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# RT10-C Ultrasonic Rail Flaw Detection Push Cart Operating Manual

Rev 1.3



Ultra Instrument, Inc.  
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Fig 1 The Front Panel of RT10-C Instrument

## Chapter 1 Instrument Overview

RT10-C is our portable ultrasonic rail flaw detector using wheel probe. It is an upgraded model from RT10-B. The instrument provides single channel A-scan as well as simultaneous A-scan and B-scan ( in the following we will just refer it as B-scan). Further more the instrument also offers an zoomed B-scan mode, where A-scan of zero degree channel is displayed for monitoring back wall echo.

The instrument provides continuous B-scan recording. The data is saved in the internal storage and can save up to 100km. With expanded external SD card, the data save range can be increased to 1000km.

In B-scan, the repetition rate is 400Hz, the max testing speed is 4.3km/hr.

Unlike the traditional only A-scan instrument, RT10-C instrument offers an user interface. The operation of RT10-C instrument is just like operating high speed rail flaw detection vehicle, the operator can input icons to annotate the B-scan image.

By using TFT screen with operating range between -30°C~80°C and water proof design, the instrument can be used in very adverse field environment.

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## Chapter 2 Main Specification

### Instrument Specification

Channels	9 (wheel probe)
Inspection Mode	A-scan, A/B-can simultaneous , Zoomed B-scan
Probe Frequency	2~4MHz
Repetition Rage	400Hz
Trigging Pulse	520V negative
Applicable Rail Type	90lb~140lb rail
Gain Range	0~72dB
Alarm	Reflection、Through Transmission
Gain Error	<1dB for every 12dB
Internal Storage	>100km
Operating Voltage	11V Lithium Battery
Screen	800x600 resolution , 8.4'' high brightness , brightness >800
Power	15W
Dimension	260x190x100mm
Weight	2kg (Including Battery)
Operating Temperature	-30℃~ 80℃

Table 1 Instrument Specification

### Push Cart Specification

Materials	ABS and POM, Insulated and water proof
Tank	18 liters
Operating Temperature	-30℃~ 80℃
Dimension	3900x900x3220mm
Weight	18kg

Table 2 Push Cart Specification

## Chapter 3 B-scan

Once the instrument is turned on, the instrument will be into simultaneous A/B scan mode. The following Figure 2 shows the simultaneous A/B scan mode after the instrument is turned on.

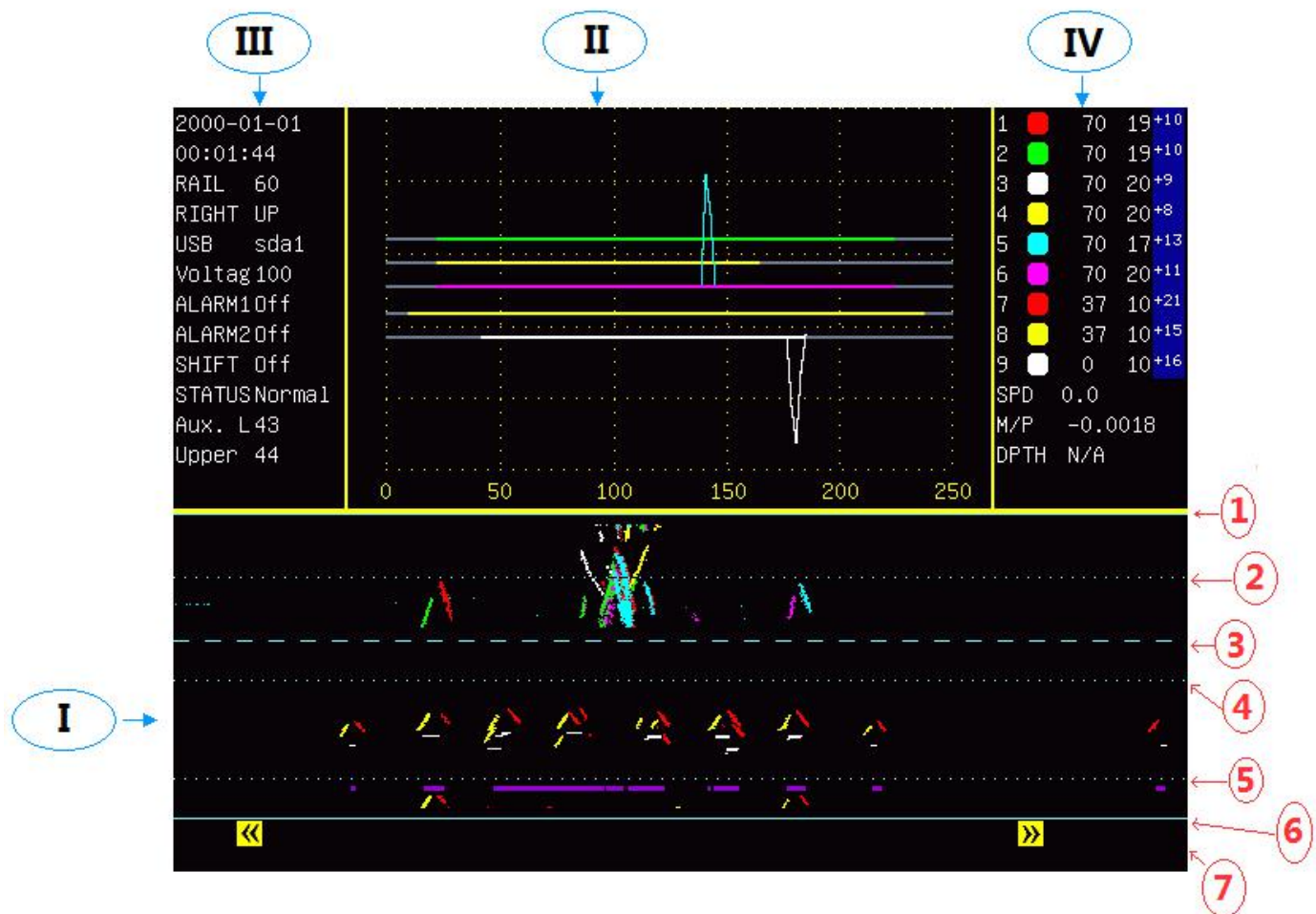


Figure 2 Simultaneous A/B scan Mode

Push the cart, the encoder will generate a pulse very 3mm and then generate B-scan image. No matter the push cart is moving forward or backward, new data will be added to the right of the screen. When the screen is full, the screen will be rolling.

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## B-scan

As it is shown in Figure 2 , The whole B-scan is divided into the following 4 areas.:

Area I: B-scan display and annotation icon display;

Area II: Multiple channel A-scan;

Area III: Setting Parameter display ;

Area IV: Channel gain setting, testing speed display;

In the above area I, there are a couple of dashed line and a solid line. These lines divide the B-scan area into several parts in order for the user to examine the signal of each channel. These lines are detailed below.

Dotted line②: auxiliary line for the fillet area reflection (second leg reflection). The position of this auxiliary line can be adjusted. Channel 1,2,5and 6 are the channels that can generate fillet area reflection. They are skewed 70 degree channels. Channel 3 and 4 are straight 70 degree channels and don't generate fillet area reflection.

Dotted line③: The area from solid line ① to dotted line ③ is B-scan area for 70° channels。

Dotted line⑤: The starting point of the base. If there are any base defect, 37° channel can find these base defect, these base defect will be displayed in the area between dotted line ⑤ and solid line②。

Solid line⑥: This is the bottom of the rail. The data from 37degree channels will be displayed in the area between dotted line ③ and solid line ⑥。

Area⑦: this area is used for displaying icon and cart directions。

Please not the data from zero degree channel will be displayed in the area from dotted line ③ to solid line⑥。

Area II is used for displaying multiple channel A-scan data. The data from 70 degree channel (channel 1~6) will be displayed upward. The data from 37 degree channel will be displayed downward. The data from 0 degree channel (channel 9) will also be displayed downward. In this area, The horizontal represents sound distance with mm as the unit. The scale is drawn at the bottom of the area II.

## Zoomed B-scan

During B-scan, press “Tab” key, it will switch to zoomed B-scan mode as shown in the following Figure. 3. Press “Tab” key again, it will switch back to B-scan mode. The zoomed B-scan allows the detail view of the defect. Please



note that in zoomed B-scan, the screen will be cleared. The channel gain and other operation parameters are displayed at the bottom of the screen.

