

**N J J - 9 5 B**

Handy Search  
Instruction Manual

# Preface

Thank you very much for purchasing this JRC NJJ-95B Handy Search

The NJJ-95B RC radar nondestructively locates, detects, and displays the depths and positions of reinforcing steel bars in reinforced concrete structures.

Before attempting to operate the NJJ-95B, please read through this instruction manual carefully to learn all of its features and ensure correct and trouble-free operation.

Keep the instruction manual handy for reference. Refer to the manual for information about the NJJ-95B or when experiencing trouble during operation.

DC01-NJJ-95B

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# Before Operation

## Pictorial Indication

Various icons are included in this manual and are shown on these equipment so that you can operate them safely and correctly and prevent any danger to you and/or to other persons and any damage to your property during operation. Such indications and their meanings are as follows.

Please understand them before you read this manual.



**WARNING**

This indication is shown where any person is supposed to be in danger of being killed or seriously injured if this indication is neglected and this equipment is not operated correctly.



**CAUTION**

This indication is shown where any person is supposed to be injured or any property damage is supposed to occur if this indication is neglected and this equipment is not operated correctly.

## Examples of Pictorial Indication



Electric shock

The  mark indicates CAUTION (including DANGER and WARNING).


Detailed content of the specific CAUTION (“Electric Shock” in the example on the left.) is shown in the mark.



Disassembling Prohibited



Prohibition

The  mark indicates prohibition.


Detailed content of the prohibited action (“Disassembling Prohibited” in the example on the left.) is shown in the mark.



Disconnect the power plug



Instruction

The  mark indicates instruction.

Detailed content of the instruction (“Disconnect the power plug” in the example on the left.) is shown in the mark.

JRC assumes no liability for any damage (such as damage caused to reinforcing steel bars, electrical pipes, gas pipes, etc.) arising from search results using this radar.

# FCC NOTICES:

This device complies with part 15 of the FCC Rules:

Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation

Warning:

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Operation of this device is restricted to law enforcement, fire and rescue officials, scientific research institutes, commercial mining companies, and construction companies. Operation by any other party is a violation of 47 U.S.C. § 301 and could subject the operator to serious legal penalties.

## **Coordination Requirements.**

(a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

(b) The users of UWB imaging devices shall supply detailed operational areas to the FCC Office of Engineering and Technology who shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area of operation, and the FCC ID number and other nomenclature of the UWB device. This material shall be submitted to the following address:

Frequency Coordination Branch., OET  
Federal Communications Commission  
445 12th Street, SW  
Washington, D.C. 20554  
ATTN: UWB Coordination

(d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.

(e) The NTIA/FCC coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

(f) The coordination of routine UWB operations shall not take longer than 15

business days from the receipt of the coordination request by NTIA. Special temporary operations may be handled with an expedited turn-around time when circumstances warrant. The operation of UWB systems in emergency situations involving the safety of life or property may occur without coordination provided a notification procedure, similar to that contained in CFR47 Section 2.405(a)-(e), is followed by the UWB equipment user.

NOTICE: Use of this device as a wall imaging system is prohibited by FCC regulations.

## <Precautions for Use>



### WARNING



Do not use any battery pack other than the BP-3007-A1 or any AC adapter other than the PW-3009-W.

Doing so may cause fire, electric shock, or breakdown.



Do not short-circuit the terminals of the battery charger or battery pack.

Doing so may cause fire, explosion, or breakdown.



Do not insert metallic or flammable objects into the compact flash memory card slot. Doing so may cause injury, fire, electric shock, or breakdown.



Do not disassemble, modify, heat, or place battery pack in fire.

Doing so may cause fire, explosion, or breakdown.



Do not use any charger other than the specified battery charger to charge the battery pack.

Doing so may cause fire, electric shock, or breakdown.



Do not attempt to disassemble, modify, or attempt to repair the NJJ-95B by yourself.

Doing so may cause fire, electric shock, or breakdown.



If the power cord is damaged (exposure of the core wire, open circuit failure, or break in the sheath), contact our nearest branch office, sales outlet, or service station for a replacement power cord. Use of a damaged power cord may cause fire or electric shock.



Do not connect/disconnect the plug while your hands are wet.

Doing so could cause an electric shock.



Do not use (place) the NJJ-95B in a location where it is exposed to flammable or corrosive gas.

Doing so could cause fire, personal injury, or breakdown.



Handy Search is a drip-proof construction but must not be placed in water.

Do not expose the NJJ-95B to water or moisture, and do not use it in rainy weather. Doing so could cause an electric shock or breakdown.



Stop using the NJJ-95B immediately when a sign of malfunctioning is detected, and follow only the detailed procedure in this instruction manual. If it cannot be restored to normal operation, contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in an abnormal state could cause fire or breakdown.



Should the NJJ-95B emit an abnormal sound, odor, or smoke, immediately turn off the power switch, remove the battery pack, disconnect the power plug from the socket outlet, and contact our nearest branch office, sales outlet, or service station.

Use of the NJJ-95B in an abnormal state could cause fire, electric shock, or breakdown.



Before disposing of the used lithium ion battery, insulate the charging terminals by taping or the like. Otherwise, the battery could cause fire or explosion if short-circuited.



## CAUTION



Making a judgement on the search results considering the depth sensing capability of the NJJ-95B:

Since the depth sensing capability of the radar is subject to the conditions of the object of investigation, judging the search results with no consideration of the depth sensing capability may cause the cutting of rebar.



Put your hand through the hand strap and hold the NJJ-95B.

Dropping of the radar may cause an accident such as a device breakdown or personal injury.



When disconnecting the power cord, hold the plug. Pulling the power cord by itself may cause cord damage, fire, or electric shock.



Do not place the NJJ-95B on an unstable place such as a wobbly table or sloping surface.

Doing so may cause a personal injury or breakdown when it drops or falls.



Do not use (place) the NJJ-95B in a humid or dusty location, or a location where water, oil, or chemical may splash onto the radar. Doing so may cause fire, electric shock, or breakdown.



Do not use (place) the NJJ-95B in a location where it is subject to vibration or shock.

Doing so may cause a personal injury or breakdown.



When loading/unloading printing paper, be careful not to cut or jam your fingers in the printer.



Point the antenna surface in the direction of the object (concrete) while you are performing a probe.

If it is pointed into the air or otherwise unsuitable direction, it can cause malfunction of other equipment or other such accidents.



Do not use the NJJ-95B in the vicinity of a radio or TV set.

Doing so may cause noise or poor reception such as disturbance of television pictures. Doing so also adversely affects the depth sensing capability of the radar, and may cause the cutting of reinforcing steel bars.



Do not use the NJJ-95B near a cell phone or transceiver that transmits electromagnetic waves. Electromagnetic waves from the cell phone or transceiver may adversely affect the depth sensing capability of the radar, and may cause the cutting of reinforcing steel bars.



When the NJJ-95B is used for probing on a road, take safety precautions such as providing guard fences to prevent traffic accidents.

<Appearance of the NJJ-95B>





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## Glossary of Terms

A mode	Displays received waveform as it is. The conditions of concrete directly underneath the Handy Search are displayed as reflected waveform in real time.
B mode	Displays the vertical cross section of a scan point by gradating the reflected waveform shown in A mode according to reflection intensity and continuously displaying it.
BA mode	Displays both B-mode and A-mode images at the same time.
Real time Auto surface wave processing	Image processing that uses internal fixed surface wave data to automatically remove the wave reflected from the surface of the concrete during scanning and only shows the reflected wave from rebar etc.
Real time Manual Deduction processing	Image processing used in the case that the effect of the reflected waves from the surface of the concrete can not be fully removed using the internal fixed surface wave data of the real time auto surface wave processing. Thus, reflected waves in the form of stripes remain in the scanning results. Image processing where an arbitrary line is designated while scanning. The data of the designated line is subtracted from the scanning results data, and the reflected wave from the concrete surface is automatically removed. Thus, only the reflected waves from rebar etc. are shown.
Manual Surface wave processing	Image processing where an arbitrary line is designated from scanning results. The surface portion of the data from the designated line is subtracted from the scanning results data, and the reflected wave from the concrete surface is automatically removed. Thus, only the reflected waves from rebar etc. are shown.
Peak processing	Image processing that shows only the waveform of the first peak on the +side of the scanning results. This enables removal of multiple reflected signals and only displays the upper rebar.
Fixed surface wave processing	Image processing that uses internal fixed surface wave data to remove the wave reflected from the surface of the concrete and only shows the reflected wave from rebar etc.
Deduction processing	Image processing where an arbitrary line from the scanning results is designated and the designated line is subtracted from the scanning results data. Stripe reflected waves throughout the entire depth, such as reflected waves from the concrete surface and reflected waves from the rear surface etc., are removed and only the reflected waves from rebar etc. are shown.
Reproduction of original image	This processing restores the image processing result to the original state and displays unprocessed raw data.
Distance feed system	Method that performs scanning in accordance with Handy Search's traveling distance, using the distance detector mounted on the wheels of the Handy Search.
Time feed system	Method that performs B-mode scanning at preset time intervals, regardless of movement of the Handy Search.
Relative dielectric constant	Object-specific coefficient. The radio wave propagation rate changes with the value of the relative permittivity. Therefore, the wave propagation velocity and scanning depth change based on the relative permittivity of the concrete. Calculation error of scanning depth can be reduced by setting a depth calibration value.

# 1 Description of Equipment

This equipment is indispensable for repairing/rebuilding and maintaining reinforced concrete structures using its accurate and speedy diagnostic technology.

The Handy Search concrete internal probe vehicle, NJJ-95B, (hereafter called this radar) radiates electromagnetic waves through the surface of concrete and receives reflected signals from objects found inside such as reinforcing steel bars, cavities, or other objects that have different electrical characteristics from concrete. Object position and depth are then displayed and recorded as image data.

	<b>CAUTION</b>
	Making a judgement on the search results considering the depth sensing capability of the NJJ-95B: Since the depth sensing capability of the radar is subject to the conditions of the object of investigation, judging the search results with no consideration of the depth sensing capability may cause the accidental cutting of rebar.

## 1.1 Function

This radar has the following functions:

- Sense depth : 5 – 300 mm<sup>\*1</sup>
- Display mode: : B mode (vertical cross section)  
BA mode (vertical cross section and reflected waveform display)
- Image processing during sensing : Automatic real-time surface wave processing  
Real time manual deduction processing
- Sensing method : Distance feed system (sensing method based on the distance the main body moves)  
Time feed system (sensing at preset time intervals)
- Sense depth : Max 15 m (case of using time feed – 150 seconds)
- Internal memory : Max 15 m (case of using time feed – 150 seconds)
- Image processing: : Manual surface wave processing, fixed surface wave processing, peak processing, deduction processing, and reproduction of original image
- External output<sup>\*2</sup> : Printer output (IrDA)
- Saving data : Compact flash memory card

\*1: For the case that the relative dielectric constant of concrete is a uniform 6.2 and the upper rebar has a diameter of 6 mm or more

\*2: The printer is optional.

## 1.2 Features

This device has the following features:

- (1) The material of the object to be scanned can be either metallic or non-metallic

Reflected electromagnetic waves are generated at an interface when the electrical property of an object is different from that of concrete. Thus, this radar can probe polyvinyl-chloride pipes and cavities (dependent on the position and size) as well as the reinforcing steel bars. Note that polyvinyl-chloride pipes and cavities echo weakly in compared with the reinforcing steel bars.

If a polyvinyl-chloride pipe or cavity is near or below the reinforcing steel bars, the reflected signals from the polyvinyl-chloride pipe or cavity may not be obtained due to the strong reflected signals from the reinforcing steel bars. Thus, care should be taken when you make a judgment on the search results.

- (2) Detects rebars that cross the scanning direction

Rebar that cross the scanning direction transmit a large magnetic wave reflection. On the other hand, rebar that is parallel to the scanning direction transmit a smaller magnetic wave reflection. Even if scanning is performed above rebar that is parallel to the scanning direction, this device can still detect any rebar that is crosswise to the scanning direction.

- (3) Obtaining continuous scanning results

The scanning results are obtained as a representation of the vertical cross section of the inside of concrete. Thus, a comprehensive view of the internal concrete conditions can be obtained.

- (4) Obtaining scanning results at the site

Handy Search does not need to be secured to the surface of concrete. Scanning is carried out while Handy Search is moved and results concerning the internal conditions of the concrete can be provided immediately.

- (5) Saving and reading scan data

Using a compact flash memory, scan data can be saved and reopened (maximum of roughly 50 sets of data can be saved in text format for a depth of 15 m using a 512 MB compact flash). The data can also be loaded from the compact flash memory card into a PC by using a card reader or the like.

- (6) Printing without cable connection

The unit is equipped with IrDA, therefore, printing can be performed without using a cable using a DPU-3345 series printer.

However, the IrDA optical receptors for this unit and the printer must be set facing each other at a distance of 50 ~ 500 mm (without any obstacles between them).

(7) Performing real time automatic surface wave processing

Internal fixed surface wave data is used to automatically remove the wave reflected from the surface of the concrete during scanning enabling the showing of the reflected wave from rebar.

Furthermore, surface wave processing can be switched to processing that uses scan data surface waves during scanning (real time manual deduction) enabling highly accurate surface processing.

(8) Displaying the data of an arbitrary point after scanning (scroll function)

This radar can store 15m worth of data at a time and display the data of arbitrary points continuously.

(9) Changing sensitivity and performing image processing for scan data

This radar can display scan results after changing sensitivity or performing image processing (manual surface wave processing, peak processing, reproduction of original image, fixed surface wave processing, or deduction processing). Thus, performing a scan test again with a new sensitivity setting is not necessary.

(10) A mark can be displayed in the scan results using the cursor mark function.

A maximum of 7 cursor marks can be placed in the scan results to display the scan position and depth of the mark.

(11) Providing the screen inversion function

(11) Screen inversion function is available

In case of scanning from right to left on a wall surface, the display on the screen is upright (normal). In the case of scanning left to right, the display will be inverted.

Therefore, the user can achieve the correct display by performing the scan either right to left or left to right.

(12) Recording of date and settings

The main unit records the date and settings (data number, sensitivity, etc.) using a backup function. When data is output, the date and settings are recorded.



(13) Compact and light weight

This radar weighs only about 1.1 kg, so it is easy to operate.

(14) Operating with the battery pack and commercial power supply

This radar can operate with the battery pack for about 1.5 hours (at normal temperature). It can also operate with the commercial power supply when an AC adapter (optional) is used.

### 1.3 Configuration

#### Standard components

Table 1-1 shows the standard configuration of the Handy Search NJJ-95B

Table 1-1 Standard Components

Name	Model Number	Quantity	Remarks
Handy Search	NJJ-95B	1	
Battery pack	BP-3007 series	1	
Battery charger	BC-3008 series	1	
AC cable	CB-A01-J1-E series	1	For the battery charger
Hand strap	H-7ZYMD0018	1	
Compact flash memory card	CF115-512M	1	Memory size: 512MB
Storage box	H-7ZYMD0017	1	
Instruction manual	DC00-NJJ-95B	1	
Quick instruction sheet	DC10-NJJ-95B	1	
License agreement for software	DC20-NJJ-95B	1	
Users Guide CD-R	H-7ZYMD0016	1	

#### Options

Table 1-2 shows optional products that are provided in addition to the standard components.

Table 1-2 Options

Name	Model Number	Remarks
Printer set	CMZ-203	Set configuration: Printer (DPU-3445 series) Paper holder (RH-48-00 series) Battery pack (BP-3007 series) Recording paper (TP451C)
AC adapter set	CBD-2485	Set configuration: AC adapter (PW-0904-W1 series) AC cable (CB-A01-J1-E) series
Battery charger set	CBK-154	Set configuration: Adapter (BC-3008 series) AC cable (CB-A01-J1-E) series
Battery pack	BP-3007 series	Shared between handy search and printer
Printing paper	TP451C	Set of 10 rolls

#### 1.4 Overall System Diagram

Table 1-1 shows the total configuration of the Handy Search NJJ-95B

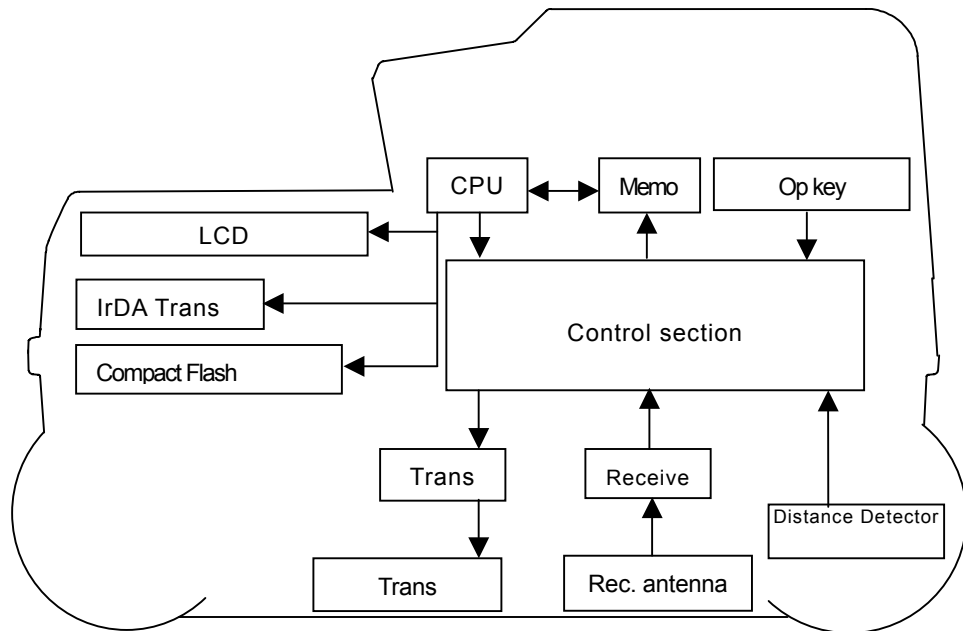
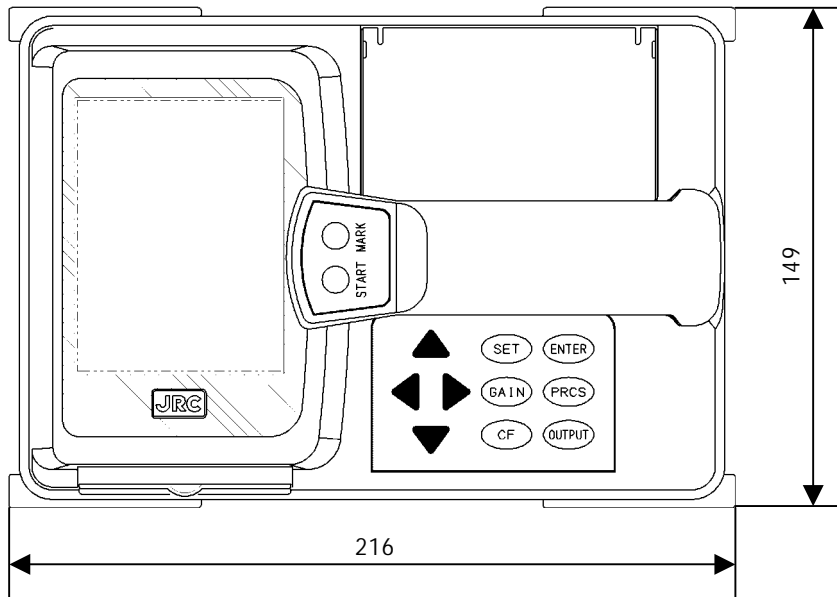


Figure 1-1 Overall System Diagram

### 1.5 Configuration

Figure 1-2 shows the external views of this radar.

