Ether NDE Application Note: AP001

EDDY CURRENT WELD INSPECTION

Eddy Current Weld Probes are specifically designed for the task of weld inspection of non-ferrous welds and steel structures. They can detect surface cracks on a weld with a non-conductive surface coating on it of up to 2mm.
The application specific design of the probe means that it is capable of inspecting welds with uneven surfaces and coatings on them.
Welds are often coated or painted making access to the weld for inspection more complicated when using other methods to Eddy Current (EC). For example, MPI and Dye Penetrant Inspection require the removal of the coating before inspection, costing both money and time. Eddy current (ECT) Weld Probes allow welds to be efficiently inspected for near-surface cracks because the weld can be inspected through paint or metallic coatings.

In-Service Inspection of Coated Steel Welds Using Eddy-Current Techniques

The WeldCheck range is designed for flaw detection and evaluation using the Eddy Current non-destructive testing (NDT) inspection method particularly for use (but not exclusively) in Eddy Current Weld Inspection to “ISO 17643:2015 Eddy current examination of welds by complex plane analysis” (was BS EN 1711).

ETher NDE recommends the following probe package to perform Weld Inspections according to the British Standard EN ISO 17643:2015.

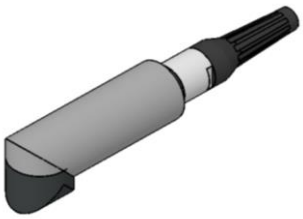
KAWEL001 - KIT, Weld, Probes + Accessories. Including:

Probe, Weld, Dia 16.00mm (Medium) 100kHz, , Straight, Disconnect	PWM100S000	1
Probe, Unshielded, Broad Band, 100k , (35kHz-250kHz), BNC	PUB100K	1
Accessory. Test Block, Weld Probe, Ferrous , (Steel EN1A) + x4 0.5mm Shims, 0.5, 1.0, 2.0mm slots	ATBW	1
Accessory, Lead, Lemo 12-Way - Lemo 4-Way, 1.5m (Bridge)	ALL12-L04-015B	1
Accessory, Lead, Lemo 00 to BNC, 1.5m	ALLCX-B02-015A	1
Accessory, Butterfly PTFE Tape (Pack of 30)	AW003	1
Accessory, Deluxe Probe Case PHDC1	AC002	1

PROBE SELECTION

1. Standard Weld probes - Bridge

Straight



90° Inline

90° Transverse

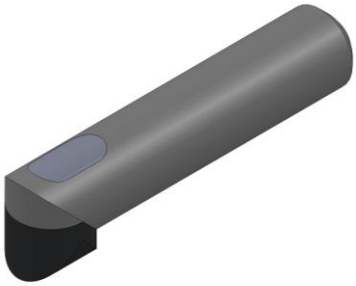
Application: Differential Weld probes - for in-service inspection of welded structures.

Specification:

- Straight, 90deg Inline, 90deg Right Angle
- Diameters, 11.0 (Small), 16 (Medium), 32mm (Large)
- Disconnectable and integral probe cables
- Cable lengths from 1.5 to 50meters
- Frequency range 100kH, 20kHz, 100-600kHz
- Minimal lift off signal, can find cracks though paint, oil and conductive and non-conductive coatings
- Made from hard wearing PET
- Stainless steel and ceramic tips available on request

Notes:
100kHz probes used on standard ferrous welds
100-600kHz probe can be used on Aluminium and Stainless Steel welds
20kHz probe can be used on multi-surface applications and Duplex

2. Disconnect Weld Probes – Bridge

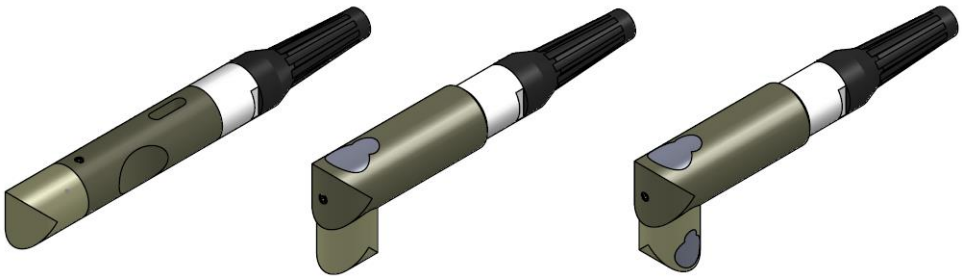


A full range of disconnectable weld probes available for quick interchange.

