

6. Application

6.1. Relative permittivity setup

The relative permittivity setup is made by detecting an embedded steel bar with a known covering depth or the wall with the known width and adjusting the relative permittivity value so as to get the measured depth or width of the object matched with the known value. This section provides the setup procedure using the wall with a known width.

(1) Confirm the wall width

Confirm the width of the wall by using the scale. Figure 6-1 shows an example of the width 140 mm.



Figure 6-1 Confirmation of the wall width

(2) Scan the wall

Scan the wall with the relative permittivity 8.0 of the sensor unit. For the procedure to set the relative permittivity of the sensor, refer to Section 4.11.1 Device setting: [Relative permittivity] menu)

The reflection wave from the opposite side of the wall appears on the main screen as the shape of the horizontal band as shown in Figure 6-2.

Move the horizontal cursor on the edge of the horizontal band. The depth value of the cursor is displayed in the cursor coordinate. (In the example of Figure 6-2, the depth is 127 mm.)

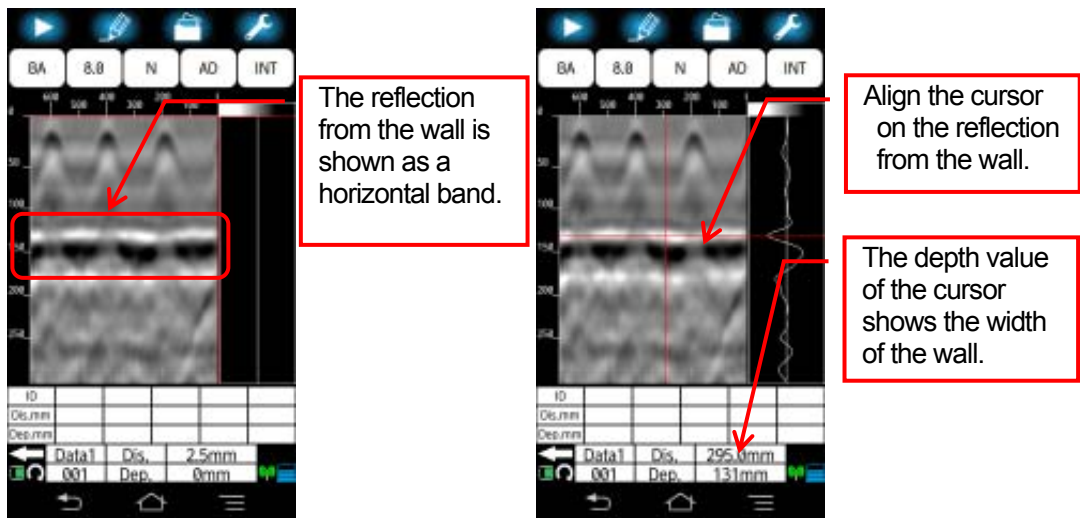


Figure 6-2 Scan of the wall

(3) Show the relative permittivity setup screen.

Tap **[Relative permittivity]** icon to show the relative permittivity setup screen. The current depth of the cursor position is shown in the screen.

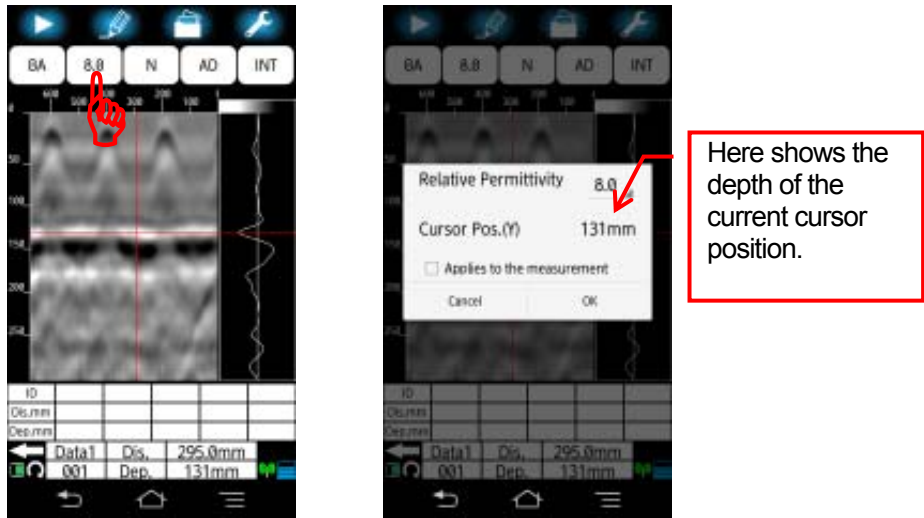


Figure 6-3 Relative permittivity setup screen

(4) Set the relative permittivity value.

