

KappaWave

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This manual was prepared to help the ultrasonic operator to fully exploit the capability of the instrument.

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Labels and information

A label is attached to the back of the instrument as shown in the following figure.

Essential information on battery, storage and calibration steps are provided. Do not remove these labels.

 Ultrasonic flaw detector Model K1. Serial No: 		
<p>Battery: 11.1V Li-Ion, 8.8 Ah Operating time: 14 Hours Power input for battery charging: 220V AC. Operating temp: 0-55° C Charge only in 0-40° C room temperature.</p>	<p>CAUTION: Recharge battery immediately after use. Serious damages may occur if used with any other battery. UFD will use AC power if supplied & changes to battery only when AC power is unavailable. Turn off the unit for battery charging. Disconnect from mains once the battery charging is complete.</p> <p>Press power button to turn on or off. For alternate power off, press & hold ESC key. Refer to operating manual supplied for detailed features & calibration steps. Use the protective cover supplied. Always transport in the protective bag. Avoid exposing power & other sockets to water. Keep display side up if placed horizontally. Do not place any heavy objects on the touch screen display.</p>	<p>0-100mm Range Calibration Steps with NB Probe, using 25mm thickness of V1 block 1. Turn on the equipment 2. Click on Delay and Probe delay one after another and enter both values to zero 3. Click on Velocity and enter 5920 m/Sec 4. Click on Range and enter 100mm 5. Place the probe on the 25mm thickness and set the 1st BWE to 25 division On the display using Probe zero and arrow controls. Use gate for precision 6. Verify calibration by placing the NB probe on 100mm thickness. This echo should appear at 100 divisions. 7. For any range >500mm, set PRFQ to 100Hz Note: Refer to Operation manual for Angle & TR probe calibration steps.</p> <p>0-100mm Range Two Point Calibration Steps with NB Probe, using 25mm thickness of V1 block 1. Turn on the equipment 2. Click on Delay and Probe delay one after another and enter both values to zero 3. Click on Velocity and enter 5920 m/Sec 4. Click on Range and enter 100mm 5. Place the probe on the 25mm thickness and place the gate on the 1st echo and enter THK1. 6. Place the probe on the 25mm thickness and place the gate on the 4th echo and enter THK2. 7. Click on ACAL button to complete. 8. Verify calibration by placing the NB probe on 100mm thickness. This echo should appear at 100 divisions.</p>
<p>Manufactured in India by:</p> <p> 454, Kitiroor North P.O, Thiruvappu, Kottayam - 686020, Kerala. India. E Mail: sales@kappawave.com Web: kappawave.com</p>	<p>LONG STORAGE: Turn on every two months and use the UFD for few hours. Recharge the battery every two months if the UFD is not used for long time.</p> <p>Do not use any sharp object on touch screen. Refer to operating manual for details. Do not open back cover. No user serviceable parts inside. Opening of case invalidates warranty.</p>	

Safety warning

The instrument is transported with the battery connected to the main circuit board. Upon receipt of the instrument, physically check for any damages that may have occurred in transit. In the absence of any visible damages, turn on the unit.

Do not turn on the unit if found with visible damages to the enclosure or display when you receive the unit. Kindly notify the carrier making the delivery of any damage since the carrier is liable for any damages that may have occurred during transportation. Call on the KappaWave number after notifying the carrier about the damages.

Do not touch the inner conductor of the LEMO connectors. This may present an electric shock.

Only the supplied Lithium-ion battery pack should be used with this instrument. Modifying the battery pack or using any other battery packs may present you the risk of serious damage to instrument and user. Do not store the unit in temperature $>55^{\circ}\text{C}$ for long, like in a parked car with the windows rolled up. Wait till the temperature drops to $<50^{\circ}\text{C}$ before operating the unit.

There are no user serviceable parts in this instrument. Should you observe any problems with the unit, call us for an appointment and kindly arrange to return the product to the manufacturer for service.

Cleaning the instrument

Slightly moistened soft cloth may be used to wipe the touch screen display and body. Do not use any solvents, thinners or any petroleum products for cleaning as this may severely affect the touch screen display or coating of the enclosure. If water spill is noticed, immediately wipe dry the liquid.

The display screen is provided with an additional screen guard. It is recommended that you do not remove this during use. Any air bubble that may be seen between the guard and display is normal and is not a defect. If the screen guard is removed, it may not tightly adhere to the display and may require you to replace the guard.

Warranty

KappaWave guarantees KappaWave products to be free from defects in materials and workmanship subject to conditions for a period of 1 year from the purchase date.

KappaWave warranty only covers instrument that has been used in a proper manner as discussed in this operation manual. Excessive abuse, broken seal, attempted unauthorized repair or modification will not be covered under warranty.

This operation manual provides instructions for a proper operation of this instrument. The user or the operator must have theoretical and practical knowledge in ultrasonic testing to fully exploit the capabilities of this instrument to a specific standard or code. KappaWave provides no warranty, expressed or implied, that the techniques, examples & instructions described in this manual are consistent with industry standards nor that do they meet the requirements of any specific application.

Introduction

We thank you for purchasing the KappaWave Ultrasonic flaw detector. The KappaWave Ultrasonic flaw detector K1 is designed for industrial flaw detection in welds, pipes, cast, forged and rolled steel and many other materials. This instrument features a large 26.4cm (10.4) full touch screen display and offers advanced ultrasonic performance. This instrument is made with the best components for a long trouble free use.

Some of the features are given below.

- Built to comply with the requirements of ASTM E 317, IS 12666
- High resolution display with large font for clear reading from a distance
- Very easy and sensitive touch capability.
- Ease of calibration and saving of settings.
- Ease of saving test files and reviewing them in the instrument or computer for reporting
- RF and Video display
- Easy construction of DAC and TCG, Saving and recalling setup files in the equipment.
- Scientific calculator with single touch inch to mm conversion
- Trigonometric functions
- No protruding knobs. Only touch controls.
- USB and VGA output capability
- 2GB Micro SD card on board
- Choice of display colours
- Maximum 1KHz pulse repetition frequency (PRF)
- 2 Energy modes for increased power in coarse materials
- Pulse width control for good resolution
- Auto calibration using 2 thickness or echoes
- Echo fill and store for comparison
- Easy transfer correction with echo store and echo reference
- dB difference from DAC / TCG/ Stored echo
- Lithium-ion battery for 14 hours of continuous use
- No separate battery charger required
- Industrial grade plastic enclosure designed to keep the dust and moisture away.

In the box

1. Ultrasonic Flaw detector with battery
2. Stylus for use on the touch screen
3. Protective cover for instrument and display
4. Padded shoulder strap for instrument
5. Power cord for battery charging
6. Flash drive or CD for KappaWave Interface software
7. USB cable for connecting the instrument to computer
8. Carry bag to safely transport the instrument.
9. Operation manual

Connectors

Using the supplied power cord, the instrument may be connected to a 220V outlet for operation and charging of battery. To charge the battery, plug the cable to the instrument and connect the other end to the wall socket for power connection. Ensure the power socket on the instrument is not wet.

When AC power is supplied and when the instrument is in operation, battery charging does not take place. Instrument automatically switches to battery when the mains supply is interrupted. To charge the battery, turn off the instrument and connect to an AC mains outlet. Do not use an inverter or generator for charging the battery.

Room temperature shall be below 50°C for battery charging. Charging will be delayed in higher temperatures. The instrument may be operated in the field up to 55°C. Ensure the supplied protective cover is in place during field testing work.

The charging status will be indicated on the display during charging. The instrument is designed to display the power status once the charging is complete. Switch off and disconnect from the mains once the charging is complete and also during thunderstorms.

Instrument top view

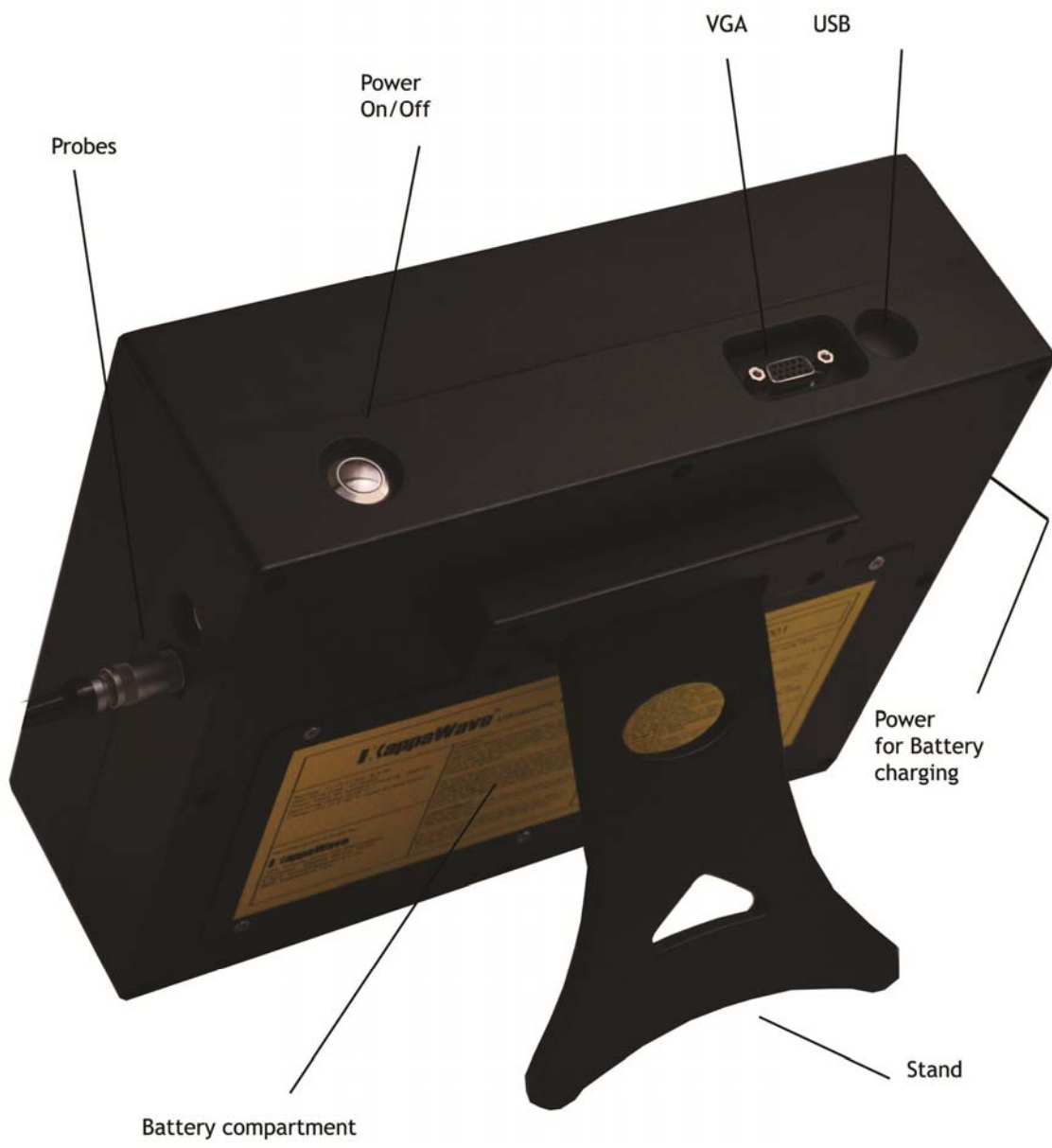


Fig 1. Identification of external connections

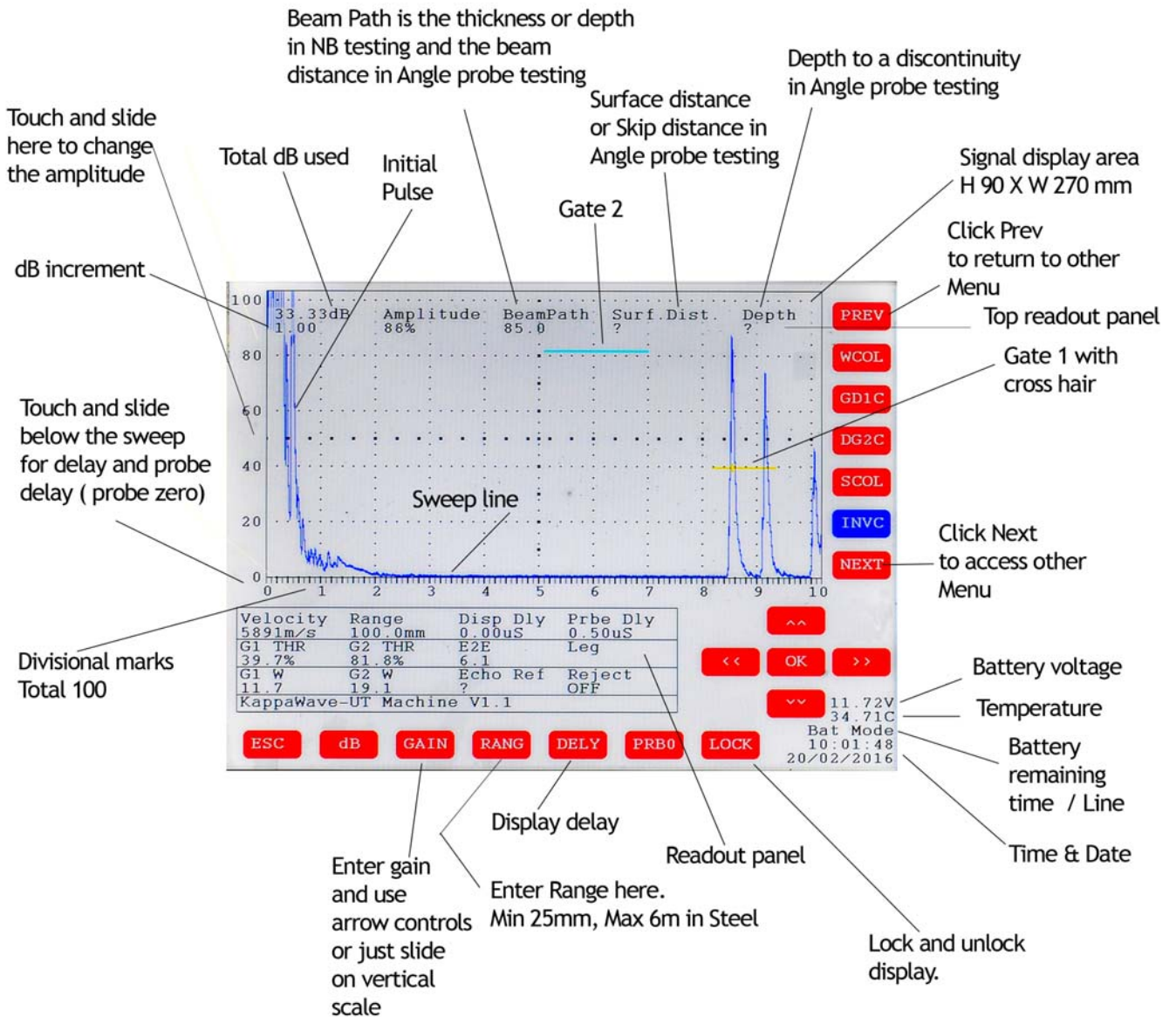


Fig 2. Identification of menu

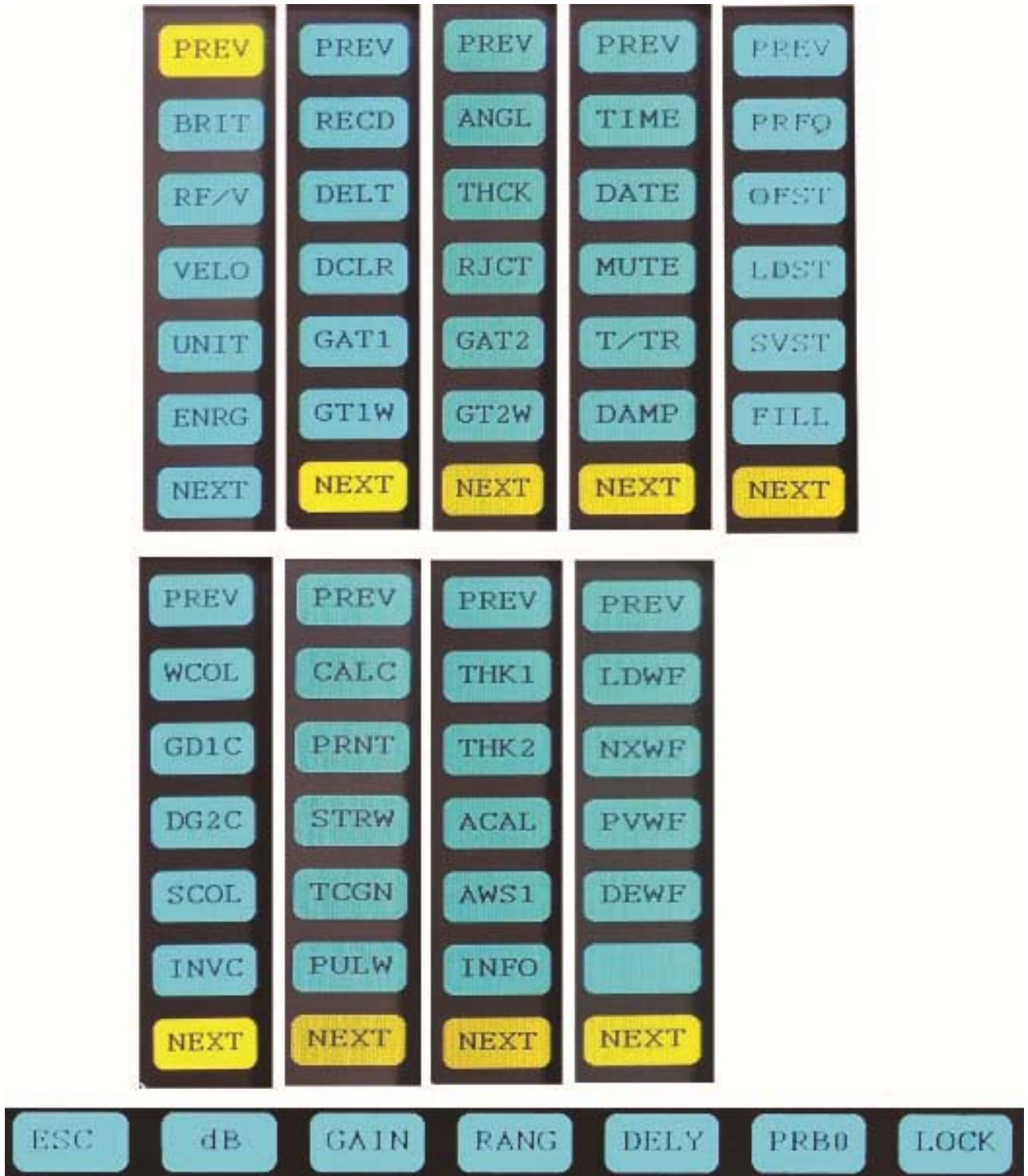


Fig 3. Menu available on the instrument

KappaWave is designed and manufactured with high quality components to give you years of trouble free use. Electronics are housed in a specially built enclosure for tough industrial use.