Plan view drawing



Side view drawing

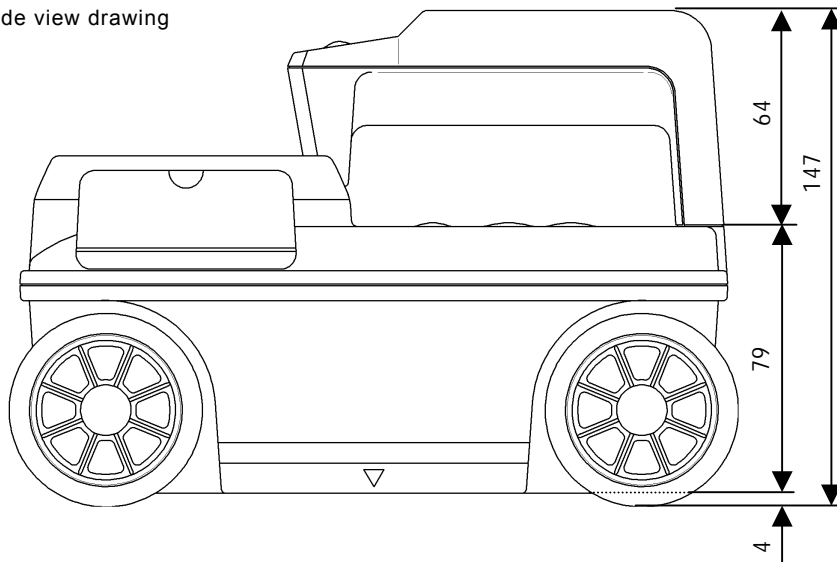
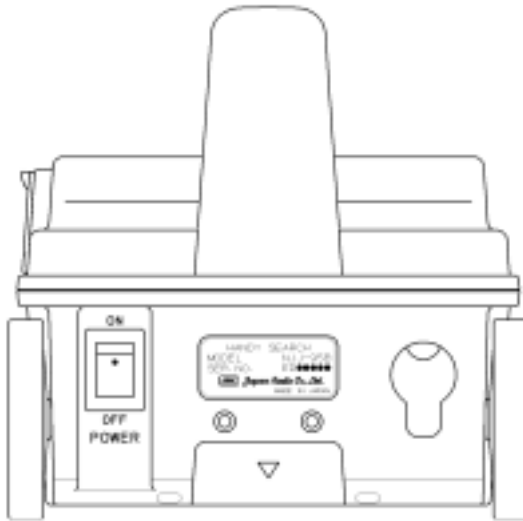


Fig. 1-2. Handy Search NJJ-95B external dimensions diagram

Rear view



[Units in trigonometry: mm]

## 2 Parts Names and Functions

### 2.1 Handy Search NJJ-95B

This section shows the operation panel of this unit and explains the functions for each group.

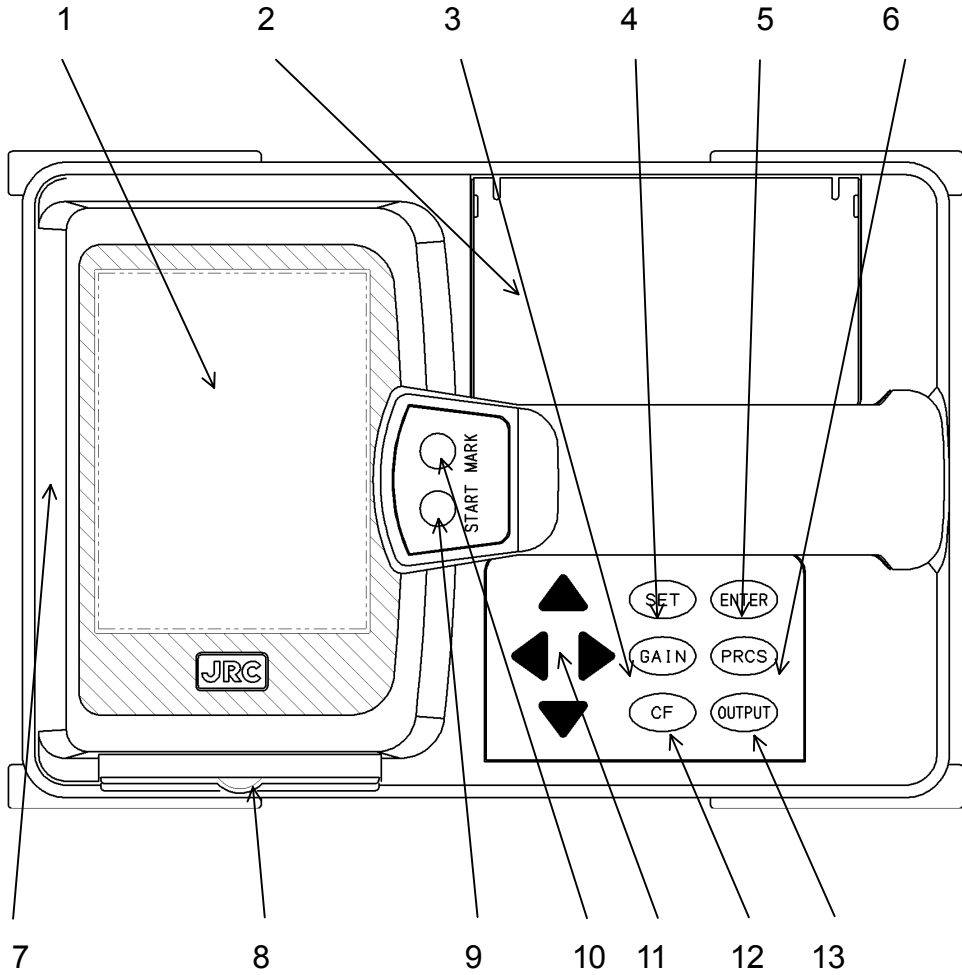



Figure 2-1 Top View

Table 2-1 Main Functions of Parts on the Handy Search

Number in Square	Label	Function
1	(None)	Liquid crystal display
2	(None)	Battery holder
3	GAIN	Sets the sensitivity
4	SET	Sets each of the parameters.
5	ENTER	Decision key for start of image processing and various types of selection.
6	PRCS	Switch to image processing mode.
7	(None)	IrDA optical receptor for communicating with the printer
8	(None)	Compact flash memory card slot
9	START	Starts/stops scan tests.
10	MARK	Displays a mark on the scan test screen.
11		Used for movement of cursor and screen and making changes to the various parameters.
12	CF	Switch to the CF control screen.
13	OUTPUT	Key for outputting data.

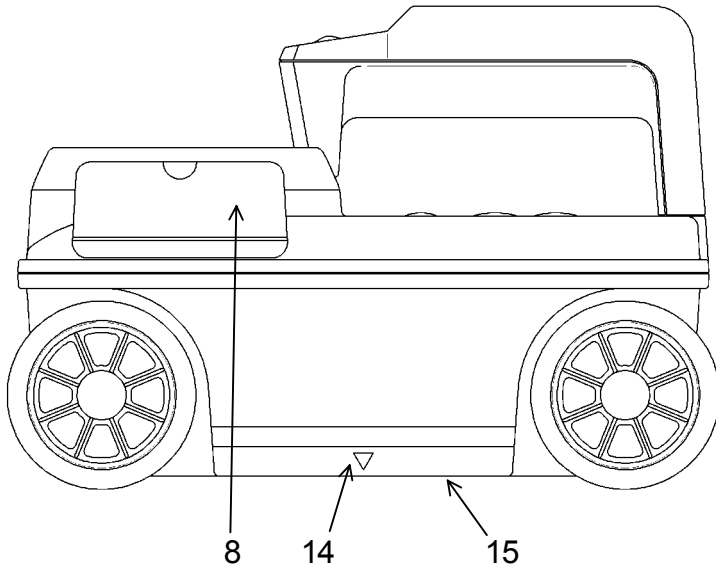


Figure 2-2 Side View

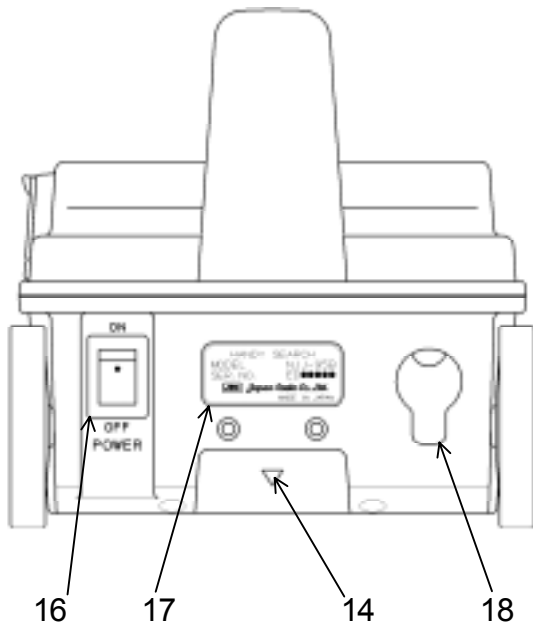


Figure 2-3 Rear View



Table 2-2 Functions of Parts on the Side and Rear Panel

Number in Square	Label	Function
14		Mark indicating the scan test position.
15	(None)	Antenna face to radiate and receive electromagnetic waves
16	POWER ON OFF	Turns power on and off.
17	(None)	Equipment nameplate
18	(None)	Connector for AC adapter

## 2.2 Example of the Scan Test Screen

Describe the configuration for each of the scan test screens.

### 2.2.1 Scan test screen example (during testing)

An example of a scan test screen (during scanning) is shown in Fig. 2-4.

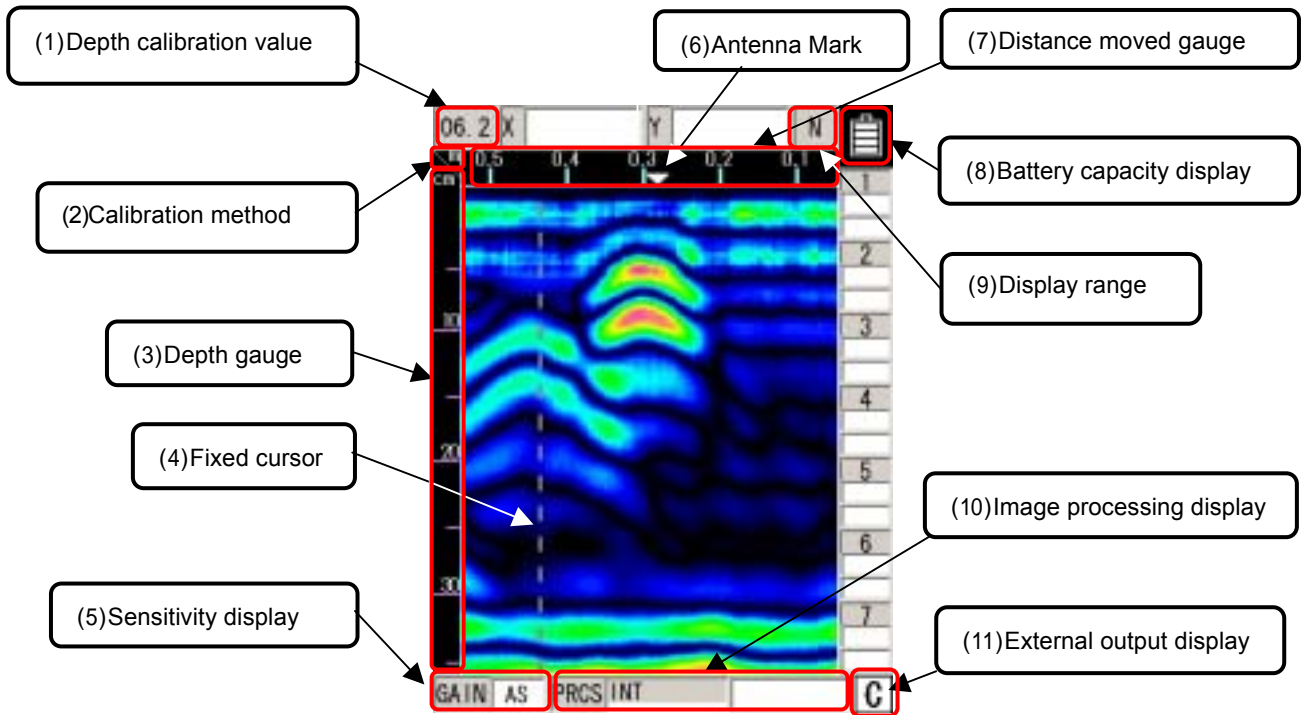


Fig. 2-4 Scanning test screen example (during scanning)

#### (1) Depth calibration value

Displays the depth calibration value set at the parameter settings screen.

The method for setting the depth calibration value can be found in 2.3.6 Depth Calibration.

#### (2) Calibration method

Displays the calibration method set using the parameter settings screen.

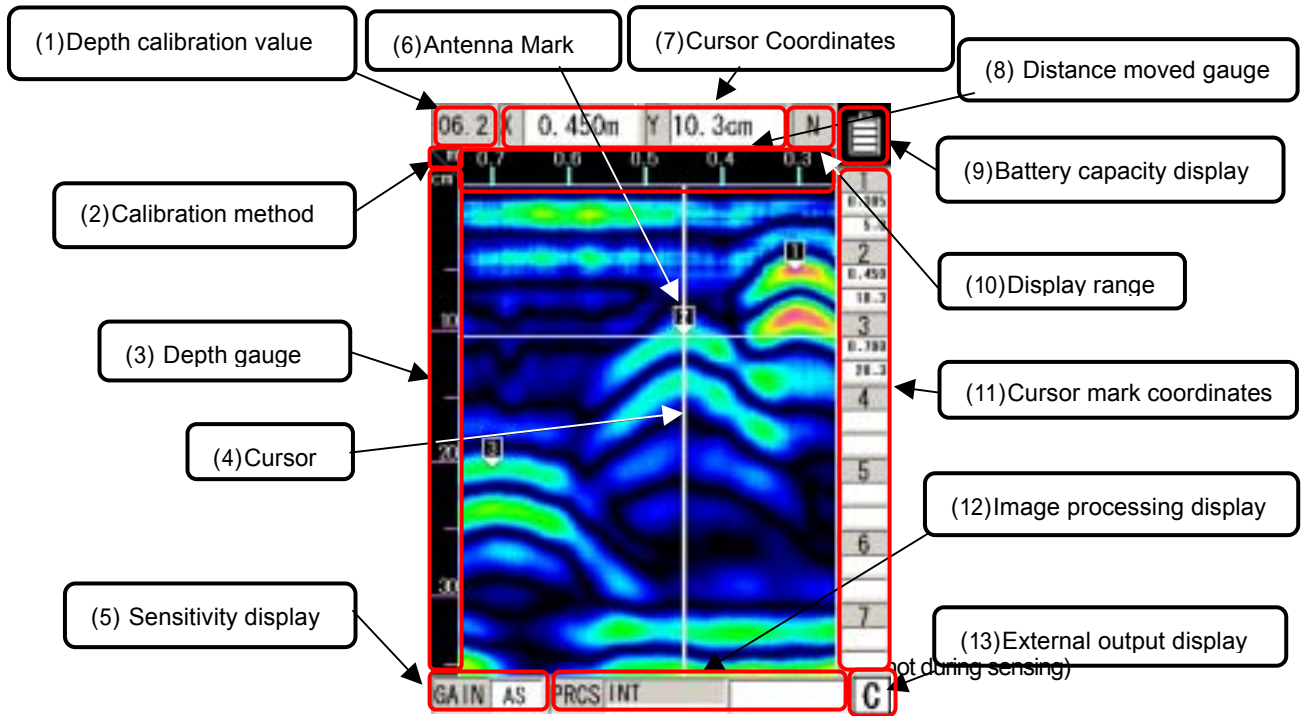
Distance feed system displays “m” and time feed system displays “s”.

The method for setting the calibration method can be found in section 2.3.5 of this manual under “Calibration Method”.

- (3) Depth gauge  
Displays a scanning depth gauge.  
The scanning depth gauge changes based on the depth calibration value.
- (4) Fixed cursor  
The fixed cursor is the cursor that is used to designate surface waves used for real time manual deduction processing.  
See section 3.2.5 “Real Time Manual Deduction processing” for the method used for real time manual deduction processing.
- (5) Sensitivity display  
Shows the scanning sensitivity setting.  
See section 3.2.3 “Sensitivity for the method used to switch sensitivity”.
- (6) Antenna mark  
Antenna mark that shows a mark for the scan distance.  
See section 3.2.4 “Antenna Mark” for how to use the antenna mark.
- (7) Distance moved gauge  
Gauge for the distance moved while performing a scanning test.
- (8) Battery capacity display  
Shows the general amount of capacity remaining in the battery pack that is being used.
- (9) Display range  
Shows the display range set using the parameter settings screen.  
See section 2.3.11 “Display Range” for the method used to set the display range.
- (10) Image processing display  
Displays the image processed items for processing performed on the sense test results.  
See section 3.4 “Image Processing” for how to process images.
- (11) External output display  
Shows the external output data destination set using the parameter settings screen.  
See section 2.3.10 “External Output” for how to set up external output.

### 2.2.2 Scan test screen example (not during testing)

An example of a scan test screen (not during scanning) is shown in Fig. 2-5



- (1) Depth calibration value  
Displays the depth calibration value set at the parameter settings screen.  
The method for setting the depth calibration value can be found in section 2.3.6 “Depth Calibration”.
- (2) Calibration method  
Displays the calibration method set using the parameter settings screen.  
Distance feed system displays “m” and time feed system displays “s”.  
The method for setting the calibration method can be found in section 2.3.5 “Calibration Method”.
- (3) Depth gauge  
Displays a scanning depth gauge.  
The scanning depth gauge changes based on the depth calibration value.

- (4) Cursor  
Indicates a cursor mark on the scanning test screen and is a “criss-cross” cursor that is used to designate A mode waveform display points in B mode and for scrolling the sensing test screen.
  
- (5) Sensitivity display  
Shows the scanning sensitivity setting.  
See section 3.3.2 “Switching Sensitivity” for the method used to switch sensitivity.
  
- (6) Cursor mark  
A mark that shows an arbitrary point on the scanning test screen.  
See section 3.3.3 “Cursor Operation” for how to display, erase the cursor mark.
  
- (7) Cursor Coordinates  
Shows the coordinates of the cross point of the cursor in item (4).  
The distance moved is shown in “X” and depth in “Y”.
  
- (8) Distance gauge  
Distance gauge in the direction the scanning was performed.  
Displays the distance the main unit has moved.
  
- (9) Battery capacity display  
Shows the general amount of capacity remaining in the battery pack that is being used.
  
- (10) Display range  
Shows the display range set using the parameter settings screen.  
See section 2.3.11 “Display Range” for the method used to set the display range.
  
- (11) Cursor mark coordinates  
Displays the coordinates of the cursor mark in item (6).  
Below each of the mark numbers, the movement distance (X) is shown in the first row and the depth (Y) is shown in the second row.
  
- (12) Image processing display  
Displays the image processed items for processing performed on the test results.  
See section 3.4 “Image Processing” for how to process images.

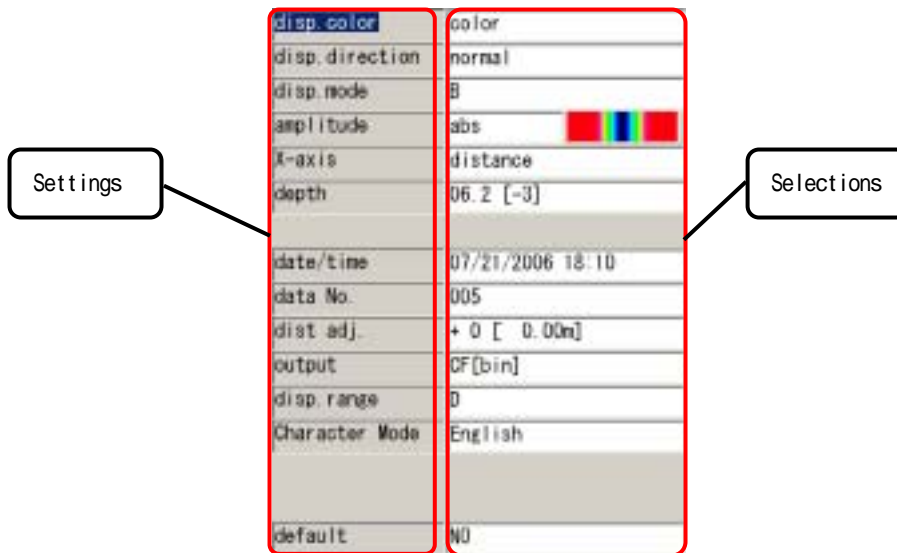
(13) Output data display

Shows the output data destination set using the parameter settings screen.