Tap the value of the relative permittivity, then the list of the available values appears. When the cursor depth is wider than the confirmed width of the wall, increase the relative permittivity value. Decrease the value when cursor depth is narrower than the confirmed width. (You can scroll the list upward and downward, and you can select a value in the range from 2.0 to 20.0)

Adjust the relative permittivity value so as to get the depth value (measured width of the wall) matched with the known value (the confirmed known width of the wall).

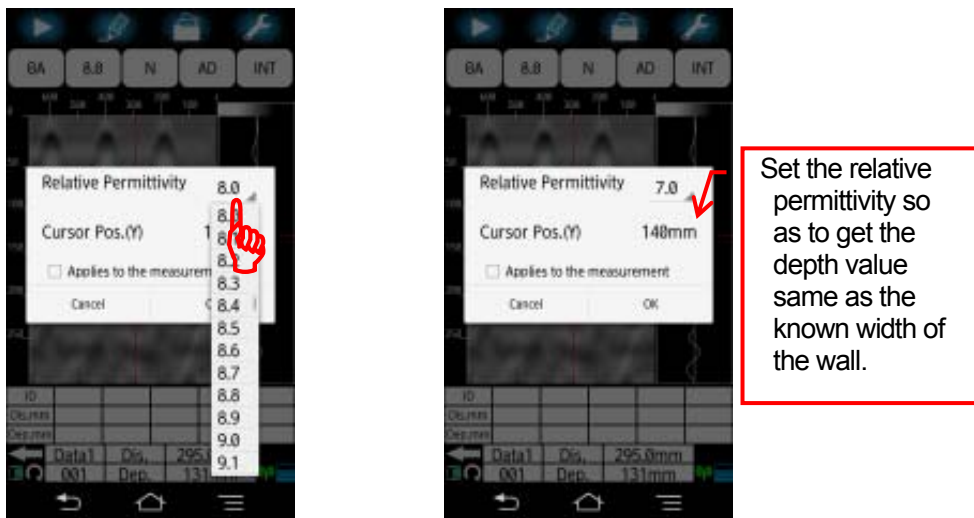


Figure 6-4 Relative permittivity setup

(5) Register the relative permittivity in the device setup screen.

Tap [**Applies to the measurement**], then confirm a mark ✓ is shown in the []. With this, the relative permittivity value is registered to [**Device setup: Relative permittivity**] menu in the parameter setup screen. Then tap [**OK**] to complete the relative permittivity setup, then the screen returns to the main screen.

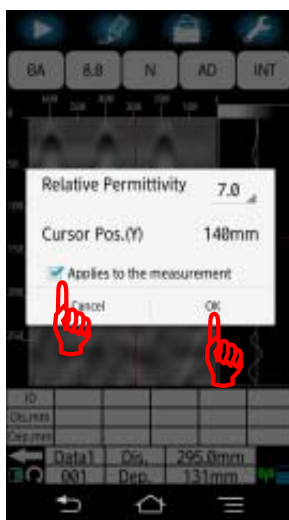


Figure 6-5 Relative permittivity setup

Caution

- When tapping [**OK**] without putting ✓ into [**Applies to the measurement**], the new relative permittivity is applied only to the scan image displayed currently, but not to the relative permittivity of the device setup which is used in scanning. The next scanning is made by using the original relative permittivity in the [**Device setup: Relative permittivity**] menu, but not using the new value defined in the procedure above.

6.2. Procedure to mark the rebar

This product is equipped with a chalk guide at the front and rear edge of the sensor unit. By using the chalk guide, you can easily mark the rebar position on the concrete during the scan. The marking is made at the position where the fixed cursor position is matched with the rebar position (peak of the inverse U shape shown in the B mode display). This section describes the procedure to mark the rebar on the concrete.

6.2.1. Forward scan marking

When scanning forward, the chalk guide at the rear panel is used to mark the rebar position.

Move the sensor unit so as for to superpose the rebar position (peak of the inverse U shape shown in the B mode display) on the fixed cursor. Then mark a line on the concrete along the rear chalk guide.

