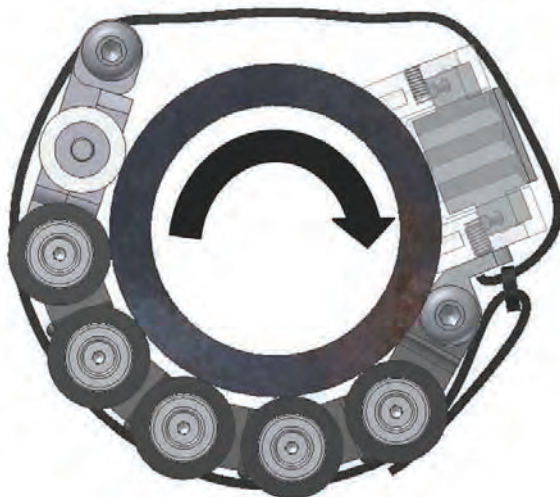


Figure 35 - Recommended Scanning Direction

5.3 Scanning the Opposite Side of the Weld (Single-Sided Inspection)

If it is desired to maintain the encoder direction of scans from two sides of the weld when using a single-sided Bracelet, the following method should be adopted. The probe should be removed from the clasp and reversed. This operation will require swapping the bar to the opposite side of the wedge, or fitting the wedge with two bars for a quicker operation. With the probe refitted in the clasp, the Bracelet can then be repositioned on the opposite side of the weld. Figure 36 shows the two setups when scanning the two sides of the weld when it is important to maintain encoder direction.

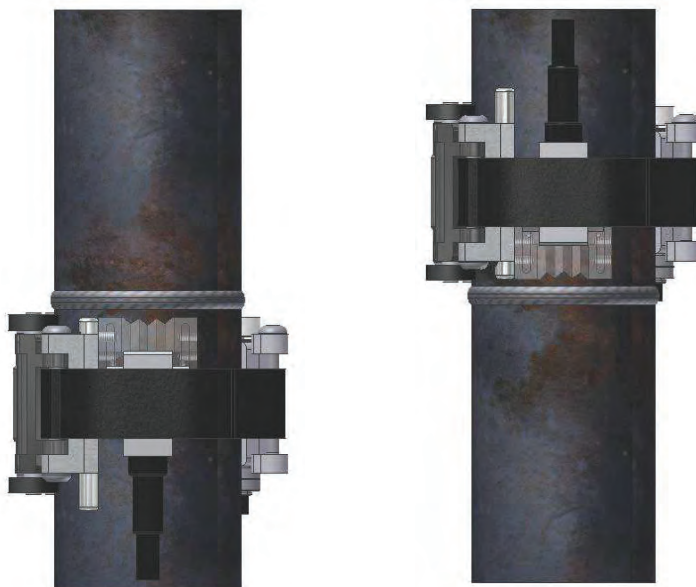


Figure 36 - Probe Repositioning to Scan Opposite Side

An alternative option is to change the encoder polarity setting in the instrument for the two sides of the inspection and simply remove the Bracelet from one side and reattach upside down on the opposite side of the weld.

6. Specifications

6.1 Single Sided Bracelet

NPS	0.5"	0.75"	1"	1.25"	1.5"	2"	2.5"	3"	3.5"	4"
No. of Links	1	2	3	4	5	8	10	14	16	20
No. of Wheels	4	6	8	10	6	8	10	14	16	20
Wedge Attachment Type	Fixed Bracket	Fixed Bracket	Fixed Bracket	Fixed Bracket	1.5"-2.5" Clasp	1.5"-2.5" Clasp	1.5"-2.5" Clasp	3" - 4" Clasp	3" - 4" Clasp	3" - 4" Clasp
Strap Style	Long	Long	Long	Long	Short	Short	Short	Short	Short	Short
Former	-	-	-	-	1.5"	2"	2.5"	3"	3.5"	4"

NPS	4.5"	5"	6"	8"	10"	12"
No. of Links	22	25	30	41	52	63
No. of Wheels	22	25	30	41	52	63
Wedge Attachment Type	4" - 6" Clasp	4" - 6" Clasp	4" - 6" Clasp	8" + Clasp	8" + Clasp	8" + Clasp
Strap Style	Short	Short	Short	Short	Short	Short
Former	-	-	-	-	-	-

6.2 Dual Sided Bracelet

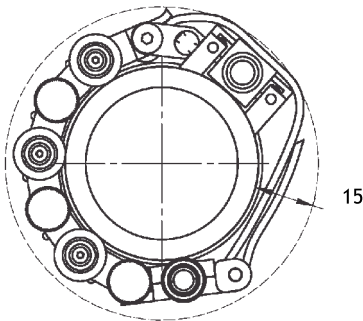
NPS	1.5"	2"	2.5"	3"	3.5"	4"
No. of Links	12	18	22	30	34	42
No. of Wheels	12	18	22	30	34	42
No. of Separators	2	2	3	4	5	6
Wedge Attachment Type	1.5"-2.5" Clasp	1.5"-2.5" Clasp	1.5"-2.5" Clasp	3"-4" Clasp	3"-4" Clasp	3"-4" Clasp
Former	1.5"	2"	2.5"	3"	3.5"	4"

6.3 Encoder

The encoder resolution is 38 quad counts/mm

6.4 Bracelet Radial Height

When assembled onto the pipe with the strap attached over the probe, the Bracelet fits within a 15mm radial envelope.



7. Maintenance

A number of checks should be made prior to inspection to ensure the correct performance of the scanner

7.1 Encoder Wheel

The encoder wheel should be kept clean. Before use, the wheel should be checked for damage or wear and if necessary replaced. Check that the wheel turns without sticking or seizing.

7.2 Wear of Wedges

The contact surface of the probe wedge is expected to wear down after many hours of operation. The wedges should be checked periodically for excessive wear which may affect the inspection and replaced if necessary.

7.3 Strap

The strap should be checked before use for damage or contamination and replaced if necessary. Ensure it is clean enough to secure the Bracelet in position.

7.4 Precautions

Care must be taken during assembly and scanning not to cause damage to the probe by pulling or kinking the phased array cable. For each scan one 360° rotation should be made and then the probe rotated back to the original position to avoid wrapping the phased array cable around the pipe too many times.

It is important that Bracelet scanners with a former are not opened beyond 180° as this is likely to put a permanent kink in the former.

8. Accessories

Phoenix supply a range of accessories for use with the Bracelet scanner:

- PA-WBRA-7.5L16 Miniature phased array probes
- WPA-WBRA-60S-IM Phased array wedges (can be contoured to your specification)
- Various contoured BTB calibration blocks
- AE-CDS Couplant Delivery System

For further information about accessories or to place an order, contact the sales team:

t: +44 (0) 1925 826 000 | **e:** sales@phoenixisl.com

Scan

For more information



Or visit www.phoenixisl.com/bracelet

Ver. 4

Contact Us

Phoenix Inspection Systems Limited

Dalton House, 40 Hardwick Grange,
Warrington, WA1 4RF, United Kingdom

t: +44 (0) 1925 826 000

f: +44 (0) 1925 838 788

e: sales@phoenixisl.com

www.phoenixisl.com