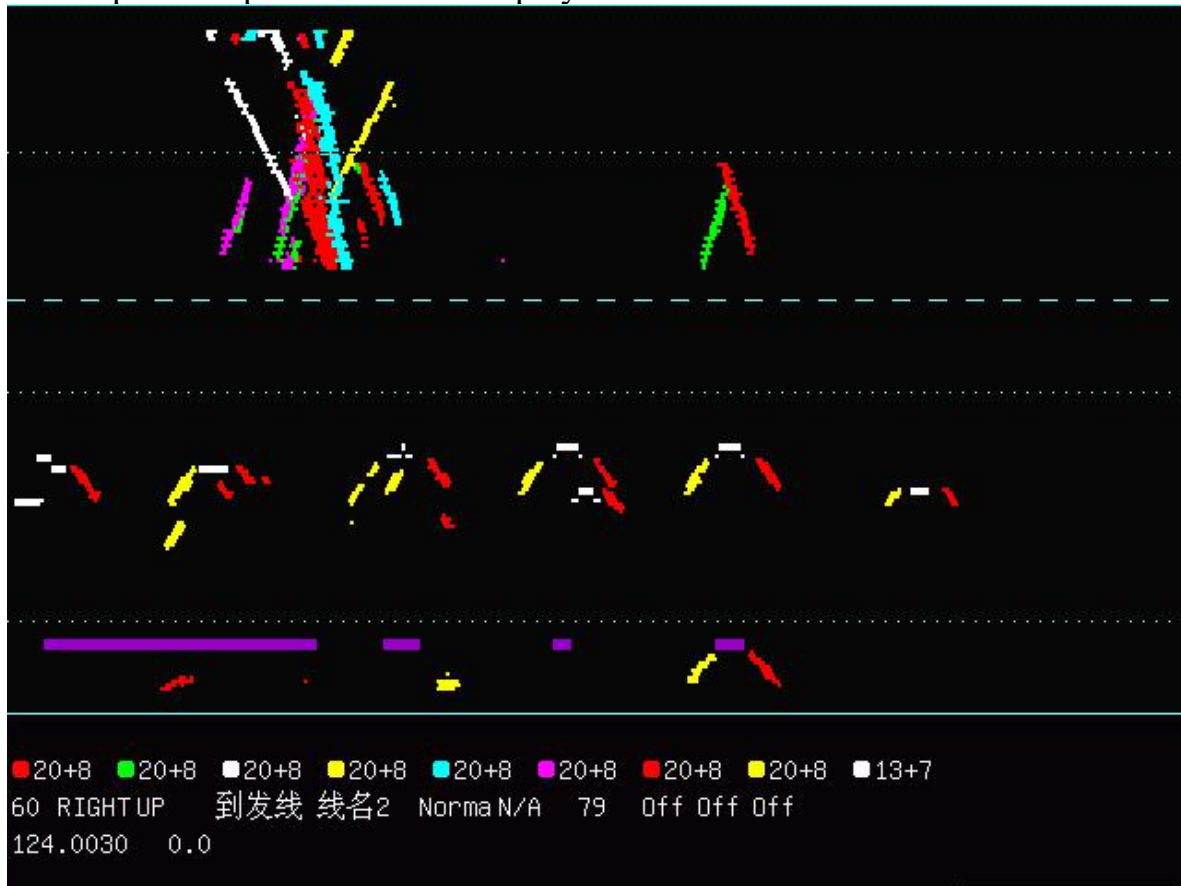


Figure 3 Zoomed B-scan

## Operation Parameter Settings

Area III shows the status and the operation parameters: date, time, rail type (rail weight), battery voltage, alarm on/off etc.

“RAIL” display the current rail type. By pressing key, it will be switched to next rail type and clear the B-scan image. The sequence is 43→50→60→75→43。

“USB” column display where there is a USB thumb drive is plugged in. When there is no USB thumb drive is plugged in, it shows “N/A”. When the USB thumb drive is plugged in, it shows “sda1”, which means the USB drive is valid and can be used for transferring data from the instrument to the USB thumb drive.

“Batter” shows the percentage of the battery. When this number drops to 5, the instrument can not be use and the battery has to be charged. Otherwise the instrument may be shut off and thus the data may be lost.

“Alarm1” and “Alarm2” shows the current alarm status. In which, Alarm1 is the reflection alarm, Alarm 2 is through transmission alarm。

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**“STATUS”** 。 When “Alignment” key is pressed, the status column will display which channel alignment is tuning. Then the user can use “+” and “-” key to align the selected channel. When the “Alignment” key is pressed again, it will be switched to next channel. The sequence is channel 1 → channel 2 → channel 3 → channel 4 → channel 5 → channel 6 → channel 7 → channel 8 → channel 9 → Auxiliary line → base of channel 7 → base of channel 8 → Normal. When the alignment is done, press “Start/Stop” key to start B-scan.

Furthermore, for convenience, one can also use numerical key directly to select the channel to be aligned. When “STATUS” shows “Normal”, press the “Alignment” key, then use numerical key 1~9 to select the channel to be aligned directly, then use “+” and “-” to do the alignment. If one wants to adjust the position of the auxiliary line, press key 0, then press “+” and “-” to adjust the position of the auxiliary line.

Area IV displays the information of each channel such as the color of each channel used in the B-scan, the gain of each channel, testing speed and current location (mile post). When the testing speed is above the up limit set by the administrator, the column of the speed will display “speeding” and it will trigger the audible alarm.

## **Operation Parameter Setting**

During B-scan operation, to alter the operation parameters (such as the operator ID, line number, milepost), one has to go to Setting interface. To do so, one has to press “Setting” key to go into setting interface as shown in the following Figure 4. After setting is done, press “Return” key to back to B-scan mode.

After entering setting interface, the first line will be selected as shown in figure 4. The selected line will be highlighted with blue color. To move to next parameter, press the “Tab” key.

The parameters can be two types. One requires to input numbers. The other one just selects from the pull down list. For numerical input type, the underline indicates the current input position. One can input any numbers 0~9. Operator ID, Device ID, line ID and switch ID are all numerical input type. For selection type, one can use the up and down arrow key to make the appropriate selection, such as Track Type, Track Name, Track position etc.

If the user is the administrator, after input the password at the authorization column, one can go into the parameters settings authorized by the administrator. The default password is 123456. The password can be changed in the time setting user interface. The general user can only have file management interface and this setting interface.

Track type and track name are the parameter that the user can input first into the instrument and saved in the instrument. Then the user can do the selection.

Device	0001
Operator	0004
Rail ID	0001
MilePost	0124.003
Track Type	DEPARTURE
Track Name	TRACK2
Station	TRACK2,Station2
Track Pos.	Right Track
Track Dir.	Up Track (+)
Speed Limit	03.0
Milepost Unit	Killometer
DW Position	Right
Differential	On
TurnOut	1234

Authorization	*****
Version	V 1.33

Figure 4 Operation Parameter Setting Interface

## Gain Adjustment

During B-scan, to adjust the gain of each channel, one can use the following keys to adjust the gain as shown in the following Figure 5.

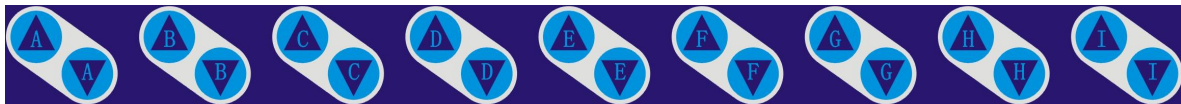



Figure 5 Keys for adjust the gain

For example, to change the gain of channel 1, just press , the modified gain will updated on the screen as shown in the gain column in area IV in Figure 2, The modified gain will also be saved in the disk and the gain change will also be shown when the data is replayed.

Please note during B-scan, only the gain fine adjustment can be implemented, i.e., the blue highlighted gain column in area IV in Figure 2.



# Input Defect and Annotation Icons

When the “Shift” key is turned off, please use numerical key 0~9 to input icon for annotation of the B-scan image. When the “Shift” key is turned on, these numerical keys can be used to input defect. The following Figure 6 shows some of the icons.