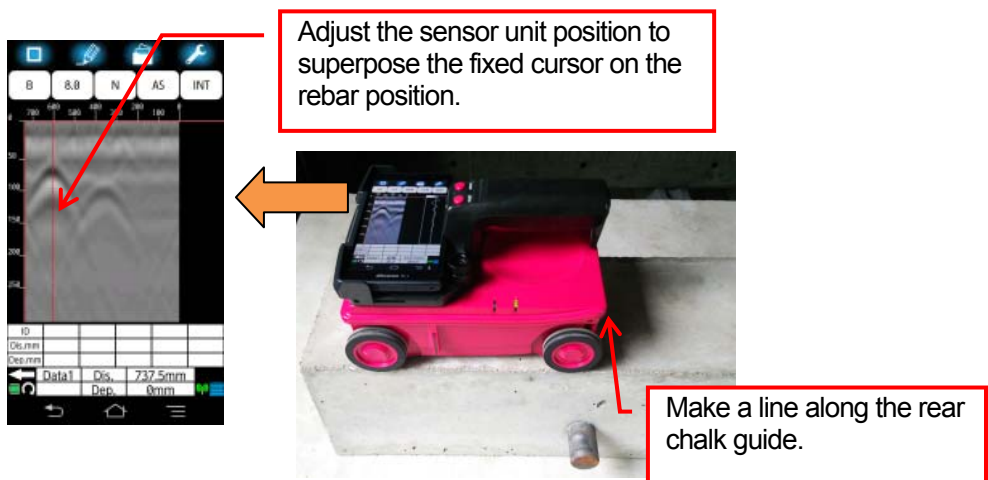


Figure 6-6 Forward scan marking

6.2.2. Backward scan marking

When scanning backward, the chalk guide at the front panel is used to mark the rebar position.

Move the sensor unit so as to superpose the rebar position (peak of the inverse U shape shown in the B mode display) on the fixed cursor. Then mark a line on the concrete along the front chalk guide.

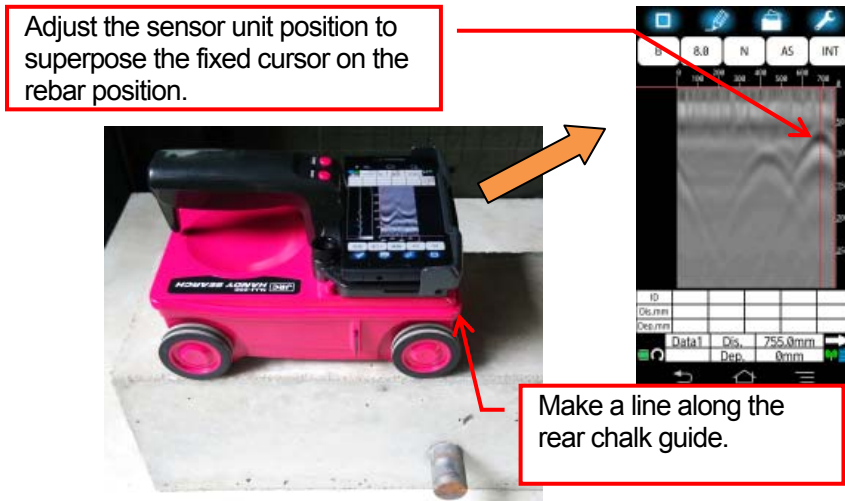


Figure 6-7 Backward scan marking

Note

- This product supports the back scroll capability. The marking can be made by confirming the rebar position while moving the sensor unit forward and backward.
- This product does not have the imitation of the scan distance. Therefore, you can make the marking without considering the distance limitation. The scan data shown on the main screen and saved into the file is maximum 15 m data of the latest scan data from the scan stop point.

6.3. AutoMark function

AutoMark is the function which automatically analyzes the scan data, detects the position of the embedded object, and adds a marker on each of all detected objects. This function improves the work efficiency of adding markers on the rebar position for the relatively easily analyzable scan data (in which the detected objects has wide pitch and is located at shallow area) at the field. This function is aimed to add markers on the rebar of the upper level, so that this function may not add markers correctly on the cavity position or the lower level rebar. (This function provides good detection performance for the rebar with the cover width (depth) ≤ 100 mm and the rebar pitch ≥ 75 mm).

You can use this function with the procedure described below.

Caution

- AutoMark function provides a guide of detecting the rebar in the scan data. It may cause wrong detection or detection failure of the rebar. After executing AutoMark function, confirm the detected and added marker placed on the rebar in the scan image visually. **JRC assumes no liability for any damage (such as damage caused to rebars, electrical pipes, gas pipes, etc.) arising from scan results using this product.**
- AutoMark function deletes all registered markers in the selected marker group and executes the automatic detection. When you need to refer to the registered markers later, save the scan result, then execute Auto Mark function.