A carry handle is not provided on the instrument in order to minimize the instrument size. The protective cover is being made with a carry handle and should be used during the field testing work.

A little attention can keep your instrument in good condition.

Avoid direct water spray. Avoid using any sharp object on the touch screen. We would encourage the use of the protective cover to keep the instrument from bumps and extreme weather conditions. It has the essential elements to keep the dust and moisture away.

When storing, either fold the stand and keep the display area up, or if on a table, keep the instrument up with the stand extended. Do not try to lift the instrument by the stand. The stand can be pulled out to a few degrees to keep the unit on a comfortable viewing position.

If required use the supplied shoulder strap for a hands free operation in the field.

Do not keep any heavy objects on display.

Keep the battery fully charged. The charged batteries would drain even when not in use. If the instrument is not in use for a long time, then fully charge the batteries every 2 months and operate the unit for half an hour or more every 2 months.

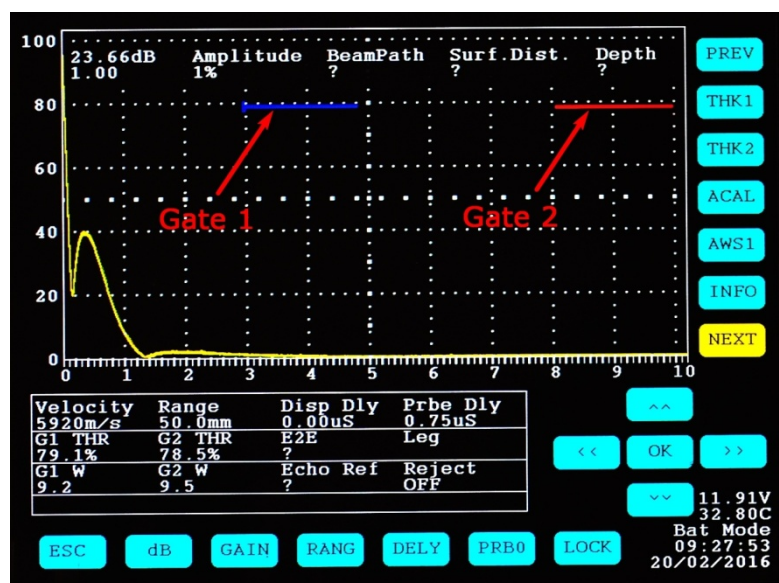


Fig 4. Identifying Gates that may be regularly used for measurements

How to measure with KappaWave instrument

Thickness measurement will require the instrument to be calibrated on a known thickness. There are few ways to measure the beam path or thickness. (1) Count the number of divisions where the signal is at and multiply the number of divisions with the value of each division in a given range or (2) Slide the Gate 1 over any echo and measure the thickness under 'Beam Path' on the top part of the display. Depending on the unit selected, the display could show in mm or inches. By default, the instrument measures the beam path, Surface distance and Depth in mm. (3) if the 1 st BWE can't be resolved well, then the width of the Gate 1 may be extended and placed to cross any 2 BWE. The distance between BWE should give you the thickness of the specimen under test and this can be read at the read out panel below under 'E2E'

Calibration of the instrument to 25mm in steel.

The following materials are required for this exercise:

1. Normal Probe of any frequency and size
2. Connecting cable for probe to the instrument. Please note the instrument is fitted with Lemo sockets for Probes
3. V2 or V1 block
4. Couplant.

Steps to set the range on instrument to 25mm using V2 block using the materials listed above.

1. Select the velocity (VELO) button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
2. Select the range (RANG) button and enter the desired range 25mm and enter 'ok' or =
3. Select the Delay (DELY) button and enter '0' and enter 'ok' or =
4. Apply the couplant on the V2 block and place the Normal probe on the block. (If the probe comes with a soft membrane, then please make sure there is couplant available between the probe and membrane) You should be able to see the Initial pulse and a back wall echo on the display.
5. Select the 'Probe zero' (PRB0) button and if the probe delay is known, then enter that value and enter 'ok', = or ESC

If the probe delay value is not known to you, then using the left or right arrow controls place the 1st back wall echo to 50 divisions on the display. You may also slide below the baseline (sweep) to correctly set the 1st back wall echo to 50 divisions.

6. Check to see whether the 2nd back wall echo is at 100 divisions. Or if V1 block is available, apply some couplant on the large flat surface of the block and check the thickness.

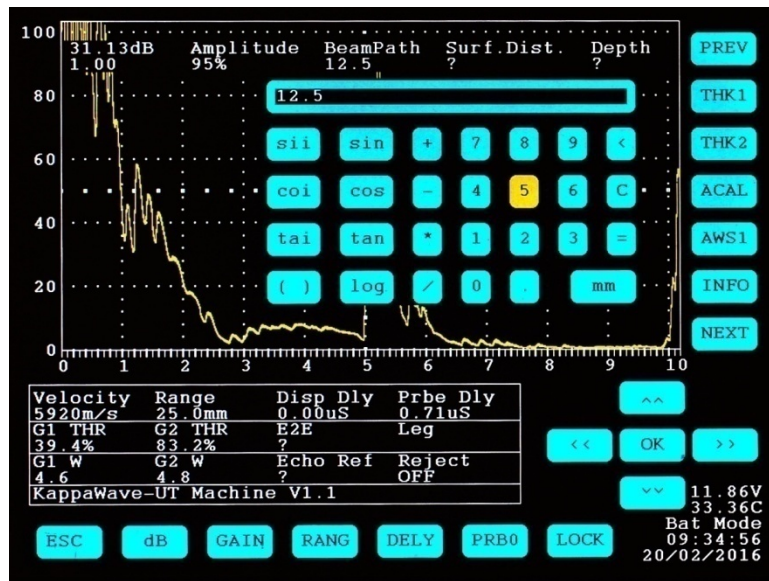


Fig 5. Positioning of echoes and entering data for calibration

Saving and recalling test settings

Once the above results are satisfactory, you may save your settings by entering save settings (SVST) button. Enter a set point number with the up or down arrow keys and enter OK or ESC.

To recall the setting, you may use the load the settings button (LDST) to access any of your set point numbers.

Probe wear and tear and temperature variations may produce different values when the settings are recalled. It is advised to verify your calibration on known reference materials any time prior to use. Use probe zero control to make minor adjustments if any observed during these verifications.

Without changing the velocity and probe delay, if the range is set to another value, say a range of 100mm, it should show 8 BWE from V2 block with the 1st BWE at 12.5 divisions and 8th at 100 divisions. Similarly any range may be calibrated. Large ranges, 500mm and above should be checked on the 100mm or 200mm of V1 block for confirmation.

Should you have difficulty in reading the base, then the floating gate (gate 1) may be used. Just touch and slide the 1st gate on to the echo that you want to measure and it should give readout of Amplitude and beam path for Normal probes.

In the case of Normal probe the beam path is the thickness of the object where the probe is placed. Although the gate may be placed at any height for measurement, we recommend that you place the gate at 40% Full screen height and ensure the signal has about 50-60% amplitude when measured. For signals that are from larger distances, the gain may have to be increased for measurements.

For signals from distances less than 10mm, when measured with a normal probe, ensure the gate is placed at about 20% FSH and sufficient gain is added to bring the signal to at least cross the gate to provide the readout. You may need a well damped, high frequency probe for resolving lower thicknesses. The width of the gate may be adjusted by using the Gate 1 width (GT1W) button. In cases where you have difficulty in reading the 1st BWE, the thickness of the material can be measured using the E2E function.

Just extend the size of the gate 1 to cross two BWE and the thickness can be read under 'E2E'.

If greater accuracy is required, then a 2 point calibration (Auto calibration) may be used. This will require 2 BWE from the same reference block or 2 BWE, placed one after another from 2 different, but essentially same velocity reference materials.

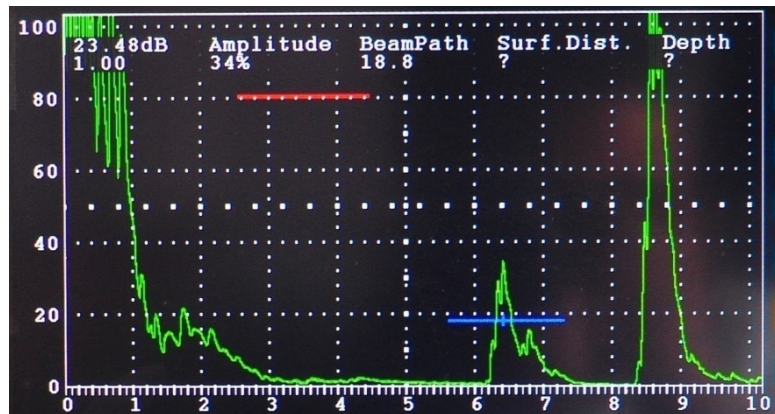


Fig 6. Use of Gate 1 for beam path measurement



Fig 7. Use of Gate 1 to measure the distance between 2 echoes

Steps to set the range on instrument to 25mm using a 2 point calibration (Auto calibration) on V2 block (with multiple back wall echoes)

You may use the same materials that were used in the earlier exercise.

1. Place a normal probe on the V2 block, 12.5mm with sufficient couplant
2. Select the velocity button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
3. Select the range button and enter the desired range 25mm and enter 'ok' or =
4. Select the Delay button and enter '0' and enter 'ok' or =
5. Apply the couplant on the V2 block and place the Normal probe on the block. (If the probe comes with a soft membrane, then please make sure there is couplant available between the probe and membrane) You should be able to see the Initial pulse and a back wall echo on the display.
6. Place the gate 1 over the 1st BWE and enter the thickness 1 (THK1) button
7. Place the gate 1 over the 2nd BWE and enter the thickness 2 (THK2) button.
8. Enter the auto calibration button once (ACAL) and the instrument should automatically adjust the range correctly to 25mm.
9. Verify the accuracy of the calibration on any known reference blocks.

Steps to set the range on instrument to 25mm using a 2 point calibration (Auto calibration) using 2 blocks. (V2 and V1 blocks in this case)

You may use the same materials that were used in the earlier exercise.

It is recommended that you select 2 different thicknesses for calibration which are close to the upper and lower thickness values that you intend to test with.

1. Place a normal probe on the V2 block, 12.5mm with sufficient couplant
2. Select the velocity button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
3. Select the range button and enter the desired range 25mm and enter 'ok' or =
4. Select the Delay button and enter '0' and enter 'ok' or =
5. Apply the couplant on the V2 block and place the Normal probe on the block. (If the probe comes with a soft membrane, then please make sure there is couplant available between the probe and membrane) You should be able to see the Initial pulse and a back wall echo on the display.
6. Place the gate 1 over the 1st BWE and enter the thickness 1 (THK1) button
7. Apply the couplant on the 25mm thickness of V1 block and place the Normal probe
8. Place the gate 1 over the 1st BWE from V1 block and enter the thickness 2 (THK2) button.
8. Enter the auto calibration button (ACAL) and the instrument should automatically adjust the range correctly to 25mm.
9. Verify the accuracy of the calibration on any known reference blocks.

The above steps may be repeated with different thickness blocks for other range calibrations.

Flaw detection with Normal probe

Once appropriate range has been calibrated, the probe may be placed on the test material. Sensitivity may be adjusted in accordance to the standards. Using the Gate 1 and 2 together can provide you an audio visual alert when a flaw is encountered. These can also be set to monitor the changes in the amplitude of a Back wall echo.

In the figure a BWE is set to 80% FSH. The echo was filled in and stored for clarity. After storing, the echo fill was again entered to unfill the echo.

During testing, an unfilled echo was observed and with Gate 1, the amplitude change was monitored. Gate 2 was set to 50% of the BWE and Gate 1 to 20%. When the BWE drops to less than 50% of the stored echo, the alarm will be activated. In the readout area, the 'Echo Ref' provides you the actual difference of echoes in dB. In this case the BWE is 9 dB less than the original setting. (Reference echo was 80% and the reduced BWE amplitude was 28%)

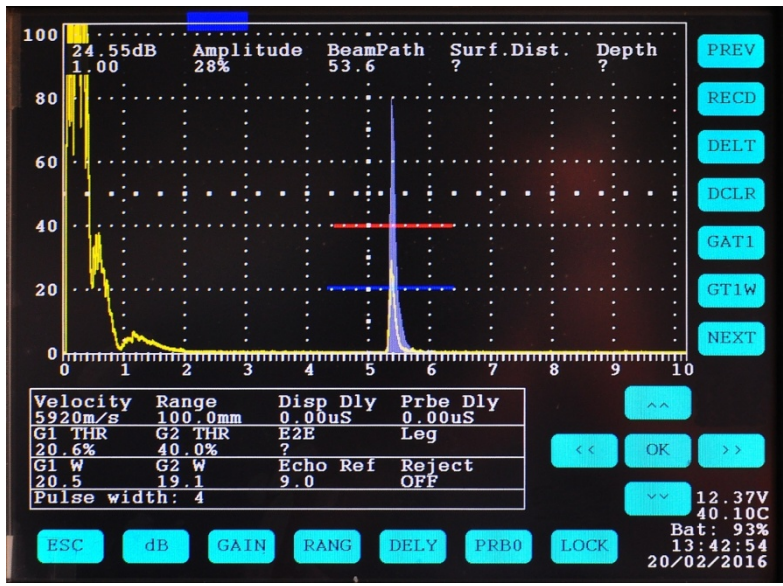


Fig 8. Monitoring Back wall echo amplitude using both gates

Another example is shown in this figure. The BWE was set to 80% FSH. Echo was filled and stored. During testing of a material, both Gates were extended to cover the expected defect locations. When a defect echo appears, an alarm is raised. The instrument gives you a choice of signal colours and the user may use these for appropriate light conditions.

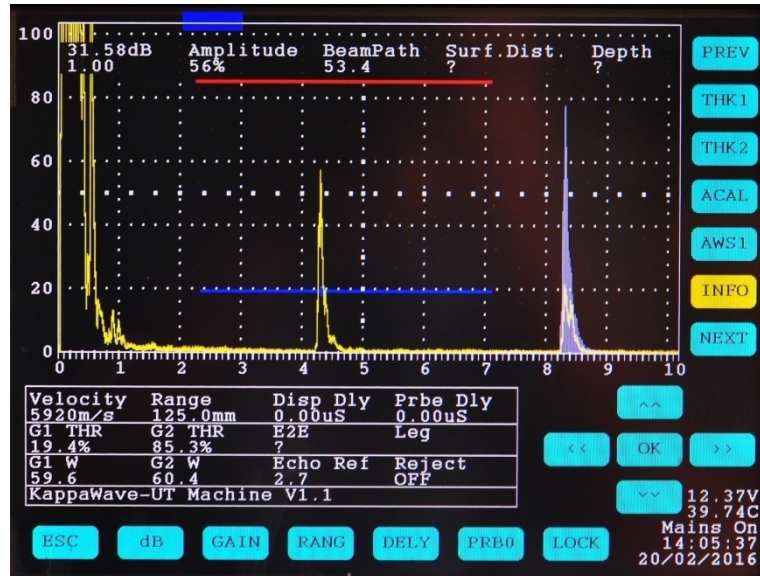


Fig 9. Positioning of both gates for flaw detection

TR Probe Calibration

TR probes are used for low thickness measurements. It becomes very handy when corrosion, erosion or any such condition in a pipe may have to be examined and when the thickness of the test material is less than 10mm. A high frequency normal probe may resolve lower thickness, but in case if the test demands very low thickness measurements that may not be possible with a normal probe, a TR probe may be used.

Since a multiple back wall echo cannot be reliably located with this probe, a 2 point calibration using 2 different thicknesses will be required. Ensure only the first BWE from both materials are used.

Steps to set the range of 25mm with a TR probe on instrument using a 2 point calibration (Auto calibration) using 2 blocks. (V2 and V1 blocks in this case)



Fig 10. TR probe on V2 block

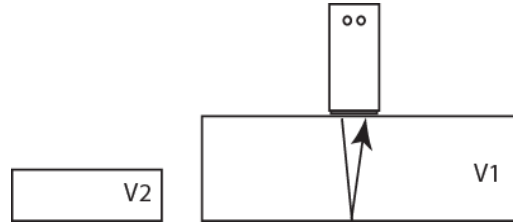


Fig 11. TR probe on V1 block

It is recommended that you select 2 different thicknesses for calibration which are close to the upper and lower thickness values that you intend to test with.

1. Select the probe type from the Menu (T/TR) to 'Dual probe'
2. Select the velocity (VELO) button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
3. Select the range (RANG) button and enter the desired range 25mm and enter 'ok' or =
4. Select the Delay (DELY) button and enter '0' and enter 'ok' or =
5. Apply the couplant on the V2 block and place the TR probe on the block.
6. Place the gate 1 over the 1st BWE and enter the thickness 1 (THK1) button
7. Apply the couplant on the 25mm thickness of V1 block and place the TR probe
8. Place the gate 1 over the 1st BWE from V1 block and enter the thickness 2 (THK2) button.
8. Enter the auto calibration button (ACAL) and the instrument should automatically adjust the range correctly to 25mm.
9. Verify the accuracy of the calibration on any known reference blocks. The instrument should be linear between the thicknesses that were selected for calibration of the range.

Steps to set the range with a TR probe on KW to 30mm using a 2 point (Auto calibration) calibration using 2 blocks. (V2 and V1 blocks in this case)

It is recommended that you select 2 different thicknesses for calibration which are close to the upper and lower thickness values that you intend to test with.

