

DA 45x improved features for a successful family of thickness probes

Dialog-Probes DA 45x

Introduction of new Dialog-Probes for the DA 45x series:

DA 451 (5 MHz, 1.2 - 200 mm steel)

DA 453 (2 MHz, 5 - 300 mm steel)

DA 458 (800 kHz, 5 - 60 mm austenit)

DA 461 (5 MHz, 1.2 - 200 mm steel)

DA 462 (10 MHz, 0.6 - 50 mm steel)

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State of the Art:

There is already a wide range of T/R probes designed for Thickness Gauge families

DM 4 and DMS 2

w/o Dialog capability:

DA 301, DA 303, DA 0.8G, DA 311, DA 312

with Dialog capability:

DA 401, DA 403, DA 408, DA 411, DA 412

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Why do we need another Series ?

To answer this question we must firstly become acquainted with the properties and differences of both the existing series!

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Properties of DA 30x series probes:



Originally designed for the DM 3, they set standards in the Thickness Measurement markets

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Properties of DA 30x series probes:

- Compatible to ALL Krautkramer Thickness Gauges from DM 2 (except DA 303) to DMS 2
- Measuring range: 0.6 - 300 mm in steel (long) from thin metal sheets to thick walls
- 0.8 - 10 MHz probe mid-frequencies for most materials
- Automatic Zeroing after probe coupling just before Thickness Measurement (ON-Block-Zeroing)
- Zeroing performed at one side only (transmitter)
- Vpath correction for normal mode: provided by the Gauges (DM 3, DM 4, DMS 2)
- Vpath correction for Dual-Multi mode (VWPath): not included
- Breakpoints for Vpath correction: preset in the Gauges (DM 3, DM 4, DMS 2)
Measurement accuracy with Vpath correction: +- 0.1 mm
- No Dialog capability

- Many Special Probes produced by modifying the standard: e.g. DA 312 B 16/29

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Properties of DA 40x series probes:

having the same mechanical and acoustical properties there is only one difference:
a tiny electronic chip containing individual information of the particular probe

- Compatible to ALL Krautkramer-Thickness Gauges from DM 2 (except DA 403) to DMS 2
- Measuring range: 0.6 - 300 mm in steel (long) from thin metal sheets to thick walls
- 0.8 - 10 MHz probe mid-frequencies for most materials
- Automatic Zeroing before probe coupling to the material under test (against air: OFF-Block-Zeroing), connected to a DM 3, DA 40x acts as an ON-Block Zeroing probe
- Zeroing performed at one side only (transmitter)
- Vpath correction for normal mode: provided by the probe (DM 4, DMS 2)
- Vpath correction for Dual-Multi mode (VWPath): preset in the Gauges (DM 4, DMS 2)
- Breakpoints for Vpath correction: provided by the Gauges (DM 3, DM 4, DMS 2)
- Measurement accuracy with Vpath correction: ± 0.1 mm
- Dialog capability for probe type, name, and serial number

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Properties of DA 40x series probes:

Contents of the Dialog chip in probe DA 401, serial number: 2517

```
Probe Serial Number ..... : 2517
Probe Name ..... : DA401
Dual Probe Type Number ..... : 0003 (DA401)
  int.VPath Correction in mm ..... : 0.62 0.58 0.40 0.29 0.18 0.31
  int.VPath Breakpoints in mm at .... : 1.20 1.60 10.00 20.00 50.00 150.00
  int.VWPath Correction in mm ..... : 0.10 0.08 0.06 0.00 0.00 0.00
ext.VPath Correction (int.VPBP) in mm : 0.64 0.60 0.38 0.27 0.14 0.20
No. of burnable locations ..... : 230
End of Data (legal)
Previous Probe data was stored on 27.06.2002 at 11:13:14 o'clock
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Properties of DA 45x series probes:

having the same mechanical and acoustical properties there is only one difference:
a tiny electronic chip containing individual information of the particular probe

- Compatible to ALL Krautkramer Thickness Gauges from DM 2 (except DA 453) to DMS 2
- Measuring range: 0.6 - 300 mm in steel (long) from thin metal sheets to thick walls
- 0.8 - 10 MHz probe mid-frequencies for most materials
- Automatic Zeroing after probe coupling just before Thickness Measurement (ON-Block-Zeroing)
- Zeroing performed at both sides (transmitter AND receiver)
- Vpath correction for normal mode: provided by the probe (DM 4, DMS 2)
on the DM 3 DA 45x series probes work the same as DA 30x series probes
- Vpath correction for Dual-Multi mode (VWPath): provided by the probe (DM 4, DMS 2)
- Breakpoints for Vpath correction: provided by the probe
- Measurement accuracy with Vpath correction: ± 0.05 mm
- Angled wear is compensated within certain limits
- Dialogue capability for probe type, name, and serial number

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Properties of DA 45x series probes:

Contents of the dialogue chip in probe DA 451, serial number: 802 (prototype):