Note

- AutoMark function can add maximum 99 markers for each marker group. When the number of added markers reaches to 99, it does not add any markers for the rest of the scan data.
- You can perform marker operations (addition and deletion) for the scan data after AutoMark function is executed. Marker operations may make marker numbers not sequential. In that case, you can re-number marker numbers to be sequential by using Sort marker function. For Sort marker function, refer to Section 6.6 Sort marker.
- When the measurement mode is set to time, AutoMark does not add markers correctly on the rebar.
- AutoMark function does not detect the rebar located at very shallow area of the depth (cover width) ≤ 1 cm.

- (1) Display the scan image on the main screen by performing a scan or reading the scan data from the file, then long tap **[Mark]** icon.

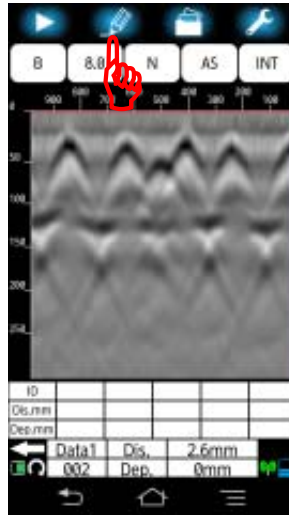


Figure 6-8 Long tap **[Mark]** icon

- (2) The marker operation screen shown in Figure 6-9 appears. Tap **[AutoMark]** menu.

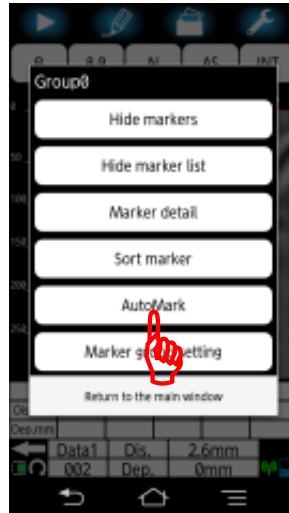


Figure 6-9 Tap **[AutoMark]** menu

- (3) AutoMark screen shown in Figure 6-10 appears. The marker group into which AutoMark function adds markers is shown at the top of the screen. Confirm the marker group is correct. To change the marker group, refer to Section 4.13.6 [Marker group setting] menu.

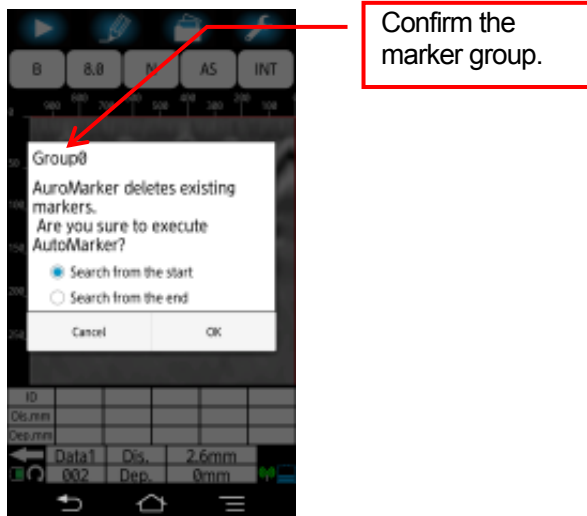


Figure 6-10 Confirmation of the marker group

- (4) Tap **[Search from the start]** when searching the rebar from the start of the scan data. When searching the rebar from the end of scan data, tap **[Search from the end]**. Then confirm ● mark is attached to the selected setting.

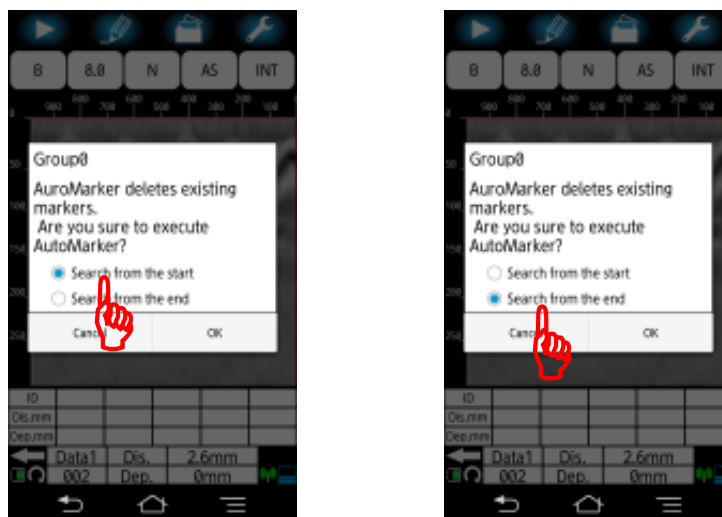


Figure 6-11 Search direction setup

- (5) Tap **[OK]** to execute AutoMark function. To cancel Auto Mark function, tap **[Cancel]**, then the screen returns to the main screen.