1. Select the probe type from the Menu to 'Dual probe'
2. Select the velocity button and enter the standard steel velocity of 5,920m/sec and enter 'ok' or =
3. Select the range button and enter the desired range 25mm and enter 'ok' or =
4. Select the Delay button and enter '0' and enter 'ok' or =
5. Apply the couplant on the V2 block and place the TR probe on the block.
6. Place the gate 1 over the 1st BWE and enter the thickness 1 (THK1) button
7. Apply the couplant on the 25mm thickness of V1 block and place the TR probe
8. Place the gate 1 over the 1st BWE from V1 block and enter the thickness 2 (THK2) button.
8. Enter the auto calibration button (ACAL) and the instrument should automatically adjust the range correctly to 30mm.
9. Verify the accuracy of the calibration on any known reference blocks. The instrument should be linear between the thicknesses that were selected for calibration of the range.

Use of a TR probe for corrosion monitoring

After calibrating the instrument to 25mm range, the BWE from the test material was set to 80% FSH. Echo was filled and stored. During testing of a material, Signal was unfilled and Gate 1 was extended to cover the reduction in thickness. When a defect echo appears, or if the BWE amplitude drops below specific amplitude, an alarm will be raised if both gates are used. The instrument gives you a choice of signal colours and the user may use these to easily monitor the thickness changes. The images below shows the setting and change of thickness.

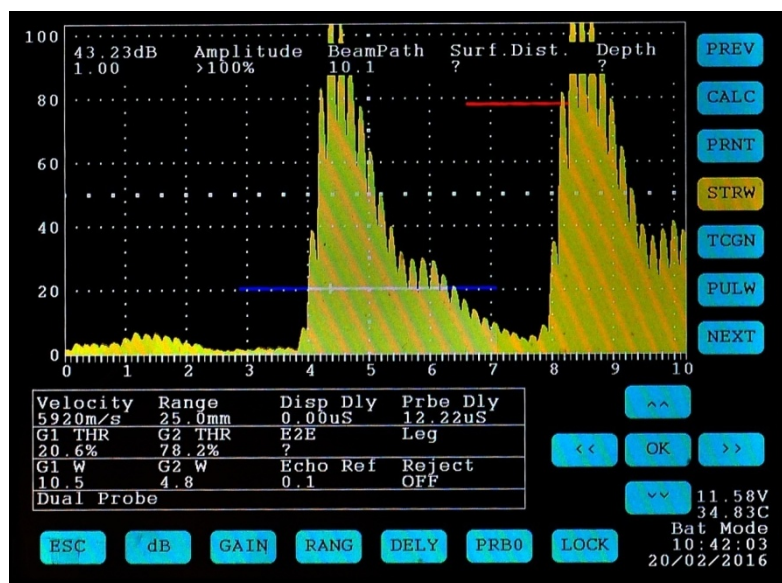


Fig 12. BWE from test material is being stored

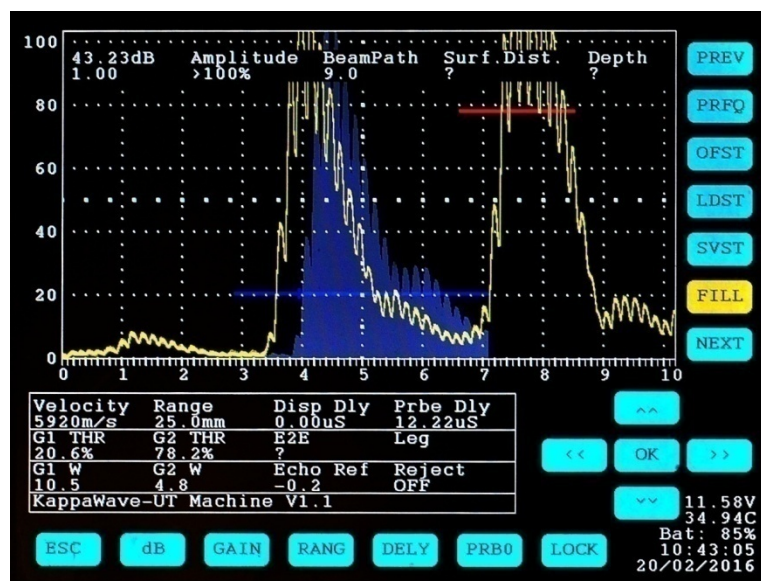


Fig 13. Reduction in thickness can be monitored easily

Angle Probe calibration

The following materials are required for this exercise:

1. Angle Probe of any frequency, size and angle
2. Connecting cable for probe to instrument. Please note the instrument is fitted with Lemo sockets for Probes
3. V2 or V1 block
4. Couplant.

We would suggest that you mark the index point on the probe and verify the angle of the probe. Although this information is not necessary for calibration of the instrument, it can be important when the same probe is used for flaw detection. KappaWave instrument can provide you the Amplitude, Beam path, Surface distance and Depth when used with an angle probe. Changes in the angle from what is written on the probe should be verified and must be entered into the instrument for generating accurate result.

Steps to set the range on instrument to 100 mm using V2 block using the materials listed above.

1. Select the velocity button and enter the standard steel velocity of 3250m/sec and enter 'ok' or =
2. Select the range button and enter the desired range 100mm and enter 'ok' or =
3. Select the Delay button and enter '0' and enter 'ok' or =
4. Apply the couplant on the V2 block and place the Angle probe on the block facing the 25mm radius of the block. You should be able to see the Initial pulse and 2 echoes on the display. If the second echo is not visible on the screen, enter the probe zero to '0' and retry.
5. Slowly move the probe on the above position and maximize the 1st echo on the screen. If the amplitude of the echo is above 100% FSH, then lower the gain (echo height) and maximise the echo again.
6. The cross hair on Gate 1 indicates the maximum amplitude position, if it is positioned above the echo. (Cross hair is identified in the next image with an arrow)
7. Select the 'Probe zero' button and if the probe delay is known, then enter that value and enter 'ok' or =

If the probe delay value is not known to you, then after maximising the 1st echo, use the left or right arrow controls to place the 1st echo to 25 divisions on the display. You may also slide below the baseline (sweep) to correctly set the 1st echo to 25 divisions.

8. Check to see whether the 2nd echo is at 100 divisions. Or if V1 block is available, verify whether the 100mm radius can be measured accurately.

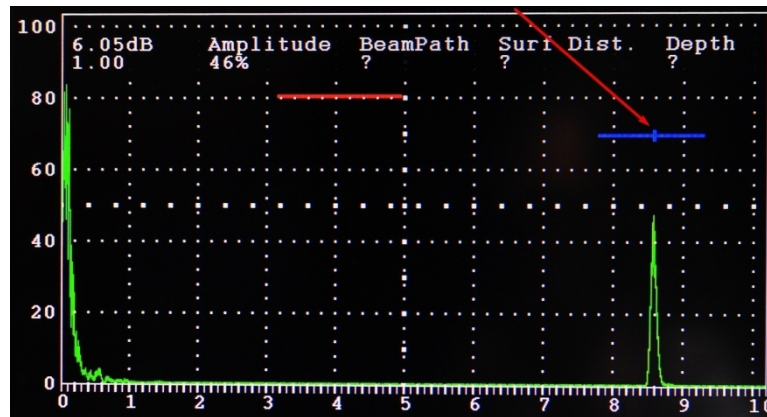


Fig 14. Maximising the echo with the help of a cross hair on the Gate 1

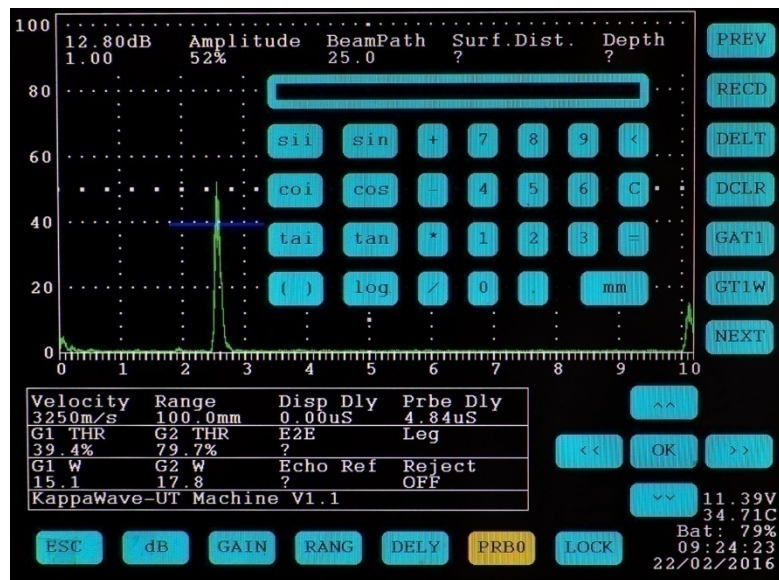


Fig 15. Echo being placed into position with probe zero control

Steps to set the range on instrument to 100mm using a 2 point (Auto calibration) calibration using a V2 block

You may use the same materials that were used in the earlier exercise.

It is recommended that you select 2 different beam paths for calibration which are close to the upper and lower beam path values that you intend to work with.

1. Select the velocity button and enter the standard steel velocity of 3250m/sec and enter 'ok' or =
2. Select the range button and enter the desired range 100mm and enter 'ok' or =
3. Select the Delay button and enter '0' and enter 'ok' or =
4. Apply the couplant on the V2 block and place the Angle probe on the block facing the 25mm radius of the block. You should be able to see the Initial pulse and 2 echoes on the display.
5. Slowly move the probe on the above position and maximize the 1st echo on the screen.
6. The cross hair on Gate 1 indicates the maximum amplitude position, if it is positioned above the echo.
7. Place the Gate 1 on the 1st echo and enter THK 1
8. Place the Gate 1 on the 2nd echo and enter THK 2
9. Enter the auto calibration button (ACAL) and the instrument should automatically adjust the range correctly to 100mm in steel.
8. Verify your calibration on another reference block such as V1.

You may now use the range control to set the instrument to any range of your choice. The instrument should correctly adjust to the range that you have entered provided you have not changed the probe zero, velocity and delay controls.

Partial calibration of the instrument with a Normal probe

There may be cases where the user wants to calibrate to a short range and use the same range to test an area of choice in a given material. In such cases, calibrate as we have mentioned earlier and use the delay (DELY) and arrow controls to place the chosen distance on the screen. In the following example a range of 50mm was calibrated using the 25mm thickness of V1 block and used the delay to display the 7th BWE at 0. After the partial calibration the display shows 175 to 225mm range. The probe was then moved to the 200mm distance on V1 block and the distance is shown on the 50th division on display.

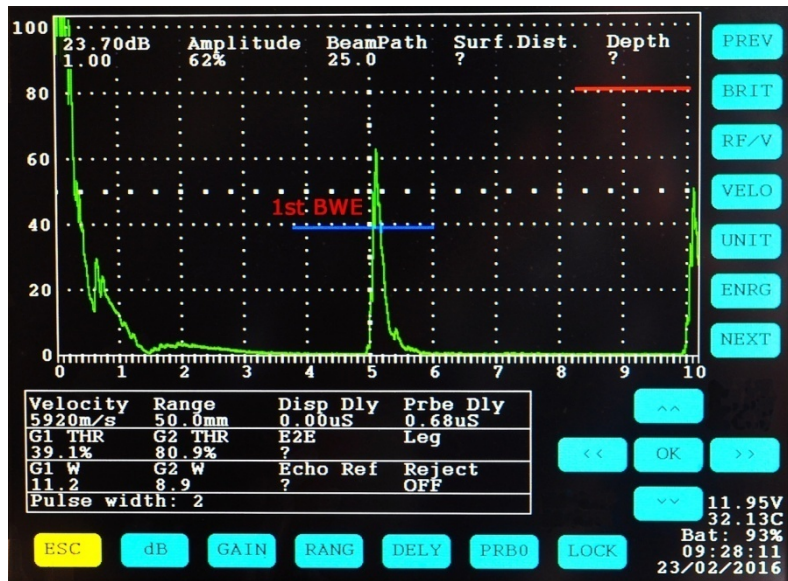


Fig 16. Calibration of the instrument to 50mm in steel

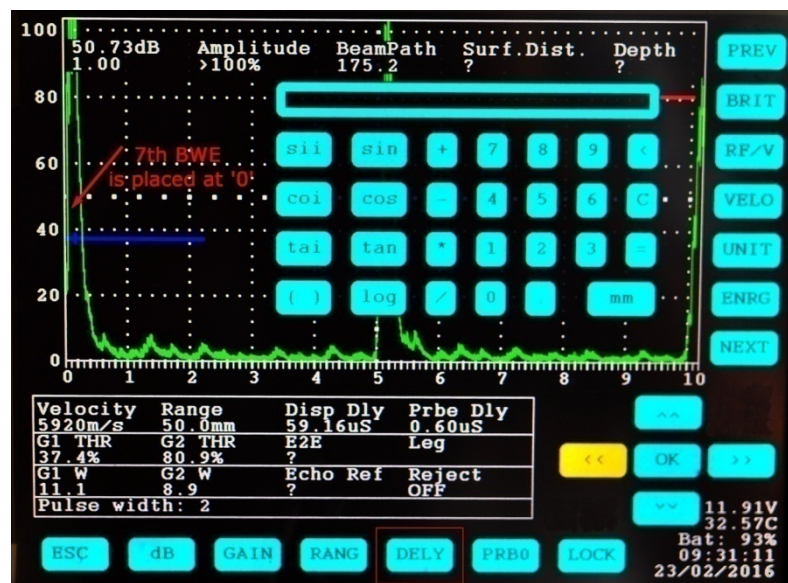


Fig 17. Positioning of the 7th BWE from 25mm thickness of V1 block to 0

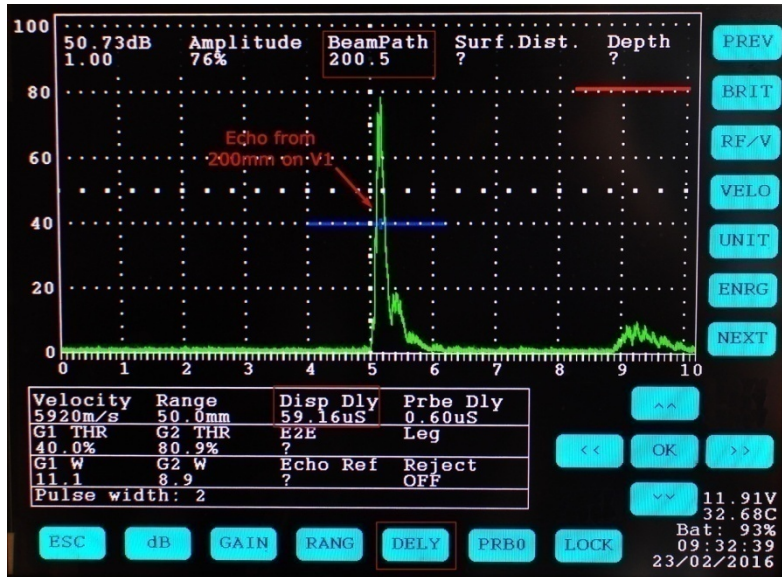


Fig 18. Echo from 200mm distance on V1 block being observed at 50 divisions

Sensitivity setting

Construction of a DAC curve with a Normal beam probe.

A DAC curve may be drawn on the display after calibrating to a desired range. The KW is designed to plot 14 point DAC if required. A 1.5mm SDH was used to plot a 3 point DAC in the following exercise.

1. Select the velocity (VELO) button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
2. Select the range (RANG) button and enter the desired range 200mm and enter 'ok' or =
3. Select the Delay (DELY) button and enter '0' and enter 'ok' or =
4. Apply the couplant on the 100mm thickness of V1 block and place the Normal probe on the block. (if the probe comes with a soft membrane, then please make sure there is couplant available between the probe and membrane) You should be able to see the Initial pulse and two back wall echoes on the display.
5. Select the 'Probe zero' (PRB0) button and if the probe delay is known, then enter that value and enter 'ok' , = or ESC
6. If the probe delay value is not known to you, then using the left or right arrow controls place the 1st back wall echo to 50 divisions on the display. You may also slide below the baseline (sweep) to correctly set the 1st back wall echo to 50 divisions.
7. Locate the SDH at the chosen depth for the first point of DAC.
8. Place the probe on the above location and maximise the signal to 80% FSH.
9. Place the Gate 1 over the above signal and enter the 'RECD' button. The first point of the DAC will be plotted along with a -6, -12, +6 & +12dB DAC's.
10. Move the probe to subsequent positions and use the GATE 1 to 'RECD' these points.
11. Save the settings including the existing range, gain, DAC etc by entering the 'SVST' button

There are 2 DAC's being plotted above the 100% DAC. These are +6 and +12 dB respectively. If a DAC point needs to be corrected during the construction you may do so by deleting (DELT) the DAC point. To delete the entire DAC, click on the 'DCLR' button.

Once a DAC is plotted for a work, the same may also be saved by entering the SVST button. This will save your existing range, delay, probe delay, DAC and dB setting and may be accessed with LDST button.

During testing of a component Gate 1 may be used to extract information on the echo. Depending on the signal height with reference to the DAC, the instrument shows the difference in dB (dB2DAC) to the DAC in the readout area.