3. Under Water Weld Probes – Bridge

Application: Under water In-service inspection of welded structures, max length 100meters.

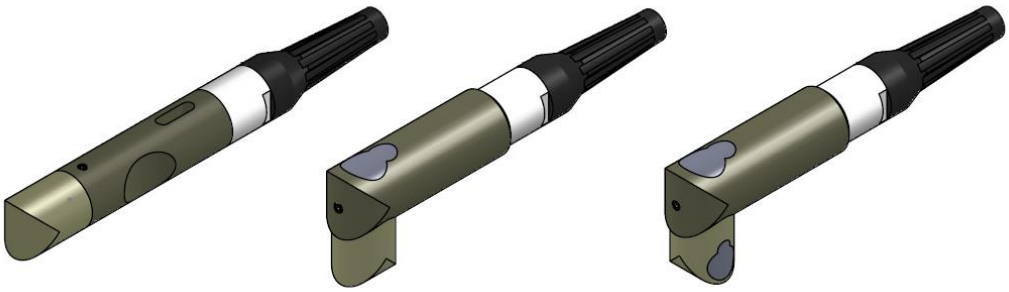
4. **High Temp Ceramic Tipped Weld Probes – Bridge**



Straight **90° Inline** **90° Transverse**

Application: In-service inspection of welded structures, works to a touch temperature of 200degC.

5. **Stainless Steel Tipped Weld Probes - Bridge**



Straight **90° Inline** **90° Transverse**

Application: In-service inspection of welded structures, with high wear resistance.

6. **Miniature Weld Probes – Bridge**

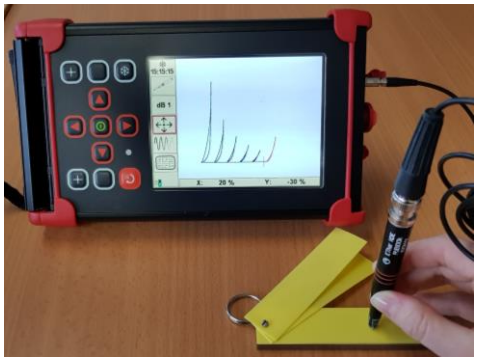
Straight **90° Inline**

Application: In-service inspection of welded structures, 100kHz, for those hard to reach/confined space inspection areas.