See section 2.3.10 "External Output" for how to set up external output.

## 2.3 Parameter Settings Screen

While scanning is stopped, pressing of the 4 SET key enables switching the screen to the parameter settings screen (see Fig. 2-6) and each of the settings can be changed. To return to the scanning test screen, press the 4 SET key again.



[Left column]	[Right column]
Display color	Color
Screen inversion	Normal
Display Mode	B
Level adjustment method	Absolute value
Measurement method	Distance feed
Depth calibration	06.2 [-3]
Date	2006/07/21 18:09
Data No.	005
Distance correction	+0 [0.00 m]
External output	CF [binary]
Display range	Depth
Character mode	Japanese
Return to standard	No

Figure 2-6 Parameter Setting Screen

### 2.3.1 Display color

"Color" or "Monochrome" can be selected for the display color for the liquid crystal display of the

main unit.

In order to change the display color, select "display color" from the settings using the ▲▼ cursor keys (inverting display) and switch to item selection using the ◀▶ cursor keys.

Select "color" or "monochrome" using the ▲▼ cursor keys or use the ◀▶ cursor keys to switch to item selection.

### 2.3.2 Inversion of the screen

This unit supports screen display inversion while it moves (scans) to the right and to the left, thereby displaying the scanning test screen upside down. (See Figure 2-7.)

In order to invert the screen, select "Invert Screen" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select "normal" or "inverted" using the ▲▼ cursor keys or use the ◀▶ cursor keys to switch to item selection.

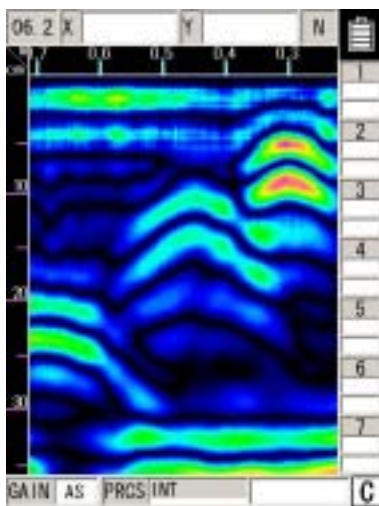
#### Remarks

The direction of image data output by the printer (optional) is changed depending on the setting of the screen inversion function.

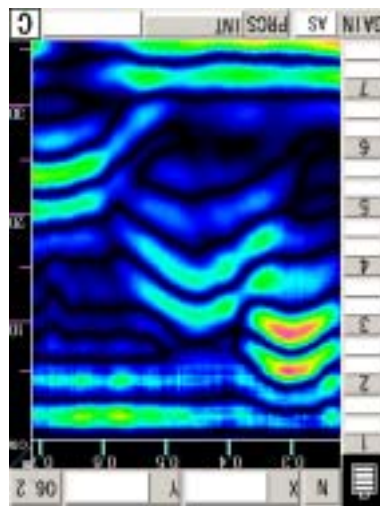
For the printer to always output image data in the same direction, retain the same setting "Normal or Reverse" for "Inversion of the screen."

- While the screen display is inverted, the cursor keys ▲▼◀▶ move in the opposite direction.

(They function in the same direction as when "Normal" is selected for "Inversion of the screen.")



Screen display direction [Normal]



Screen display direction [Reverse]



Figure 2-7 Screen Inversion Function

### 2.3.3 Display mode

This unit can scan/display data in both "B" mode (vertical cross section) and "BA" mode (vertical cross section and reflected waveform display).

In order to change the display mode, select "display mode" from the settings using the ▲▼ cursor keys (inverting display) and switch to item selection using the ◀▶ cursor key.

Select "B" or "BA" using the ▲▼ cursor keys or use the ◀▶ cursor keys to switch to item selection.

#### Remarks

- When the display mode is switched between "B" and "BA" after scanning, data scanned in "B mode" is displayed in "BA mode," and data scanned in "BA mode" is displayed in "B mode." See section 3.3.1 "Mode switching."

### 2.3.4 Gradation system

"Absolute value" or "Offset" can be selected for the gradation system.

When "Color" is selected for "Display color," the absolute value gradation changes between Black → Indigo → Green → Yellow → Red as the A-mode amplitude increases as shown in Figure 2-8. The offset gradation changes between Black → Indigo → Green → Yellow → Red from the left in A mode as shown in Figure 2-9.

When "Monochrome" is selected for "Display color," the gradation changes between White → Gray → Black in this order.

In order to change the gradation method, select "Gradation Method" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select "absolute value" or "offset" using the ▲▼ cursor keys or use the ◀▶ cursor keys to switch to item selection.

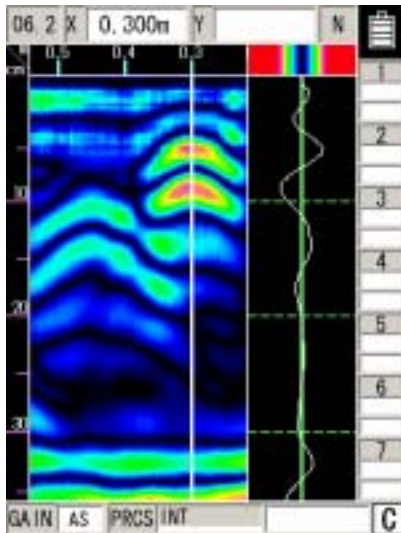


Figure 2-8 Absolute Value Gradation

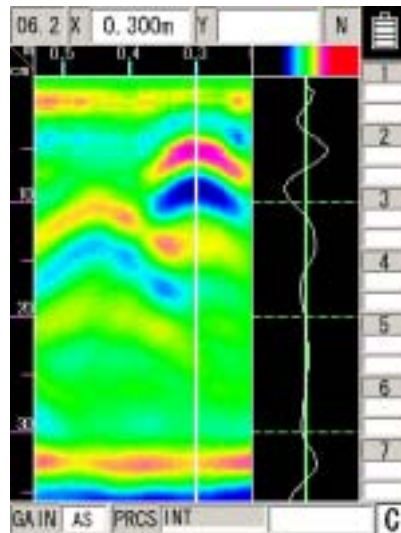


Figure 2-9 Offset Gradation

### 2.3.5 Calibration method

"Distance feed" or "Time feed" can be selected as the scanning method of this unit.

When "Distance feed" is selected, the scanning method measures/displays data in units of 5 mm in "B/BA mode" conforming to the wheels' moving distance. When "Time feed" is selected, the scanning method measures/displays data at 50 ms intervals in "B/BA mode," regardless of the wheels' moving distance.

In order to change the scanning method, select "Scanning Method" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select "distance feed" or "time feed" using the ▲▼ cursor keys or use the ◀▶ cursor keys to switch to item selection.

### 2.3.6 Depth calibration

The depth calibration is the scan depth obtained from the wave propagation speed and reflected time with the depth gauge corrected using the relative dielectric constant of concrete. The value must be changed based on the condition (such as moisture content) of the concrete being scanned.

A large difference between the relative permittivity of the concrete being scanned and the depth calibration value will cause a large depth error.

In order to reduce the depth error, detect an object where the depth can be confirmed (as with rebar) and perform a correction of the depth gauge by setting the depth calibration value so that the depth displayed in the scanning results basically matches the actual depth.

If it is not possible to scan an object (such as the case with rebar) where the depth can be confirmed, and the depth calibration value is unclear, it is recommended to set the depth calibration to "08.0 (+0)".

In order to change the depth calibration value, select "Depth Calibration" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Set the "depth calibration value" using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

#### Remarks

The intervals on the depth gauge are not equivalent. Confirm the depth using the cursor display value.
--

### 2.3.7 Date, time

This radar contains a rechargeable button-type lithium battery with which dates and times can be recorded.

In order to correct time and/or date, select "Date and Time" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select the position of the date or time that you would like to correct using the ◀▶ cursor keys and change the values using the ▲▼ keys.

Switch to item selection using the ◀▶ keys.

### 2.3.8 Data No.

Data is recorded and numbered when externally output. The data number (Data No.) is incremented each time data is recorded.

In order to change the data No., select "Data No." from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select the position that you would like to correct using the ◀▶ cursor keys and change the values using the ▲▼ keys.

Switch to item selection using the ◀▶ keys.

#### Remarks

When data is to be recorded again, it can be easily managed by changing the value of Data No.

### 2.3.9 Distance compensation

This unit determines distance using the number of rotations the wheels make. Thus, wear of the wheels causes an error in calculating the scanning distance. If the scanning distance has an error, compensate the distance error.

In order to change the distance error correction value, select "Distance Correction" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Set the "distance error correction value" using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

#### (Example of distance error compensation)

a) Perform a 1m (actual value) scan test and stop the scanning.

b) Press the 4 SET key and switch to the parameter settings screen

c) Select the settings item "Distance Correction" using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

d) Using the ◀▶ cursor keys, set the correction value so that the distance of the last line (displayed by [ ] to the right of the correction value) is as close as possible to 1 m.

e) Use the ◀▶ cursor keys to switch to item selection and press the 4 SET key to return to the scan test screen.

#### Remarks

The distance of the last scan test line is displayed to the right of the compensation value. When the compensation value is changed, the distance is also changed in accordance with the new compensation value. With this value as a rough standard, set a new compensation value.

### 2.3.10 Output Data Format

Set the external output destination of scan test data. The table below shows the relationship between external output destinations and output data formats.

The currently set external output destination is indicated with the character displayed at the lower right of the scan test screen.

External Output Destination	Output Data Format	Scan Test Screen Destination on Measurement Screen
Printer (I)	Print to the printer	P
CF [text]	Saved in text format in compact flash memory	C
CF [binary]	Saved in binary format in compact flash memory	C

In order to change external output, select “External Output” from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Set the “external output” using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

See Section 3.6 External Output Methods for the operation method.

### 2.3.11 Display Range

The display range is an item for setting the display limits of the scanning depth. There are three settings: “deep”, “standard”, and “shallow”.

Set the range of display based on depth of the object to be scanned using the following.

Depth of the object to be scanned is 30 cm or less: “deep”

The depth of the object to be scanned is 20cm or less: “standard” (same as NJJ-95A)

Depth of the object to be scanned is 10cm or less: “shallow”

In order to change the display range, select “display range” from the settings using the ▲▼ cursor keys (inverting display) and switch to item selection using the ◀▶ cursor key.

Set the “display range” using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

### 2.3.12 Character Mode

Switches displayed characters between Japanese and English.

In order to change the character mode, select “Character Mode” from the settings using the ▲▼ cursor keys (inverting display) and switch to item selection using the ◀▶ cursor key.

Set the type of characters using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

### 2.3.13 Return to standard

This function changes all the parameters other than "Data, time" back to the standard settings.

In order to revert to standard settings, select "Return to Standard" from the set up items using the ▲▼ cursor keys (invert display) and switch to item selection using the ◀▶ cursor keys.

Select "Yes" using the ▲▼ cursor keys and use the ◀▶ cursor keys to switch to item selection.

## 2.4 CF Control screen

While scanning is in off status and the 12 CF key is pressed, the screen switches to the CF control screen and compact flash memory control can be performed. Return to the scan test screen by pressing on the 12 CF key once more or "Cancel".

See 3.6.2 ~ 3.7.4 for how to control the compact flash memory.

The CF control screen is shown in Fig. 2-10.

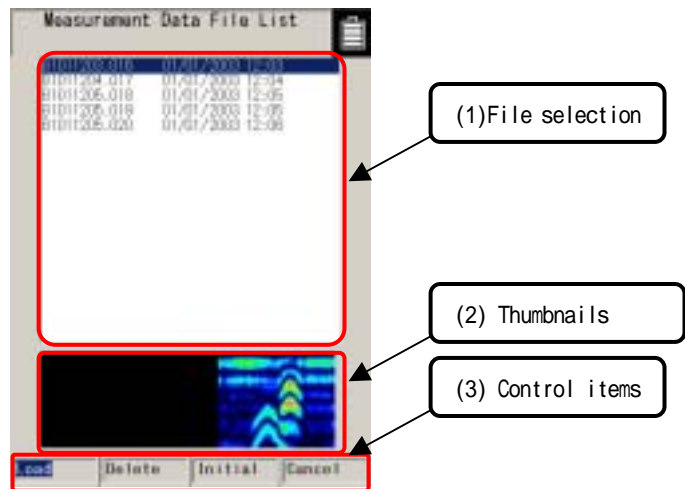


Figure 2-10 CF Control Screen

### (1) File Selection

The filenames for data saved on the compact flash memory are displayed.  
Select the file (inverted display) using the ▲▼ cursor keys.

### (2) Thumbnail image display

Displays the file selected in (1) as a thumbnail.







### (3) Control items





Control items for the compact flash memory.

Select (inverted display) an item using the ◀▶ cursor keys and choose it with the 5 ENTER key.

### 3 Operating Method

The numbers in squares in this chapter correspond to the numbers in Tables 2-1 and 2-2 on pages 8-11. Furthermore, keys are displayed on this unit using **bold Gothic** characters.

 <b>WARNING</b>	
	Do not use any battery pack other than the BP-3007-A1 or any AC adapter other than the PW-3009-W. Doing so could cause fire, electric shock, or breakdown.
	Do not short-circuit the terminals of the battery charger or battery pack. Doing so could cause fire, explosion, or breakdown.
	Do not insert anything metallic or flammable into the compact flash memory card slot. Doing so could cause a personal injury, fire, electric shock, or breakdown.
	Do not use any charger other than the dedicated battery charger to charge the battery pack. Doing so could cause fire, electric shock, or breakdown.
	Handy Search has a waterproof construction but must not be placed in water. Do not expose the NJJ-95B to water or moisture, and do not use it in rainy weather. Doing so could cause an electric shock or breakdown.

 <b>CAUTION</b>	
	Making a judgment on the scan results considering the depth scanning capability of the NJJ-95B. Since the depth scanning capability of the radar is subject to the conditions of the object of investigation, judging the scan results with no consideration of the depth scanning capability may cause the cutting of rebar.
	Put your hand through the hand strap and hold the NJJ-95B. Dropping of the radar may cause an accident such as a device breakdown or personal injury.
	Do not use any battery pack other than the BP-3007-A1 or any AC adapter other than the PW-3009-W. Doing so may cause fire, electric shock, or breakdown.





## CAUTION



Point the antenna surface in the direction of the probed object (concrete) while you are performing a probe.

If it is pointed into the air or otherwise unsuitable direction, it can cause malfunction of other equipment or other such accidents.



Do not use the NJJ-95B in the vicinity of a radio or TV set.

Doing so may cause noise or poor reception such as disturbance of television pictures. Doing so also adversely affects the depth sensing capability of the radar, and may cause the cutting of reinforcing steel bars.



Do not use the NJJ-95B near a cell phone or transceiver that transmits electromagnetic waves. Electromagnetic waves from the cell phone or transceiver adversely affect the depth sensing capability of the radar, and may cause the cutting of reinforcing steel bars.



When the NJJ-95B is used for scanning on the road, take safety precautions such as providing guard fences to prevent traffic accidents.

”

### 3.1 Scanning Preparation

#### (1) Mounting the hand strap

A hand strap for drop prevention is provided as standard with this radar. Mount the hand strap on the handle of the radar as shown in Figure 3-1, put your hand through the hand strap to grip the handle, and start sense testing.

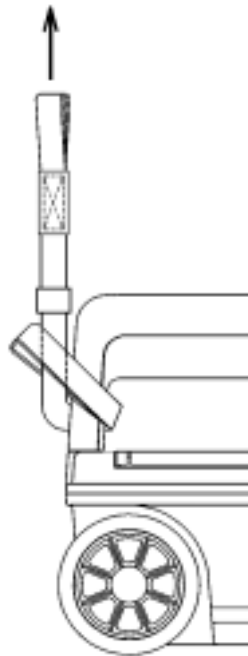


Figure 3-1 Hand Strap

#### (2) Connecting the power source (battery pack)

This radar can be operated with the battery pack or 100 VAC power when an optional AC adapter is used.

#### Notes

Use this radar in a place where the ambient temperature is 0 to 50 °C and the humidity is 45 to 80%.

Do not move the radar in cold condition to a place where it is subject to sharp temperature rise. Doing so generates condensation inside the radar that could cause a breakdown.

Confirm that the power switch 16 is set to "OFF" before mounting/dismounting the battery pack or the AC adapter.

a) Mounting the battery pack (See Figure 3-2.)

1. Confirm that the 16 power switch is set to "OFF."
2. Open the battery cover 2 at the top of this unit, confirm the direction of the battery pack and put it into the battery holder.
3. Push the battery pack forward to connect with the terminals, and close the battery cover 2.

b) Dismounting the battery pack (See Figure 3-3.)

1. Confirm that the 16 power switch is set to "OFF."
2. Open the battery cover 2 at the top of this radar, and slide the battery pack backward.
3. Push down the rear of the battery pack to raise its front, so it can be easily dismantled.

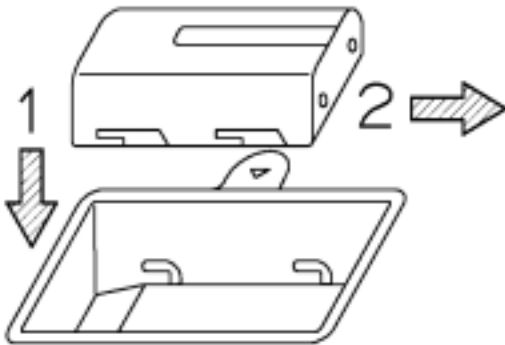


Figure 3-2 Mounting the battery pack

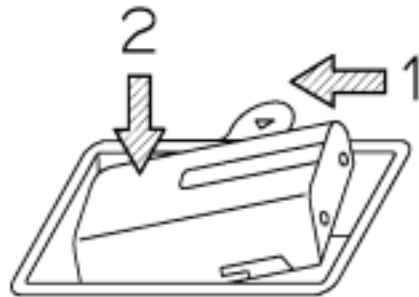


Figure 3-3 Removing the battery pack

Remarks

- When opening the battery cover, hold onto the handle with your left hand, push up on battery cover lock with your middle finger, open the battery cover slightly and lift the battery cover with your right hand to easily remove the battery cover.

c) Mounting the AC adapter

1. Confirm that the 16 power switch is set to "OFF."
2. Connect the AC cable to the AC power connector on the AC adapter.
3. Open the AC adapter input connector cover 18 at the rear, and connect the DC jack of the AC adapter.
4. Connect the AC adapter cable to the socket outlet.

d) Dismounting the AC adapter

1. Confirm that the power switch **16** is set to "OFF," and disconnect the AC adapter cable from the socket outlet.
2. Pull out the AC adapter DC jack from this unit and close the connector cover for the **18** AC adapter input.

3) Mounting/dismounting a compact flash memory card

This radar can save scan test data by using a compact flash memory card.

To save scan test data, mount the compact flash memory card according to the procedure in Figure 3-4 while the **radar power switch is off**.

To dismount the compact flash memory card, perform the procedure in Figure 3-5 while the **radar power switch is off**.

Notes


Mount/remove the compact flash memory card while the power switch of this unit is off.

Make sure of the insertion direction before mounting the compact flash memory card.

Operation of this unit has been confirmed with compact flash CF115-512M manufactured by IO Data. The unit may not operate with a compact flash memory card of another company, so an IO Data compact flash memory card should be used.