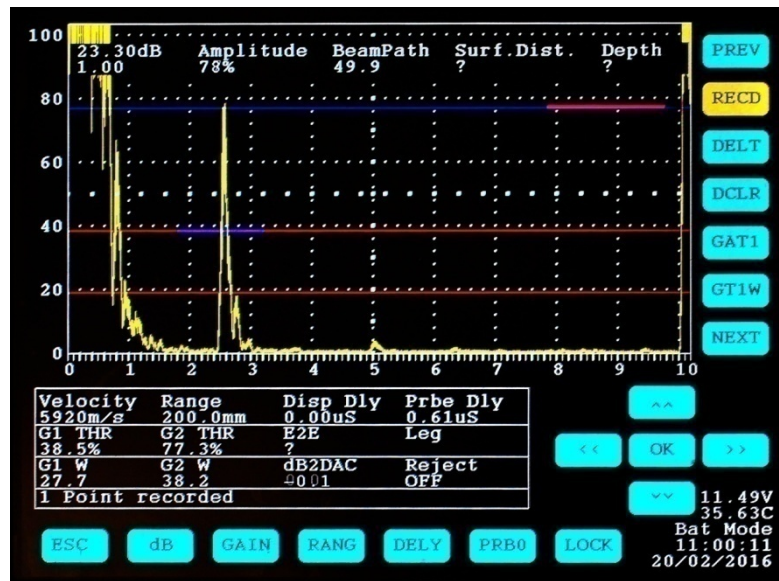


Fig 19. Echo from 1st position is being maximised and set to about 80% FSH with record

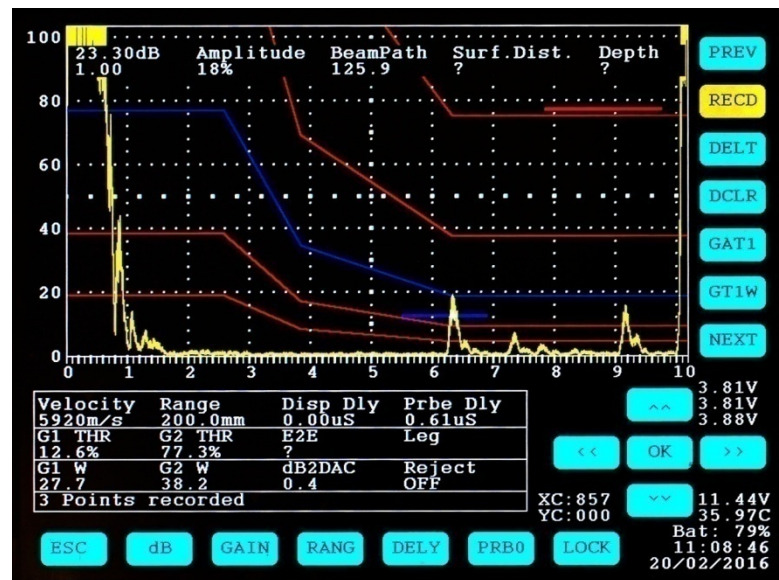


Fig 20. Echo from 3rd position is being maximised and set with record (RECD) button for DAC

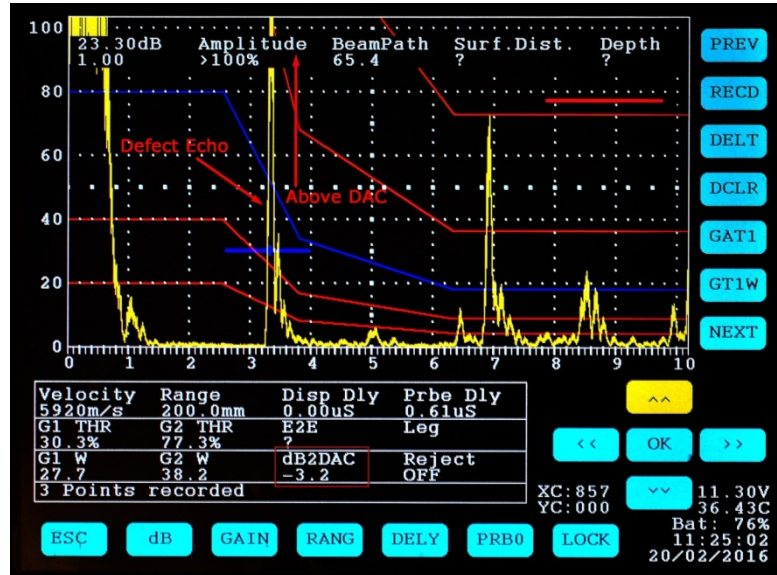


Fig 21. Echo from a reflector (defect) is being evaluated with reference to the DAC

TCG (Time corrected gain)

A TCG may be constructed with a reference reflector of your choice. In the case of DAC the first signal was brought to 80% FSH and without changing the sensitivity, each subsequent echo were marked for the amplitude it produced. The first point shall be set to a desired amplitude (80% or amplitude of your choice). Follow the steps below for a TCG construction.

1. Calibrate the instrument to a desired range with the Normal beam probe.
2. First reference signal is raised to 80% FSH and enter 'RECD' button.
3. Place the probe to obtain the second point and increase the amplitude of this signal to 80% and enter 'RECD' button.
4. Do the same step as above for as many points as needed for a TCG
5. Once all the points are recorded, click on the TCG (TCGN) button and the amplitude of all signals taken so far will be equalized and a straight line will be drawn.

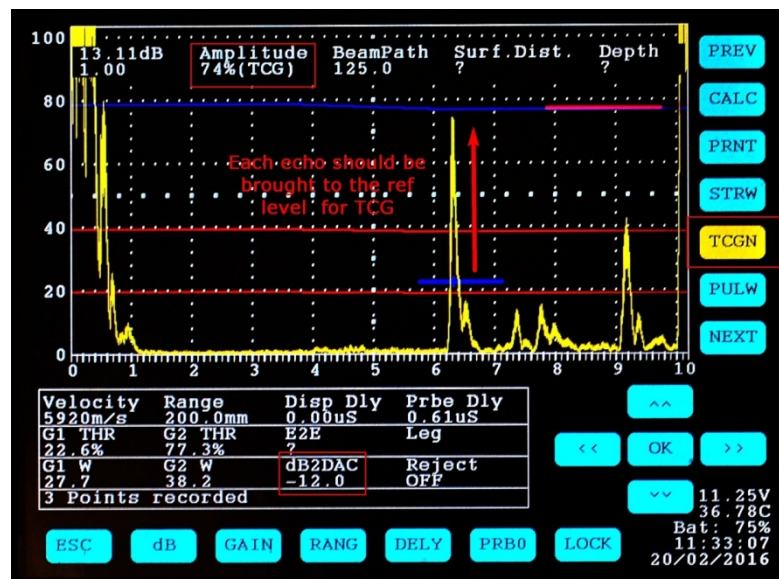


Fig 22. Echo from 3rd position is being maximised and set to 80% FSH with Gain control for TCG

Construction of a DAC curve with an Angle beam probe.

A DAC curve may be drawn on the display after calibrating to a desired range. The KW is designed to plot 14 point DAC if required. A 1.5mm SDH was used to plot a 3 point DAC in the following exercise.

1. Select the velocity (VELO) button and enter the standard steel velocity of 3,250m/sec and enter 'ok' or =
2. Select an angle probe of 45 degree, 4MHz, 10mm dia.
3. Select the range (RANG) button and enter the desired range 200mm and enter 'ok' or =
4. Select the Delay (DELY) button and enter '0' and enter 'ok' or =
5. Apply the couplant on the 100mm radius of V1 block and place the angle probe on the block. You should be able to see the Initial pulse and the first echo on the display.
6. Select the 'Probe zero' (PRB0) button and if the probe delay is known, then enter that value and enter 'ok' , = or ESC
7. If the probe delay value is not known to you, then using the left or right arrow controls place the 1st echo to 50 divisions on the display. You may also slide below the baseline (sweep) to correctly set the 1st echo to 50 divisions.
8. Locate the SDH at the chosen depth for the first point of DAC.
9. Place the probe on the above location and maximise the signal to 80% FSH.
10. Place the Gate 1 over the above signal and enter the 'RECD' button. The first point of the DAC will be plotted along with a -6, -12, +6 & +12dB DAC's.
11. Move the probe to subsequent positions and use the GATE 1 to 'RECD' these points.
12. Save the settings including the existing range, gain, DAC etc by entering the 'SVST' button

There are 2 DAC's being plotted above the 100% DAC. These are +6 and +12 dB respectively. If a DAC point needs to be corrected during the construction you may do so by deleting (DELT) the DAC point. To delete the entire DAC, click on the 'DCLR' button.

Once a DAC is plotted for a work, the same may also be saved by entering the SVST button. This will save your existing range, delay, probe delay, DAC and dB setting and may be accessed with LDST button.

During testing of a component, Gate 1 may be used to extract information on the echo. Depending on the signal height with reference to the DAC, the instrument shows the difference in dB (dB2DAC) to the DAC in the readout area.

Flaw detection with angle probe and the DAC.

After having the DAC in place, the probe may then be moved for flaw detection on the test material. The instrument is capable of calculating the Depth and surface distance if the thickness and angle of the probe is given.

1. Click on the angle (ANGL) button and enter the actual angle of the probe and enter 'ok' or '='
2. Click on the thickness (THCK) button and enter the thickness of the material that you are testing and enter 'ok' or '='

For evaluation of a signal during testing, the gate 1 (GAT1) should be moved over to this echo. The instrument should thus show you the following:

1. Amplitude of the echo
2. Beam path
3. Surface distance from the index point of the probe
4. Depth to the reflector from the testing surface
5. Leg where the echo was produced
6. Amplitude difference in terms of dB from the existing DAC

BRIT (Brightness control)

Click on this control and vary the arrow controls for a brightness level that may be required.

If required, use the INVC control for daylight viewing. If the instrument is turned off in this mode, then the screen may appear bright during battery charging. This is not an instrument fault. If this is not desired, then use the INVC control to return to any other display of your choice.

RF/V (RF/V control)

Enter this control with arrow controls for Radio frequency (RF) or Video display.

VELO (Velocity control)

Click on this control and enter the velocity of the material that you intend to calibrate or test and enter 'ok' or =

UNIT (Unit control)

Click this control and vary the arrow controls and click ok or ESC to change the Unit or measurement. By default the instrument measures in mm. If you use this instrument in a country where inch unit is used, or work to AWS D1.1 code, then you may consider changing the unit to inch.

ENRG (Energy control)

Energy supplied to the probe may be varied when large and coarse materials are to be examined. Higher energy (Energy 2) can be engaged by clicking on the ENRG button and varying the arrow control. Engage ENRG to 2, if Penetrative power checks are to be performed.

RECD (Recording of echo amplitude control)

Echo amplitude from 14 different reflectors may be recorded for DAC and TCG purposes. Follow the steps below for a DAC.

1. Calibrate to a range desired
2. Obtain an echo from the reflector of choice.
3. Maximise the echo
4. Touch and Slide the amplitude control and raise the first echo to 80% FSH.
5. Slide the Gate 1 on to this echo. Gate may be positioned anywhere on that echo.
6. Click on RECD button and it will record the first DAC point.
7. Point 3-6 should be repeated for all other reflectors that you intend to include in the DAC.

DELT (Delete DAC /TCG point control)

If you need to delete a DAC point during the construction, then you may simply click on the delete (DELT) button. You can only delete the last point that is shown on display. One by one you may delete the entire DAC as well. Deleting this DAC point will not delete the DAC point from the memory if it was saved well.

DCLR (DAC /TCG clear control)

After having the DAC or TCG displayed on the screen, for any reason, if you want to delete the whole DAC / TCG, then just click on the DCLR button once. Deleting this DAC will not delete the DAC from the memory if it was saved well.

GAT1 (Gate 1 control)

Gate 1 may be moved vertically or horizontally using the arrow controls or move to any position of your choice by simply touching and sliding the Gate 1. In the read out panel the vertical position of the Gate 1 in % is given (G1THR). The width of the Gate 1 can be seen under G1W in mm.

GT1W (Gate 1 width control)

The width of the Gate 1 may be adjusted by clicking on the GT1W button and engaging the arrow controls. The width can be expanded to cover the entire screen width or can be contracted to 5 divisions on the display. The read out panel provides the width under G1W.

ANGL (Probe angle control)

When an angle beam probe is used, the actual angle of the probe may be entered for calculation of the Beam path, Surface distance and depth when a flaw is encountered.

1. After range calibration, click on ANGL
2. Enter the angle of the probe you are using
3. Click OK, = or ESC
4. The angle information can now be seen in the read out panel.

When the probe is changed to Normal, the probe angle should be changed to 0 degree.

THCK (Thickness control)

When an angle beam probe is used, the actual thickness of the material may be entered for calculation of the Beam path, Surface distance and depth when a flaw is encountered.

1. After range calibration, click on THCK
2. Enter the thickness of the material you are testing
3. Click OK, = or ESC
4. The thickness information can now be seen in the read out panel.
5. On the top of the display area, you may now read the Beam path, Surface distance and Depth.

When the probe is changed to Normal, the thickness should be changed to 0.

RJCT (Reject control)

You may observe many unwanted echoes when coarse materials are examined. To eliminate some of these echoes, the Reject control may be used. Please note that most Codes may not permit the use of Reject control. KappaWave introduces a new Reject control that may be very easy for any inspector to realize whether this control is being used or not.

1. Place the Normal probe on the test material after calibrating to a desired range.
2. Click on RJCT button. You may now read the status as 'Reject Off' under the read out panel.
3. Touch and slide up the amplitude control. You may now read the status as 'Reject On' under the read out panel.
4. As you slide up the amplitude panel, you will notice the base line is moving up, leaving a clean appearance on display.
5. Amount of reject engaged can be read in % on the vertical amplitude scale where the base line is at or if the Gate 1 is not positioned on any echo, then the Amplitude information on the top of the display also provides the amount of reject in %. The maximum reject that can be engaged is limited to 44%

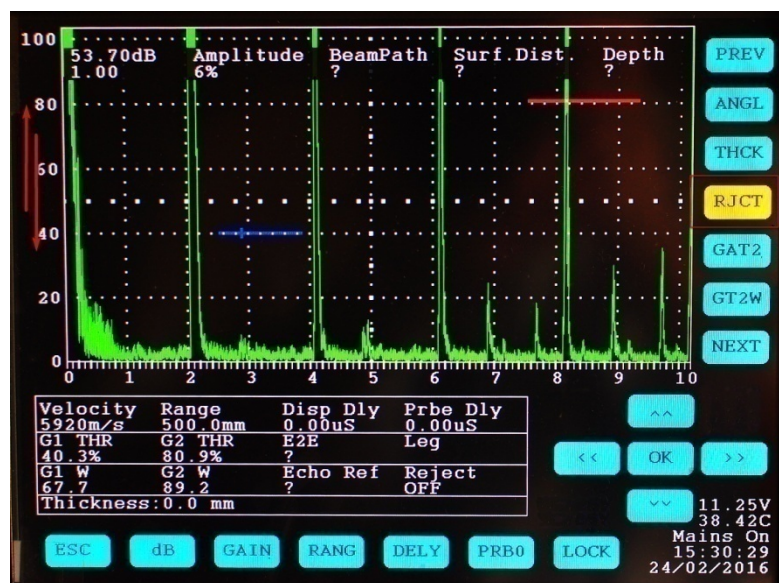


Fig 23. Reject control

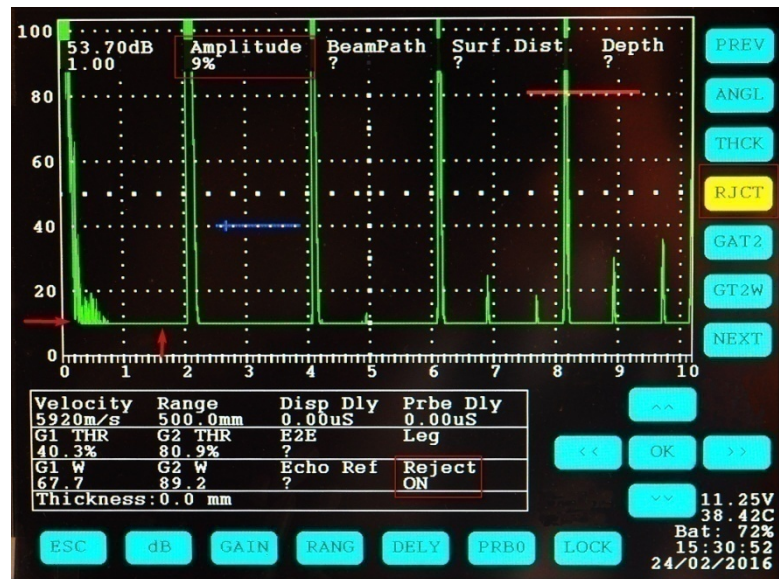


Fig 24. Reject control engaged

GAT2 (Gate 2 control)

Gate 2 may be moved vertically or horizontally using the arrow controls or move to any position of your choice by simply touching and sliding the Gate 2. In the read out panel the vertical position of the Gate 2 in % is given (G2THR). The width of the Gate 2 can be seen under G2W in mm.

Gate 2 can be used for monitoring the echo height along with Gate 1. Actual use of Gate 2 with Gate 1 can be read under the title: Flaw detection with normal beam probe.

GT2W (Gate 2 width control)

The width of the Gate 2 may be adjusted by clicking on the GT2W button and engaging the arrow controls. The width can be expanded to cover the entire screen width or can be contracted to 5 divisions on the display. The read out panel provides the width under G2W.

TIME (Time control)

The instrument is provided with a clock that provides the time in a 24 hour format. It is given in HH:MM:SS . The standard time of the country where the instrument may be used shall be entered. Use this control when you feel the clock is not keeping time.

1. Click on TIME button
2. Enter the time
3. Click OK

This can be of importance. A test file when saved will contain the time of the test.

DATE (Date control)

Current date may be entered by clicking on the DATE button.

MUTE (Mute control)

Click on the mute button to turn on or off. There is a buzzer provided in the instrument that would produce a beep when the Gates 1& 2 are used appropriately.

T/TR (Single / Dual probe selection control)

Click on T/TR button and use the arrow controls to select a single or a dual probe to be used. Select Dual probe for Tandem and Through transmission.

DAMP (Damping control)

Use this control to obtain an appropriate damping with a probe that you may be using. There are 2 settings: 120E and 1K. Click on the DAMP control and vary the value with the arrow controls for best results.

PRFQ (PRF Control)

Use this control to obtain an appropriate signal presentation on the display. The chosen PRF can be seen in the read out panel. Use 1KHz for short ranges and 100Hz for ranges above 500mm. The instrument may calibrate for 600mm only in steel if you try to calibrate for a 1m range with a PRF of 1KHz

OFST (Offset control for RF wave)

The base line on an RF wave can be adjusted by the user if needed so. This should be positioned at the center for all coded work.