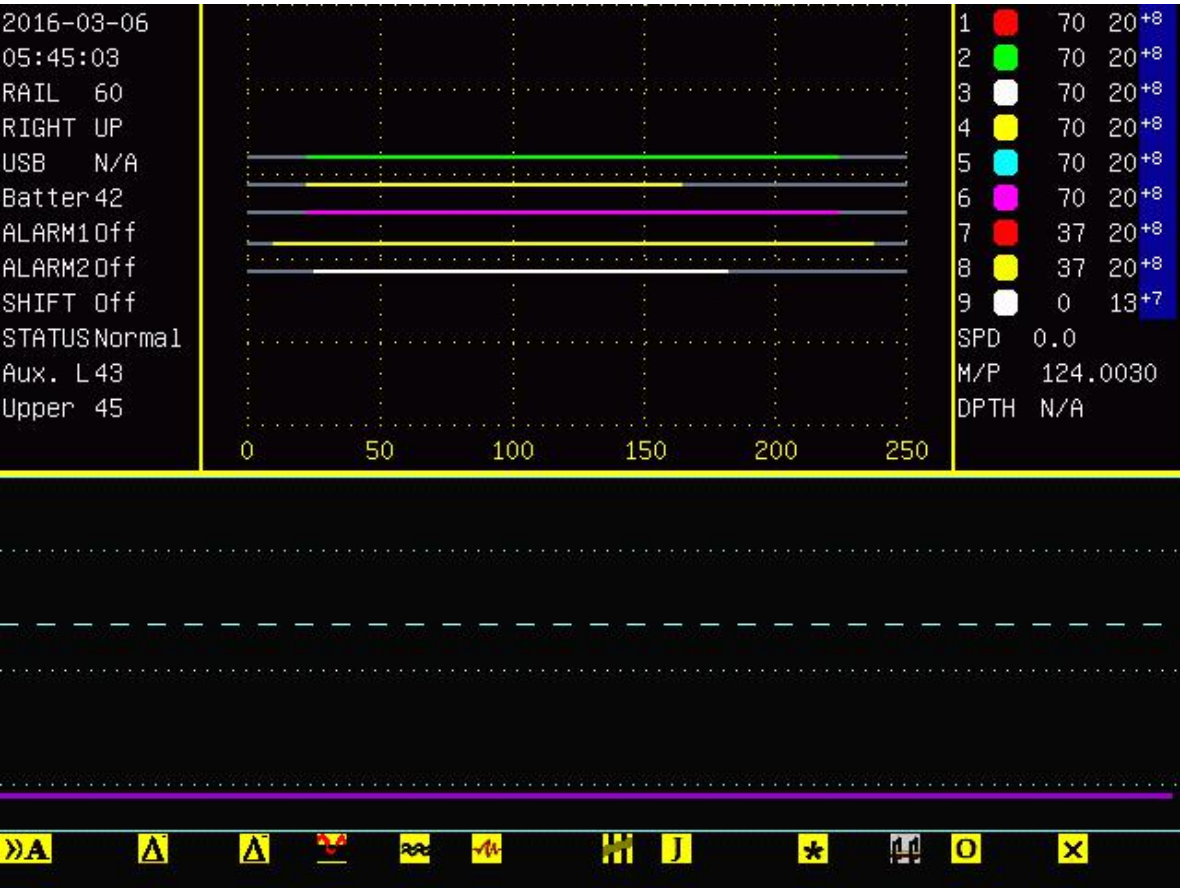


Figure 6 Examples of icons entered during B-scan

When the push cart is moving, press the numerical keys, annotation icon will be shown at the bottom of the B-scan area ( Area ⑥ ) of Figure 2). Please note only when the cart is move, the icons will be shown on the screen. If the cart is not moving or B-scan stops, no icons will be shown.

List of Icon and its meanings are shown in the following Table 3、Table 4





Type	Icon	Key	Sequence	Note
Manual Alarm		Numerical Key 1	0	Shift Key On
Defect (Small)		Numerical Key 2	1	Shift Key On
Defect (Medium)		Numerical Key 3	2	Shift Key On
Defect (Big)		Numerical Key 4	3	Shift Key On

Table 3 Manual Defect Input












Type	Icon	Key	Sequence	Note
Surface Wave		Numerical Key 1	4	Shift Key Off
Welding		Numerical Key 2	5	Shift Key Off
Noise		Numerical Key 3	6	Shift Key Off
Crossing		Numerical Key 4	7	Shift Key Off
Junction		Numerical Key 5	8	Shift Key Off
Switch		Numerical Key 6	9	Shift Key Off
Bridge		Numerical Key 7	10	Shift Key Off
Multiple Hole		Numerical Key 8	11	Shift Key Off
Confirm		Numerical Key 9	12	Shift Key Off

Table 4 Icon List

**Key**  is used for odometer reset to avoid accumulation error. For example: if current milepost is 124.1055, press  key, the milepost will display as 124.0000 (round to the closest whole number)

## Defect Recognition

Some typical defects are shown in Figure 7. The indication marked by 4 dash ova line are 4 detail fracture in the head of the rail, where Defect Number 1 is found by channel 1 and 2, Defect Number 4 is found by channel 5 and 6. These two defects are side drilled holes.

Head defect 2 and head defect 3 are Ø4 bottom drilled hole. Defect number 2 are actually two defects, detected channel 2 and channel 6, but they are overlapped. Similarly defect number 3 are also two defect, detected by channel 1 and channel 5. Figure 7 also shows bolt hole break and base defect. All four bolt holes marked by number 5 have bolt hole breaks. The indication at the base of the rail are base defect as marked by number 6 and 7.

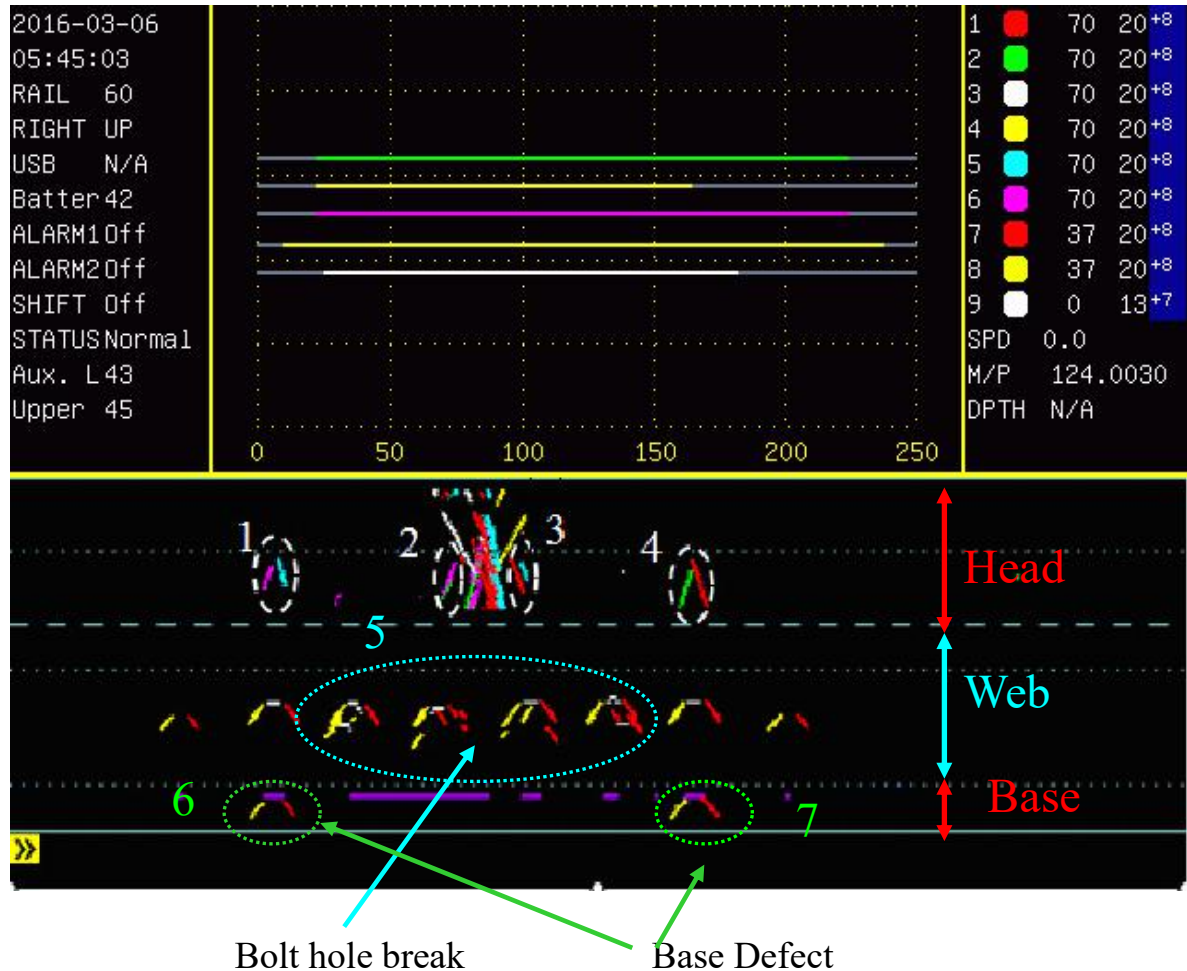


Figure 7 Some Defects shown in the B-scan image

The bolt hole break shown in Figure 7 are explained in detail in Figure 8. The bolt hole break are all 3mm except the horizontal bolt hole break which is 5mm.