**Be sure to initialize the compact flash memory using this unit.** If this is performed using other equipment (NJJ-95B, PC etc.) the compact flash may not be recognized.

**Please do not use a compact flash memory that was used with a NJJ-95A.** As the data format used by NJJ-95A and NJJ-95B are different, this may cause an error.

(1) Open the lid over the  compact flash insert opening

(2) If the eject switch is extended, push in the switch.

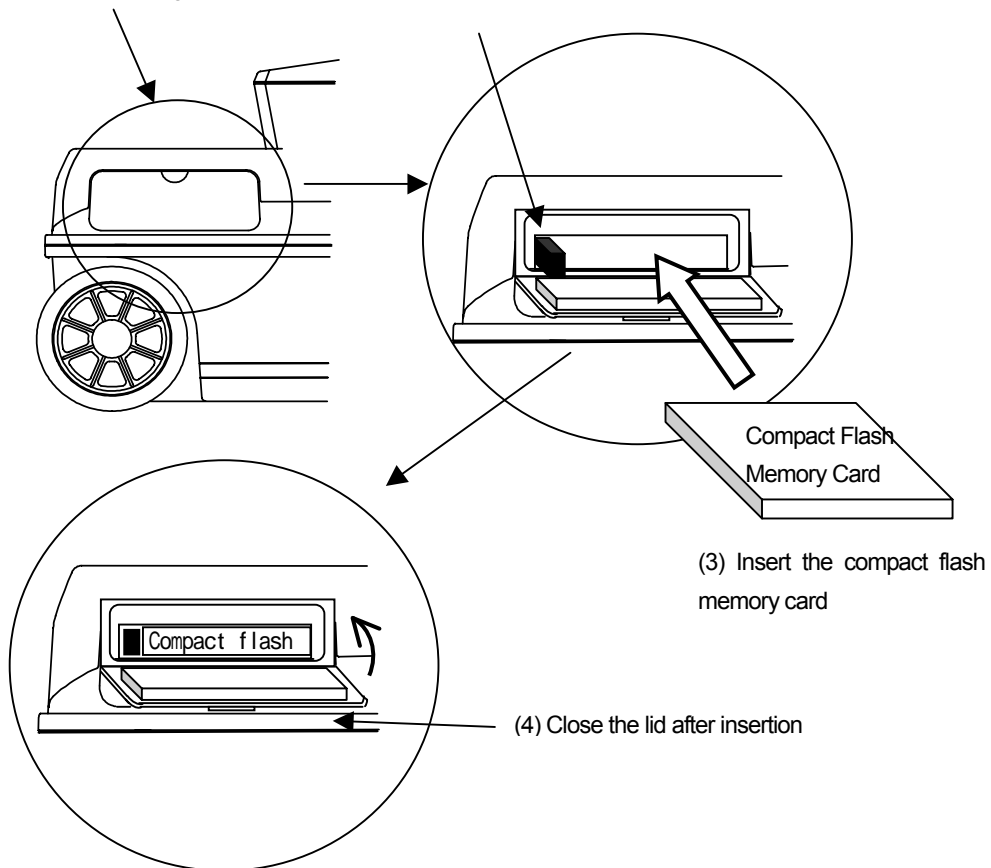


Figure 3-4 Mounting the Compact Flash Memory Card

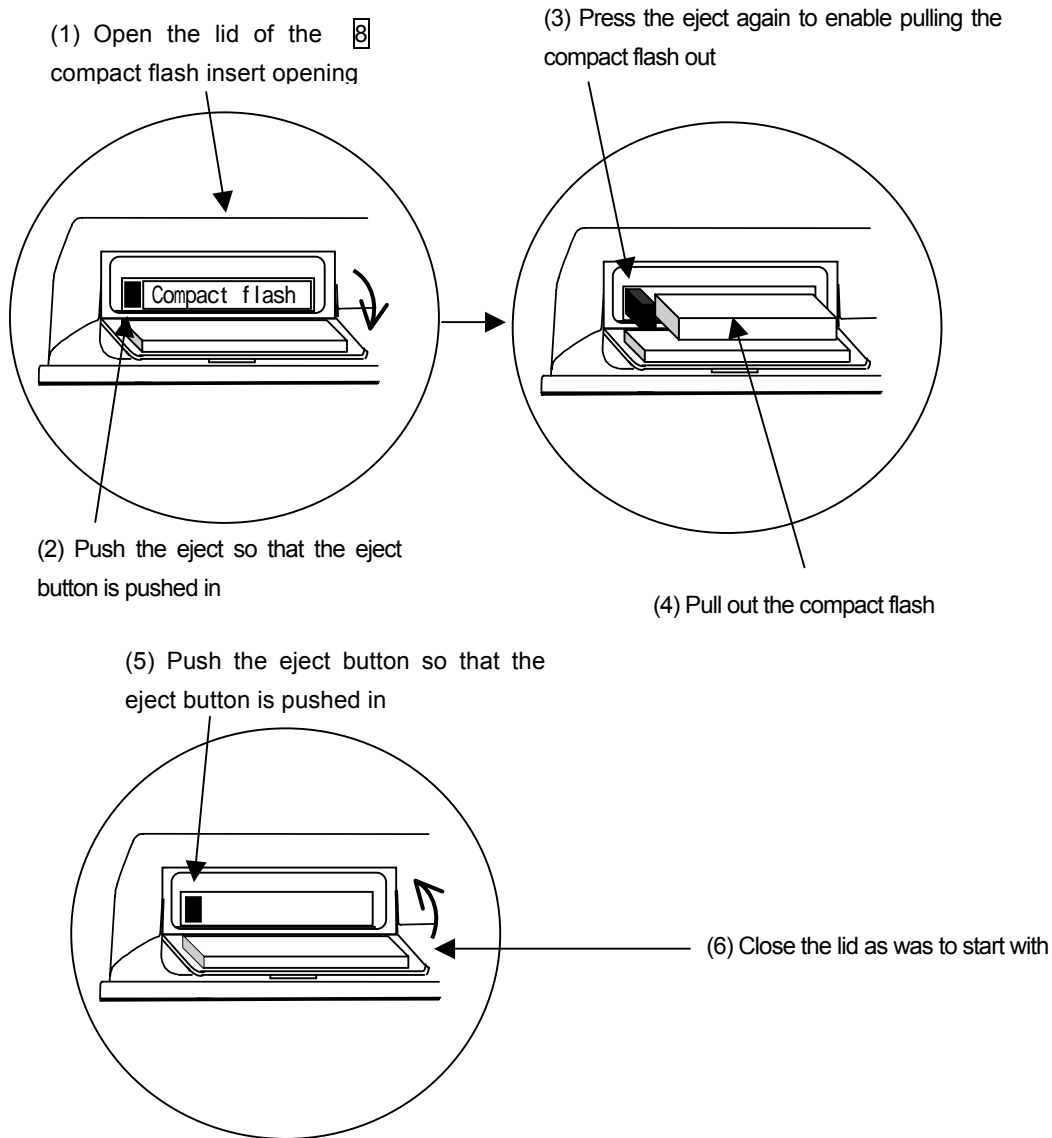


Figure 3-5 Dismounting the Compact Flash Memory Card

(4) Target Preparation for Scanning

Using chalk (or similar) make markings on the concrete surface to indicate where to start testing (starting line) and where to scan (scan test line).

Make sure the start line and the scan test line are orthogonal.

(As necessary, in order to perform a retest, use an endpoint of the wall as a standard for the start line and scan test line)

A scan test applicable set up example is shown in Fig. 3-6.

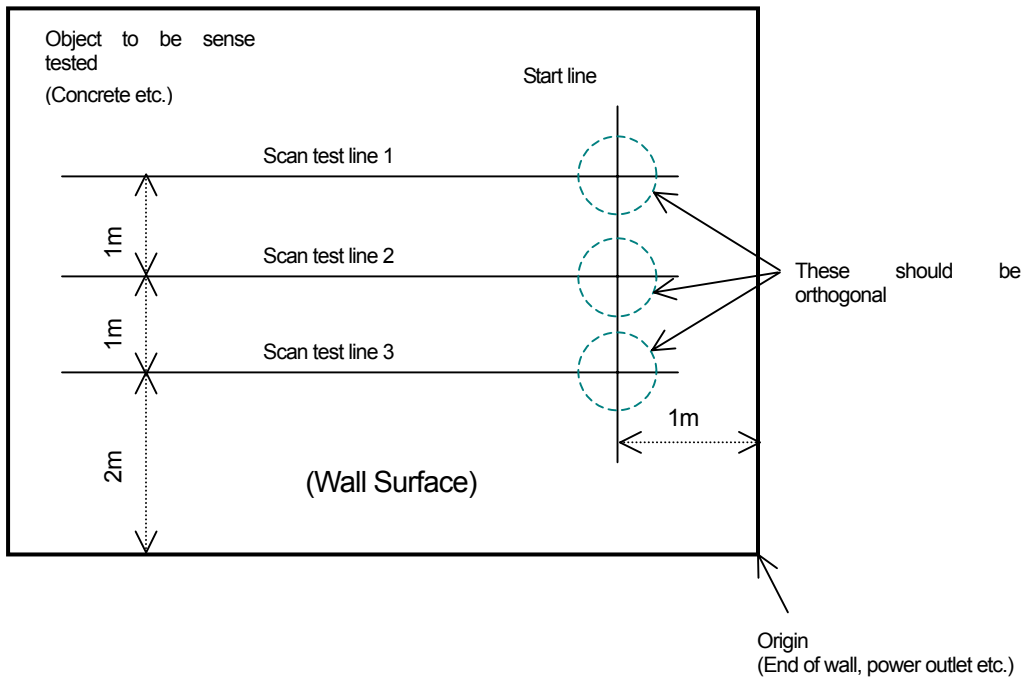


Fig. 3-6 Scan test applicable setup example

## 3.2 Scan Test

### 3.2.1 Power-on Procedure

The **[1]** liquid crystal display lights up roughly 5 seconds after the power is turned on by turning on the **[16]** power switch, and next the initialization screen is displayed. After the initialization screen completes, the scan test screen is displayed.

After confirming that the scan test screen is displayed on the liquid crystal display, start the scan test.

The battery availability indicator is displayed with an approximate value at the upper right of the LCD screen **[1]**. (See Figure 3-7.)



Figure 3-7 Battery Capacity Indicator

#### Notes

- This unit gives priority to the AC adapter for power input. Therefore it operates with the AC adapter when both the battery pack and AC adapter are connected. If the AC adapter is connected while operating using the battery, the power turns off and then back on.

### 3.2.2 Scan Test

The scan test method is shown below.

- a) Place the **[14]**  $\nabla$  on the side of the unit over the start line and the forward/backward **[14]**  $\nabla$  over the scan test line.
- b) Press **[9]** **START**. After about one second, a short single buzzer sound is generated, the fixed cursor is displayed at a position of about 10cm of the movement distance scale on the B mode screen, and then scan test preparation is complete.
- c) Move the unit on top of the scan test line at a speed of less than 40 cm/s by rotating the wheels. If speed exceeds 40 cm/s, a buzzer sounds and the data for that timeframe is invalid. Please perform the scan test again.
- d) Press **[9]** **START** again to finish. A double buzzer sound is generated and the scan test is stopped.

However, if the scan distance reaches 15 m, the buzzer sounds twice and the scan test automatically finishes.

Figure 3-8 shows an example of scan test.



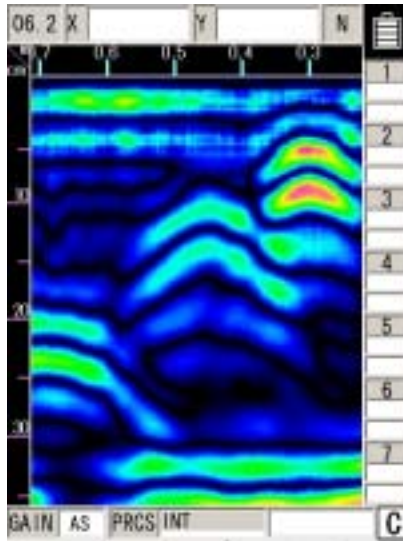


Figure 3-8 B Mode Sense Test

Remarks

- For the settings such as B/BA mode, Distance feed/Time feed, Absolute value gradation/Offset gradation, Depth calibration value, and Sensitivity, see section 2.3 "Parameter Setting Screen."
- Automatic real-time surface wave processing may not eliminate all waves reflected by the concrete surface depending on the conditions. If the peak processing of image processing is performed in this state, waves reflected by reinforcing steel bars may become invisible.  
The waves reflected by reinforcing steel bars can be displayed by the method explained in section 3.2.5 "Manual real-time deduction processing" or section 3.4 "Image processing."
- If the unit is moved too fast, a buzzer will sound. Data at the time is not displayed.
- Even if this unit moves in the direction opposite to the traveling direction, data will be displayed on the assumption that the antenna moves in the traveling direction.
- The latest scan test data in B mode includes data about the antenna's center mark "▼" at the lower part of the case.
- The position of the fixed cursor on the B-mode display indicates the rear end of this radar, and it can be used to identify the position of the reinforcing steel being scan tested. (See Figure 3-9 for the fixed cursor.)

### 3.2.3 Sensitivity

When the power is turned on, sensitivity is set to "A shallow". "A shallow" is a sensitivity setting that is applicable to the detection of rebar with a depth of less than 10 cm in general concrete.

"A" of "A shallow" indicates the overall sensitivity; "shallow" indicates depth sensitivity.

There are five levels for overall sensitivity: "-2, -1, A, +1, +2." In general, use the unit in the "A" setting. Use the +side to increase sensitivity and use the –side to reduce sensitivity.

There are two levels for depth sensitivity: "shallow and deep." Select "shallow" when the object to be probed is at a depth less than 10 cm. Select "deep" when the object to be probed is at a depth of 10 cm or more.

To change the sensitivity, press **[3] GAIN** . The sensitivity is changed as follows:

A, shallow → +1, shallow → +2, shallow → -2, deep → -1, deep → A, deep → +1, deep →  
→ +2, deep → -2, shallow → -1, shallow → A, shallow → +1, shallow →

#### Remarks

- To change sensitivity for scanning results, press **[3] GAIN** after scanning.  
If sensitivity is changed after scanning, the unit uses the new sensitivity for the next scanning.  
For the changing of sensitivity after scanning, see "Section 3.3.2 Sensitivity Switching."

### 3.2.4 Antenna Mark

If core-boring or reinforced rebar locations are known beforehand (shown on a construction diagram) the NJJ-95B can mark the locations by placing an "Antenna Mark" at the applicable places during scanning.

The method of use for this antenna mark is shown below.

- a) Place the **[14] ▽** on the side of the unit over the start line and the forward/backward **[14] ▽** over the sense test line.
- b) Press **[9] START**. After about one second, a short single buzzer sound is generated, the fixed cursor is displayed at a position of about 10cm of the movement distance scale on the B mode screen, and then scan test preparation is complete.
- c) Move the unit on top of the scan test line at a speed of less than 40 cm/s by rotating the wheels. If speed exceeds 40 cm/s, a buzzer sounds and the data for that timeframe is invalid. Please perform the scan test again.
- d) Push **[10] MARK** when the **[14] ▽** on the side of this unit overlaps the rebar position or core-boring as based on design blueprints. (A ▼ is shown on the movement distance gauge)
- e) Press **[9] START** again to finish. A double buzzer sound is generated and the scan test is

stopped.

However, if the scan distance reaches 15m, the buzzer sounds twice and the scan test automatically finishes.

### 3.2.5 Real time manual deduction processing

Waves reflected by objects to be probed (e.g., reinforcing steel) at a position near the concrete surface are difficult to identify because they are combined with waves reflected by the concrete surface (called surface waves). This radar contains the standard surface wave data (fixed surface wave data) with which it eliminates the influence of the concrete surface waves in real time, thereby making it easy to identify the waves reflected by the objects to be probed.

However, with the condition of the concrete surface and moisture content in the concrete and for special concrete, the effect of the reflected wave from the surface of the concrete may not be fully removed even if auto surface wave processing for standard surface waves is performed and there may be lateral stripe reflected waves near the surface.

In this type of situation switch to real time surface wave processing based on surface waves in the scanning data to remove lateral stripe reflected waves.

Perform manual deduction processing as explained below.

- a) Place the **[14]** ▽ on the side of the unit over the start line and the forward/backward **[14]** ▽ over the scan test line.
- b) Press **[9]** **START**. After about one second, a short single buzzer sound is generated, the fixed cursor is displayed at a position of about 10cm of the movement distance scale on the B mode screen, and then scan test preparation is complete.
- c) Move the unit on top of the scan test line at a speed of less than 40 cm/s by rotating the wheels. If speed exceeds 40 cm/s, a buzzer sounds and the data for that timeframe is invalid. Please perform the scan test again.
- d) When results for objects that are not being probed overlap with the fixed cursor position, push **[5]** **Enter**. (See Figure 3-9.)

The reflected wave that the fixed cursor is pointing to can be processed into a surface wave by real time manual deduction. The resulting data of this processing is indicated in "A" mode or "BA" mode.

A "↓" is shown at the position that the real time manual deduction processing was performed on the movement distance guide. In the "Processing" area at the bottom right of the screen, <<Manual>> is displayed.

- e) Press **[9]** **START** again to finish. A double buzzer sound is generated and the scan test is stopped.


However, if the scan distance reaches 15m, the buzzer sounds twice and the scan test automatically finishes.

Remarks

- Real time manual deduction processing performs the same processing as deduction processing for image processing during scanning.  
See section 3.4.5 "Deduction Processing" regarding deduction processing.
- If image processing is performed for scan data by using real-time manual deduction processing and the surface wave data for manual surface wave processing is rewritten, data may not be reproduced during scanning.  
See section 3.4 "Image Processing."
- If scanning is to be performed again after scanning is complete using real-time manual deduction processing, automatic real-time surface wave processing using the fixed surface wave data will be performed.
- The fixed cursor position shows the rear end of this unit and can be used to decipher the position of the rebar during scanning.

Example of where results for object that is not being probed

overlaps with the fixed cursor position

( Press  ENTER )

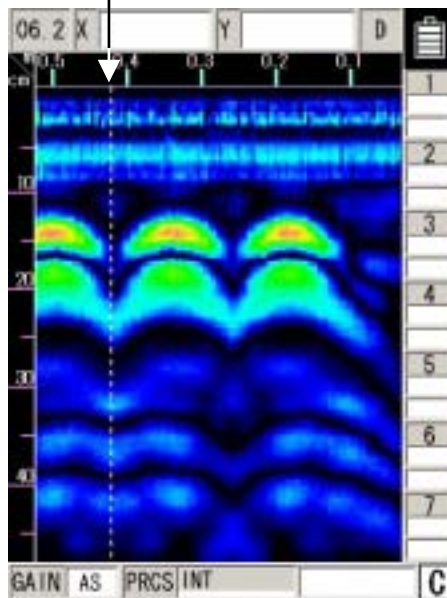


Figure 3-9 Display after real-time manual deduction processing

### 3.3 Operation while not Scanning

#### 3.3.1 Mode switching

This radar can scan test/display data in both "B mode (vertical cross section)" and "BA mode (vertical cross section and reflected waveform display)". When the display mode is switched between "B" and "BA" after scanning, data scan tested in "B mode" is displayed in "BA mode," and data scan tested in "BA mode" is displayed in "B mode." (See Figure 3-10.)

When the "Distance feed system" method is being used as the "Scan test method", one screen displays 49 cm of sense test (movement) distance in "B mode" (maximum recordable test distance is 15 m). In "BA mode" one screen is the same as in A mode, which is 32.5 cm shown in B mode (maximum recordable scan test distance is 15 m).