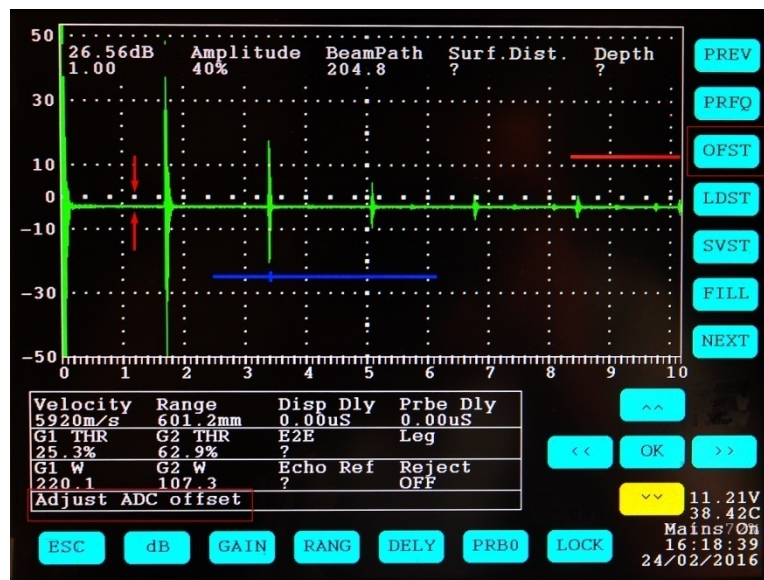


Fig 25. Offset control engaged

LDST (Load settings control)

The saved parameter settings can be re-called if needed so. Click on LDST and using arrow controls the 'Set point' can be re-called. Click OK to load the chosen setting.

SVST (Save settings control)

20 settings can be saved in to the memory. To save, click on SVST and use arrow controls to select a 'Set point' number and click OK to complete. This can be time saving for most calibrations provided the same probe and accessories are used with when the settings are recalled. Do verify the status on a frequent basis.

FILL (Echo fill / un-fill control)

If the instrument is used in direct sunlight, the FILL feature could be beneficial. Simply click on FILL and click again to un-fill. Try with different colour combinations and choose the one that provides the best visibility in the lighting conditions.

WCOL (Wave colour control)

Echo (wave) colour may be changed to the taste of the UT operator. Click on WCOL and use the arrow keys to select the available colours.

GD1C (Gate 1 / DAC colour control)

Gate 1 colour and DAC colour (when engaged) can be changed to the taste of the UT operator. Click on GD1C and use the arrow keys to select the available colours.

GD2C (Gate 2 / DAC 2 colour control)

Gate 2 colour and DAC 2 colour (when engaged) can be changed to the taste of the UT operator. Click on GD2C and use the arrow keys to select the available colours.

SCOL (Switch colour control)

Switch colour can be changed to the taste of the UT operator. Click on SCOL and use the arrow keys to select the available colours.

INVC (Light background control)

Display colour can be inverted by engaging INVC control. Click on INVC to invert or click again to return to the previous state.

CALC (Calculator control)

A scientific calculator is provided in the instrument to assist the inspector in testing work.

Another feature is the direct unit conversion from mm to inch provided in the calculator. To convert, just click on the mm or inch button and the value in display will be converted to the other unit.

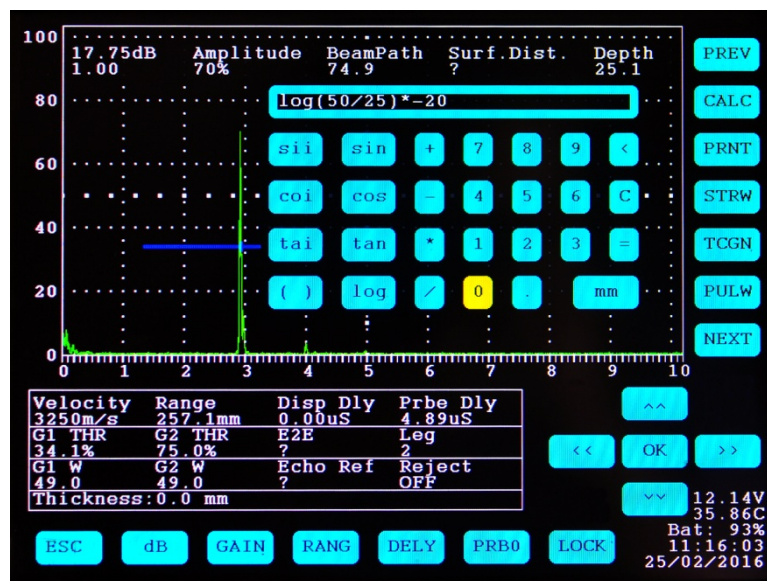


Fig 26. Calculator control

PRNT (Print control)

Click on the PRNT button and a screen shot will be saved with all Ultrasonic data that are there on the screen and date and time data. The instrument may be connected to a PC for transferring the test files. By running the supplied software on the computer, all the files can be accessed and later deleted if required. The file may be recalled by the date and time details using the computer or in the KW instrument itself. The selected file along with the information that you intend to add, can be exported as a JPEG or pdf file. The default printer would print the report for your records.

STRW (Echo Storing control)

An echo or all the echoes on the screen can be stored temporarily for comparison purposes. To store an echo slide the Gate 1 onto the echo of choice and click on the STRW button. The echo is now stored in the background. You may now move the probe onto other areas on your test material for comparison.

If all the echoes are to be stored for comparison, then the Gate 1 width shall be extended to cover all the chosen echoes before the STRW button is engaged.

This feature can be used with any probe and becomes very useful to evaluate the transfer correction and attenuation difference in materials. After storing an echo, if a new echo is obtained, just slide the Gate 1 over the new echo to see the difference in dB. The dB difference is given in the Read out panel under 'Echo reference'.

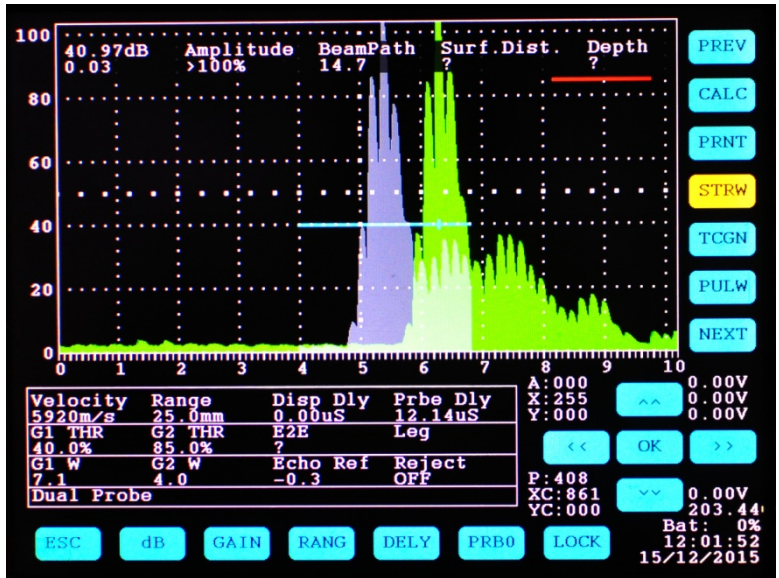


Fig 27. Echo store & reference

TCGN (TCG control)

A TCG (Time corrected gain) may be constructed with a reference reflector of your choice. In the case of DAC the first signal was brought to 80% FSH and without changing the sensitivity, each subsequent echo were marked for the amplitude it produced.

1. Calibrate the instrument to a desired range with the Normal beam probe.
2. First reference signal is raised to 80% FSH and enter 'RECD' button.
3. Place the probe to obtain the second point and increase the amplitude of this signal to 80% and enter 'RECD' button.
4. Do the same step as above for as many points as needed for a TCG
5. Once all the points are recorded, click on the TCG (TCGN) button and the amplitude of all signals taken so far will be equalized and a straight line will be drawn.

Refer Figure 22 in the manual for details.

Pulse width control

When the initial pulse is large and near surface resolution may be difficult with the available normal probe, the pulse width control may be used to verify the measurement ability. A lower pulse width should shorten the initial pulse and thus a low thickness measurement may become possible.

Enter the Pulse width (PULW) control and use the arrow controls to change the setting. There is no preset value to engage, the user should vary the control to suit a particular probe and test situation. The following figures show the difference between 2 pulse widths for the same probe. If better near surface resolution is sought, then a value close to 2 may be selected.

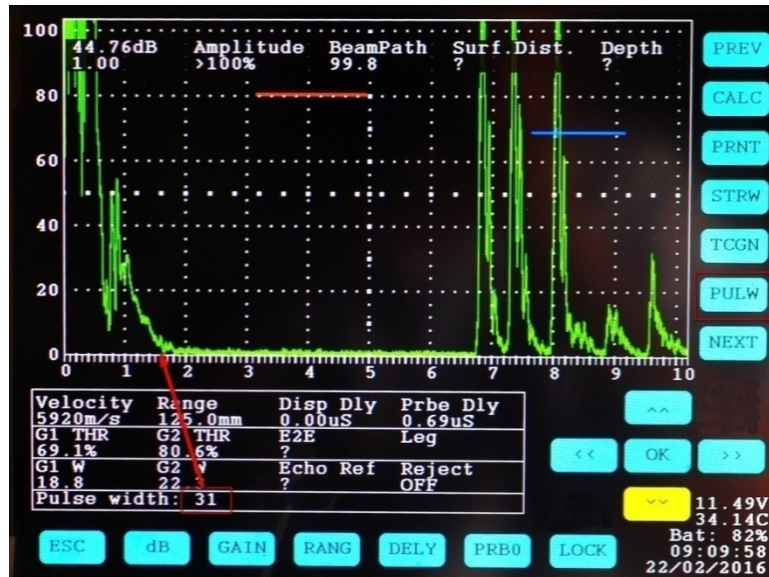


Fig 28. Use of pulse width control for better near surface resolution

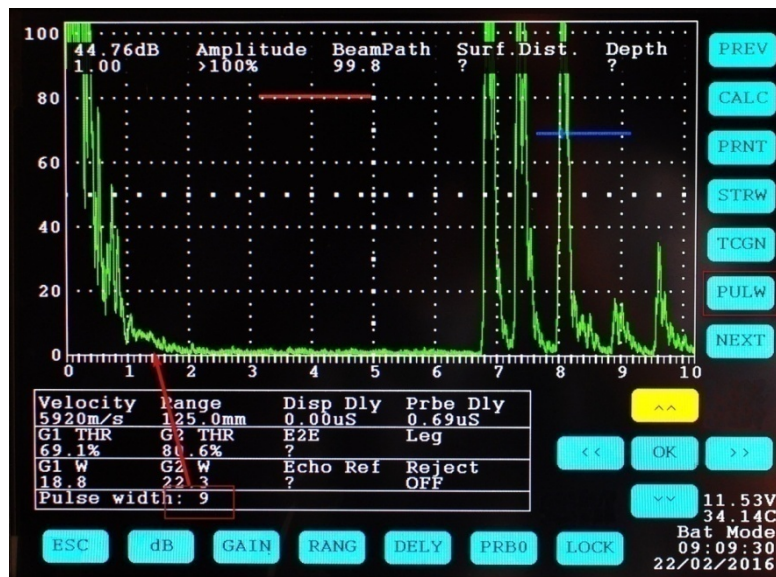


Fig 29. Use of pulse width

THK 1 (Thickness 1 control)

This control should be used whenever a 2 point calibration is sought. This control should be used with THK 2 and ACAL controls.

THK1 should be used for the lower thickness for calibration. Detailed calibration instructions are given under the 2 Point calibration using Auto calibration. There are examples given for 2 different thickness uses and examples for 2 echoes produced from the same material for Auto Calibration.

THK 2 (Thickness 2 control)

This control should be used whenever a 2 point calibration is sought. This control should be used with THK 1 and ACAL controls.

THK2 should be used for the higher thickness which may be used for calibration. Detailed calibration instructions are given under the 2 Point calibration using Auto calibration. There are examples given for 2 different thickness uses and examples for 2 echoes produced from the same material for Auto Calibration.

ACAL (Auto calibration control)

Using the above THK 1 and THK 2, the instrument can be calibrated to a range you choose. The calibration will be accurate provided the 2 thickness that you use have precise thickness (dimensions).

Steps to set the range on instrument to 100 mm using a 2 point (Auto calibration) calibration using 2 thicknesses on the same block. (V1 block in this case)

It is recommended that you select 2 different thicknesses for calibration which are close to the upper and lower thickness values that you intend to test with.

1. Select the velocity button and enter the standard steel velocity of 5920m/sec and enter 'ok' or =
2. Select the range button and enter the desired range 25mm and enter 'ok' or =
3. Select the Delay button and enter '0' and enter 'ok' or =
4. Place a normal probe on the V1 block, 25mm with sufficient couplant (if the probe comes with a soft membrane, then please make sure there is couplant available between the probe and membrane) You should be able to see the Initial pulse and a back wall echo on the display.
5. Place the gate 1 over the 1st BWE and enter the thickness 1 (THK1) button

6. Apply the couplant on the 100mm thickness of V1 block and place the Normal probe
7. Place the gate 1 over the 1st BWE from V1 block and enter the thickness 2 (THK2) button.
8. Enter the auto calibration button (ACAL) and the instrument should automatically adjust the range correctly to 100mm.
9. Verify the accuracy of the calibration on any known reference blocks.

You may use this ACAL method to calibrate to other ranges.

AWS1 (AWS D1.1 Weld testing control)

There are specific requirements placed on the instrument and probes for use with AWS D1.1 code. The operator is expected to have completed all such verifications prior to attempting the steps below for AWS weld testing work. Please note that only specific size and frequency probes are to be used for this work.

- a. Index point of the probe
- b. Actual angle of the probe
- c. Internal reflections
- d. Horizontal linearity of the instrument
- e. Vertical linearity of the instrument
- f. Other calibration requirements
- g. Appropriate blocks

Having completed all the above checks, the following steps may be taken for an AWS weld testing work.

1. Click on VELO button and enter the shear wave velocity for steel: 3250 m/sec
2. Click on ANGL and enter the actual angle of the probe.
3. Click on THCK and enter the thickness of the parent metals where the weld is made.
4. Using the 2.25MHz angle probe calibrate to 250mm (or the range required in accordance to AWS code) on the V1 block.
5. Place the probe on the V1 block to detect the 1.5mm diameter SDH at 15mm depth.
6. Maximise the echo from 1.5mm SDH and increase the amplitude of this echo to 40% FSH.
7. Place the Gate 1 on this echo and click on AWS1 button once.
8. You should be able to read the Reference dB under the column AWS B in the read out panel.

9. The instrument memorises this reference dB throughout the test. If you click again on the AWS1 button, the reference data will be erased.
10. When an echo needs to be evaluated, place the Gate 1 over the echo and the instrument automatically calculates and provides you the 'Indication rating d' under the column AWS D in the readout panel. The echo amplitude should be within the display for an accurate measurement.

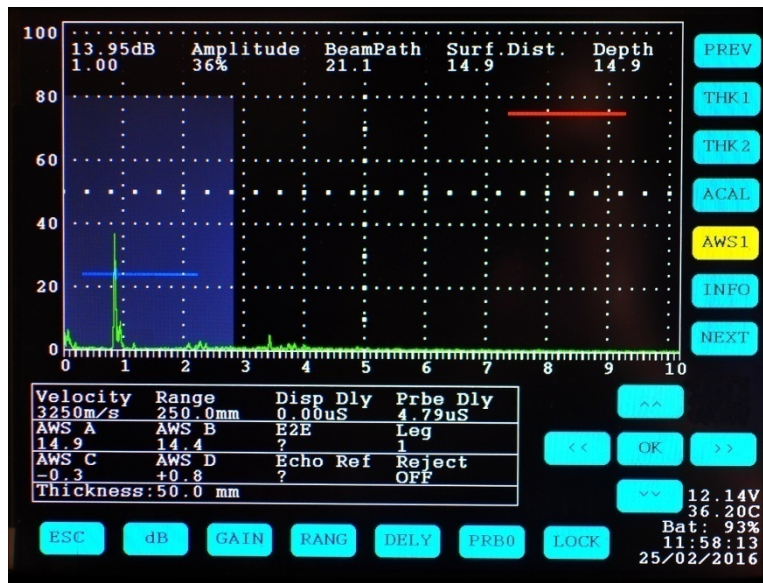


Fig 30. 1.5mm dia SDH to 40% FSH

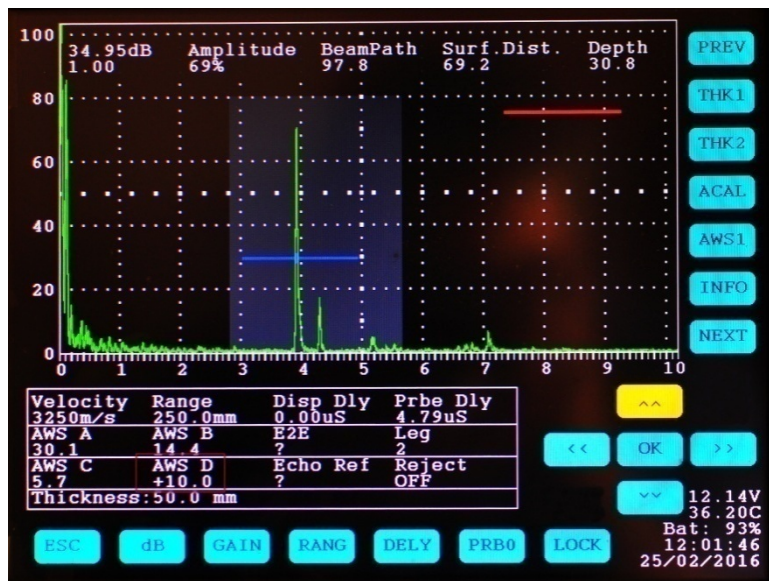


Fig 31. Defect evaluation to AWS D1.1

INFO (Information on the instrument)

Click on this button for the current version information. This will be provided at the read out panel.

Battery

KappaWave uses Lithium-ion batteries. 11.1V, 10.4Ah, 97.6Wh, Rechargeable.

Do not use any other batteries as this can cause serious damages to the instrument and personnel operating the unit.

Charging time

Battery charging does not take place when AC power is supplied and when the instrument is in operation. Instrument automatically switches to battery when the mains supply is interrupted. To charge the battery, turn off the instrument and connect to an AC mains outlet. Do not use an inverter or generator for charging the battery.

Room temperature shall be below 50 degree C for battery charging. Charging will be delayed in higher temperatures. The instrument may be operated in the field up to 55 degree C. Ensure the supplied protective cover is in place during field testing work.