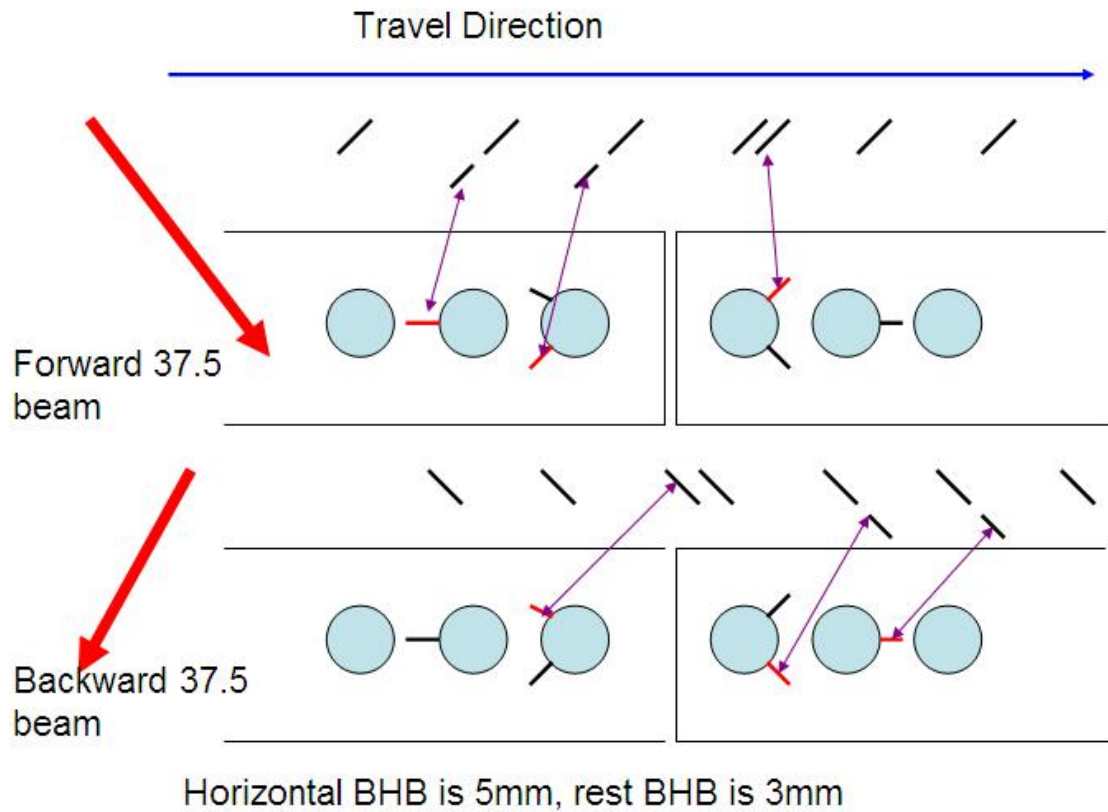


Figure 8 Explanation of Bolt hole break image

Horizontal defect is most likely found by zero degree channel. Please note horizontal bolt hole break can also be detected by 37.5 degree channels. In the following Figure 9, the area circled by the dashed oval line are the indication from 37.5 degree channels.

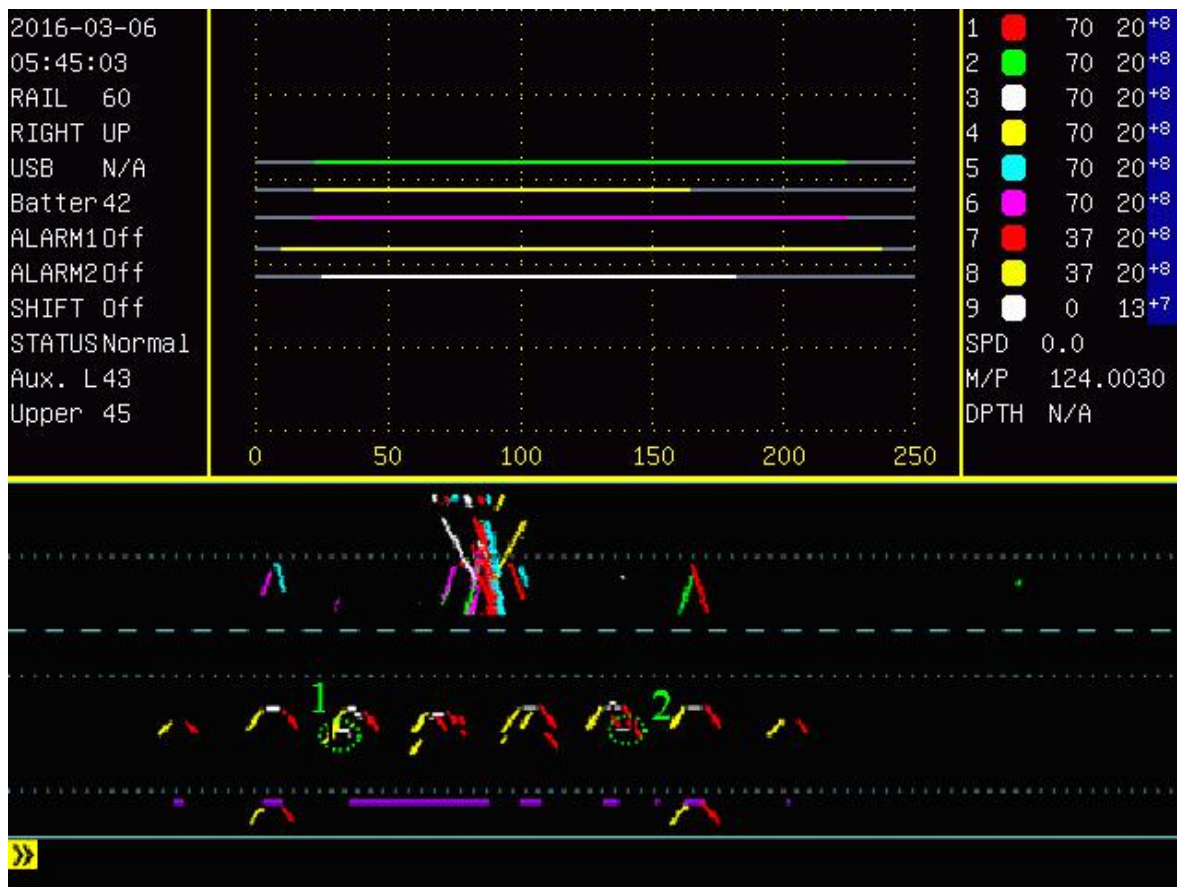


Figure 9 Horizontal Bolt Hole Break

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## Chapter 4 Single Channel A-scan

Single channel A-scan is used for display the A-scan of one channel in the whole screen. It can be used for setting the sampling gate of B-scan as well as manual verification of defect.

In B-scan, press key “A/B”, the screen will be switched A-scan. Press key “A/B” again, the screen will return back to B-scan.

In A-scan, press numerical key 1~9 to selected the desired channel. The selected channel will be highlighted blue as shown in the following Figure 10.

At the bottom of the A-scan grid there is a scale. It is the sound distance( unit is mm). This is easy to the user to see the position of the signal. In the right corner of the screen, it will display the sound distance, the horizontal offset and the vertical offset of the signal above the threshold. For example, in the following Figure 9, it shown the sound distance as well as the vertical offset is 179mm (this is the height of the rail)。

In A-scan, one can also make the following operations: Setting up the position and gate of B-scan, Suppression of A-scan, the Main Gain Setting of one channel and the fine gain setting of one channel, switching of different rail weight.

Please note that for each rail weight, there is one complete setting. Any setting change will be saved for the selected rail weight.

### Sampling Gate Setting

As an example, how to set up the gate of 0 degree channel is shown in the following Figure 10. In Figure 10, the green line is the sampling gate of used in the B-scan.

In the following we will describe how to change the sampling delay and sampling gate.



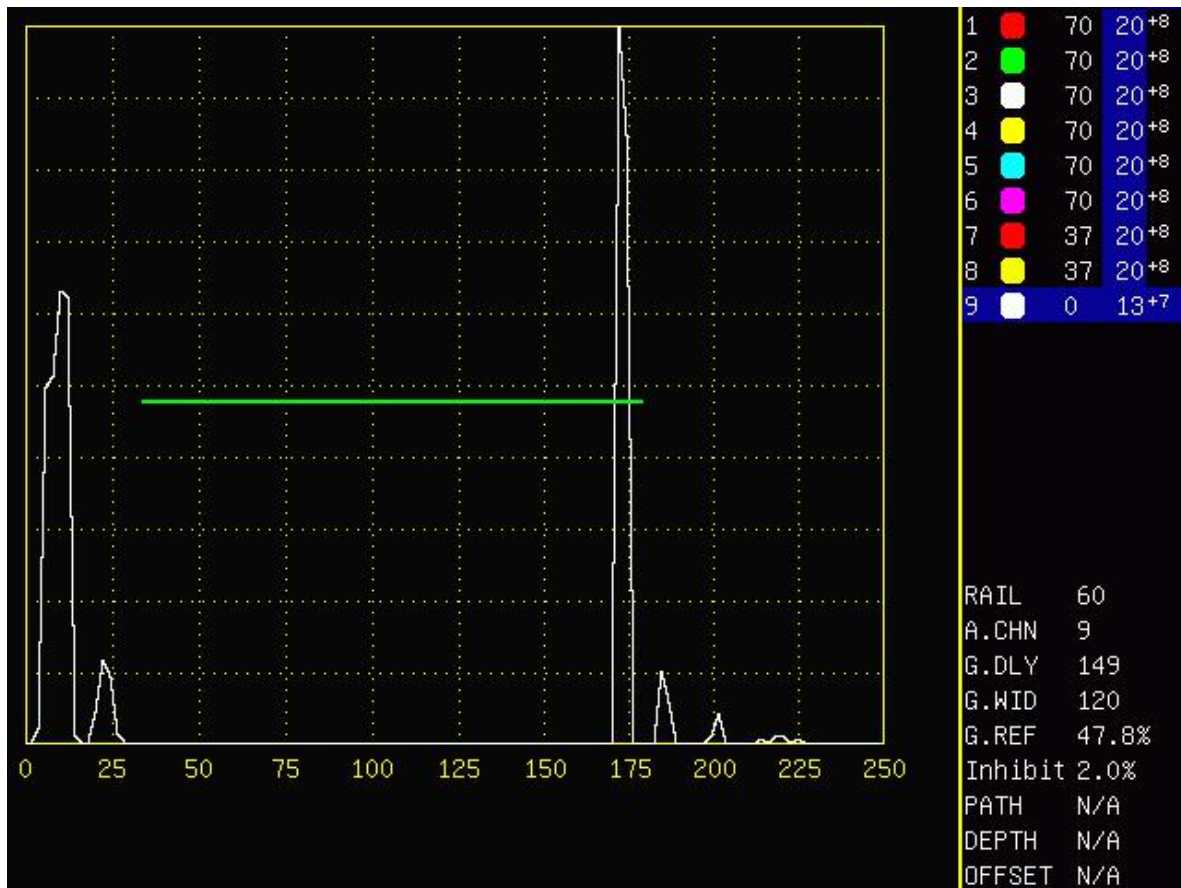




Figure 10 Setting Up the Sampling Gate

To change the gate delay, first press , which means you are adjusting the gate delay. Then press “+” or “-” key to increase or decrease the gate delay. If you press and hold “+” or “-” key, the gate delay will be keep on increasing or decreasing. The green line in Figure 10 will move left or right; At the same time, G.DLY at the right side of the screen will be updated accordingly.