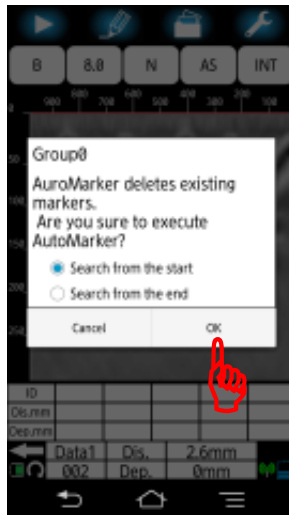


Figure 6-12 AutoMark execution

- (6) A message “Automarker processing...” shown in Figure 6-13 appears.



Figure 6-13 AutoMarker processing

- (7) The message in the above step automatically disappears, and a message **“AutoMark competed”** is shown briefly, and the markers on the detected rebar are displayed on the main screen as shown in Figure 6-14. Here the cursor moves on the position of the marker number 1.

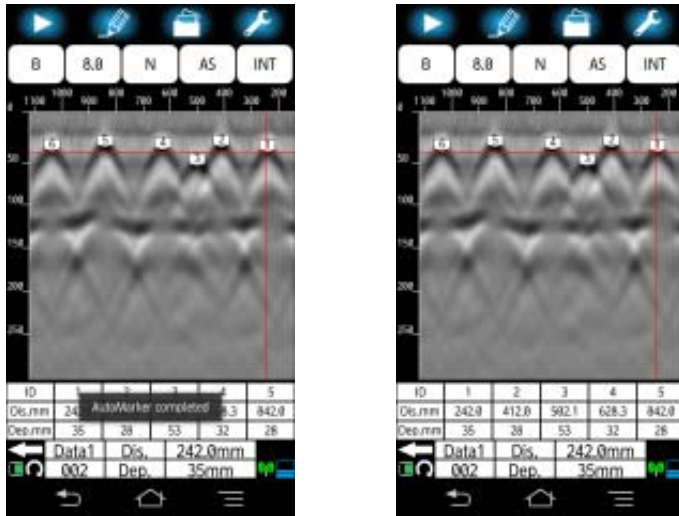


Figure 6-14 AutoMark completion

Note

- The processing time of AutoMark function depends on the scan data. For the scan data of long distance, it takes around 10 seconds.
- The AutoMark result (number of detected rebars) and the position (coordinate) of each added marker may vary according to the search direction of Auto Mark function.

- (8) When no rebar is detected and no marker is added in AutoMark processing, a message “**Any markers not detected**” appears a while and disappears automatically.

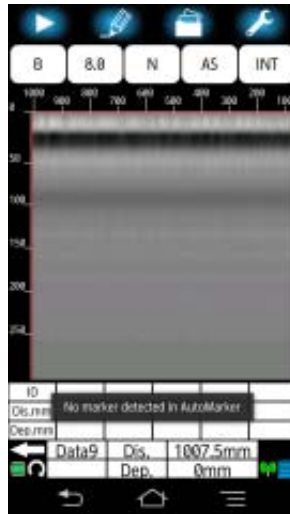


Figure 6-15 Message when no marker is added.

6.4. Location notification function

Location notification function is the function available during the scan and assists to show the rebar position by beeping and lighting the front and rear LED every time when the fixed cursor is superposed on each marker position. This function is similar to and can be used in addition to the AutoMark function which automatically analyzes the scan data, detects the position of the embedded object, and adds a marker on each of all detected objects. This function improves the work efficiency of adding markers on the rebar position for the relatively easily analyzable scan data (in which the detected objects has wide pitch and is located at shallow area) at the field.

This function is aimed to add markers on the rebar of the upper level, so that this function may not add markers correctly on the lower level rebar or the rebar at the cavity position. (This function provides good detection performance for the rebar with the cover width (depth) ≤ 100 mm and the rebar pitch ≥ 75 mm).

You can use this function with the procedure described below.