7. **Flat Faced and Stainless Steel Dome Faced**

TEST PROCEDURE

1. Procedure for measuring coating thickness and material comparison relative to calibration block



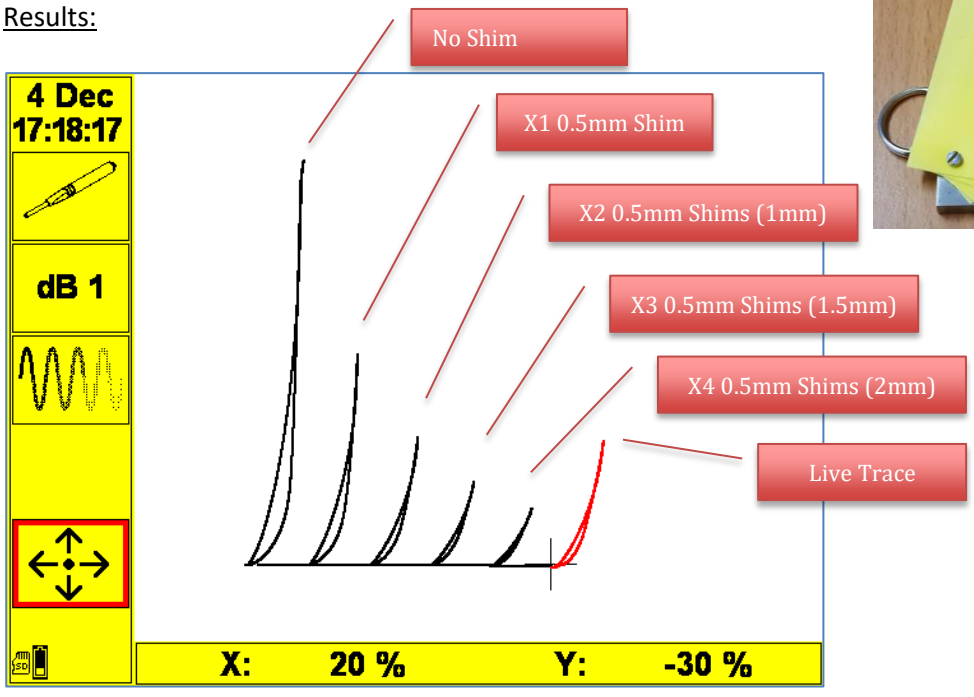
Equipment required:
Probe: Unshielded, Broad Band, 100k - PUB100K
Accessory: Lead, Lemo 00 to BNC, 1.5m - ALLCX-B02-015A
Steel Test Block with 3 slots: 0.5, 1.0, 2.0mm and 4 - 0.5 mm shims - ATBW

Setup:

1. Connect probe to cable and connect to the instrument.
2. Switch instrument on.
3. Use the cursors to scroll the menu until Load & Save is highlighted, press Enter key. Use the up down cursor to select PAINT WELD, select the load icon and press Enter.
4. The main Operating screen will appear as soon as the setup has been recalled.
5. Place the probe on the test block and Press Balance
6. Select the offset Icon on the front panel.
7. Adjust gain and phase as required to set the lift off vertical by either using the Probe Phase Item or the Quick-Menu.
8. Then moving the X Offset create the trace for the 4 shims.
9. Set Trace function on and store trace (this gives a black version of the image) to enable easy comparison.

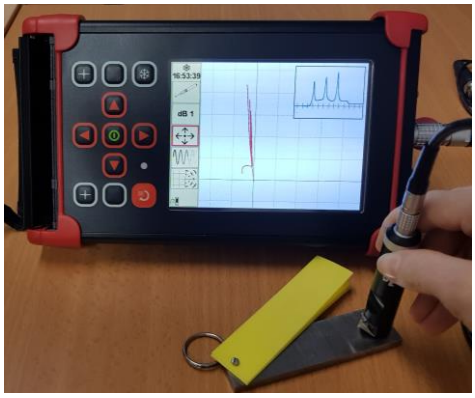
- CH1 -		Summary - Alarm -		- Probe -	
Freq	100 kHz	Source	1st	Drive:	0 dB
Phase	90.0 °	Action		Type	Absolute
Gain X	17.0 dB	Stretch	500ms	Load	Auto
Gain Y	17.0 dB	Type	Off	- Panes -	
Input gain:	12 dB	- Offset -		Pane 1	XY
High Pass	DC	P1 XY	-30,-30 %	Source	Ch 1
Low Pass	11	P2 XY	0,-25 %	Pane 2	Off
				Source	Ch 1

Results:



Material and Coating Thickness Variations Using the Absolute Coil

2. Procedure for testing welds in ferritic materials



2.1 Calibration

The material of the calibration block should be similar to the test piece.