To change the gate width, first press , which means you are adjusting the gate width. Then press “+” or “-” key to increase or decrease the gate width. If you press and hold “+” or “-” key, the gate width will be keep on increasing or decreasing. The length of the green line in Figure 10 will be increasing or decreasing; At the same time, G.WID at the right side of the screen will be updated accordingly.

## Gate Setting For 0 Degree Channel

The gate setting for 0 degree channel must meet the following two requirement:

- 1、 Gate delay must be after the interface signal;
- 2、 The width of the gate must cover the base reflection。

The following Figure 10 shows the gate setting of 0 degree channel.

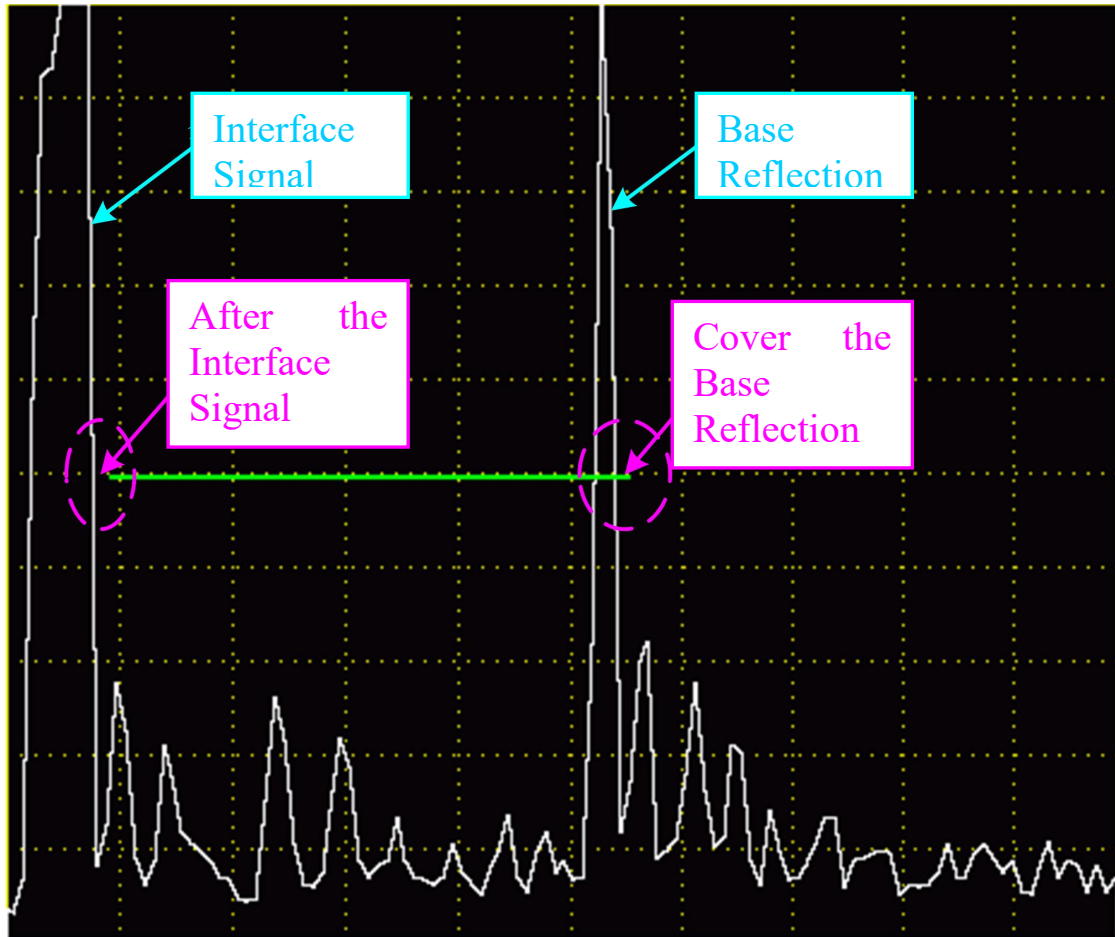


Figure 11 Gate Setting of Zero Degree Channel

## Suppression Setting

In A-scan , by suppression one can get rid of the noise that will interference the recognition of the defect reflected signal. The suppression setting in single channel A-scan is also used in the multiple channel A-scan.

As shown in the following Figure 12 is the zero degree channel A-scan signal after suppression. When it is compared with Figure10, one can see the noise is get rid of and the signal is much easier to recognize.

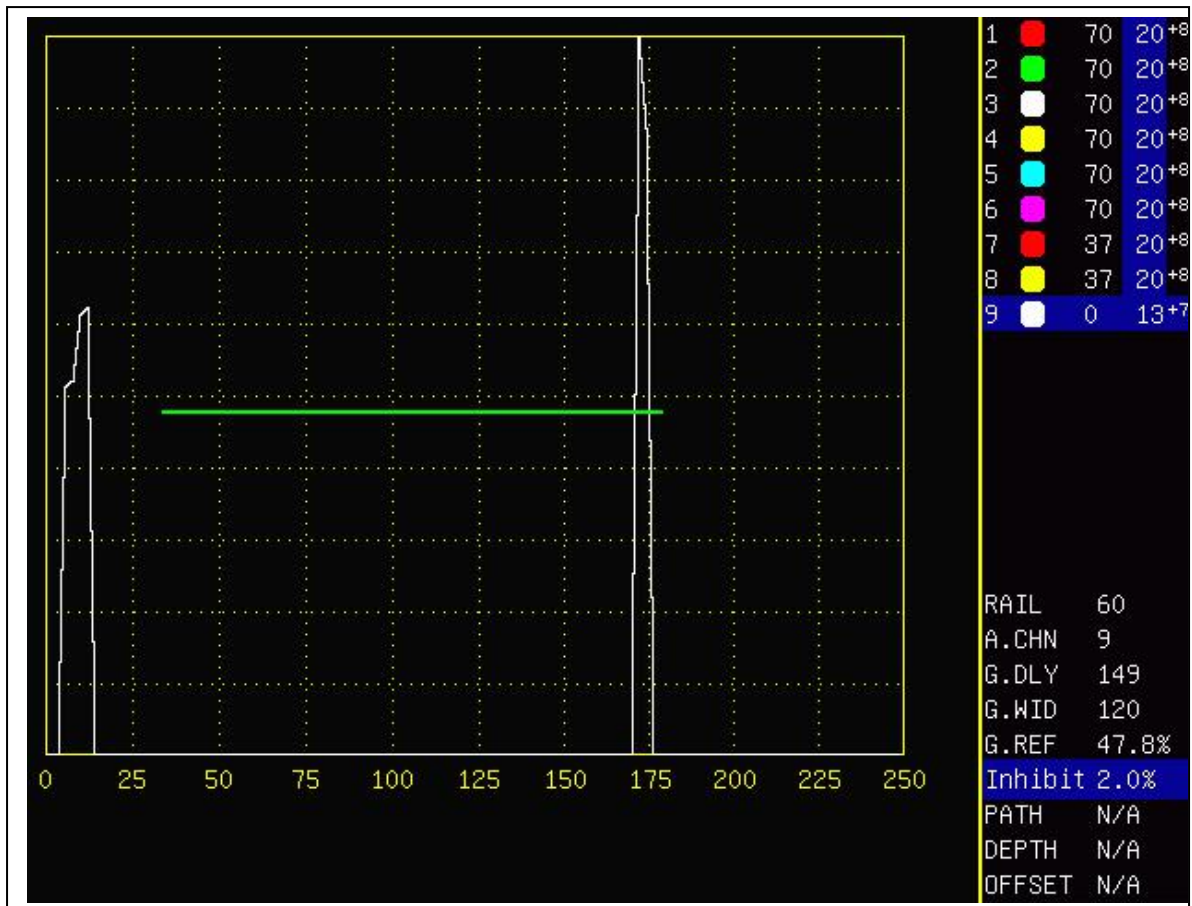



Figure 12 Suppression Setting

Suppression is donated by the percentage and displayed at the bottom right corner of the screen as shown in Figure12. The whole percentage of A-scan is 100%, the suppression setting is 1~99%.

Setting up suppression. First press , indicating we are going to adjust the suppression settings. Then press “+” or “-” to increase or decrease the suppression. When suppression is increased, one can the signal below the suppression level is remove while the signal above the suppression level is kept. At the same time, one can notice the suppression value shown at the right bottom corner is updated.

Please note that the suppression setting is universal to all channels. The suppression level setting used in one particular channel will be applied to all channels.