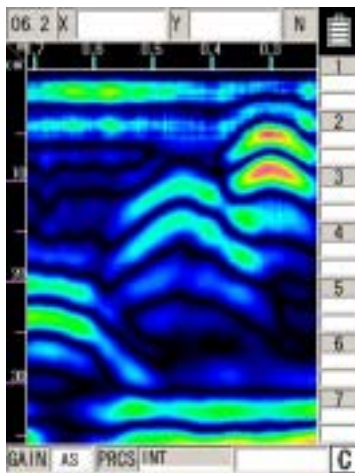
The A-mode (waveform display) portion in BA mode indicates the waveform at the vertical cursor position in BA mode.

Perform the following procedure to switch between the "B mode" and "BA mode:"

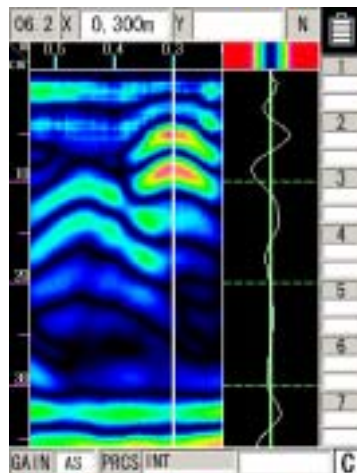
- Push **4** SET while scanning is stopped and switch to the parameter settings screen.
- Select the settings item "Display Mode" using the **▲▼** cursor keys (invert display) and transfer to item selection using the **◀▶** cursor keys.
- Select "B" or "BA" using the **▲▼** cursor keys or use the **◀▶** cursor keys to transfer to set up items.
- Push **4** SET to switch to the scan test screen.

#### Remarks

- If the display mode is switched from "B" mode to "BA" mode or vice versa when the scan testing stops then the display mode last selected when the scan testing restarts will be in operation when scan testing is resumed.



B mode



BA mode

Figure 3-10 B-mode/BA-mode Display

### 3.3.2 Sensitivity switching

As sensitivity can be switched for the scan test results in the same way as during scanning, scanning does not have to be performed again after changing sensitivity.

Sensitivity is displayed, for example, as "A shallow." "A" indicates the overall sensitivity; "shallow" indicates sensitivity to depths.

There are five levels for overall sensitivity: "-2, -1, A, +1, +2." In general, use the unit in the "A" setting. Use the +side to increase sensitivity and use the –side to reduce sensitivity.

There are two levels for depth sensitivity: "shallow and deep." Select "shallow" when the object to be probed is at a depth less than 10 cm. Select "deep" when the object to be probed is at a depth of 10 cm or more.

To change the sensitivity, press **[3] GAIN**. The sensitivity is changed as follows:

A, shallow → +1, shallow → +2, shallow → -2, deep → -1, deep → A, deep → +1, deep → +2, deep → -2, shallow → -1, shallow → A, shallow → +1, shallow →

#### Remarks

If sensitivity is changed when scanning is stopped and scanning is performed again, the new sensitivity set while scanning was stopped will be used for scanning.

### 3.3.3 Cursor operation

Figure 3-11 shows sample display with cursor operation.

#### (1) Cursor Display

If the cursor keys **[▶]**, **[▼]** are pushed after scanning is complete, a vertical cursor is displayed on the **[1]** liquid crystal display screen.

The cursors on the screen move vertically when the **[▲]** **[▼]** keys are pressed, and horizontally when the **[◀]** **[▶]** keys are pressed. The distance and depth at the intersecting point are displayed in the upper area of the screen.

If the scan test data does not fit into the scan test screen, the vertical cursor disappears when it reaches the right or left end of the screen, and the scroll mode is enabled to continuously display the data stored in the memory.

#### (2) Cursor Mark Display

With scanning stopped, if the vertical/horizontal cursor intersection point is moved to the position of the rebar etc. and **[10] MARK** is pushed, a cursor mark (**[▼]** symbol and number) is displayed at the cursor intersection point. The coordinates of the cursor mark are distance moved and depth and are shown on the right side of the **[1]** liquid crystal display. Up to seven cursor marks can be displayed.

To delete a cursor mark, move the cursor onto the cursor mark and press **[10] MARK**.

Remarks

- When switching from a scanning stopped state to scanning state, all of the cursor marks are erased.

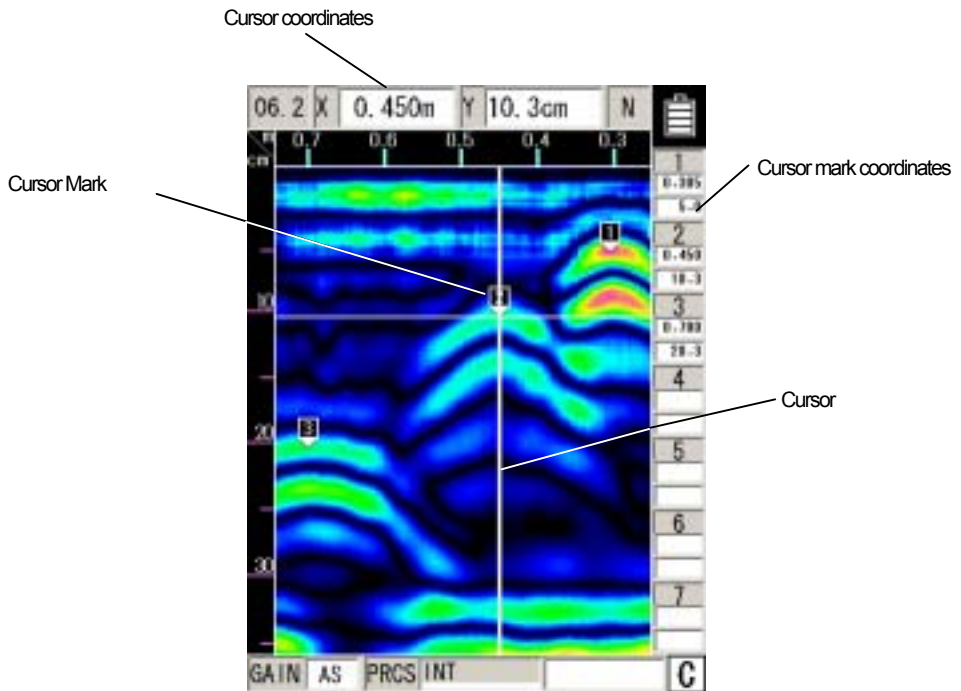


Figure 3-11 Cursors and Cursor Marks



### 3.4 Image Processing

Image processing is processing that is performed on data input through scanning and enables easy deciphering of objects that are being probed for from the scanning results.

This radar contains the following five types of image processing:

- a) Manual surface wave processing
- b) Peak processing
- c) Reproduction of original image
- d) Fixed surface wave processing
- e) Deduction processing

#### 3.4.1 Manual surface wave processing

Manual surface wave processing is used when the effect of reflection near the surface of the concrete on the scanning results can not be completely removed. (See Figure 3-12.)

(1) Move the cursor to a location where there is not an object that is being probed

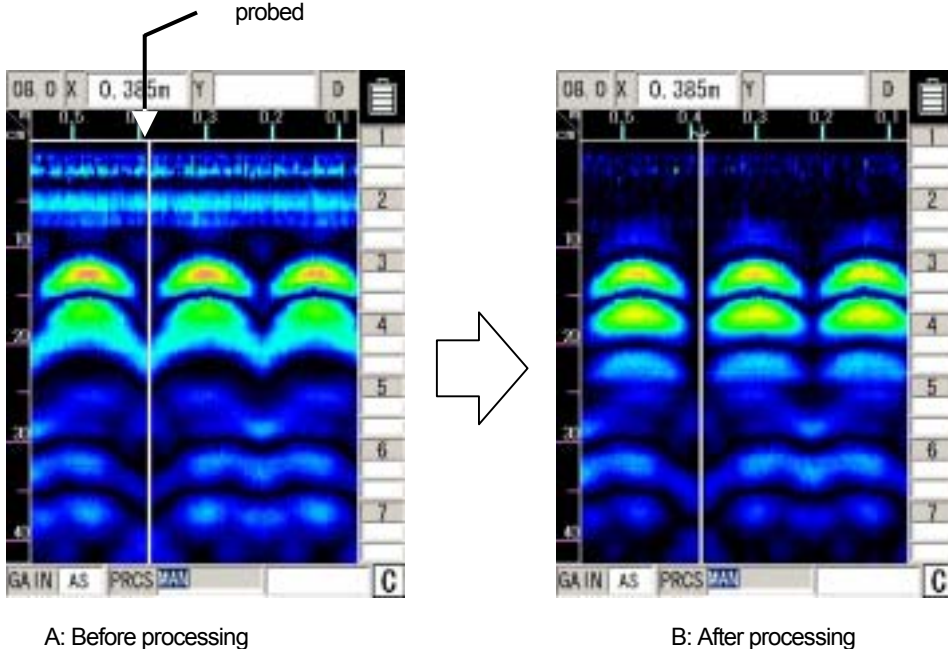


Figure 3-12 Display before/after Manual Surface Wave Processing

The operation is performed as described below.

- a) a) Press the **PRCS** key .  
“Inverted display” is shown as the item for “Processing” at the bottom of the screen and operation switches to image processing.
- b) Set "Manual" using the cursor keys **▲▼** .
- c) Use the cursor keys **◀▶** to move the cursor to a location where there is not a object to be probed in the sense test results. (See Figure 3-12 A-(1))
- d) Press **ENTER** . Manual surface wave processing will be performed while the reflected wave at the cursor position is used as the surface wave. At this time, the mark "↓" is displayed at the previous cursor position.  
(See Figure 3-12B.)
- e) To end the image processing mode, press the **PRCS** key again.  
“Normal display” is shown as the item for “Processing” at the bottom of the screen and image processing mode is exited.

#### Remarks

- When "Manual" is set with the cursor keys **▲▼** after manual surface wave processing (including real-time manual deduction processing) and deduction processing, image data will be displayed using manual surface wave processing that uses the surface wave at the cursor position (indicated by "↓") of the last-executed processing. (Manual surface wave processing can be newly performed by moving the cursor and pressing **ENTER**.)  
→ See section 3.2.5 “Real Time Manual Deduction processing” regarding real time manual deduction processing.
  - If manual surface wave processing and deduction processing (including real time manual surface wave processing) after scanning are not performed, the image does not change when the cursor keys **▲▼** are used to set operation to “manual”.  
(Manual surface wave processing can be performed by moving the cursor and pressing **ENTER**.)
  - To perform manual surface wave processing again, repeat steps c) and d).
  - Manual surface wave processing and deduction processing are almost the same but have a different depth processing range.
    - Manual surface wave processing: area where the effect of surfaces waves is high
    - Deduction processing: full scanning depth
- See "Section 3.4.5 Deduction processing" regarding deduction processing.

### 3.4.2 Peak Processing

Peak processing deletes multiple reflected waves of surface wave processing results and displays only the reflected waves from objects being probed (rebar etc.). Use this when it is difficult to see the depth of the objects being probed due to multiple reflected waves.

Note that peak processing cannot be used for probing objects (e.g., cavities) that have a lower relative permittivity than concrete.

Peak processing can be performed for the results of fixed surface wave processing (including real-time automatic surface wave processing), manual surface wave processing (including real-time manual surface wave processing), and deduction processing.

Procedure for reduction processing:

- a) a) Press the **PRCS** key.  
“Inverted display” is shown as the item for “Processing” at the bottom of the screen and operation switches to image processing.
- b) Set "Peak" using the cursor keys ▲ ▼ .
- c) c) Select “Peak manual,” “Peak fixed,” or “Peak deduction” using the cursor keys ◀ ▶ .  
Peak processing will be performed for the relevant process results.
- d) To end the image processing mode, press the **PRCS** key again.  
“Normal display” is shown as the item for “Processing” at the bottom of the screen and image processing mode is exited.

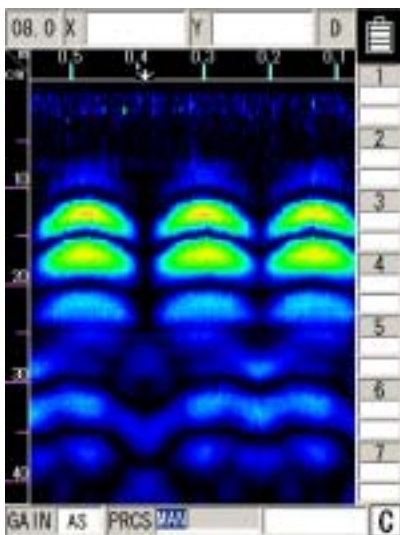
Figure 3-13 shows sample display when peak processing is performed for the result of manual surface wave processing.

Remarks

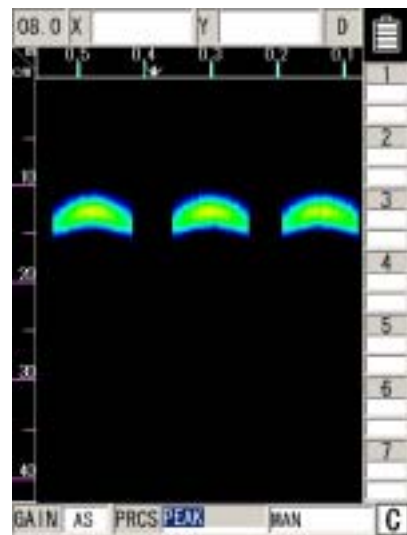
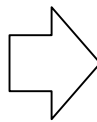
- The display items at the bottom of the screen and their meanings are as follows:
  - Peak manual: Peak processing for the result of manual surface wave processing
  - Peak fixed: Peak processing for the result of fixed surface wave processing
  - Peak deduction: Peak processing for the result of deduction processing
- If "Peak manual" or "Peak deduction" is set without manual surface wave processing or deduction processing being performed after scanning, the same data as when "Peak fixed" is set will be displayed.
- If reflected waves shaped as horizontal stripes appear near the surface of concrete after scanning (with automatic real-time surface wave processing performed), the setting of "Peak fixed" may cause waves reflected by the reinforcing steel bars to be invisible due to the remaining horizontal stripes.

In this case, use the following method (1) or (2) to solve the problem:

1. Perform manual surface wave processing for scanning results to eliminate the reflected horizontal stripe waves from the data, and then perform "Peak manual."
2. Perform deduction processing for scanning results to eliminate reflected horizontal stripe waves from the data, and then perform "Peak deduction."



A: Before processing



B: After processing

Figure 3-13 Peak processing

### 3.4.3 Reproduction of original image

This processing restores the image processing result to the original state and displays unprocessed raw data.

Procedure for reduction processing: (See Figure 3-14.)

- a) a) Press the **6** **PRCS** key.  
“Inverting display” mode will be indicated at the bottom right hand side of the screen as the operation switches to image processing from the manual mode..
- b) Set "Original image" using the cursor keys **▲▼**. Reproduction of original image will be performed.
- c) To end the image processing mode, press the **6** **PRCS** key again.  
“Normal display” is shown as the item for “Processing” at the bottom of the screen and image processing mode is exited.

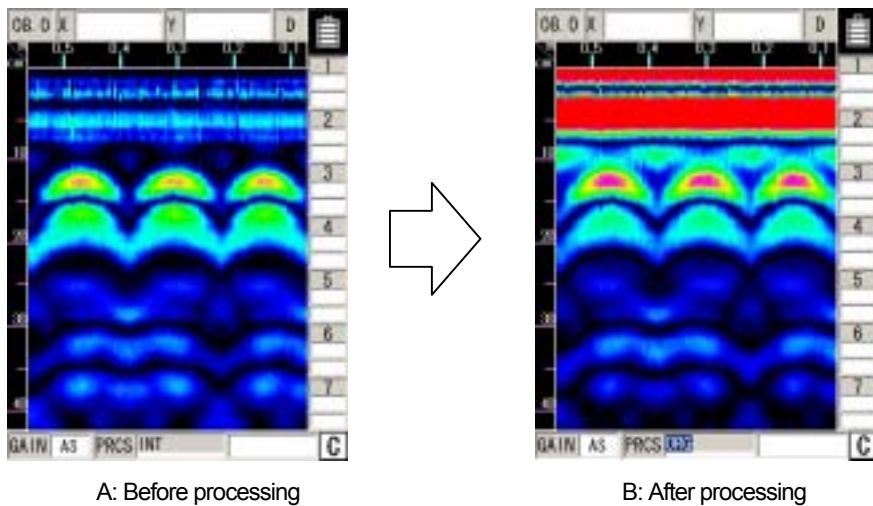


Figure 3-14 Reproduction of original image

#### 3.4.4 Fixed surface wave processing

This image processing displays surface processing results using internal fixed surface waves. (Same as real time automatic surface wave processing results)

Procedure for reduction processing:

- a) a) Press the **6** **PRCS** key.  
“Inverting display” mode will be indicated at the bottom right hand side of the screen as the operation switches to image processing from the manual mode.
- b) Set "Fixed" using the cursor keys **▲▼**. The result of surface wave processing performed with the fixed surface wave will be displayed.
- c) To end the image processing mode, press the **6** **PRCS** key again.  
“Normal display” is shown as the item for “Processing” at the bottom of the screen and image processing mode is exited.

#### 3.4.5 Deduction processing

Deduction processing eliminates reflected horizontal stripe waves from the screen after completion of scanning for extremely deep depths of 20 cm or more as shown in Figure 3-15A.

Procedure for reduction processing:

- a) Press the **6** **PRCS** key.  
“Inverting display” mode will be indicated at the bottom right hand side of the screen as the operation switches to image processing from the manual mode.
- b) Set "Deduction" using the cursor keys **▲▼**.
- c) Use the cursor keys **◀▶** to move the cursor to a location where there is not a object to be probed in the scan test results. (See Figure 3-15 A-(1))
- d) Press **5** **ENTER**. Deduction processing will be performed with the reflected wave at the cursor position.  
At this time, the mark "↓" is displayed at the previous cursor position. (See Figure 3-15 B.)
- e) To end the image processing mode, press the **6** **PRCS** key again.  
“Normal display” is shown as the item for “Processing” at the bottom of the screen and image processing mode is exited.

## Remarks

- When "Deduction" is set with the cursor keys ▲▼ after manual surface wave processing (including real-time manual deduction processing) and deduction processing, the image generated through deduction processing using the reflected wave of cursor position (indicated by "↓") of the last executed processing is displayed. (Deduction processing can be newly performed by moving the cursor and pressing **ENTER**.)
    - See section 3.2.5 "Real Time Manual Deduction processing" regarding real time manual deduction processing.
  - If manual surface wave processing and deduction processing (including real time manual deduction processing) after scanning are not performed, the image does not change when the cursor keys ▲▼ are used to set operation to "deduction". (Deduction processing can be performed by moving the cursor and pressing **ENTER**.)
  - To perform deduction processing again, repeat steps c) and d).
  - Manual surface wave processing and deduction processing are almost the same but have a different processing range.
    - Manual surface wave processing: area where the effect of surfaces waves is high
    - Deduction processing: full scanning depth
- Deduction processing may eliminate reflected waves such as waves reflected by the rear surface of a concrete wall.
- For details, see "Section 3.4.1 Manual surface wave processing.

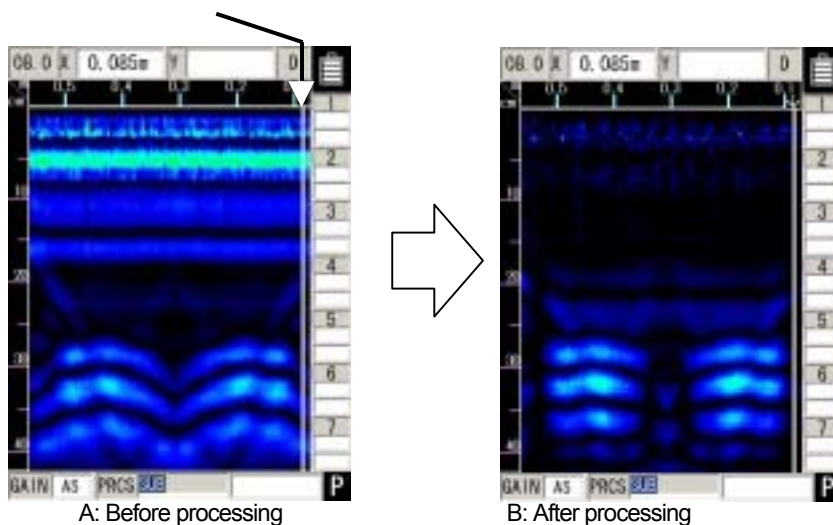


Figure 3-15 Display before/after Deduction Processing

### 3.5 How to Determine Depths and Sample Scan Test Data

The reflected waves shown in the scan test example in Figure 3-16 are reflections of rebar. (↓ position)

The position of the object to be probed (e.g., reinforcing steel) in the traveling direction is determined as the peak of the reflected wave.