Equipment required:

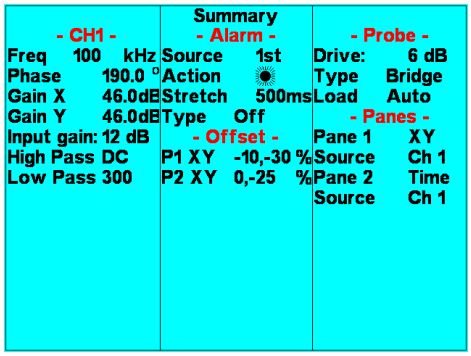
Probe: 100kHz Weld Probe Bridge – PWM100S000

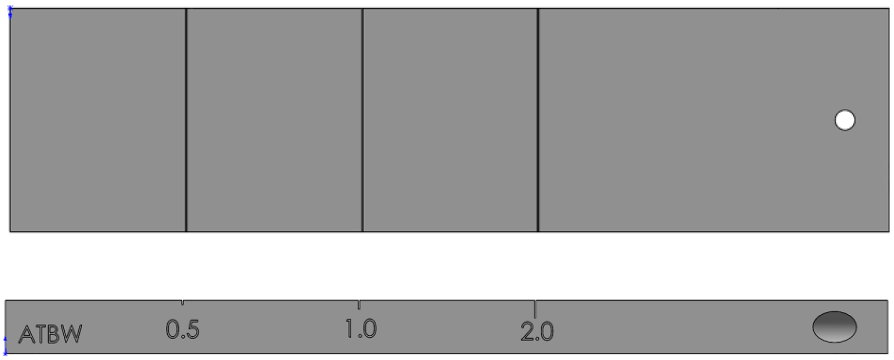
Accessory: Lead, Lemo 12-Way to Lemo 4-Way Bridge Type – ALL12-L04-015B

Steel Test Block with 3 slots: 0.5, 1.0, 2.0mm and 4 - 0.5 mm shims - ATBW

Setup:

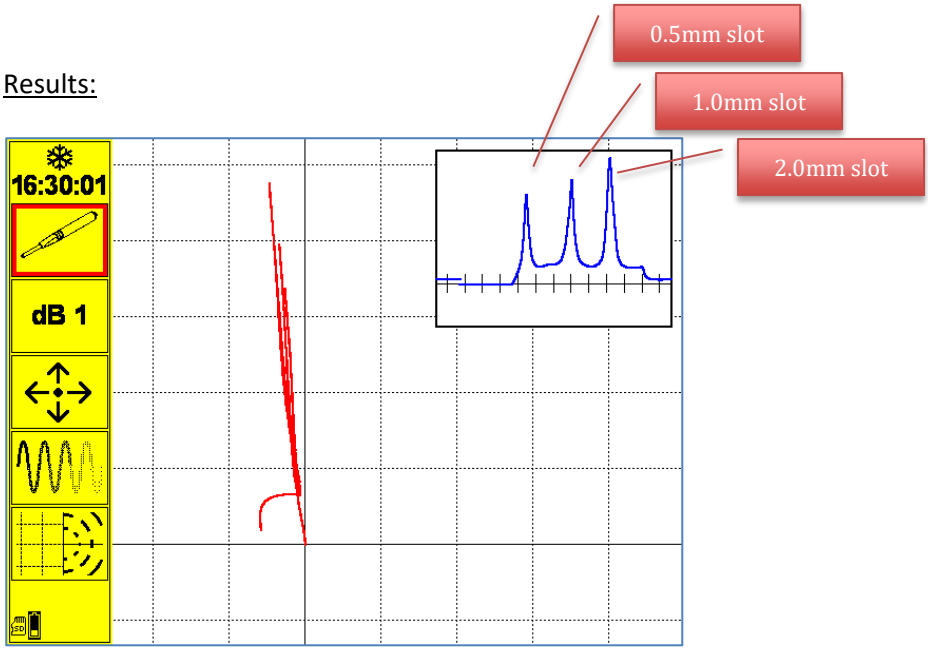
1. Connect probe to cable and connect to the instrument.
2. Switch instrument on.
3. Use the cursors to scroll the menu until Load & Save is highlighted, press Enter key. Use the up down cursor to select Weld 100kHz, select the load icon and press Enter.
4. The main Operating screen will appear as soon as the setup has been recalled.
5. Place the probe on the test block and Press Balance
6. Move the probe over the defects.
7. If more or less sensitivity is required, use the Gain (dB key) or Quick-Menu to increase or decrease signal amplitude as required.
8. Adjust the phase to set the defect signal vertical by either using the Probe Phase Item or the Quick-Menu
9. Carry out scan of component.