Further more, one can also use differentiation attenuation to make the signal even clear as shown in Figure 13. Shown in Figure 13 is the signal after differentiation is turned on. When it is compared with the signal in Figure 12, one can see the signal is much clear.

Please see the following section about the differentiation attenuation setting.

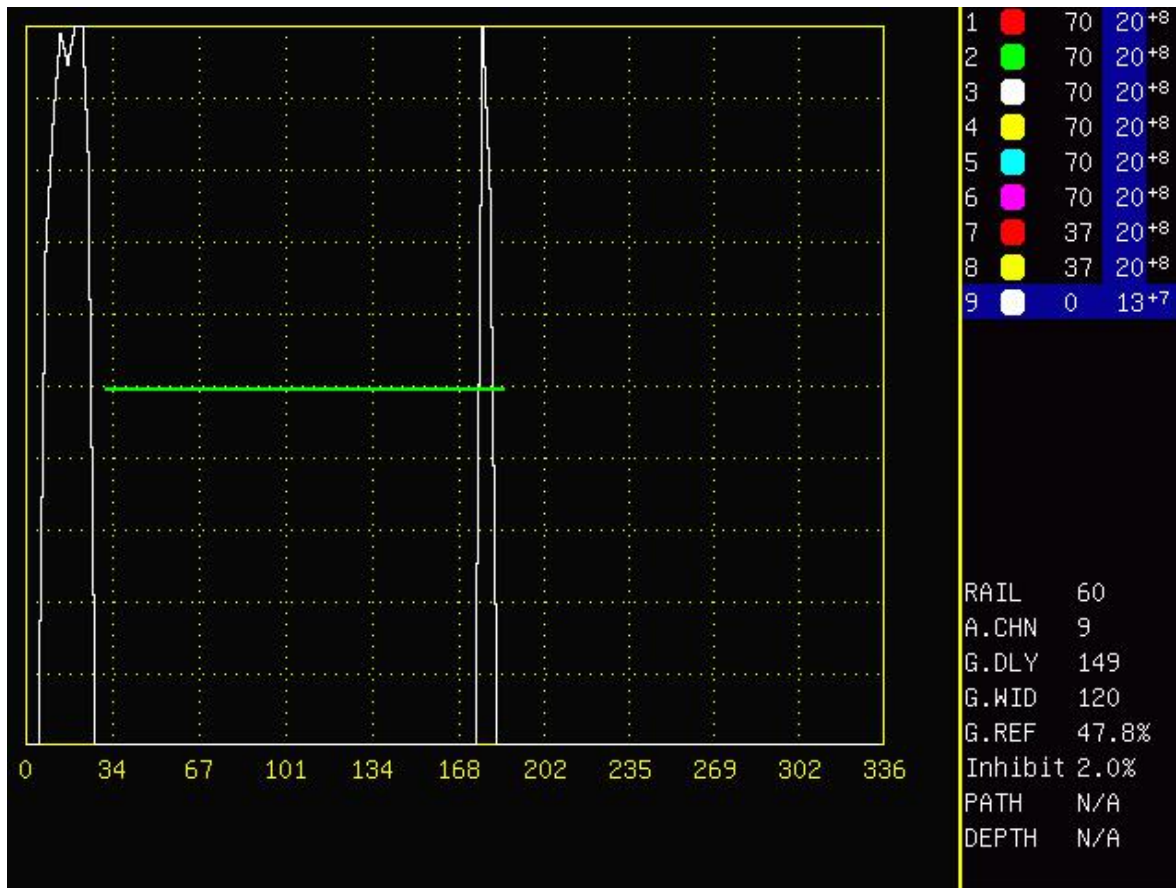


Figure 13 Differential Attenuation

## Gain Setting in A-scan

Unlike B-scan only the margin gain setting can be adjusted. In single channel A-scan, both main gain setting and margin gain setting can be adjusted.

In single channel A-scan, when the main gain column is selected ( the blue high lighted column in Figure 13, the gain change made the gain adjustment key will be updated in the blue high lighted column.

In this case, if one want to make change on the margin gain setting, just press “shift” key, any gain change will be updated in the marginal gain column. Please see Figure 2 where marginal gain column is highlighted.

In A-scan, when “Shift” is turned off, the main gain column will be selected. When “Shift” is turned off, only the marginal gain column will be selected.

Please no matter the instrument is in A-scan or B-scan, the minimal value of gain is 1dB, the minimal value of the marginal gain is 0. The gain used for that particular channel is the sum of the main gain and marginal gain.

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## Chapter 5 Settings

The Settings can be divided into the following sections, “File Management”, “Operation Parameters”, “Probe Parameters”, “Trigger Delay”, “A-scan Setting”, Distance Amplitude Correction Curve Setting”, “Other Administration Setting” etc, in which “File Management” and “Operation Parameter” can be modified by user with out authorization. The rest have to be modified with administration authorization.

In the following we will describe each setting user interface. “Operation Parameter” user interface has already been described before and will not repeat thereafter.

### File Management

This is the first interface that appears on the screen when tthe setting key is pressed.

file	size	data/time
0001-20140312.ckdat	4 KB	2014-04-14/09:58
2014-03-12--02-31-41--sas.bmp	900 KB	2014-04-14/09:58
2014-03-12--02-28-51.bmp	900 KB	2014-04-14/09:55
2014-03-12--02-25-38.bmp	900 KB	2014-04-14/09:52
2014-03-12--02-25-40.bmp	900 KB	2014-04-14/09:52
0001-20140311.ckdat	15 KB	2014-04-14/09:32
2014-03-11--22-20-31--mas.bmp	900 KB	2014-04-08/04:39

Figure 14 File Management Interface

In file management, one can save the data to U disk, delete the file and reply the data file as shown in Figure 14 above. As shown in Figure 14 above, the file end with –sas.bmp is the screen saving data file of single channel A-scan. The file end with –mas.bmp is the screen saving data file of B-scan.



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The file end with .ckdat is the complete B-scan data file. This file can be replayed in the instrument or transferred to a PC for replaying by using a U disk.

To transferred the data file to U disk, use “ ↑ ”、“ ↓ ”to select the desired data file, the selected data file will be highlighted blue. Press the save button, the data file will be saved to U disk. The blue progress bar will be shown on the screen. When the progress bar disappears, the date file is saved to U disk successfully. One can then unplug the U disk.



Figure 15 Data File Save Progress Bar

If no U disk is plugged into the instrument, then an error message “USB not available” will pop out as shown in the following Figure 16. After Press OK, the message will be gone. Then one can do other file management operation.

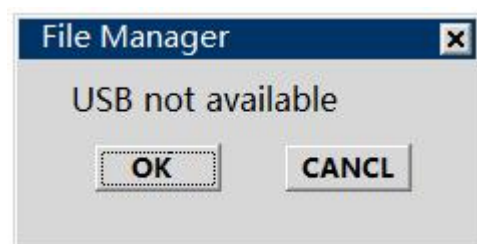


Figure 16 Message for No U-Disk Available

To delete file, use “ ↑ ” 、 “ ↓ ” key to select the desired file, then press “Backspace” key to delete the selected file. Please note that once the file is deleted, it can not be recovered and there is no deleting file confirmation message. So please be cautious before deleting the file.

## Replay the Data in the Instrument

In “File Management” Interface, use“ ↑ ”、“ ↓ ”key to select the desired file, then press “OK” key, one can replay the data in the instrument.

The following Figure 17 is a screen shot of a replay data.

Since all the operation parameters are recorded, all these parameters are displayed during the replay. These parameters includes: Gain (Main Gain and Margin Gain), Operator ID, Line ID, Rail ID and Rail Type etc.

During replay, press “+” 、 “-” to control the replay speed. Press “OK” key to pause the replay. Press “OK” key again to resume the replay.



If the data is replayed to the end, press “OK” key twice and then the data will be replayed again from the beginning.

During the replay or when the replay comes to the end of the data file, press “Return” key will return back to “File Management” interface.