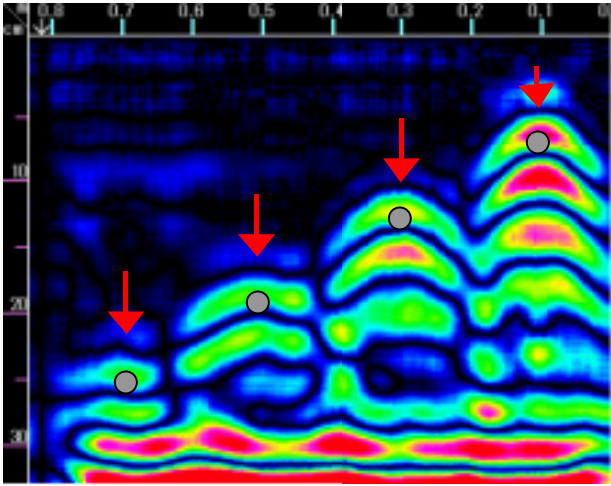
An approximate depth (covering depth) of the object to be probed (e.g., reinforcing steel) is determined as the center of the reflected wave.

Perform depth calibration (see section 3.2.6 “Depth Calibration”) to reduce the error in the depth (covering depth) of the object being probed (such as rebar). Use the A mode waveform from BA mode (see section 3.3.1 “Mode Switching”) to determine the position of the object to be probed.

The position of the object to be probed (such as rebar) is shown by the peak on the right side of the A mode waveform.

Match the cursor to the peak position to determine the depth.





● Position of rebar shown among the reflected waves of the scan test results (The ● mark is not actually shown in the sense test results.)

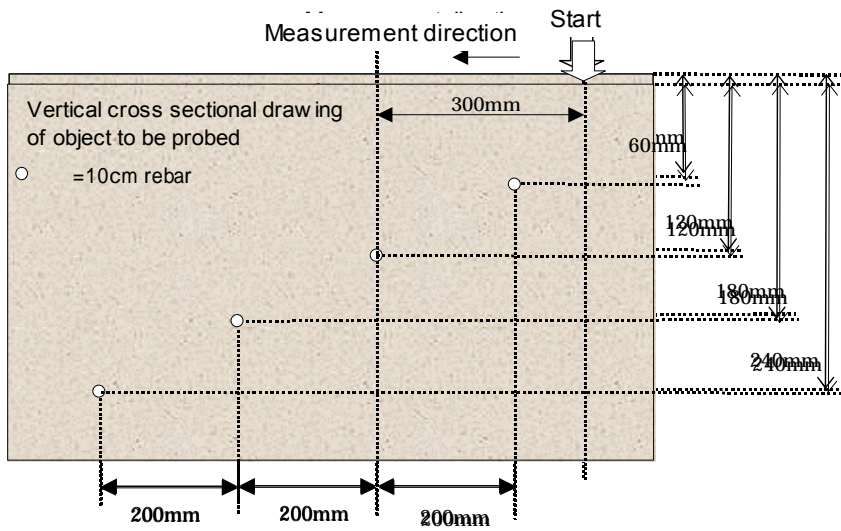


Figure 3-16 Scan test example

### 3.6 External Output Methods

This unit is equipped with functions for printing the screen to a special printer (option) and a function for saving scan test data to a compact flash memory card.

The following explains how to use the functions:

#### 3.6.1 Printer Output

##### (1) Setting of an output destination

Press the **[4] SET** key on the scan test screen, and set "Printer (I)" for "External output" on the parameter setting screen.

##### (2) Installation of the printer

Set up the printer so that the IrDA optical receiver faces the IrDA optical receiver on the front of this unit at a distance of between 50 and 500 mm.

Note that if there is an obstacle between the radar and printer or the printer is not installed at an angle of  $\pm 15$  degrees, the printer is unable to operate.

##### (3) Printing

Pressing the **[13] OUTPUT** key enables printing to the printer.

Data in the range from 0 m (0 s) up to the currently displayed screen contents will be printed.

During output to the printer, "Date, Data No." as well as the message "Under printing" will be displayed on the LCD screen.

#### Notes

Use the designated (recommended) printer.

## Remarks

- For details on the printer, see the printer instruction manual.
- To stop in the middle of printing, press any key.
- The printing range is from 0 m (0 s) up to the currently displayed screen contents. To print all the scan test data, scroll to the last scan test screen using the cursor keys ◀ ▶, and then start printing.
- The direction of printed image data changes depending on the setting of the screen inversion function. For the printer to always output image data in the same direction, retain the same setting "Normal or Reverse" for "Inversion of the screen."  
See section 2.3.2 "Inverting the Screen" regarding inverting of the screen.
- As the voltage of the printer's battery pack lowers, the printing speed decreases. Replace the battery pack as soon as a sign of a voltage drop is detected.
- When the message "Charge the printer's battery" is displayed on the screen, the voltage of the printer's battery pack has lowered.  
In this case, charge the battery pack or change to a new battery pack according to the message, and press the **13** OUTPUT key again to start printing.
- If pressing the **13** OUTPUT key does not start printing and the message "Turn OFF/ON the printer" is displayed, the printer settings may have been initialized. (The system may take about 30 seconds to display this message after the **13** OUTPUT key is pressed.)  
In this case, turn OFF/ON the printer according to the message. The printer will be set again and get ready for printing. Press the **13** OUTPUT key again to start printing.
- When the message "No printing paper" is displayed on the screen, the printer has run out of paper.  
In this case, load a new roll of printing paper, and press the **13** OUTPUT key again to start printing.

### 3.6.2 Data saving in compact flash memory

#### Notes

Mount/remove the compact flash memory card while the power switch of this unit is off.

Make sure of the insertion direction before mounting the compact flash memory card.

Operation of this unit has been confirmed with compact flash CF115-512M manufactured by IO Data. The unit may not operate with a compact flash memory card of another company, so an IO Data compact flash memory card should be used.

**Be sure to initialize the compact flash memory using this unit.** If this is performed using other equipment (**NJJ-95B, PC etc.**) the compact flash may not be recognized.

**Please do not use a compact flash memory that was used with a NJJ-95A.** As the data format used by NJJ-95A and NJJ-95B are different, this may cause an error.

This unit can save sense testing results as data to a compact flash memory card.

There are two types of data save formats: binary format and text format.

- (1) Binary format
  - a) Configuration

The data format in binary mode consists of the following two sections:

Header section (ASCII data) + data section (binary data)

The header section contains information incidental to the scan test data (date, scan test parameters, scan test data size, etc.).

The data section contains data attributes and scan test data.

b) Header section

The following shows a sample configuration of the header section and explains the items.

The control codes in the header section are as follows: [0x0D] = CR, [0x0A] = LF, and [0x1A] = EOF.

Sample configuration of the header section:

- (1) NJJ-95 B Measurement Data ####[0x0D][0x0A]
- (2) Date : 31.12.06[0x0D][0x0A]
- (3) Time : 23:59[0x0D][0x0A]
- (4) Data # : 999[0x0D][0x0A]
- (5) X Data Size : 3000[0x0D][0x0A]
- (6) Y Data Size : 512[0x0D][0x0A]
- (7) X Scale : Distance[0x0D][0x0A]
- (8) Y Scale : 06.2[0x0D][0x0A]
- (9) X Scale Adjust : +5[0x0D][0x0A]
- (10) Y Scale Range: 6ns[0x0D][0x0A]
- (11) MarkX 1 : 3[0x0D][0x0A]
- (12) MarkY 1 : 14[0x0D][0x0A]
- ␣
- (13) MarkX n : 2997[0x0D][0x0A]
- (14) MarkY n : 508[0x0D][0x0A]
- (15) END[0x0D][0x0A]
- (16) [0x1A] [0x0D][0x0A]

Items in the header section:

- (1) ID data such as the model name
- (2) Date
- (3) Time
- (4) Data No.: 000 to 999
- (5) Number of lines: 1 to 3000
- (6) Number points per line: 512 (fixed value)
- (7) Scan test system: "Distance" for distance feed, and "Time" for time feed
- (8) Depth calibration value: 06.0 to 11.0, or ns
- (9) Distance error compensation value: -20 to +0 to +20
- (10) Shows the display range when saving: shallow  
= 4ns, standard = 6 ns, deep = 8 ns
- (11) X coordinate of the 1st cursor marker: Shown by line No.
- (12) Y coordinate of the 1st cursor marker: Shows the point No.
- (13) X coordinate of the n-th cursor marker: Max. n = 7

(14) Y coordinate of the n-th cursor marker

(15) Header section ending data

(16) EOF

c) Data section

Scan test data is configured as a collection of 1-line data.

One-line data is fixed to a length of 769 bytes as follows:

1 byte of header + 768 bytes of scan test data = 769 bytes

The header represents line attributes in the following format:

A0-Bit7(MSB)	0
A0-Bit6	0
A0-Bit5	1 when this line contains an antenna marker; 0 when it does not.
A0-Bit4	1 when this line is specified as the surface wave; 0 when it is not
A0-Bit3	0
A0-Bit2	0
A0-Bit1	0
A0-Bit0(LSB)	0

Details on 768 bytes of scan test data:

Scan test data per line includes 512 points, and 1-point data consists of 12 unsigned bits.

Two-point data is sent after being re-listed as 3 bytes, so a total of 512 points (= 768 bytes) are sent.

Data is re-listed according to the rule shown below.

$$[0xABC]+[0xDEF] \rightarrow [0xAD]+[0xBC]+[0xEF]$$

Following the fixed surface wave data, the single-line scan test data explained above is output for each scan test line. The header of the fixed surface wave data is [0xFF].

Therefore, the length of the data section is variable:

$$(1 \text{ byte of header} + 768 \text{ bytes of scan test data}) \times (\text{number of scan test lines} + 1)$$
$$(\text{number of measurement lines} + 1)$$

(2) Text mode

a) Configuration

The data format of the text mode is the same as for the binary mode.

The difference from the binary mode is that the text mode processes all data as ASCII data.

Header section (ASCII data) + data section (ASCII data)

b) Header section

The configuration of the header section is the same as for the binary mode.

c) Data section

The text mode converts one byte of data output by the binary mode to two bytes of ASCII data (HEX) and outputs the converted data with [0x0D] and [0x0A] being added.

Remarks

- The size of data in binary mode is smaller than that in text mode, thereby saving space of the compact flash memory.
- The saved data is A/D conversion data (original image data), but not the one after image processing such as surface wave processing has been performed.

(3) Saving data to compact flash memory

Procedure for saving data in compact flash memory:

a) Setting of an output destination

Press the **4** **SET** key on the scan test screen, and set "CF (text)" or "CF (binary)" for "External output" on the parameter setting screen.

b) Setting of a data number

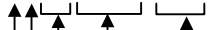
An arbitrary number can be assigned to scanned data by setting the number for "Data No." on the parameter setting screen. The data number (Data No.) is incremented each time data is saved.

c) Saving of sense test data

If the **13** **OUTPUT** key is pressed while a scan test is stopped on the scan test screen, data from scan testing can be saved to a compact flash memory card.

The file name of saved data is determined as follows:

**B 1 2 3 0 4 5 0 . 0 0 1**



Data No.

Scan test time: The first 2 digits indicate hours; the last 2 digits indicate minutes.

Scan test date

Scan test month month: A, B, and C stand for October, November, and December, respectively.

Save format: T stands for text format; B stands for binary format.

d) Confirmation of data saved

Press the **12** **CF** button. The screen will be switch to the CF control screen shown in Figure 3-17 where you can check whether data has been saved. On the CF control screen, you can also display the thumbnail images of saved data, read/delete data, and initialize the compact flash memory. For details, see "Section 3.7 CF Control Screen."





Display of thumbnails

Figure 3-17 CF Control Screen

### 3.7 CF Control Screen

When not scan testing, if the **12** CF button is pushed, operation will be switched to the CF control screen. Once at the CF control screen, thumbnail image display can be viewed. Also, data storage, data erasure, and initialization for the compact flash memory card can be executed.

To return to the measurement screen, select "Cancel" using the cursor keys ◀▶, and press the ENTER key or the **12** CF button.

All of the functions of the CF control screen are shown below.

#### 3.7.1 Displaying the thumbnail images of saved data

When a file is selected at the CF control screen using the ▲▼ cursor keys, scan test results can easily be displayed on the display area. (See Figure 3-17.)

The thumbnail display enables an easy check on saved image data.

If "Monochrome" is selected for "Display color" on the setting screen, the thumbnail image display will also be monochrome.

#### 3.7.2 Reading saved data

To open data that has been saved, select the file to be opened using the ▲▼ cursor keys on the CF control screen, select "Open" using the ◀▶ keys and press the ENTER key.

The screen changes to the scan test screen, the screen is scrolled, and the selected data is opened.

"Read" is finished when the screen stops scrolling.

If there is data that has not been saved or data opened from the CF on the scan test screen prior to switching to the CF control screen a message "Data that has not been saved will be erased – Yes/No" is displayed. Select "Yes" using the ◀▶ keys and press the ENTER key to open the file. If "No" is selected and the ENTER key is pressed, operation returns to the CF control screen. (See Figure 3-18.)

Operations such as changing sensitivity, image processing, external output (printing), and cursor operations can be performed on the data that has been opened.

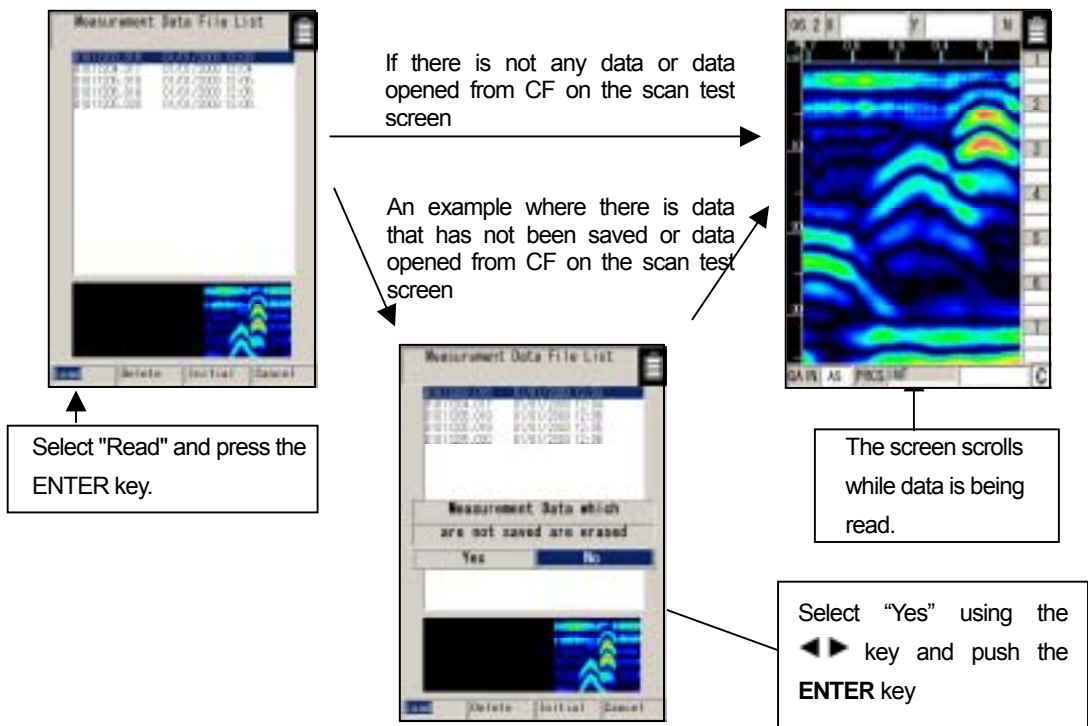


Figure 3-18 Reading Saved Data

### 3.7.3 Deleting saved data

Select the file to be deleted on the CF control screen using the cursor keys ▲▼, select "Delete" using the cursor keys ◀▶, and press the **ENTER** key.

When the message "Do you want to delete the data? Yes/No" is displayed, select "Yes" using the cursor keys ◀▶, and press the **ENTER** key. (See Figure 3-19.)

(To cancel the deletion, select "No" and press the **ENTER** key.) )

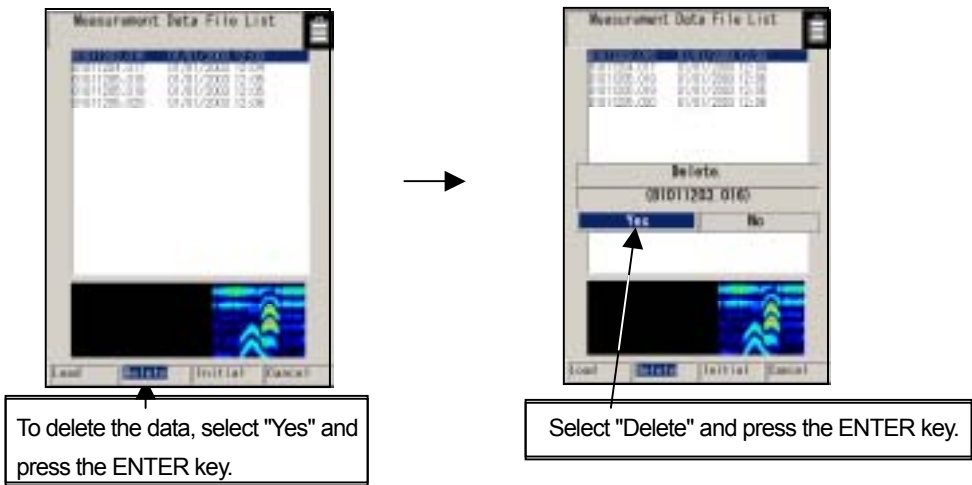


Figure 3-19 Deleting Saved Data

#### 3.7.4 Method for initialization of Compact Flash

Select "Initialization" on the CF control screen using the cursor keys ◀ ▶, and press the **ENTER** key.

The message "Do you want to initialize memory? Yes/No" is displayed. Select "Yes" using the cursor keys ◀ ▶, and press the **ENTER** key. (To cancel the initialization, select "No" and press the **ENTER** key.)

The message "Initializing" is displayed and initialization is started. After the message disappears, the compact flash memory is initialized and all data is deleted. (See Figure 3-20.)

#### Notes

- Never remove/insert the compact flash memory card or turn off the power switch while initializing is in progress. Doing so may cause a malfunction.
- Be sure to initialize the compact flash memory using this unit.
- If the CF button is pressed without a compact flash memory card being mounted, the message "No compact flash memory" will be displayed. In this case, press the ENTER key to close the screen, turn off the power, and then insert the compact flash memory card.