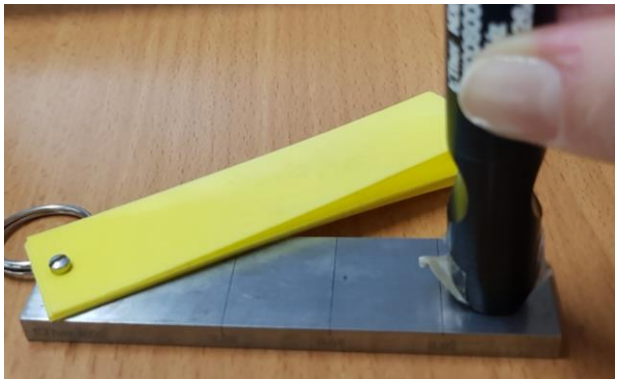
Calibration Block with 0.5, 1.0 and 2.0mm Deep Spark Eroded Slots

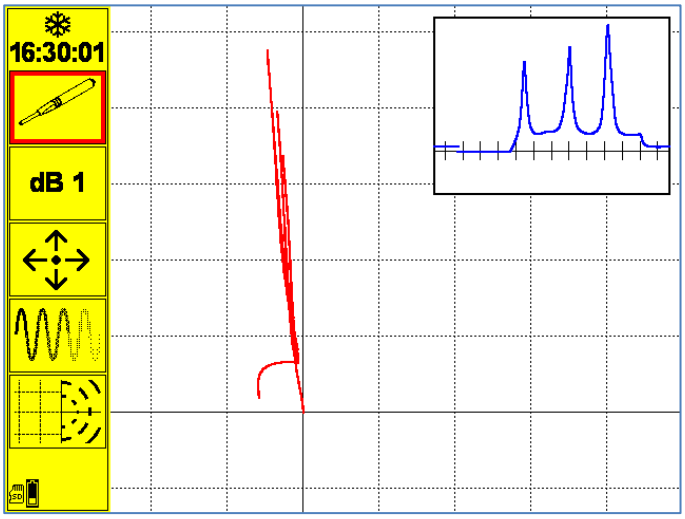
Results:



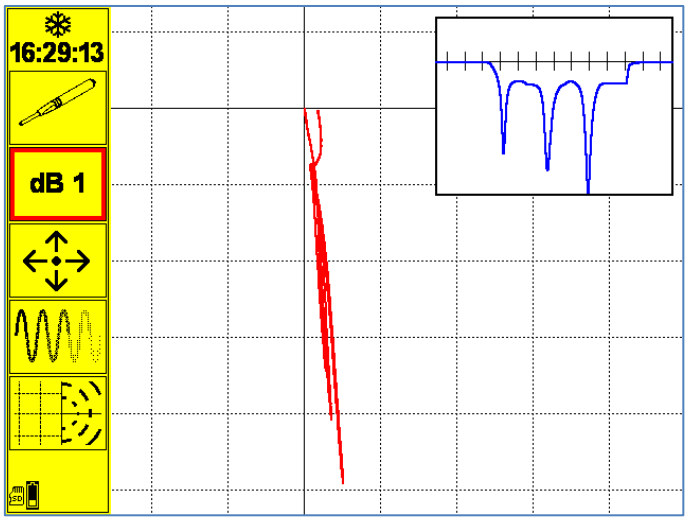
NOTE:
The phase angle of the defect signals is relative to the orientation of the defect to coils. See below.