```

Probe Serial Number ..... : 802
Probe Name ..... : DA451
Dual Probe Type Number ..... : 0003 (DA401)
  int.VPath Correction in mm ..... : 0.62 0.58 0.40 0.29 0.18 0.31
  int.VPath Breakpoints in mm at .... : 1.20 1.60 10.00 20.00 50.00 150.00
  int.VWPath Correction in mm ..... : 0.10 0.08 0.06 0.00 0.00 0.00
Filter Setting ..... : High
Probe Zero Method ..... : ON-Block Zeroing TX & RX (DA45x)
NOP 16
ext.VPath Breakpoints in mm at +Tc ... : 1.18 2.98 7.97 14.94 19.95 59.94 0 nSec
NOP 20
ext.VPath Correction (ext.VPBP) in mm : 0.46 0.36 0.25 0.16 0.11 0.01
DualMulti VWPath Correction in mm .... : 0.09 0.09 0.04 0.02 0.02 0.02
No. of burnable locations ..... : 163
End of Data (legal)
Previous Probe data was stored on 27.06.2002 at 11:11:52 o'clock
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Differences between DA 301, 401, 451, 461:



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Differences between DA 303, 403, 453:



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Differences between DA 0.8G, 408, 458:



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Differences between DA 312, 412, 462:



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Differences between DA 30x, 40x, 45x:

Parameter Probe type	Zeroing method	Breakpoints preset by the	Vpath correction preset by the
DA 30x	ON-Block, 1 side	Gauge (fixed)	Gauge (fixed)
DA 40x	OFF-Block 1 side	Gauge (fixed)	Probe (individual)
DA 45x	ON-Block both sides	Probe (individual)	Probe (individual)

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The difference between ON-Block and OFF-Block Zeroing

The determination of the probes' delay line length(s) is very important to get optimum thickness measurement results without using a calibration block. The time of flight of minimum one acoustical delay line is therefore measured and subtracted from the total time of flight for the thickness echo.

2 different methods are known:

ON -Block Zeroing: Time(s) of flight of delay line(s) measured AFTER coupling the probe to the material under test

OFF-Block Zeroing: Time(s) of flight of delay line(s) measured BEFORE coupling the probe to the material under test

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The difference between ON-Block and OFF-Block Zeroing

Both procedures have advantages and disadvantages, directly affecting probe selection by the application:

ON -Block Zeroing:

Probe delay lines consist of plastic material. A phase shift occurs if such a probe is coupled to a material, acoustically harder than the delay lines (e.g. steel). All probes of the series DA 45x are designed to expect this phase shift.

If such a probe is coupled to an acoustically softer material, then no phase shift will occur happen, and all thickness values will be wrongly determined and displayed.

OFF-Block Zeroing:

is now the correct answer, because the delay line is measured BEFORE coupling!

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The difference between ON-Block and OFF-Block Zeroing

In many cases material thickness is measured, which has a different temperature compared to the probe, or to be more precise: to the temperature of the probe delay lines. In such cases the following method is available:

ON -Block Zeroing

The time of flight of the delay line(s) is/are determined after coupling to the material immediately BEFORE thickness values are taken. Therefore any kind of temperature dependent deviation of the probe delay line (increase or decrease of delay line length, sound velocity) is principally compensated.

This is the reason for the high reproducibility of thickness values unexpected for T/R probes; a prerequisite for a higher accuracy.

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The difference between ON-Block and OFF-Block Zeroing

OFF-Block Zeroing

is performed when the probe is uncoupled. This means: probe delay is determined against air. Therefore it is of essential importance, that the contact area of all OFF-Block Zeroing probes be cleaned carefully from couplant BEFORE each measurement!

If Zeroing was successful, the quality of material's contract area is not very important. Corroded or curved surfaces can be more or less ignored, only the backwall echo is of importance.

Another difference must be noted:

After switching on a DM 4 or a DMS 2, OFF-Block Zeroing probes need to be zeroed at least once in the uncoupled mode, whereby ON-Block probes can remain coupled permanently...

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The difference between ON-Block- and OFF-Block-Zeroing

All advantages at ONE glance:

Zeroing method For measurements	OFF-BLOCK	ON-BLOCK
on hot and cold material surfaces	-	+++
on rough surfaces	++	-
on curved surfaces	++	+
on plastic materials	+++	-
with probes worn at an angle	-	++
With high reproducibility	-	+++

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The difference between ON-Block and OFF-Block Zeroing

All Thickness Gauges react differently:

Probe series Gauge	DA 40x	DA 30x	DA 45x
DM 3	ON1	ON1	ON1
DM 4 - AUTO	OFF1	OFF1	ON2
DM 4 – DA_3	OFF1	ON1	ON2
DMS 2	OFF1	ON1	ON2

ON1 = ON-Block Zeroing on one side (transmitter)

ON2 = ON-Block Zeroing on both sides (transmitter + receiver)

OFF1 = OFF-Block Zeroing on one side (transmitter)