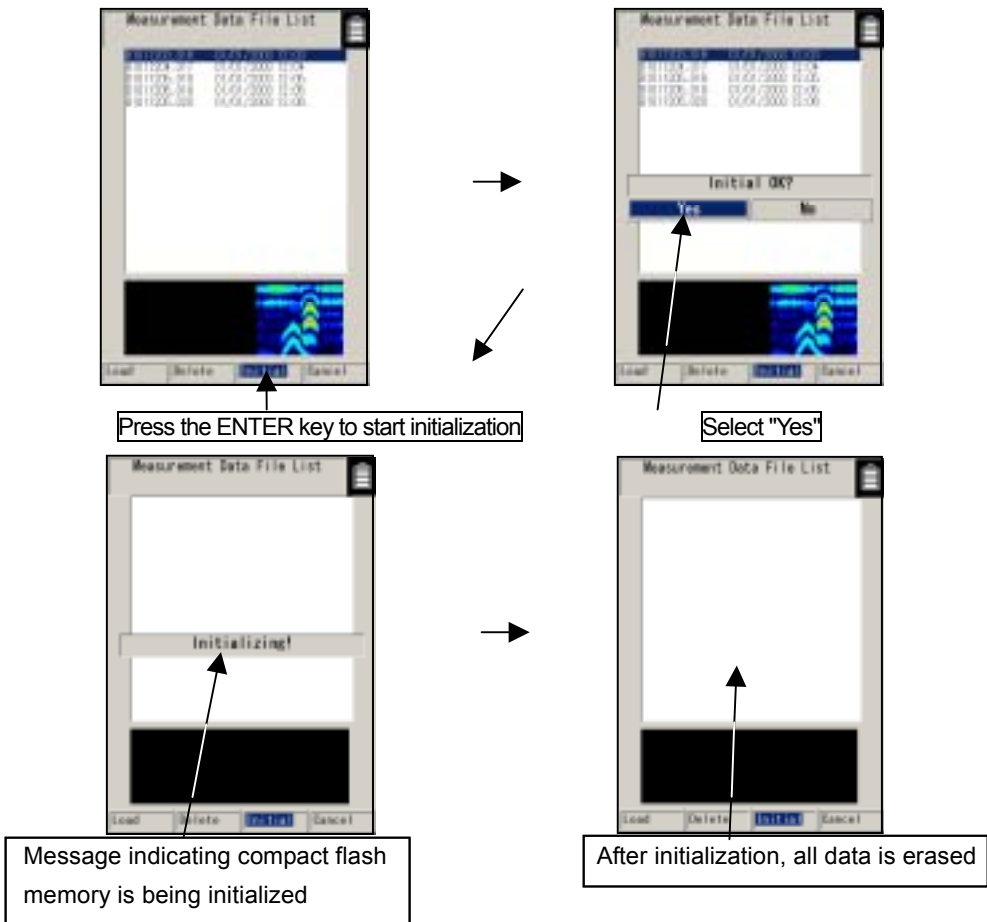


Figure 3-20 Initializing Compact Flash Memory

### 3.8 Power-off Procedure

When scan testing is finished, set the 16 power switch to "OFF."

#### Notes

- All scan test data that is not saved in the compact flash memory is deleted when the power is turned off.








### 3.9 Clearing up the radar and accessories

Turn off the power, disconnect all cables the radar, and put them together with the radar into the provided storage box.

#### Remarks

If this radar is not to be used for a long time, dismount the battery pack when storing the radar.

### 3.10 About the Battery Pack and Charger

 <b>WARNING</b>	
	Do not short-circuit the terminals of the battery charger or battery pack. Doing so could cause fire, explosion, or breakdown.
	Do not disassemble, modify, heat, or throw the battery pack on fire. Doing so could cause fire, explosion, or breakdown.
	Do not use any charger other than the dedicated battery charger to charge the battery pack. Doing so could cause fire, electric shock, or breakdown.
	Do not connect/disconnect the plug while your hands are wet. Doing so could cause an electric shock.
	Stop using the NJJ-95B immediately when a possible malfunction is detected, and follow only the detailed procedure in this instruction manual. If it cannot be restored to normal operation, contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in abnormal state could cause fire or breakdown.
	Should the NJJ-95B emit an abnormal sound, odor, or smoke, immediately turn off the power switch, remove the battery pack, disconnect the power plug from the socket outlet, and contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in abnormal state could cause fire, electric shock, or breakdown.

 <b>CAUTION</b>	
	Do not use any battery pack other than the BP-3007-A1. Doing so may cause fire, electric shock, or breakdown.



### 3.10.1 Battery pack BP-3007 series

The battery pack BP-3007 series, which is commonly used with the Handy Search and printer (optional), contains a rechargeable lithium ion battery.

While the battery pack is fully charged, it can operate the Handy Search for about 1.5 hours.

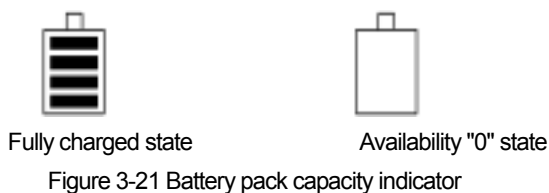
#### (1) Mounting/dismounting the battery pack

See "Section 3.1 Preparations for Sense Testing", for how to mount/remove the battery pack.

#### (2) Battery pack remaining capacity

The battery availability indicator is displayed at the upper right of the LCD screen of this radar.

When the battery availability indicator shows the "0" state (see Fig. 3-21) and the buzzer sounds, set the 16 power switch to "OFF" and replace the battery pack.



#### (3) Usage of the charging check mark

Use the green charging check mark (see Fig. 3-22 A) to check if the battery pack has been used after being charged.

- The mark turns green when the battery pack is removed from the dedicated battery charger.
- This mark can also be switched by hand.

#### Remarks

- The battery pack is charged just enough for the radar's test operation before it is shipped.  
The battery pack needs to be charged when used for long operation.
- The battery pack should be charged immediately before being used.
- Keep the battery pack in as cool a location as possible to make it last longer and it is recommended to charge the battery in an area with a temperature between +10 and +30 °C.
- The battery pack's operating time is shortened in a cold region.
- The battery pack does not need to be discharged or used up before it is charged.
- It is considered that the battery pack has reached its service life when the operating time sharply decreases. Change to a new battery pack.
- When using the battery pack, be careful that any foreign matters like dust or sand do not get into the terminals (see Fig. 3-22 B). If foreign matters have got into the terminals, remove them completely with soft, pointed sticks, and repeat mounting/dismounting it on/from the battery charger several times until the terminals have good contact.

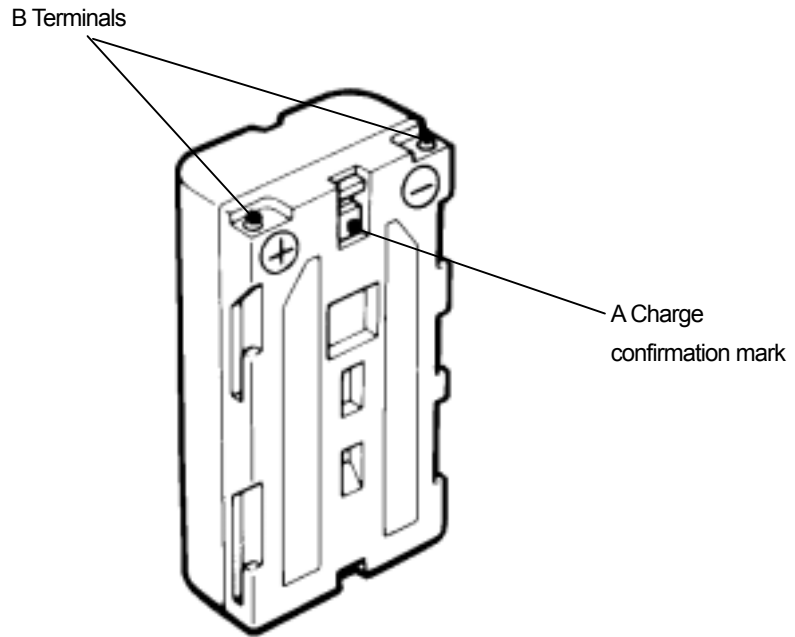


Figure 3-22 Battery Pack

### 3.10.2 Charging Device BC-3008 series

The battery charger BC-3008-series is exclusively used with the battery pack BP-3007-series.

When the battery pack is in the availability "0" state, charging will take about 2.5 hours.

(1) Procedure for using the charger

a) Mount the battery in the charger (see Fig. 3-23-(1))

While pushing the battery pack against the charger, slide it in the direction indicated by the arrow. Mounting of the battery pack is completed when it is pushed in until the shutter of the charger is hidden.

b) Connect the AC cord to the charger

Connect the AC cable to the charger, and connect the AC cable plug to the socket outlet. The CHARGE lamp (orange) on the charger will light indicating the start of charging.

(See Figure 3-23-(2).)

c) Completion of charging

When the CHARGE lamp goes off, the battery pack has been charged enough for "practical use." The battery pack will be "fully charged" if it is charged for another hour continuously after the lamp goes off.

d) Removing the battery

When charging is finished, remove the battery pack sliding it in the opposite direction from the mounting, and disconnect the AC cable plug from the socket outlet.

Notes

Thoroughly read the "charger instruction manual" to use the battery charger correctly and safely.  
Charge the battery pack in a place where the ambient temperature is 0 to 35 and the humidity is 45 to 90%.  
After using the battery charger, be sure to disconnect it from the socket outlet. Dismount the battery pack from the charger within 24 hours after it has been charged.

Remarks

- Store the battery pack in a cool location to ensure the longevity of the battery. It is recommended to charge the battery in an area with a temperature between +10 and +30 °C.

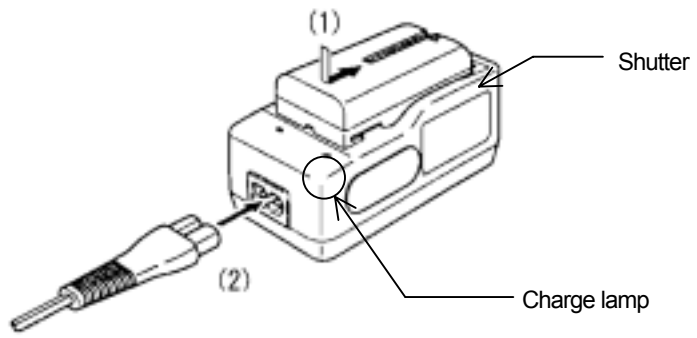


Figure 3-23 Battery Charger

## 4 Options



### WARNING



Do not use any battery pack other than the BP-3007-A1 or any AC adapter other than the PW-3009-W.

Doing so could cause fire, electric shock, or breakdown.



Do not short-circuit the terminals of the battery charger or battery pack.

Doing so could cause fire, explosion, or breakdown.



Do not insert anything metallic or flammable into the compact flash memory card slot. Doing so could cause a personal injury, fire, electric shock, or breakdown.



Stop using the NJJ-95B immediately when a sign of malfunctioning is detected, and follow only the detailed procedure in this instruction manual. If it cannot be restored to normal operation, contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in abnormal state could cause fire or breakdown.



Should the NJJ-95B emit an abnormal sound, odor, or smoke, immediately turn off the power switch, remove the battery pack, disconnect the power plug from the socket outlet, and contact our nearest branch office, sales outlet, or service station.

Use of the NJJ-95B in abnormal state could cause fire, electric shock, or breakdown.

#### 4.1 Printer DPU-3445 series

Printer DPU-3445-series is of the thermal type and prints out the records of data scan tested with the Handy Search.

##### Notes

- Thoroughly read the "printer instruction manual" to use the printer correctly and safely.

##### Remarks

- See Section 3.6 External Output Methods regarding Handy Search settings.
- For details on printer handling, see the printer instruction manual.

##### 4.1.1 Printer's main parts names and functions

Figure 4-1 shows the main parts of the printer, and Table 4-1 explains their functions.

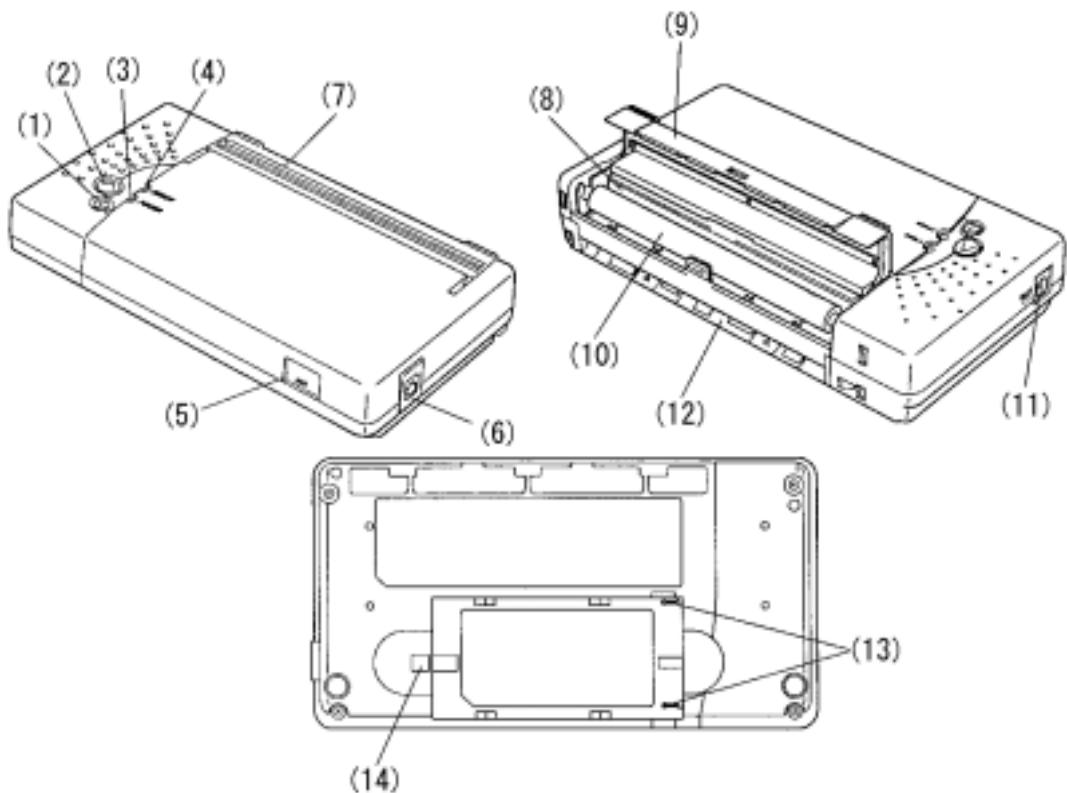


Figure 4-1 Printer's Main Parts

Table 4-1 Printer's Main Parts and Functions

No.	Name	Function
1	Power button	Turns "ON" or "OFF" the power. To turn on the power, hold the button down until the power lamp turns on. To turn the power off, hold the button down until the power lamp turns off.
2	FEED button	Paper is fed a small amount each time this button is pressed. To continuously feed paper, hold down the button.
3	POWER lamp	Lights when the power is turned on.
4	ERROR lamp	Lights when a printer error has occurred.
5	IrDA light receiver-emitter	Light receiver-emitter for IrDA (infrared data communication)
6	Interface connector	Connects the interface cable. Open the rubber cover, and insert the connector.
7	Paper ejection port	Paper is ejected from this port equipped with a paper cutter. While the platen cover is closed, paper is ejected from the top of the printer.
8	Thermal head	Records data on paper. Be careful that the thermal head is hot immediately after printing.
9	Platen cover	The thermal head is released from paper when this cover is opened. Open the cover to remove paper or clean the thermal head.
10	Platen roller	Brings the thermal head into contact with paper. Paper is fed by turning the roller.
11	Power connector	Connects the AC adapter.
12	Paper insertion port	Paper is inserted through this port.
13	Battery connection terminal	Used to connect the battery pack.
14	Button for releasing the battery	Used to remove the battery pack from the printer.

#### 4.1.2 Printer Specification

The specification for the printer is shown below.

Printing system: : Thermal line dot system

Printing width/printing paper width: : 104/112mm

Interface: : RS-232C, IrDA

Operating temperature range: : +5 ~ +40

External dimensions: : 160 x 89 x 29.5mm

Weight: : About 250 g (the printer alone)



#### 4.1.3 Connecting the battery pack/power source

##### Notes

- Confirm that the power switch is set to "OFF" before mounting/dismounting the battery pack or the AC adapter.

(1) Mounting the battery pack (See Figure 4-2 A.)

Align the printer's battery connecting terminals with the battery pack's connecting terminals, and push the battery pack in the direction indicated by the arrow.

(2) Removing the battery pack (See Figure 4-2 B.)

- a) Turn the printer power switch "OFF".
- b) Slide the battery pack in the direction indicated by the arrow while pushing the battery release button.

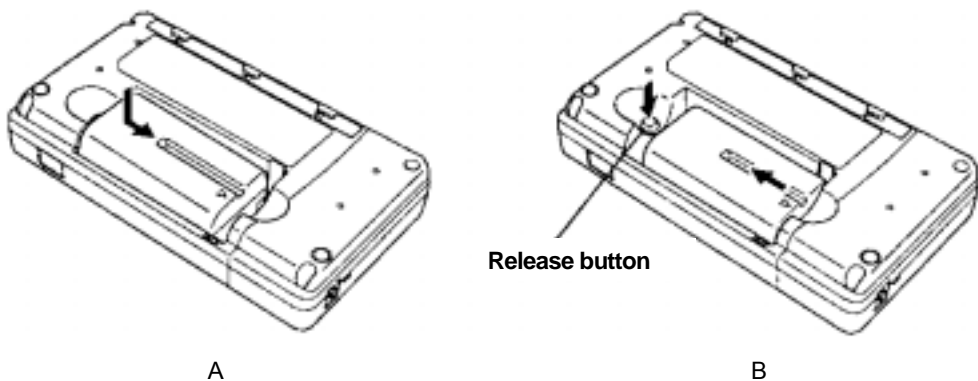


Figure 4-2 Connecting the Battery Pack

(3) When using the AC adapter:

- a) Connect the output plug of the AC adapter to the "power connector."
- b) Connect the AC adapter power cable to the socket outlet.

(4) Mounting the Paper Holder and Loading Paper



## CAUTION



When loading/unloading printing paper, be careful not to cut or jam your fingers in the printer.

Mount the paper holder on the printer and then load paper.

1. Insert the paper holder hooks into the square holes (upper) in both sides of the platen cover of the printer.  
(Arrow 1 in Figure 4-3 A.)

Then push in the paper holder while hooking the paper holder claws in the square holes (lower) in the printer. Mounting is completed when a click sound is heard. (Arrow 2 in Figure 4-3 A.)

2. Turn "ON" the printer power switch.

3. Place the printer upside down, and slide the paper cover in the direction indicated by the arrow while softly pressing the center of the paper cover. The paper cover is unlocked and can be opened. (See Figure 4-3 B.)

4. Load a paper roll into the paper holder as shown in Figure 4-3.

5. Insert the end of paper from the paper insertion port as far as it will go. The printer detects that paper has been loaded and draws in the paper automatically. (See Figure 4-3 D.)

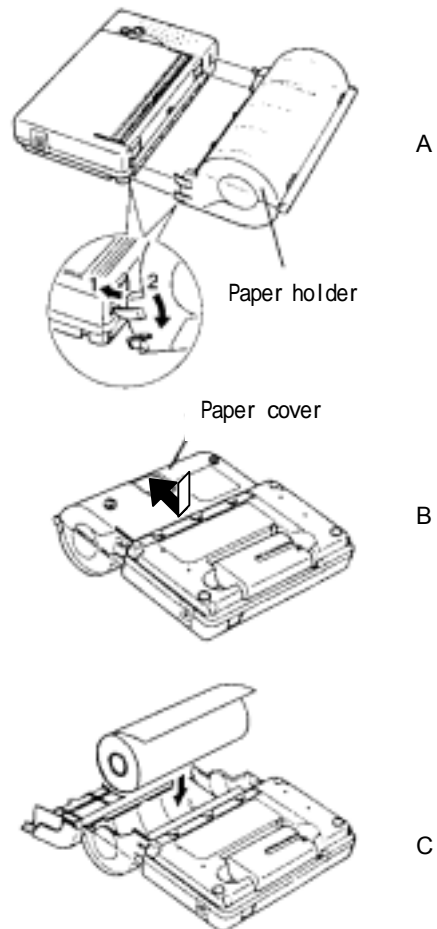
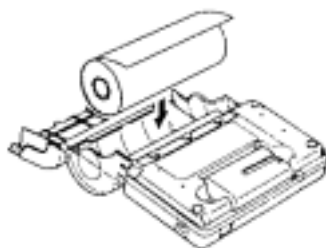


Figure 4-4  
Mounting the Paper Holder and Loading  
Paper

6. Close the paper cover, and slide it in the opposite direction of step 3 until a click sound is heard. The paper cover will be locked.