Tangential, side view:

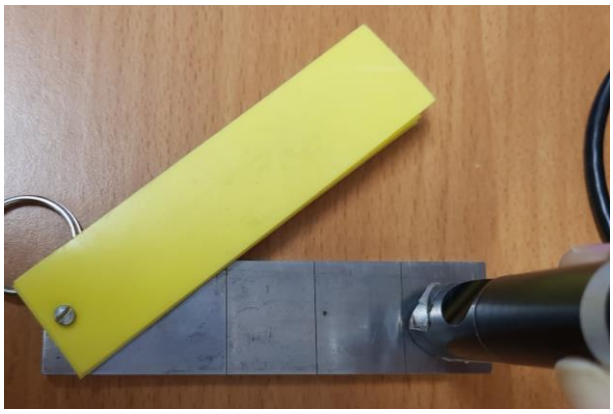


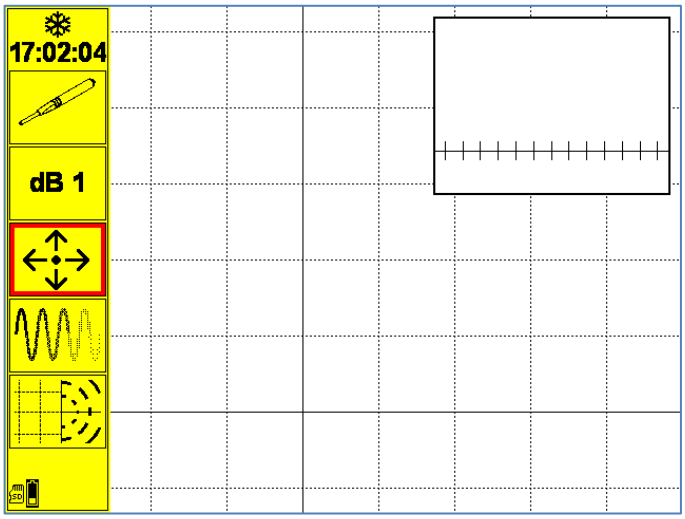


Tangential, front and rear view:

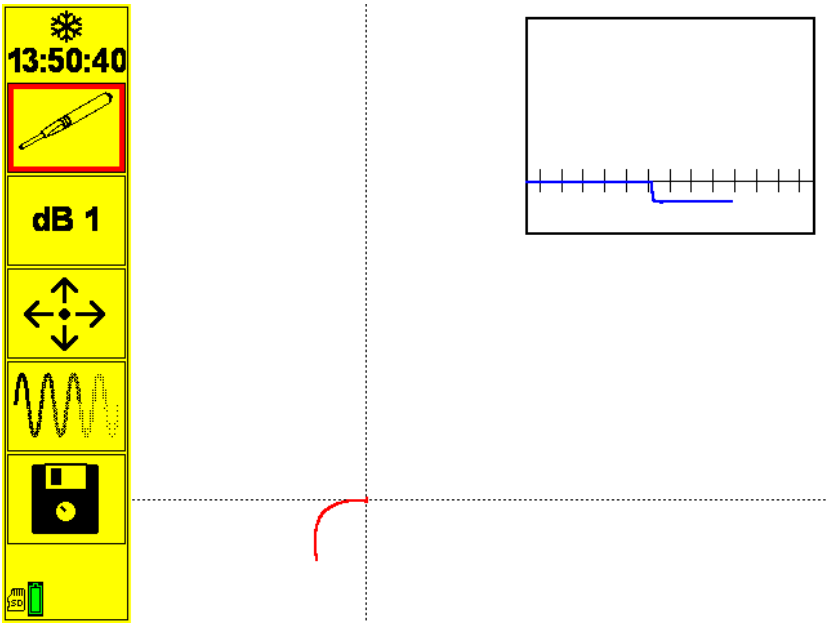


NO defect will be detected if the probe is 45° to the defect:





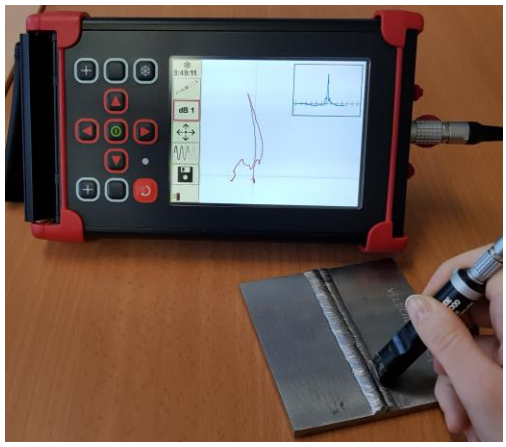
Lift Off signal:



2.2 Scanning

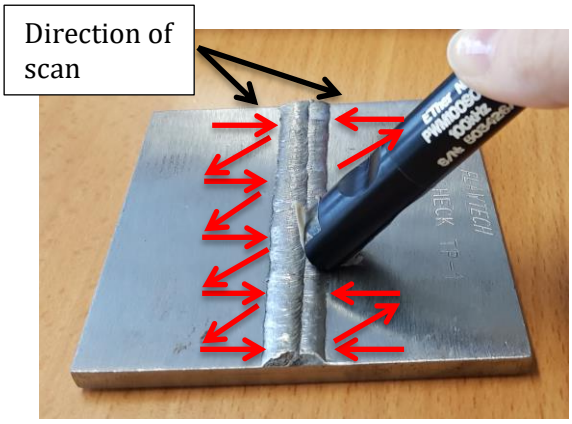
- The probe should be moved perpendicular to the main direction of the defect, if this is unknown or if the defect has different directions, two scans should be performed, one perpendicular to the other.

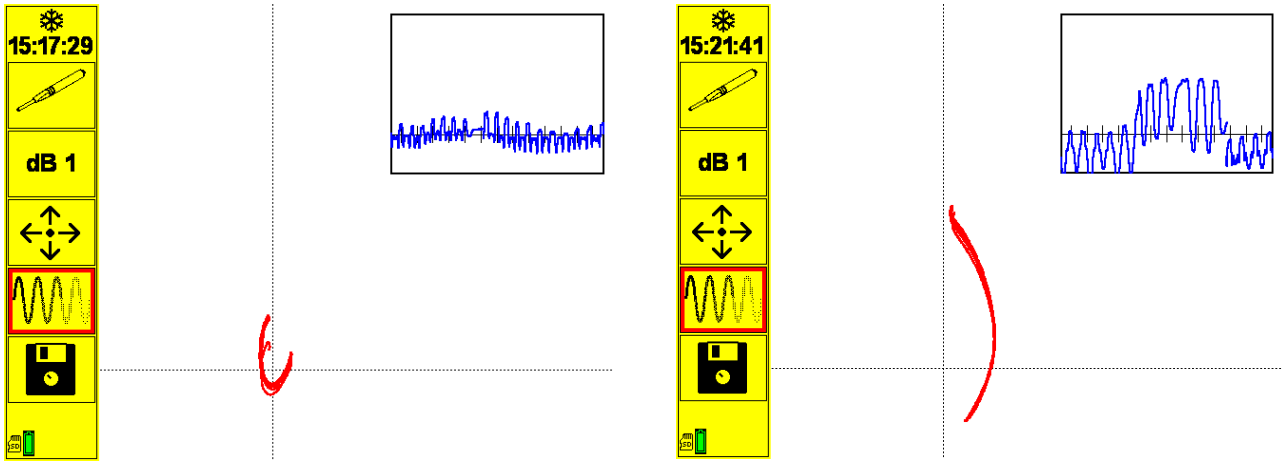
- CH1 -		Summary - Alarm -		- Probe -	
Freq	100 kHz	Source	1st	Drive:	6 dB
Phase	190.0 °	Action		Type	Bridge
Gain X	46.0dB	Stretch	500ms	Load	Auto
Gain Y	46.0dB	Type	Off	- Panes -	
Input gain:	12 dB	- Offset -		Pane 1	XY
High Pass	DC	P1 XY	-10,-30 %	Source	Ch 1
Low Pass	300	P2 XY	0,-25 %	Pane 2	Time
				Source	Ch 1