The charging status will be indicated on the display during charging. The instrument is designed to display the power status once the charging is complete. Switch off and disconnect from the mains once the charging is complete and during thunderstorms.



Fig 32. Power connector for Battery charging

Printing and recalling files in the instrument

Using the PRNT command button you may take a screen shot for printing. This file can be accessed (1) by the computer (2) by the instrument using the menu control. If recalled by the instrument, the file, as saved, will be displayed. Using the interface software, this file may be loaded for report creation. The interface software also allows you to load an external image such as a drawing (JPEG) or another image file relevant to the test performed, in to the report.

If required, the files can be deleted one by one using the menu from the instrument. The instrument has a 2GB flash drive that can store thousands of files in the instrument. In a normal work cycle, there may not be a need to delete all these files to save space.

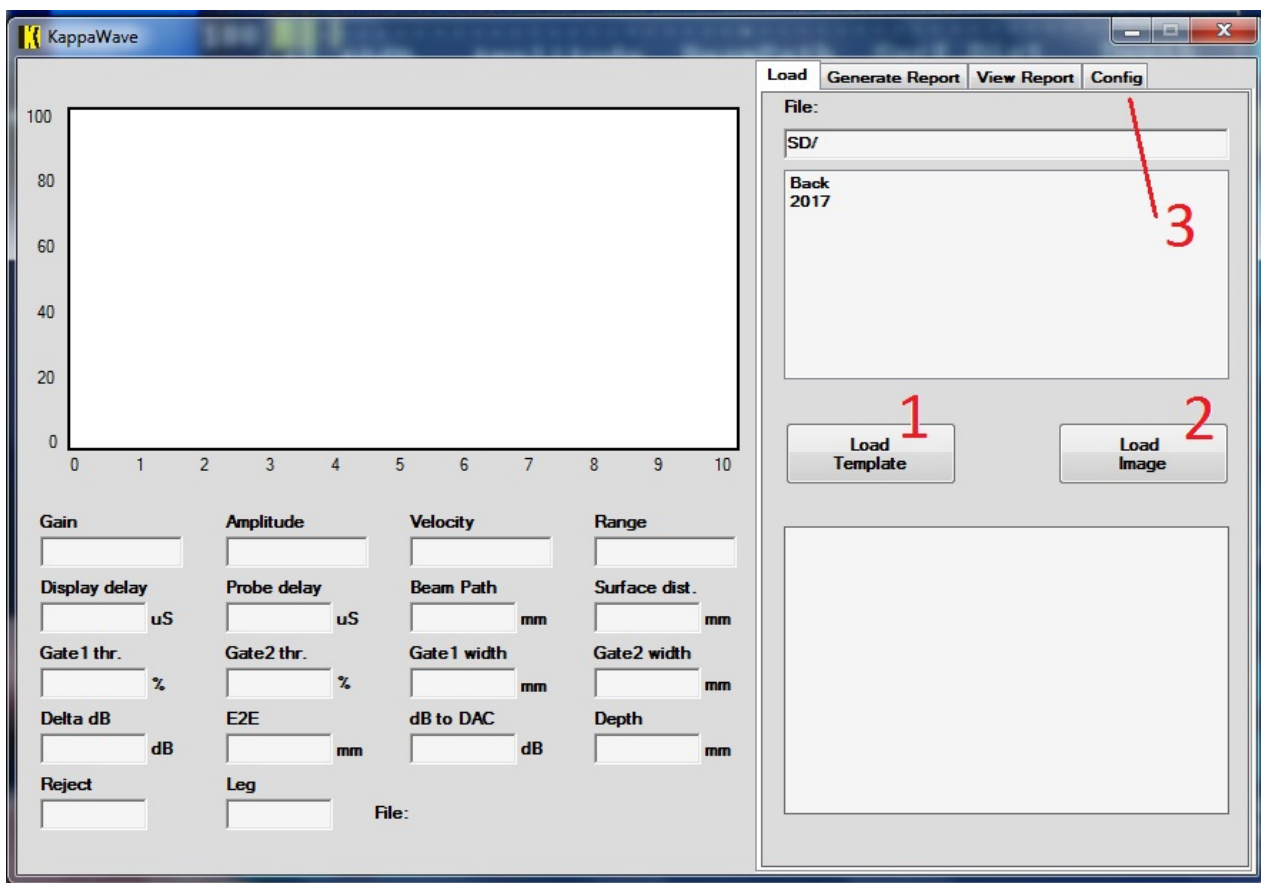


Fig 33. Interface software accessing files from the instrument

You may open the required files in the instrument itself. This can be handy to verify or show information to customers during the test. Click on Load file LDWF and enter the year, month, date, hour, second etc and click OK to open.

If these details are not known, then enter the year and month and click OK and it will open the directory for you (list of files saved in that month).

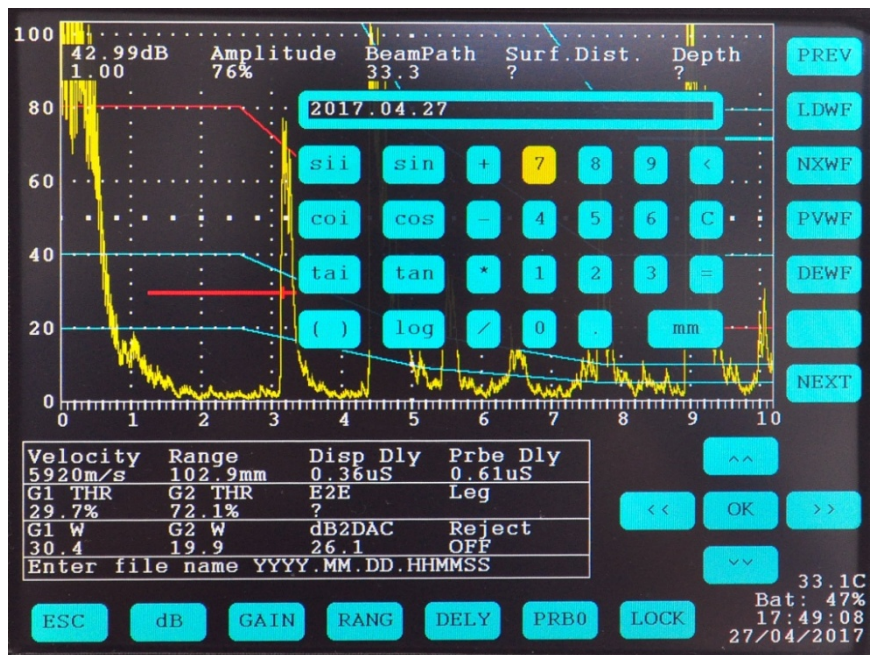


Fig 34. Entering file details in the instrument for display

Once the file is selected and clicked OK, then the file will be opened in the instrument with all the parameters that were saved during the test.

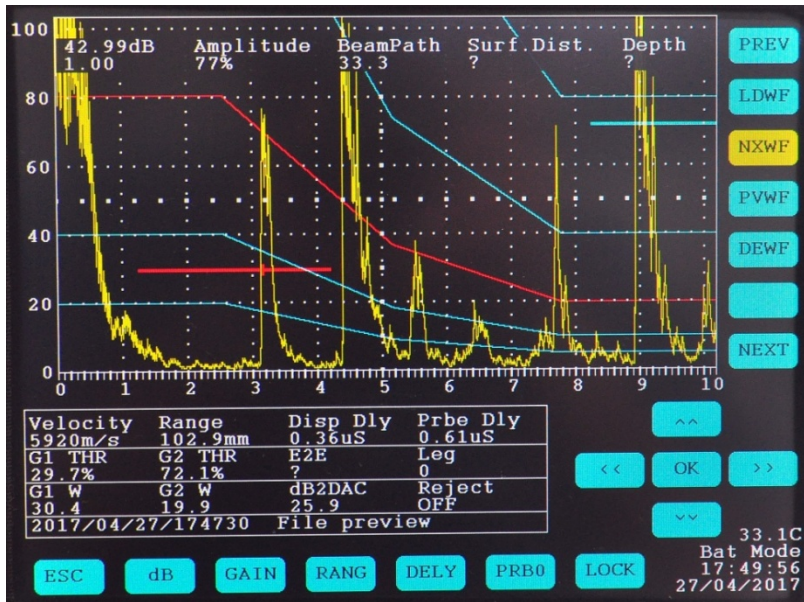


Fig 35. selected file in display

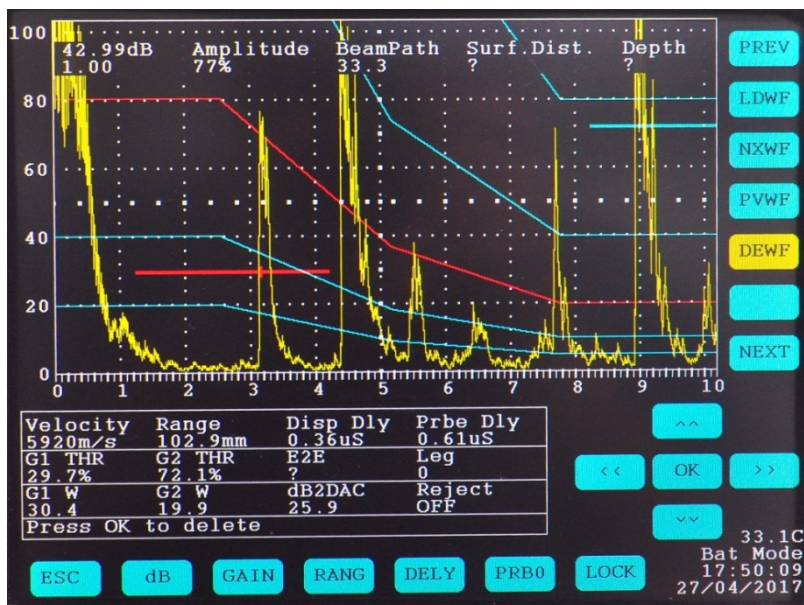


Fig 36. File may be selected to be deleted from the instrument

If required, you may select this file to be deleted from the instrument. Click on DEWF to select the file to delete and click OK. Once deleted, the file can't be retrieved. It may be prudent to transfer the files to the computer and delete later what is not required.

VGA out

The instrument is provided with a VGA output for displaying on an external display screen or a projector. This feature is useful for large audience in training.



Fig 37. VGA, USB port

USB Port

A USB port is provided for connecting the instrument to the computer and transferring the test files that are saved in the instrument.

Turn off the instrument before connecting to the computer. Once connected, the interface software should automatically detect the instrument and will make available the page where you may select the file for viewing or reporting.

Refer figure 38 for the interface software. You may use the menu buttons to select the file you want to create the report for.

Report preparation

Create a folder named 'Template 1'. The new template work will be saved into this folder. Each time a new Template is made for your work, you should create a separate folder with Template 1, 2, 3... etc.

A template may be created by editing the existing 'TEMPLATE' file using 'Paint'. Do not change anything other than your company name, logo and address on the top of the TEMPLATE. Once edited, save as a png file with the file name: TEMPLATE in the Template 1 folder.

The interface software may not load the template if it is given another name. Each time a new template is generated, it may be saved into another folder with the name 'TEMPLATE'.

The supplied illustration software gives you a lot of capability. Although you have a basic report generation ability in the supplied KappaWave software, You may also choose to write your report in inkscape, that offers a lot of capabilities for text or illustrations.

Once the report is completed, it may be exported in a png format. You may also save as a pdf file. Save as an SVG file if you think there could be some rework may be required later. Of course you should also export as a png file irrespective of whether you save as an SVG file or not.

If the computer shows some error messages during loading of the template or files for report creation, it could be related to the template file that is being selected. If the path mentioned is clear, it should load the files without any trouble.

Kindly ensure the UT instrument is connected and in the turned on mode for accessing the files. Files that may be saved during this time may also be accessed by refreshing the folder. To do this, Open the load page and click on 'Back'. You should be able to see the file that was saved during this time.

The software is being designed to work on Windows 7 and above.

KappaWave interface software installation

1. Plug in the portable USB drive or the CD supplied with the interface software and run the program.
2. Click on the KappaWave set up file and run it to install the software.
3. Install the illustration software.
4. Connect the USB cable to Computer and KappaWave instrument
5. Run the KappaWave interface software
6. Turn on the instrument
7. The software should identify the instrument and display the files in the instrument as in figure 38 below

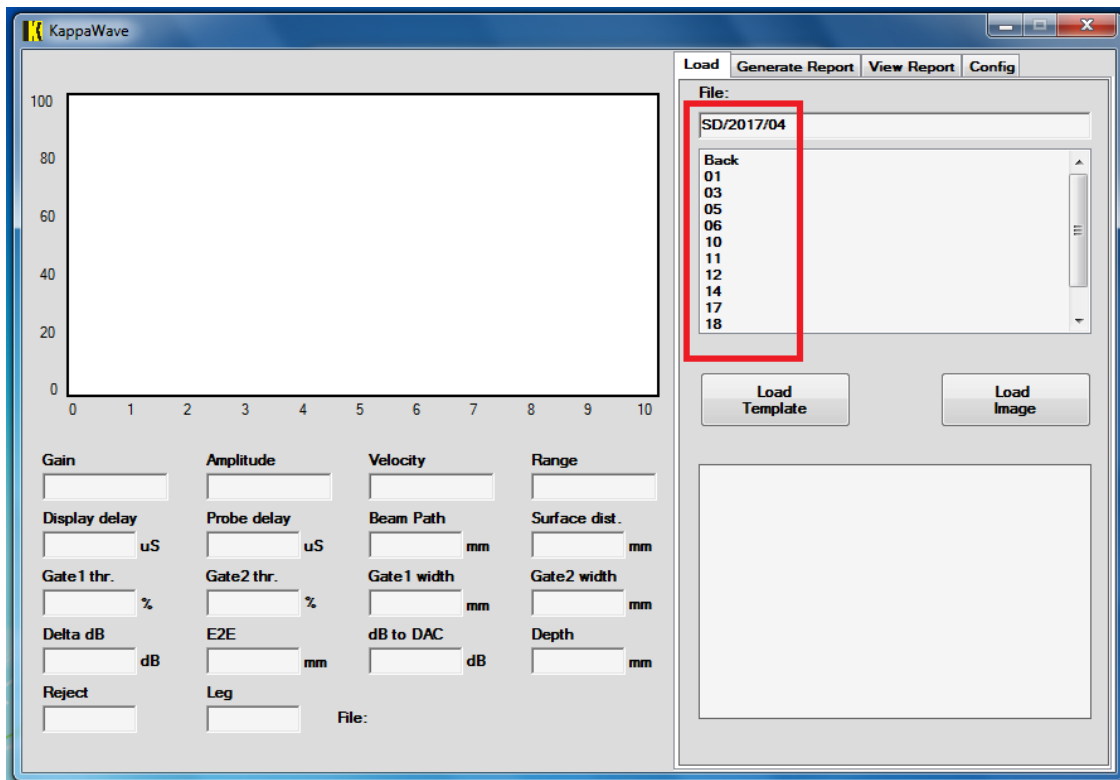


Fig 38. Computer accesses the instrument and you may Select the file to open

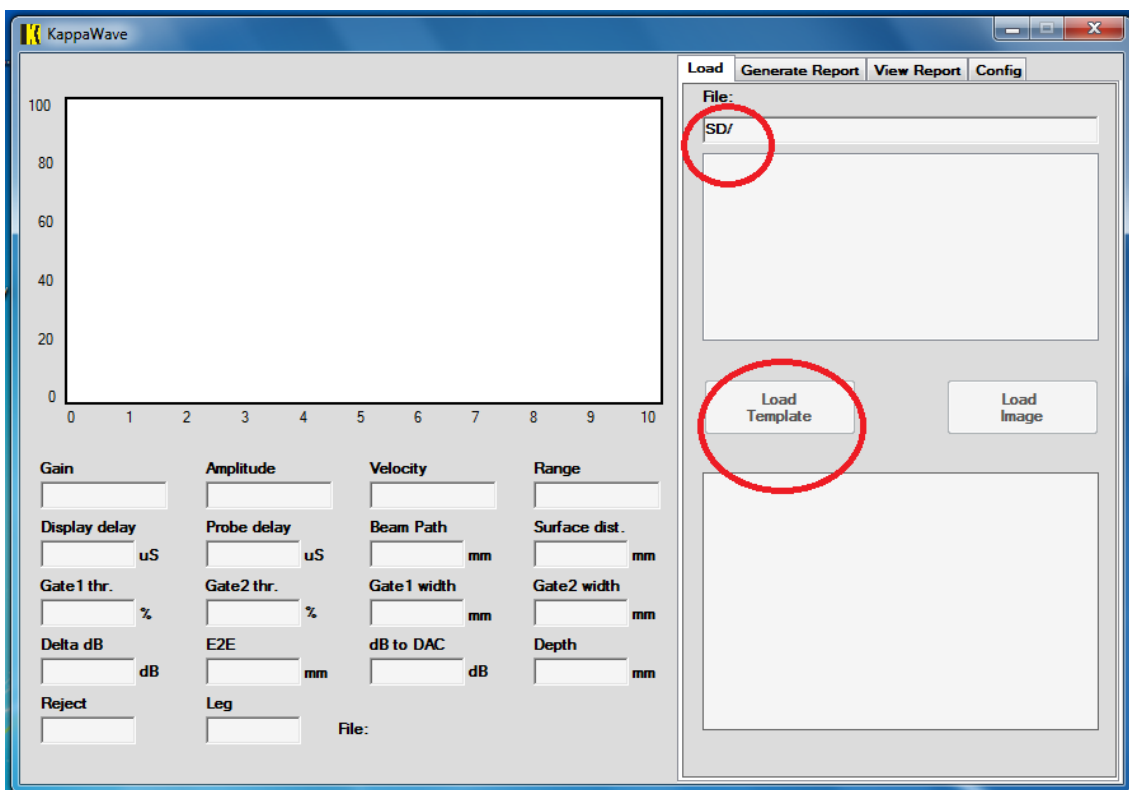


Fig 39. Computer does not access the instrument

8. Figure 39 shows the instrument is not being accessed by the computer. In this case, you should update your driver. There is a detailed step involved in this. Follow the steps below to update the driver.
9. In the CD or the drive supplied, there is a folder ' CDM v2.08.28 Certified. Click open this file and extract to a folder in the C drive in your computer. Make sure you know the path.
10. This driver is identified as: FT232R USB UART
11. You should now uninstall the incorrect drivers on your computer. Go to Control Panel - Device Manager
12. Click on USB serial port (COM19) in Device Manager and Uninstall this.
13. It will ask for confirmation to delete driver software for this device. Click okay to uninstall.
14. Now click on Universal Serial Bus Controllers on the Device Manager and select USB Serial Converter and Uninstall this.
15. Now disconnect the USB cable from computer to KappaWave
16. Reconnect the USB cable from KappaWave to Computer. You will notice a new Yellow flagged item will appear FT232R USB UART
17. Right click on FT232R USB UART and select Update Driver Software. As shown in point 9 above, you have to point to the software to the directory and click Next to continue.
18. By now the USB serial convertor would be installed.
19. The Yellow flagged item in the Device Manager should have changed name to USB Serial Port
20. The Serial port will now install and that will be the final installation. There should not be any Yellow flags now.
21. Click start your KappaWave Interface software, Start the UT machine and see whether you can access the files. It may take few seconds to display the file list.