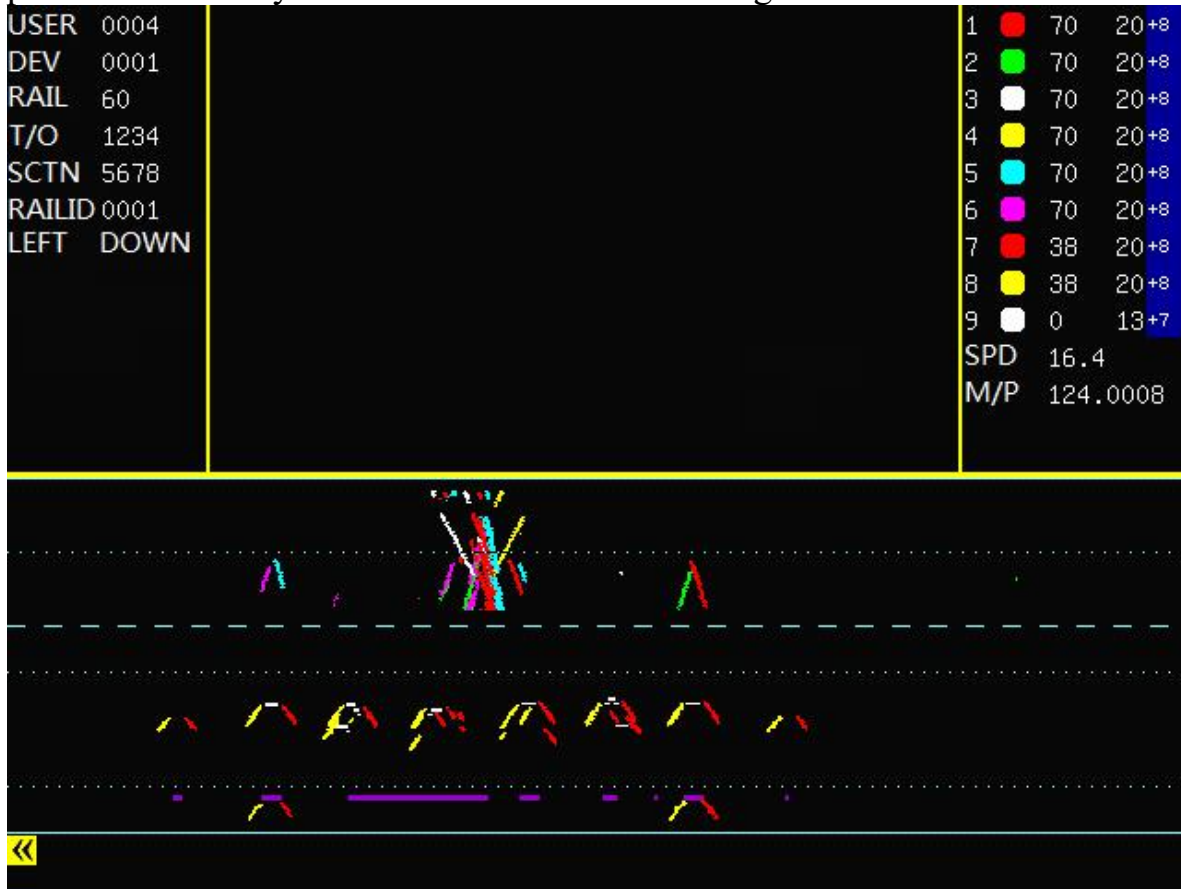


Figure 17 Replay the Data in the Instrument

## Trigger Delay Setting

Trigger delay is used to set up the trigger sequence of each channel. It is setup by the manufacture and normally does not require any modification.

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## A-scan Setting

The A-scan setting here is different from the single channel A-scan described before. The A-scan here shows the signal from the trigger pulse. In this particular case, it will include the sound travel inside the wheel probe. The purpose of A-scan setting described here is mainly used to set up the rail interface. As shown in Figure 10 described before, the instrument can show the height of the rail, the depth of the rail and sound distance scale. All these

calculation is by reference the top of the rail. Shown in the following Figure 20 is the A-scan of zero degree channel.

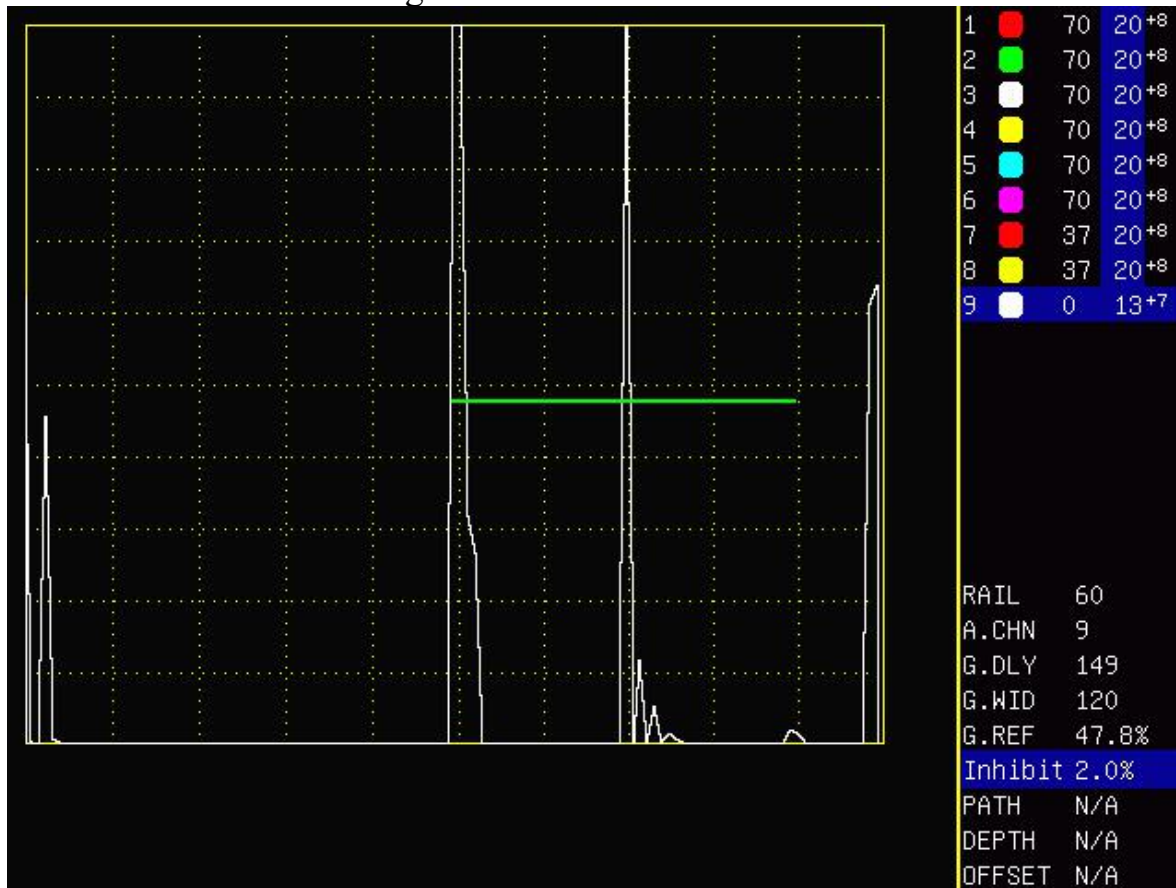


Figure 18 A-scan of Zero Degree Channel

As shown in Figure 20, the starting point of the green line is the interface of zero degree channel and is the top of the rail. On the right one can see the G.DLY is 143, which means the delay of the green line is 143us. With this parameter, the instrument can know the top of the rail and thus is able to calculate the sound distance as describe in single channel A-scan in previous chapter.

## Distance Amplitude Correction Curve

This interface allows user to setup the distance amplitude correction curve. Shown in Figure 21 is the distance amplitude correction curve for channel 9 (zero degree channel) for 60KG rail.

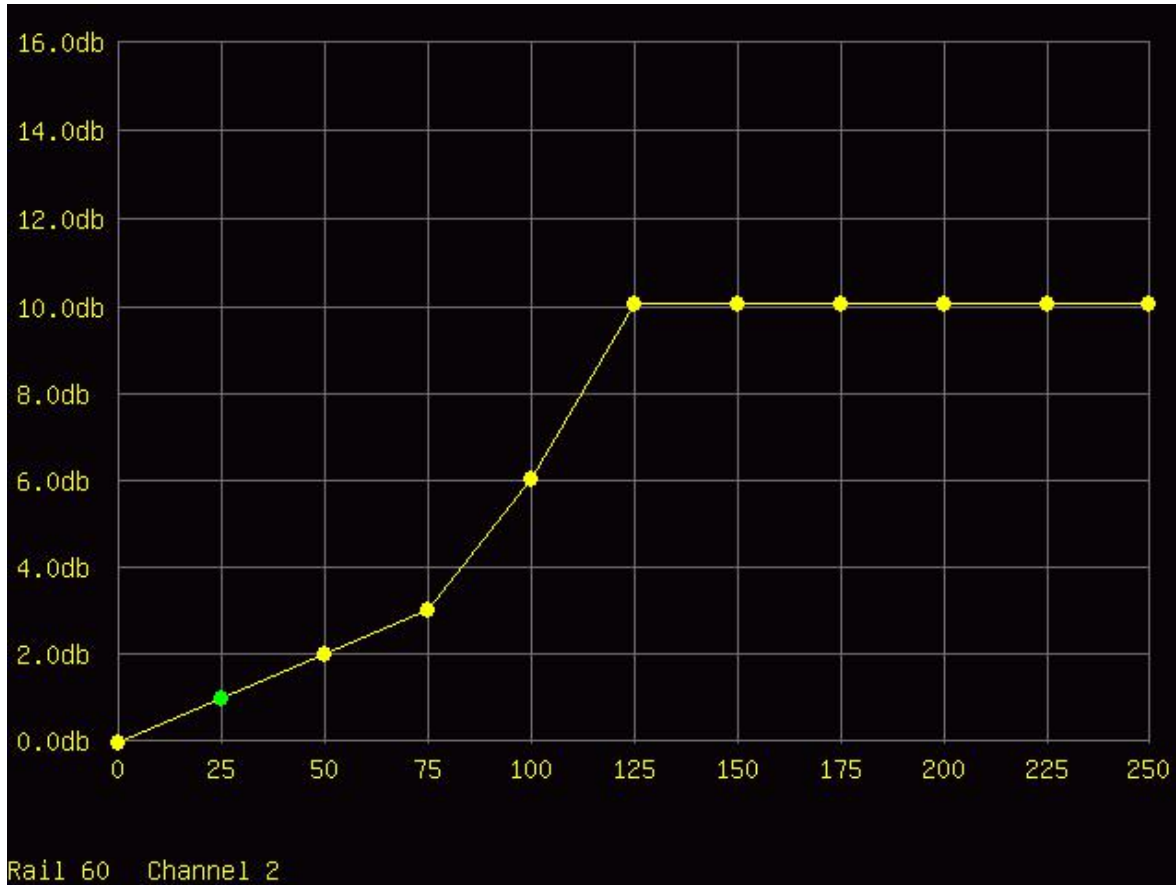



Figure 19 Distance Amplitude Correction Curve

As shown in Figure 21, the current rail type and the channel is displayed at the bottom left corner of the screen. One can press numerical key 1~9 to switch to other channel or press  to switch to other rail type..