In order to scan the material, multiple scans need to performed. These are:

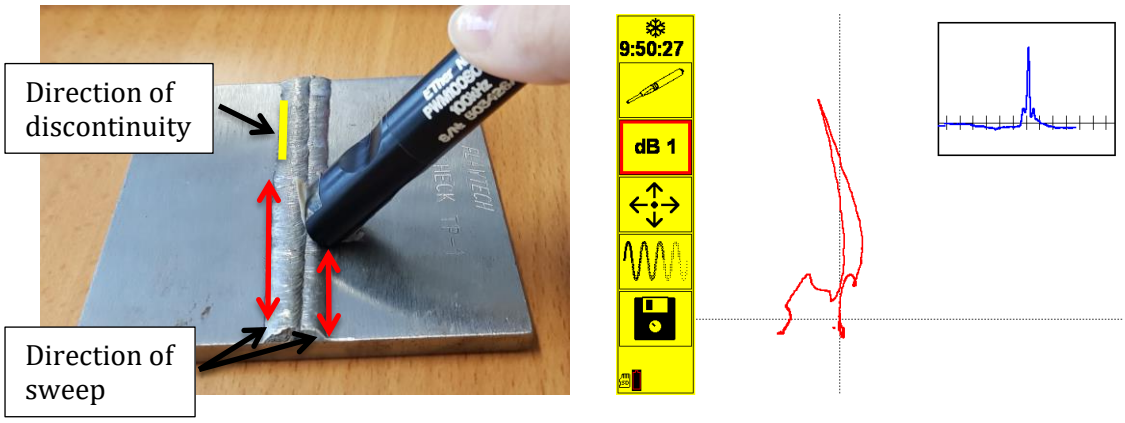
2.2.1 Zig zag scan in the heat affected zone along the length of the toe



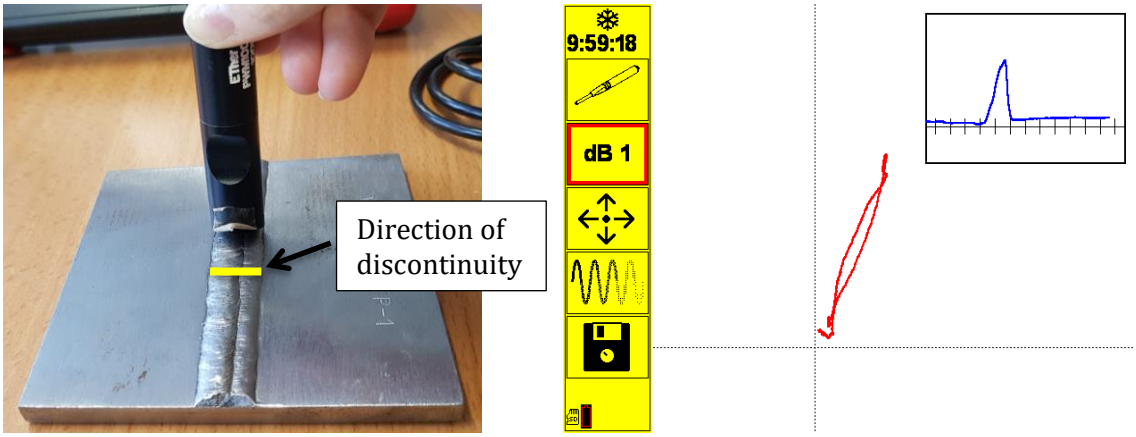


Defect FREE signal **DEFECT signal**

2.2.2 Sweep along the toe



2.2.3 Scan of the weld surface



NOTE:

The detectability of the discontinuities may be affected by:

- The material of the calibration block
- Conductive or non-conductive coating, which reduce the sensitivity of the test
- Orientation of coils to the discontinuity
- Geometry of the component