Once the file is selected to open, a report form may also be opened to fill up the essential data for a test. Once these data are filled up, click on the view report to see how your report appears. You may edit again if required before a print command is given.

There are many customers who may want more information to be added to a report. A standard word processing software may be used to create a report in such cases. Click on View report once the data is filled in. You will be asked to select a print copy or save as pdf for your records.

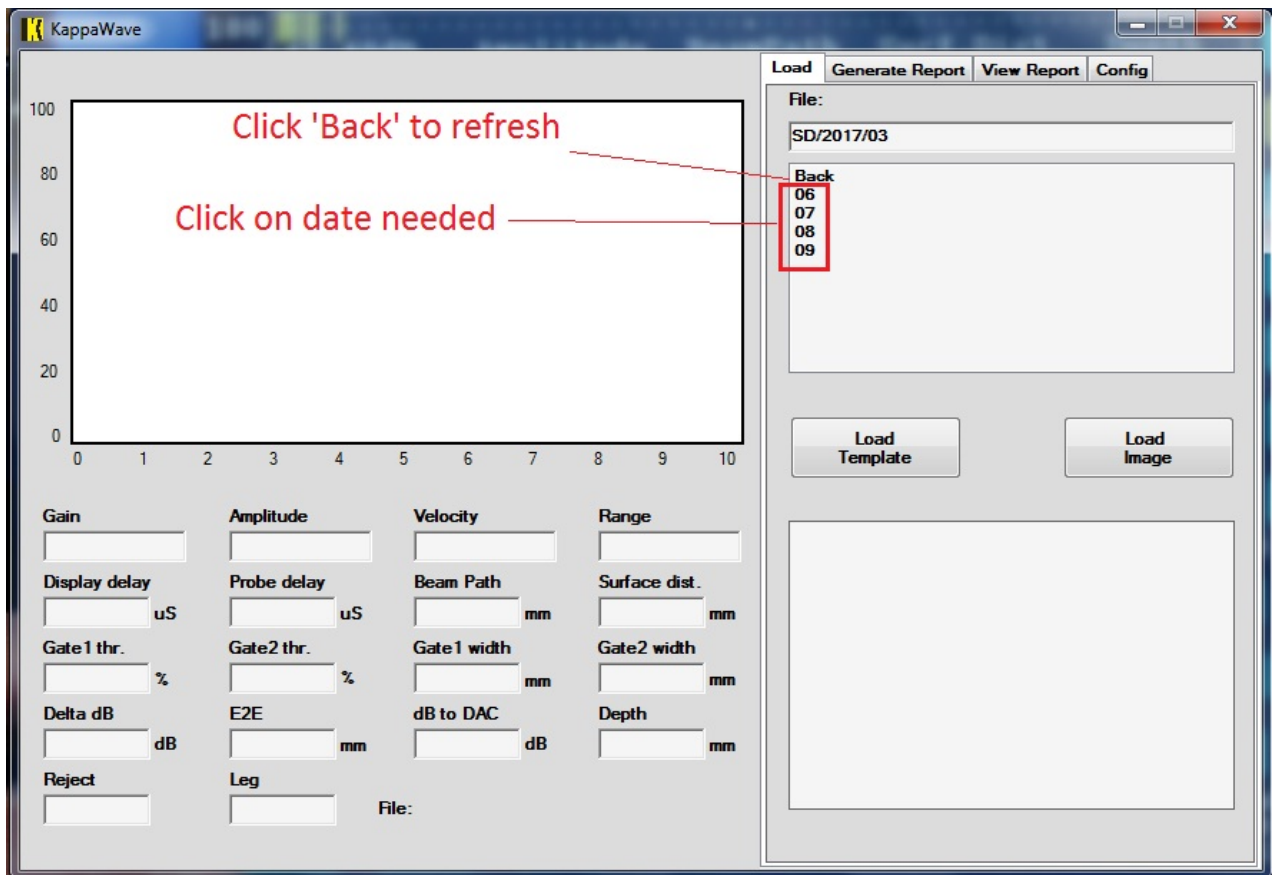


Fig 40. Selecting the file

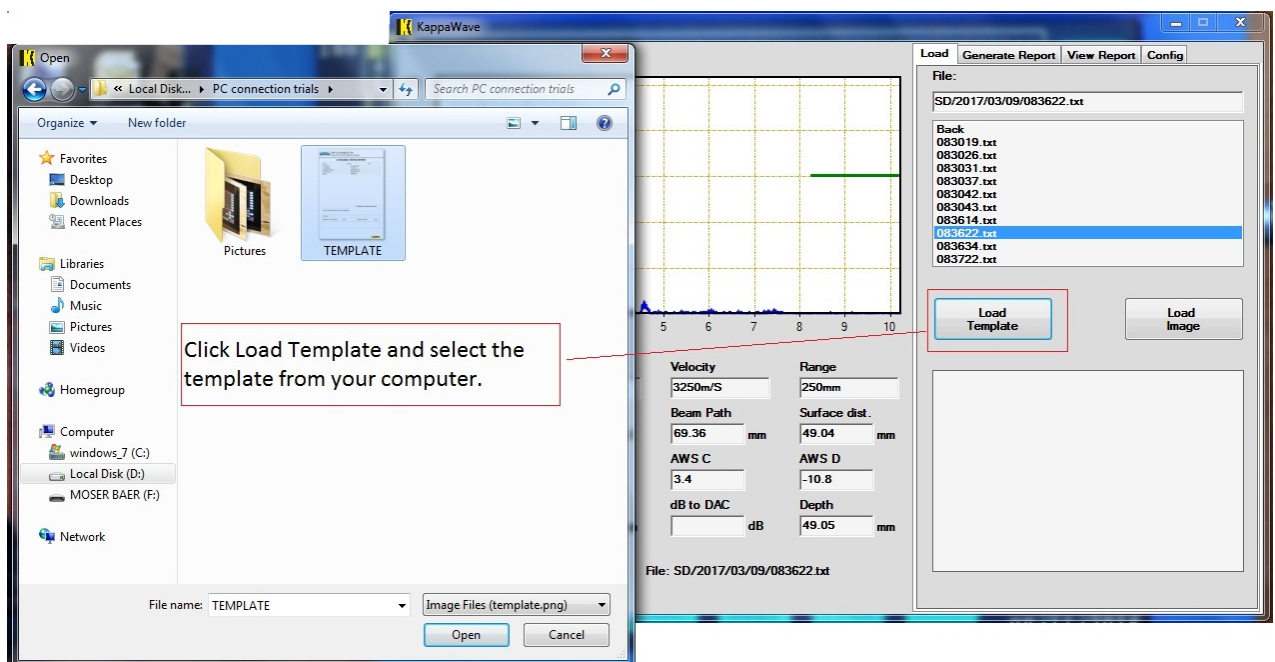


Fig 41. Selecting the Template

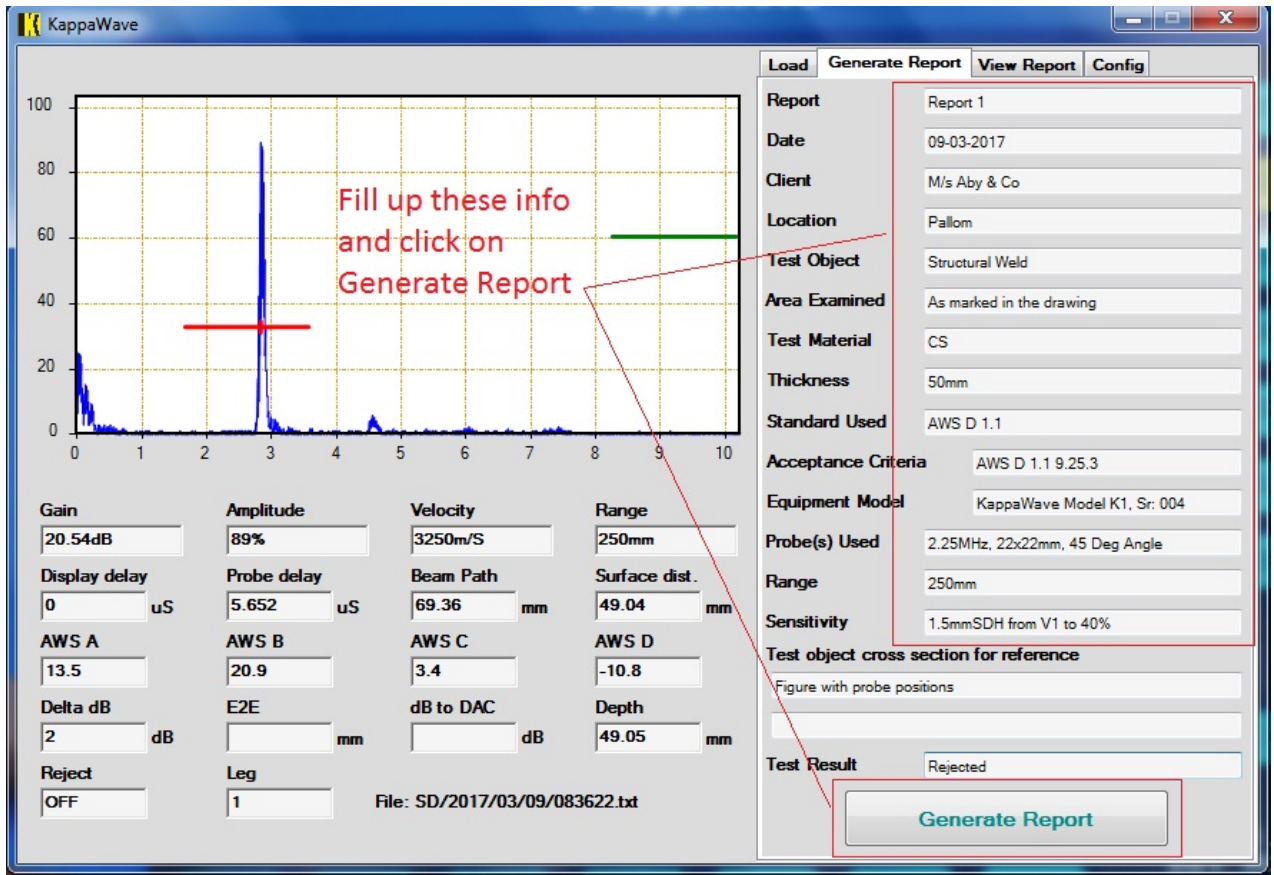


Fig 42. Entering data for report

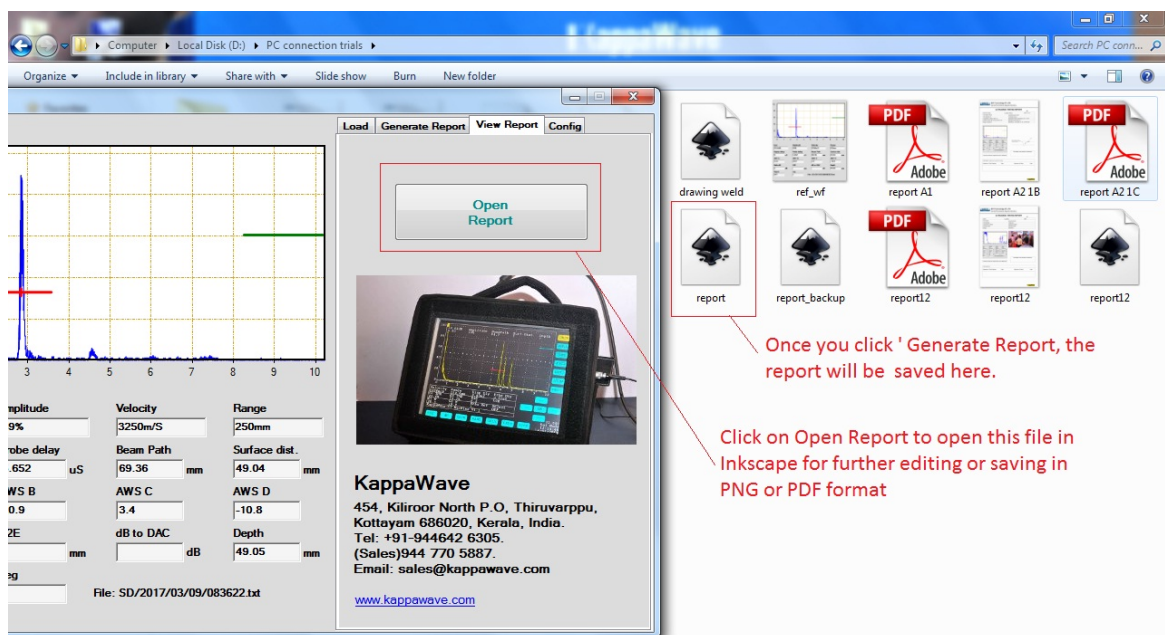


Fig 43. Selecting the 'report' file to open in inkscape

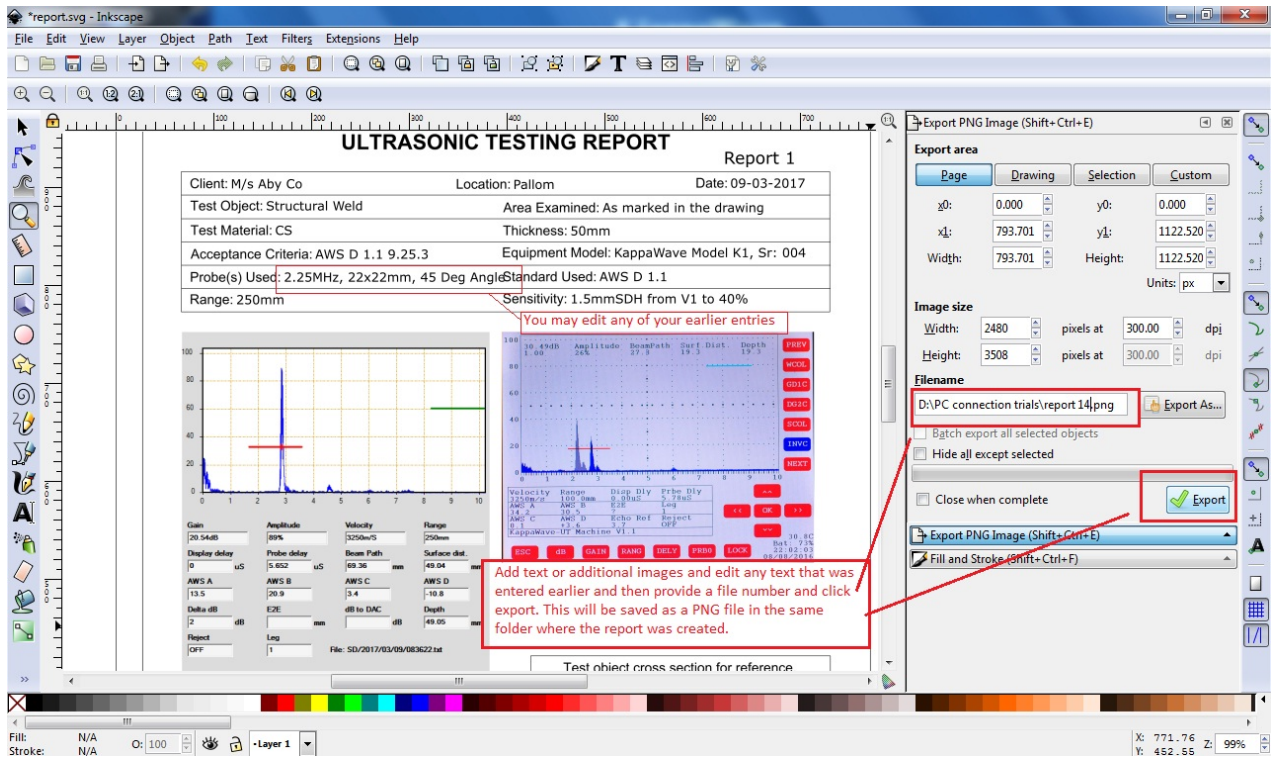


Fig 44. Opening the 'report.svg' file in inkscape for editing

Connecting to a Projector or external displays

The instrument can be connected to a large screen projector or external displays for large audiences. To do this use the supplied cable to connect the projector or display to the VGA port on the instrument. Resolution settings may be performed on the Projector or external display that is in use.