Note that paper will drop if the paper cover is not locked securely in this step.



D

Fig. 4-3 (continued)  
Mounting the Paper Holder and Loading Paper

7. Replace the printer to its original position.

The ERROR lamp is lighted in this state. Press the FEED button once to get the printer ready for printing.

#### Notes

- Do not apply excessive force to the paper holder. Be careful, in particular, when releasing the paper cover.

#### Remarks

- To unload paper, turn "OFF" the power, and then open the platen cover fully. Place the printer upside down, and open the paper cover. Then, simply lift the paper roll to remove.
- Insert the end of paper straight into the paper insertion port. Diagonal insertion may cause a paper feed failure.

#### (5) Method for removing the paper holder

Perform the following procedure to dismount the paper holder. (See Figure 4-4.)

1. Remove the paper roll from the paper holder.

2. While the paper cover is open, simultaneously press the right and left claws of the paper holder to unlock. When the paper holder is unlocked, it can be removed from the printer.

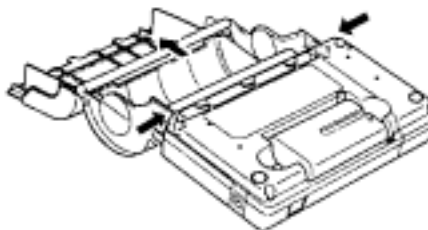


Figure 4-4  
Dismounting the Paper Holder

#### (6) Connecting with the Handy Search

Set up the main unit (Handy Search) and the printer so that the IrDA optical receivers are facing each other.

At this time, there is a range where printing is enabled through IrDA. Set the units up with a distance of between 50 and 500 mm and an angle of within  $\pm 15$  degrees.

(7) Printing of Handy Search scan test data

Before starting to print, check the external output destination setting on the parameter setting screen.

Make sure that external output is set to printer (I).

After the confirmation, return to the scan test screen, and perform the following printing procedure:

- a) Press the **13** **OUTPUT** key.
- b) Data in the range from 0 m (0 s) up to the currently displayed screen will be printed.
- c) During printing, the name of the file ("No Name Data" for case where the data was not opened and has not been saved), date, data no. are displayed on the liquid crystal display in addition to the message "Printing".

Remarks

See Section 3.6 External Output Methods regarding Handy Search settings.

For details on printer handling, see the printer instruction manual.

To stop in the middle of printing, press any key.

The printing range is from 0 m (0 s) to the display screen. To print all the scan test data, scroll to the last scan test screen using the cursor keys ◀ ▶, and then start printing.

The direction of printed image data changes depending on the setting of the screen inversion function. For the printer to always output image data in the same direction, retain the same setting "Normal or Reverse" for "Inversion of the screen."

See "Section 3.2.3 "Inverting the Screen" regarding inverting of the screen.

## 4.2 AC Adapter PW-0904-W1 series

The AC adapter PW-3009 series is used with both the Handy Search and printer.

### 4.2.1 AC Adapter Specification

The specification for the AC adapter is shown below.

Input voltage:	: AC 100 to 240V
Output voltage	: DC 9.3V
Output current	: 4A
Operating temperature range:	: 0 ~ +40□
External dimensions:	: 110 x 62 x 30mm
Weight:	: Approximately 300g

### 4.2.2 Connecting the AC adapter

- (1) Confirm that the power switch on the main unit is set to "OFF."
- (2) Connect the AC cable to the AC power connector on the AC adapter. (See Figure 4-5 (1))
- (3) Connect the DC jack of the AC adapter to the connection destination equipment (Handy Search/printer).  
(See Figure 4-5 (2))
- (4) Connect the AC adapter cable to the socket outlet.

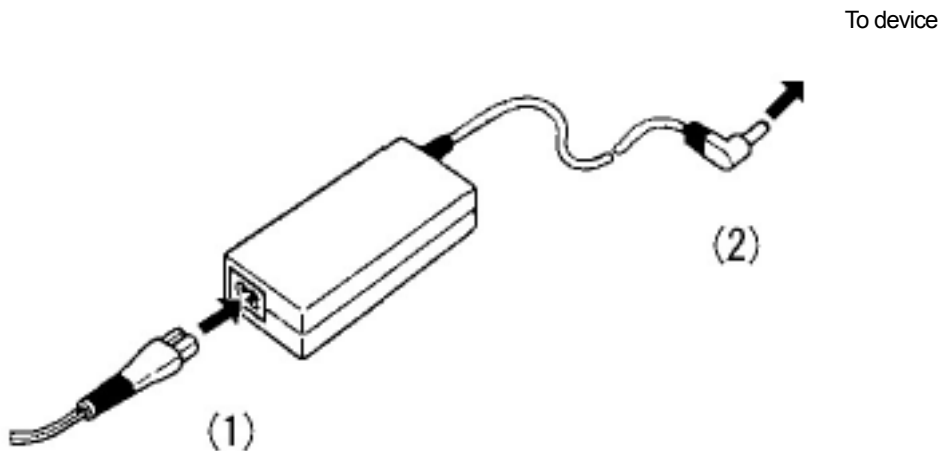


Figure 4-5 Connecting the AC Adapter

#### Notes

Thoroughly read "AC Adapter Usage" to use the AC adapter correctly and safely.  
Connect the AC adapter while the power switches on the radar and printer are turned off.

## 5 Theory

### 5.1 Principle of Operation

The principle of this radar is basically the same as for general radars widely used at present.

Electromagnetic waves are transmitted from the antenna toward the concrete as shown in Figure 5-1. The electromagnetic waves are reflected by an interface with the reflecting objects (e.g., reinforcing steel bars or cavities) whose electrical property is different from that of concrete. The waves are reflected back onto the surface of concrete and received by the receiving antenna placed near the concrete surface. The distance to the reflecting objects can be calculated from the time the reflected waves need to reach the receiving antenna. The horizontal locations of the objects can be detected by moving the main unit on the surface of concrete.

Since this radar is designed to probe objects with high resolution that are near from the surface of concrete, it transmits pulse waves having a width of only about one nanosecond (one-billionth of a second) or less.

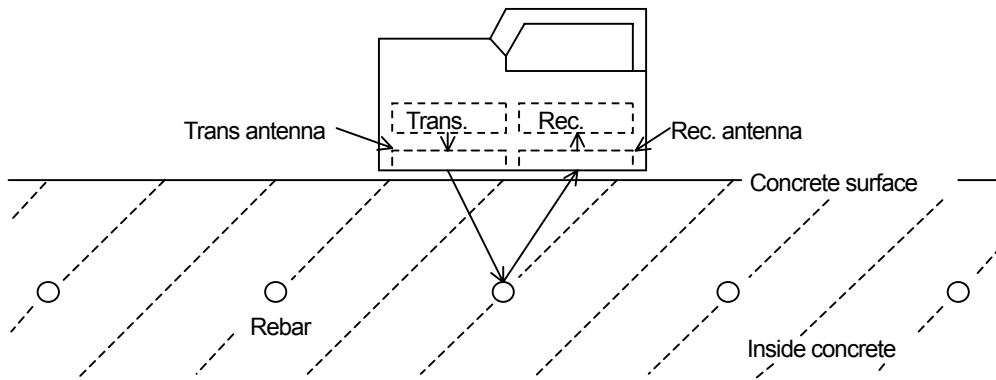


Figure 5-1 Diagram of Principle

Figure 5-2 shows a wave reflected by a reinforcing steel bar or the like in a concrete structure, which is obtained by this radar.

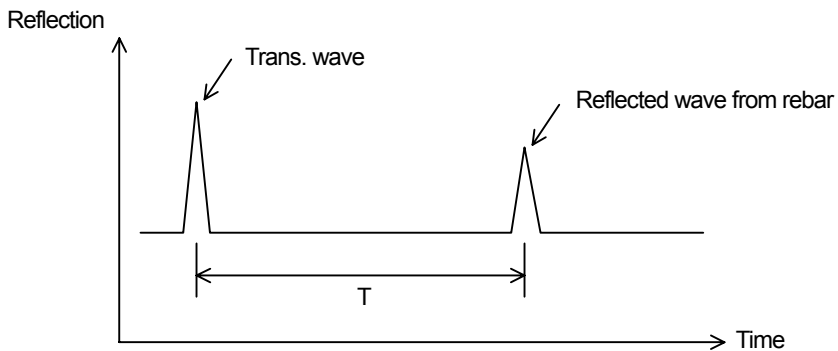


Figure 5-2 Sample of Reflected Waveform

Velocity V of electromagnetic waves in concrete is obtained from the following formula:

$$V = \frac{C}{\sqrt{r}} \text{ ( m / s )}$$

C: Velocity of electromagnetic waves in vacuum (in air) ( $3 \times 10^8$  m/s)  
r : Relative dielectric constant of concrete (6 to 11 in the example)

Distance D to the reflecting object is obtained from the following formula:

$$D = \frac{1}{2} V T \text{ ( m )}$$

## 5.2 Applicable Conditions

### (1) Applicable measuring conditions

(Waves reflected by objects to be scan tested in reinforced concrete structures must be received adequately, so the applicable measuring conditions vary slightly depending on the on-site condition.)

Scan test depth (covering depth) within 0.5 ~ 30 cm (case where relative permittivity of concrete is 6.2 and the diameter of the rebar is at least 6mm)

Objects to be probed that are at a depth of less than 75 mm have an interval spacing of at least 75 mm and where the depth of the object to be probed is greater than 75 mm, the interval spacing of the objects is more than the depth

Quality of concrete: Uniform

Direction of reinforcing steel: Orthogonal to the Handy Search's traveling direction

### (2) Inapplicable measuring conditions

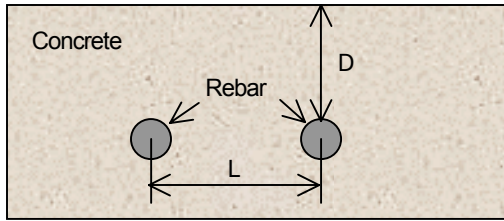
Scanning of reinforcing steel or the like in concrete whose surface contains objects such as metal that reflect radio waves

Presence of reinforcing steel bars that are parallel to the Handy Search's traveling direction

Concrete that has a narrow (pitch) arrangement for the interval of rebar in the horizontal direction

(Target: depth less than 75 mm → interval between rebar, less than 75 mm

Depth of greater than 75 mm → interval of rebar less than depth)



$D < 75\text{mm} \rightarrow L > 75\text{mm}$   
 $D \leq 75\text{mm} \rightarrow L \geq D$  } Difficult to implement



## 6 Maintenance Inspection



### WARNING



Do not attempt to disassemble, modify, or repair the NJJ-95B. Doing so could cause fire, electric shock, or breakdown.



When the power cord is damaged (exposed core wire, open circuit failure, or broken sheath), please contact our headquarters on Page **93** or our nearest branch office, sales outlet, or service station for a replacement power cord. Use of a damaged power cord could cause fire or electric shock.



Stop using the NJJ-95B immediately when a sign of malfunctioning is detected, and follow only the detailed procedure in this instruction manual. If it cannot be restored to normal operation, contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in abnormal state could cause fire or breakdown.



Should the NJJ-95B emit an abnormal sound, odor, or smoke, immediately turn off the power switch, remove the battery pack, disconnect the power plug from the socket outlet, and contact our nearest branch office, sales outlet, or service station. Use of the NJJ-95B in abnormal state could cause fire, electric shock, or breakdown.

### 6.1 Daily Inspection

Before attempting to operate this radar, confirm that the battery pack, optional equipment cables, and the like are connected correctly and there is no abnormality in appearance.

### 6.2 Daily Maintenance

Users are not to carry out any maintenance except for cleaning of the radar's external surfaces.

Wipe out stains with a soft damp cloth (which was squeezed of any excess water after being soaked in cold or warm water), and then wipe the radar with a dry cloth again. Do not use solvents such as thinner, benzine, and alcohol because they may damage the top finish of the radar.

### 6.3 Troubleshooting

The radar's states listed below are not always a sign of trouble.

Check for the radar again before asking for repair.

Main unit state	Check Items and Response
The main unit cannot be turned on. Nothing is displayed.	<ul style="list-style-type: none"> <li>• Check if the battery pack is mounted. →Mount a fully charged battery pack according to section 3.1 "Preparations for Scanning."</li> <li>• Check if the battery pack is exhausted. →Mount a fully charged battery pack according to section 3.1 "Preparations for Scanning."</li> <li>• Check if the power plug of the AC adapter is connected. →Connect the AC adapter correctly according to section 3.1 "Preparations for Scanning."</li> <li>• Check if the battery pack is mounted while the output plug of the AC adapter is connected to the AC input connector on the radar. →Disconnect the AC adapter according to according to section 3.1 "Preparations for Scanning," and operate the radar with the battery pack.</li> </ul>
The battery pack is exhausted rapidly.	<ul style="list-style-type: none"> <li>• Check if the battery pack is charged sufficiently. → Charge the battery pack fully according to section 3.10.2 "Battery charger BC-3008 series."</li> <li>• Has the battery pack itself reached the end of its life? → Exchange it for a new battery pack that is fully charged.</li> </ul>
Sense testing does not start when the <b>START</b> key is pressed.	<ul style="list-style-type: none"> <li>• Are you at the parameter settings screen? Return to the scan test screen following section 2.3 "Parameter Settings Screen."</li> </ul>
The B-mode display is advanced when the <b>START</b> key is simply pressed.	<ul style="list-style-type: none"> <li>• Check if "Time feed" is set as the sense test method. Set "Distance feed" according to section 2.3.5 "Sense Test Method."</li> </ul>
Printing is not started when the <b>OUTPUT</b> key is pressed.	<ul style="list-style-type: none"> <li>• Check if "External output" is set correctly on the parameter setting screen. Set it up correctly following section 3.6 "External Output."</li> </ul>

Main unit state	Check Items and Response
The message "Turn OFF/ON the printer" is displayed when the <b>OUTPUT</b> key is pressed.	<ul style="list-style-type: none"> <li>• Check if the printer settings have been initialized. Turn OFF/ON the printer, and press the <b>OUTPUT</b> key again to start printing.</li> </ul>
The message "Charge the printer's battery" is displayed when the <b>OUTPUT</b> key is pressed.	<ul style="list-style-type: none"> <li>• Check if the battery pack is exhausted. Mount a fully charged battery pack, and press the <b>OUTPUT</b> key again to start printing.</li> </ul>
The message "No printing paper" is displayed when the <b>OUTPUT</b> key is pressed.	<ul style="list-style-type: none"> <li>• Is the printer out of paper? Load a new paper roll, and press the <b>OUTPUT</b> key again to start printing.</li> </ul>
The message "Printer error" is displayed when the <b>OUTPUT</b> key is pressed.	<ul style="list-style-type: none"> <li>• Check if the printer displays an error message. Eliminate the cause of the printer error according to the printer instruction manual.</li> </ul>
"CF Not Available" message appears if the <b>CF</b> key is pushed	<ul style="list-style-type: none"> <li>• Has the compact flash card been removed?</li> <li>• Was the compact flash card inserted after turning the power on? → Whether or not compact flash is inserted is checked when the power is turned on Insert a compact flash card following section section 3.1 "Preparations for Sense Testing."</li> </ul>
<b>Data from the compact flash card can not be read</b>	<ul style="list-style-type: none"> <li>• Has the compact flash card been removed? → Insert a compact flash card following section 3.1 "Preparations for Scanning."</li> <li>• Is the file attempting to be read data from the NJJ-95B? → The NJJ-95B can not open data from the NJJ-95A. Please check the data</li> </ul>
The date/time indication has been changed to "0s."	<p>Not trouble</p> <p>The voltage of the internal button-type lithium battery has dropped. The battery is rechargeable and is charged automatically when the radar is used. Set the "date and time" according to section 2.3.7 "Date, time."</p>
Continuous use warms the casing.	This is a normal phenomenon.

## After-sales Service

If this radar malfunctions, read section 6.3 "Troubleshooting" carefully, and check the radar again. If the radar still malfunctions, stop using it, and contact our nearest branch office, sales outlet, or service station.

### Information to be reported

- ★ Product name, model number, and serial number
- ★ Detailed information about the abnormal state
- ★ Company/organization name, address, and telephone number

For inquiries about after-sales service, contact our nearest branch office, sales outlet, or service station. "Contact information" is on page **93**.

## 8 Disposal



### **WARNING**



Before disposing of the used lithium ion battery, insulate the charging terminals by taping or the like. Otherwise, the battery could cause fire or explosion if short-circuited.

#### 8.1 Disposal of Used Battery Pack

- ★Discharge the used battery pack (lithium ion battery) completely, insulate the charging terminals by taping or the like, and then dispose of it as nonflammable refuse. If the explanation here does not conform to local regulations, ask your local government for details.

#### 8.2 Disposal of the NJJ-95B

- ★Dispose of this radar as required by local regulations.

## 9 Specification

### 9.1 Handy Search NJJ-95B

Item	Specifications
System	Radar system
Transmission output	About 10 V (pulse output)
Primary objects to be probed	Concrete wall, and reinforcing steel bars under the floor
Covering depth	5 ~ 300 mm (case where relative permittivity of concrete is 6.2 and the diameter of the rebar is at least 6mm)
Resolution in the horizontal direction (spacing)	Object to be probed is at a depth of less than 75 mm: at least 75 mm Objects to be probed are at a depth of 75 mm or more: Interval greater than depth thereof
Maximum depth distance	15m
Display mode	B mode (vertical cross section) BA mode (vertical cross section and reflected waveform display)
Image processing (during sense testing)	Automatic real-time surface wave processing Real time manual deduction processing
Image processing (while not sense testing)	Manual surface wave processing, peak processing, reproduction of original image, fixed surface wave processing, and deduction processing
Display	Color TFT LCD (640 x 480 dots)
Depth calibration	6 ~ 11 0.1 step (set the relative permittivity of the object to be probed)
Internal storage	Data for up to 15 m can be stored
Maximum scanning rate	Approximately 40 cm/s, equipped with a over speed buzzer
Control functions	Screen inversion, cursor marks (up to 7), and battery capacity indicator
Output functions	Output function for printer
Data save function	Use of a compact flash memory card
Temperature range	0 ~ + 50°C
Power supply	Operation with the battery pack or AC power (optional)
Continuous operating time	Approximately 1.5 hours (with use of battery pack BP-3007 series when fully charged)
Structure	Drip-proof construction

Dimensions	About 149 (W) x 147 (H) x 216 (D) mm
Weight	Approximately 1.1kg

### 9.2 Battery pack BP-3007 series

Item	Specifications
Battery	Lithium ion battery
Nominal capacity	1500 mAh
Nominal voltage	7.2 V
Temperature range (when charging)	0 ~ +40°C
Temperature range (when discharging)	- 10 ~ +60°C
Dimensions	About 38 x 70 x 20mm
Weight	Approximately 103g

### 9.3 Charging Device BC-3008 series

Item	Specifications
Power supply	AC 100 ~ 240V, 50/60 Hz
Output voltage	DC 8.4 V
Output current	0.6A
Temperature range	0 ~ +35°C
Dimensions	About 56 x 107 x 44mm
Weight	Approximately 120g



## 10 Where to Contact

For inquiries about this radar, contact our main office below for the nearest branch office, sales outlet, or service station.

**Japan Radio Co. Ltd.**

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