In the distance amplitude correction curve, there are 11 solid circles, represent 11 setting point. Shown in Figure 21, one can see that the second point is high lighted green. One can use “+”、“-”key to increase or decrease the gain at this point. Press “Tab” key to switch to next setting point. As shown in Figure the max gain for distance amplitude correction curve is 10dB, the min value is 0dB.

## Other Administration Parameters

This interface allows the user to change the time and date settings, change the administration password, update the line list and do software upgrade as shown in Figure 20.

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Yea	<input type="text" value="2000"/>	Hou	<input type="text" value="0"/>
Mon	<input type="text" value="1"/>	Min	<input type="text" value="17"/>
Day	<input type="text" value="1"/>	Sec	<input type="text" value="10"/>

Update Password	<input type="password" value="*****"/>
Repeat Password	<input type="password" value="*****"/>

<input type="button" value="Update Track Name List"/>
<input type="button" value="Update Gain Curve Data"/>
<input type="button" value="Software Upgrade"/>

Figure 20 Other Administrative Parameters

Use “Tab” key to switch to different field. The selected field will be high lighted blue, one can then type in to change the date and time. If the number typed in is not valid, the change will be ignored and can not be saved.

For administrative password, if the password typed in twice are not same, the change will also be ignored and the password will not be saved.

To update the track name list, press “Tab” key so as the “Update Track Name List” is highlighted which is shown as a dashed frame. After plug in a U disk and the U disk is recognized by the instrument, press “OK” key, the track name list will be updated with the list file in U disk. If it is updated successfully, it will display a message “Files are Updated Successfully”. If the U disk is not plugged in or is not recognized by the instrument, it will show a message “U disk is not available”. If there is no track name list file in the U disk, it will display message “Track Name List File is not Available”.

To update the instrument software, press “Tab” key until Software Upgrade is selected (indicated by a dashed frame outside). Plug in the U disk and wait until the U disk is recognized, press “OK” key and the software will be upgraded. If it is upgraded successfully, the instrument will go directly into B-scan.

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## Chapter 6 Mechanical Operation



Figure 21 The push cart on the Ground

As shown in the above Figure 21, when the part is not on track for testing, the wheel for walking on the ground is at down position.◦

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## On track Testing

To put the cart on track for testing, lift the handle up as shown in the following Figure 22



Figure 22 How to make the walking wheel in up position

As shown in the following Figure 23, the ground walk wheel is in the up position.





ground walking wheel is in up position

Figure 23 The push cart is on track for testing

### **Tilting Adjustment of the Push Cart**

After the push cart is put on the track, one as to adjust the tiling of the cart so as the base reflection signal is at maximum. To do so, go to single channel A-scan of the instrument and switch to channel 9 (zero degree channel). First decrease the gain so as the signal is not full scale. Use the two buttons on the cart to move the motors so as to make the adjustment of the tilting of the push cart. Watch the base reflection signal, when the signal is at maximum, the cart tilting is at the right position.

During the real testing, the rail condition change can cause the base reflection signal decrease, one also has to make the adjustment of the tilting of the push cart as described above.

## Wheel Probe Adjustment

The position of the wheel probe is very well adjusted before shipping. However for some reason such as wheel probe replacement, the wheel probe position needs to be adjusted again. The following Figure 28 demonstrate how to

The red knob in Figure 24 is used to adjust the lateral movement of the wheel probe so as to make the wheel probe is in the center of the rail. The black knob is used to rotate the axis of the wheel probe so at to make the sound beam from the zero degree channel transducer is at right angle of the base.

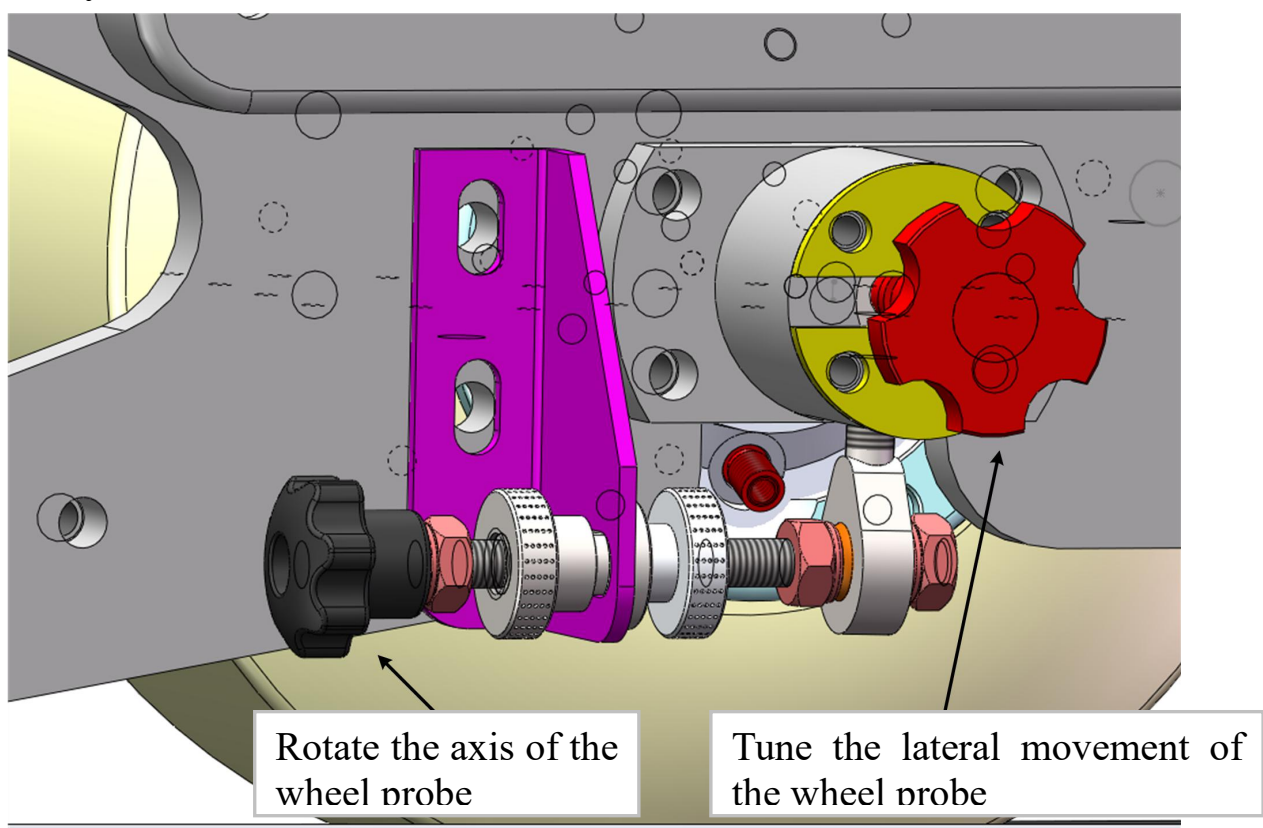


图 24 水轮调整

To make the zero degree channel sound beam at right angle of the base, go the single channel A-scan of the instrument, switch to zero degree channel, decrease the gain so the signal is not full scale. Loose the bolts at the other end of the axis of the wheel probe, rotate the black knob and watch the base reflection signal. When the signal is at maximum, the sound beam from zero degree channel transducer will be at right angle of the base. Tight the two nuts near the black knob. Then tight the bolts on the other side of the axis of the wheel probe.

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To make the wheel probe at the center of the rail, rotate the red knob as shown in Figure 28. The red knob will make the lateral movement of the wheel probe. One can observe if the wheel probe is in the center of the rail. Once the wheel probe is in the center of the rail, one can tight the bolts on the other end of the axis of the wheel probe.

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## Chapter 7 Turn Instrument On and Off

### Turn the Instrument On

To turn on the instrument, first move the power button at the back of the instrument up, then press the Power button in the front of the instrument for 2 seconds. The screen will be lit up and a progressive bar will appear on the screen. Once the progressive bar comes to the end, the B-scan interface will be on the screen

### Turn the Instrument Off

To turn the instrument off, follow the following steps.

- (1) In B-scan interface, press  , a reverse progressive bar will appear on the screen and the screen will slowly turn to white, which means all the software are turned off.
- (2) Press the Power button in the front of the instrument, turn off the instrument.
- (3) Move down the switch at the back of the instrument, which will shut off the power of the instrument.