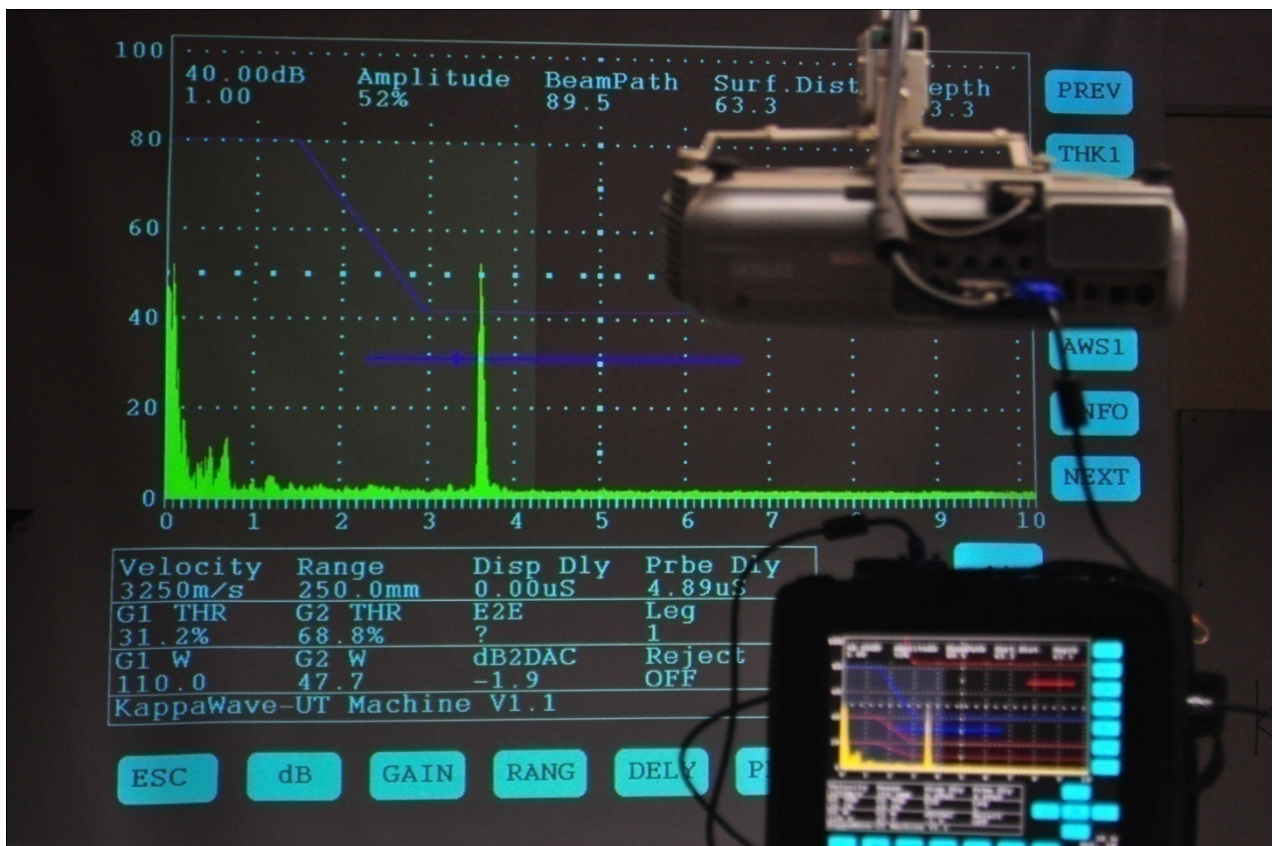


Fig 45. Connecting to external projector or displays.

Important notice: When using the instrument, for example, when Range button is pressed and without closing the Range input, if other controls are engaged, (like Delay, Probe zero, Velocity etc) the instrument may not give you the correct values. You should always complete the steps for each function before another function is engaged.

General instrument verification checks.

Horizontal Linearity

Probe: NB, 4MHz, 24mm dia, Energy: 1, Pulse width control should be set to: 6.

Place the NB probe on the 25mm thickness of V1 block and set the range to 0-275mm in steel (or obtain 11 BWE)

Place the gate at 40% FSH and raise the amplitude of the 1st BWE to 80%. Click on THK1 and enter the thickness as 25mm. The beam path should read 25mm on the top readout panel.

Raise the signal amplitude of the last signal (11th BWE) to 80% FSH and place the gate at 40% FSH and click on THK2 and enter the thickness as 275mm. The beam path should read 275mm on the top readout panel.

Position the gate over the 2nd BWE at 40% FSH and raise the amplitude of the 2ndBWE to 80% FSH. Read the beampath on the top readout panel and write down the reading on paper.

Position the gate over the 3rd BWE at 40% FSH and raise the amplitude of the 3rd BWE to 80% FSH. Read the beampath on the top readout panel and write down the reading on paper.

Repeat the above steps for all other BWEs and note down the reading on paper.

Signal	Beam Path	%	Deviation in BP
1	25	80	Nil
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	275	80	Nil

If performed to AWS D1.1, DS Block, 20" Range			
Signal	Beam Path	%	Deviation in BP
1			
2			
3			
4			
5			

It may be considered linear if the signals are within $\pm 1\%$ of the range. ($\pm 2\%$ if performed to AWS D1.1)

Vertical limit and linearity Procedure

Probe: NB, 4MHz, 10mm dia, Energy: 1, Pulse width control should be set to: 6.
 Reference block in Fig 1, ASTM E 317 will be required to perform this test.

Place the NB probe on the block and obtain 2 BWE. Direct the beam along the H dimension toward the two holes. Position the search unit so that two echo signals are obtained having amplitudes in the ratio of about 2 to 1. Ensure the probe remains in place.

Manipulate the probe on the surface to get the 1st BWE (Ha)@ about 36% and 2nd BWE (Hb) @18% FSH. Position the gate over each of these indications and note down the dB and % on the paper.

Return the gate to the first position and increase gain by 2 dB and write the dB and amplitude on paper. With the same dB setting, Move the gate over the 2nd BWE and note down the dB and amplitude of the 2nd BWE on paper.

Repeat the above steps till the 1st BWE reaches 100% FSH. Linearity test data may be reported in tabular form or presented graphically with Ha on the vertical scale and Hb on the horizontal scale as shown in ASTM E 317

1st BWE (Ha)					2nd BWE (Hb)		
Increase dB	dB	Observed %	Expected %	Remarks	Observed %	Expected %	Remarks
2							
2							
2							
2							
2							
2							
2							

Vertical linearity (Linearity of instrument gain)					
Probe: NB, 4MHz, 10mm dia, Energy: 1, Pulse width control should be set to: 6.					
<p>This check monitors the combined result of two characteristics that affect linearity of the instrument gain, i.e. Linearity of amplifier and the accuracy of the calibrated gain control. Any standard calibration block can be used for this test, preferably in conjunction with the probe that will be used in subsequent testing.</p> <p>Obtain a signal from the 5mm diameter hole on the V2 block that may be set to 80% FSH and note the value of the dB. Then increase the gain by 2dB and confirm that the signal rises to more than full screen height (101%).</p> <p>Restore the gain to its original value and then reduce it by a further 6dB. Confirm that the signal amplitude falls to approximately 40% screen height.</p> <p>Successively reduce the signal by three further increments of 6dB and confirm that the signal amplitude falls respectively to 20%, 10% and 5% FSH.</p>					
dB	Expected echo height	Permissible echo height	Observed %	dB	Remarks
+2	101%	98->100%			
+1	90%	88-92%			
0	80%	80%			
-2	64%	62-66%			
-4	50%	48-52%			
-6	40%	38-42%			
-10	25%	23-27%			
-12	20%	18-22%			
-18	10%	8-12%			
-24	5%	3-7%			

The equipment may be considered linear if it falls within the permissible echo heights shown above.

Penetrative power

Probe: NB, 2MHz, 25mm diameter. Energy: 2, Pulse width control should be set to: 6.

Calibrate to 500mm range in steel using 100mm thickness of V1 block.

Apply couplant and firmly place the NB probe on the 50mm diameter Perspex insert on the V1 block. It is recommended that you place the probe without the protective membrane on the Perspex.

Ensure the Reject control is turned off.

Using the high energy mode setting, measure the number of BWE's that can be read. Place the gate at 40% FSH and measure each echo at 50% FSH. Document the noise level as well.

Echo	dB for 50% FSH	Noise level %	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

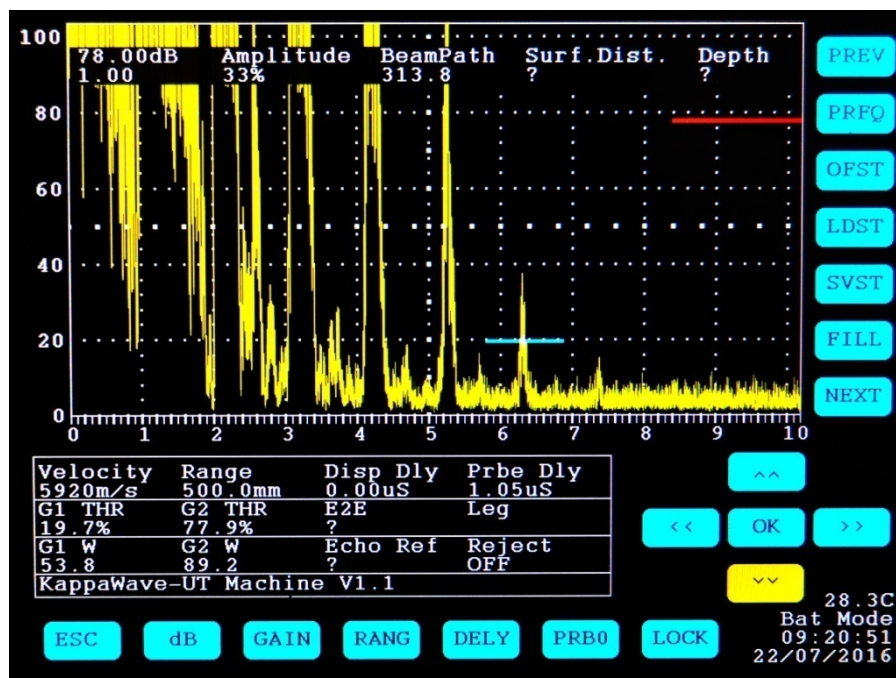


Fig 46. Noise level and Penetrative power showing 6th BWE from Perspex

Resolving power

Probe: NB, 4MHz, 10mm dia. Block: V1 block, Energy: 1, Pulse width control should be set to: 2

Using Range control, set the range to 0-125mm in steel.

Place the NB probe on the block and obtain the BWE from 85, 91 and 100mm distances. Ensure the probe remains in place.

Move the probe in such a way to adjust the echoes from 85mm and 91mm BWE to the same height.

Increase the gain so that these 2 signals are at 50% FSH

Check to see whether the echoes are clearly separated at least up to 6dB below maximum echo height.

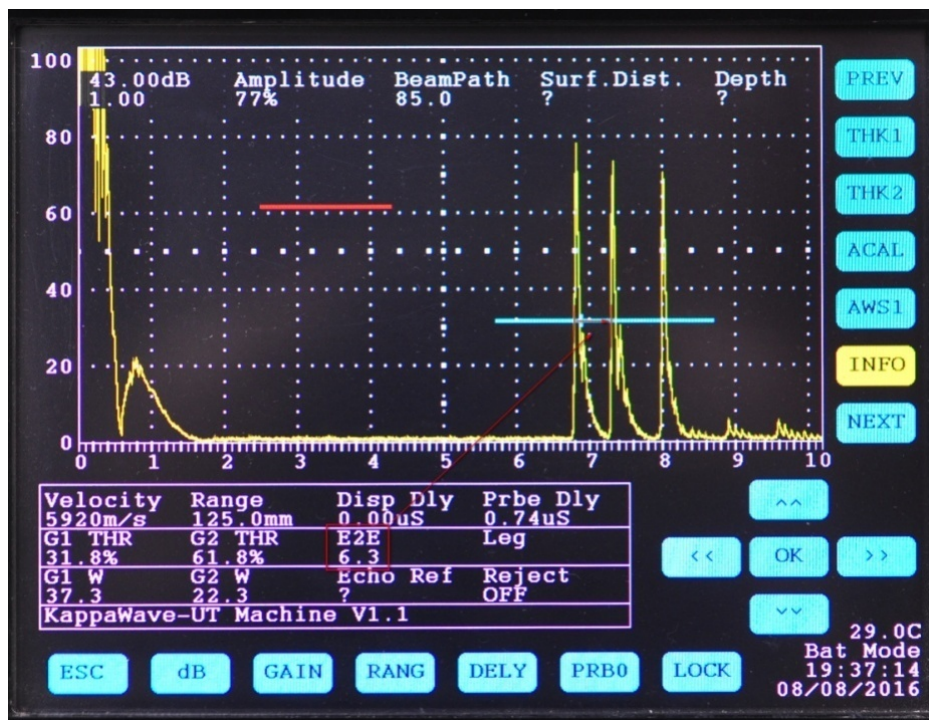


Fig 47. Resolution check on V1 block

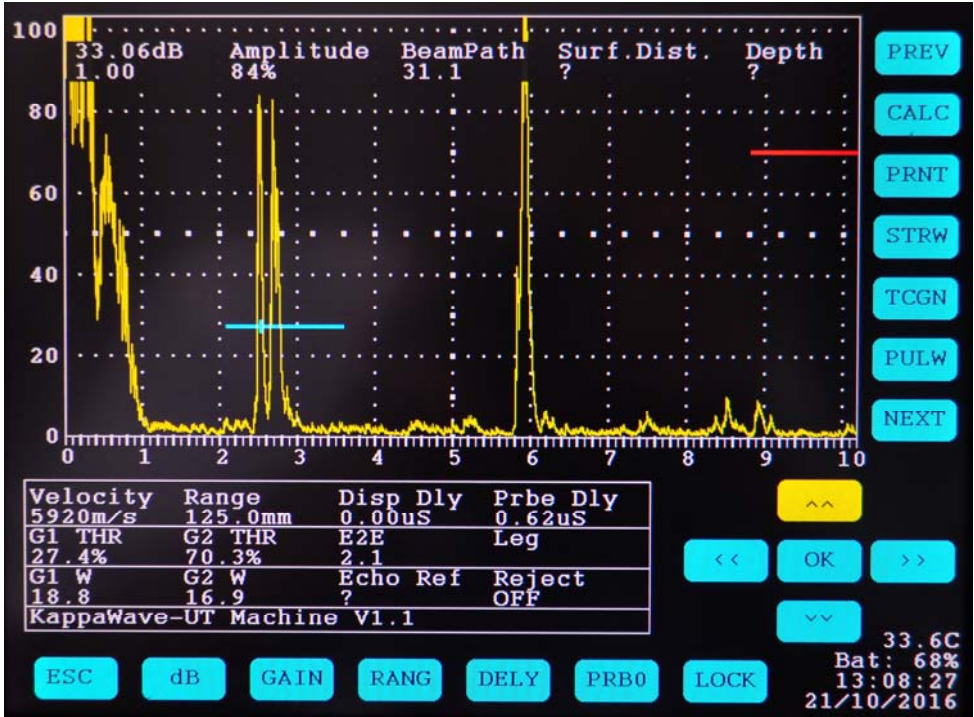


Fig 48. Resolution check on another block where a difference of 2.1mm from a beam path of 31.1mm being displayed. BWE can be seen at 72.5mm

Verification of other materials.

After calibrating in steel, thickness of materials other than steel can also be measured. To do this, place the probe on the new material and change the velocity in the instrument for new material. The Beam path on the top readout panel should give you the actual thickness of the new material.

For example, calibrate the instrument in steel using V1 block to 100mm range. Place the probe on the Perspex insert of the V1 block. Change the velocity in the instrument to 2730 m/sec and read the beam path shown on the top readout panel. It should read 50mm. If you see some slight changes, it could be due to (a) differences in machining the Perspex (b) actual velocity of Perspex in the block could be different from the velocity you have entered in the instrument.

Specifications

Range	
Test Range	25mm to 6m in steel
Velocity	Selectable in m/sec, 1400-8000 m/sec
Unit	Selectable: mm or inches for range
Delay	0-2812 μ sec
Zero offset	0-1000 μ sec
Range	Selectable with velocity & thickness
Range calibration	Single echo with velocity or 2 point calibration
Display	
Screen	Touch screen 26.4cm (10.4") TFT
Resolution	800 (RGB) X 600
Active area	211.2 (W)X158.4 (H)mm
Last action	Colour on display button
Cancel function	Escape key
A scan display area	175mm(W) X 93mm(H)
Display marks	100 divisions (Horizontal) 5 divisions (Vertical)
Measurement method	Gate & display marks for distance and amplitude
Pulser	
Pulser	Negative spike
Pulse width	User variable
PRF	Selectable: 100Hz, 1 KHz
Energy	Selectable: 2 levels
Damping	Selectable. 1K, 120E
Frequency	1-10MHz
Cross talk attenuation for TR	78 dB with 4MHz probe
Receiver	
Gain	0 to 96dB
Gain increment	.03, .2, 1, 2, 6, 12dB
Rectification	RF, Positive half wave
Reject	Selectable: 0-44%FSH
Modes	Pulse echo, through transmission or dual
Amplitude measurement	0-100% FSH
Horizontal Non linearity	< 1% FSW
Vertical Non linearity	2% FSH
Gates	
Measurement gates	Selectable: 2 independent gates
Echo measurement	Flank
Gate start	Selectable over entire displayed range
Gate width	Selectable from gate start to end of displayed range
Gate colour	User variable
Gate height	Selectable from 5% to 100% FSH
Alarms	Selectable Audio, coloured visual
Echo to echo	Gate 1
Display locations	Transparent overlay on top of screen and in boxes below
Gate 1	Amplitude, beam path, Surface distance, depth, Echo to echo, Echo ref, dB difference
Gate 2	Amplitude, Alarm

Flaw detection	
Amplitude measurement	Maximum amplitude locator on Gate 1
AWS D1.1	Standard
DAC / TCG	Standard
DAC points	Upto 14 points
DAC offset	+6, 12, -6, 12 dB
Dimensions (mm)	270(W)X217(H)X87(D)
Weight	4.0 kg with batteries
Keypad	Touch entries
Language	English
Probe connections	2 nos, Lemo
Probe angle	0 - 90 degree
Power	
Battery	11.1V, 10.4Ah, 97.6Wh, Lithium-ion, rechargeable
Battery life	14h
Input Power	220V Ac mains, 50Hz
Charge indicator	For charge % during charging and use
Battery charging max temp	50°C
PC Connectivity	
Saving of test files	20 Calibration set-up files in equipment with DAC / TCG
Loading of settings	Selectable from any saved
Printing of test files	Print command to save and transfer to computer or for review in equipment
File names	Auto naming with date & time, thus avoids duplicating
Echo Display	Fill, unfill
Display Lock	Display can be fully locked for work
Storage	SD card on board
Data interface	USB 2.0
VGA connector	1 no for additional display or projector
Recording of signals	SD card 2 GB
Operating Temperature	0° to 55°C
Enclosure	Dust and moisture resistant



Notes