Caution

- AutoMark function provides a guide of detecting the rebar in the scan data. It may cause wrong detection or detection failure of the rebar. After executing AutoMark function, confirm the detected and added marker placed on the rebar in the scan image visually. **JRC assumes no liability for any damage (such as damage caused to rebars, electrical pipes, gas pipes, etc.) arising from scan results using this product.**

Note

- Location notification function works for the scan data of 1 m range from the final scan position.
- All markers added by Location notification function are removed automatically after the scan is completed. To detect rebars and add markers automatically after the scan is completed, use AutoMark function described in 6.3 AutoMark function.
- Location notification function is not available when the measurement mode is set to time.
- Location notification function does not detect the rebar located at very shallow area of the depth (cover width) ≤ 1 cm.

- (1) Long tap **[Parameter setup]** icon to show the parameter setup screen. Then turn Location notification function to ON by tapping **[Location notification]** menu. Then tap **[Return to the main window]**.

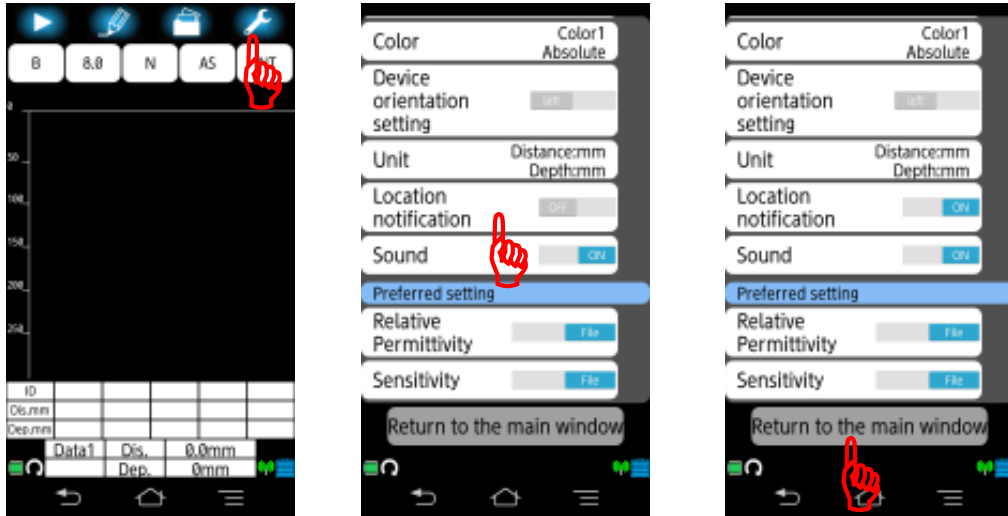


Figure 6-16 Turn Location notification function on

- (2) Execute the scan.

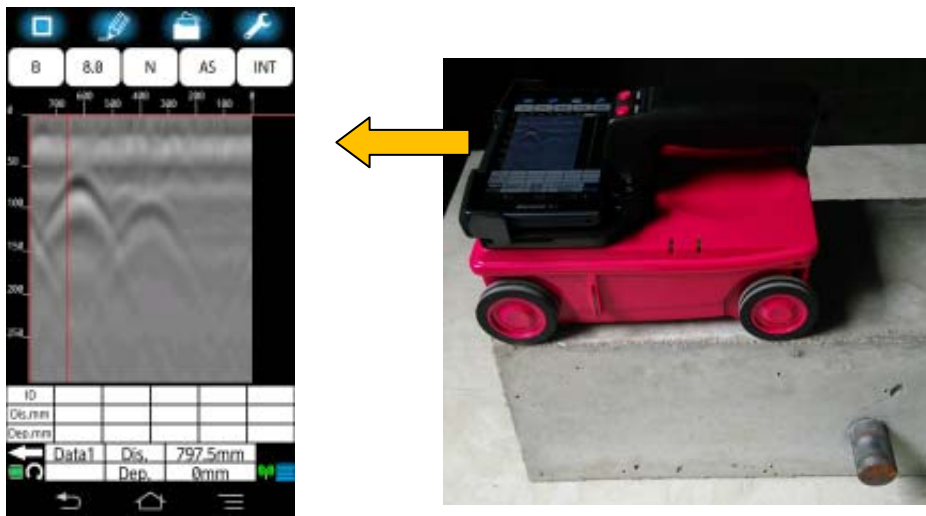


Figure 6-17 Scanning

- (3) Move the sensor unit backward 10 mm and more. Then Location notification function is activated and adds markers automatically on the position of rebars.

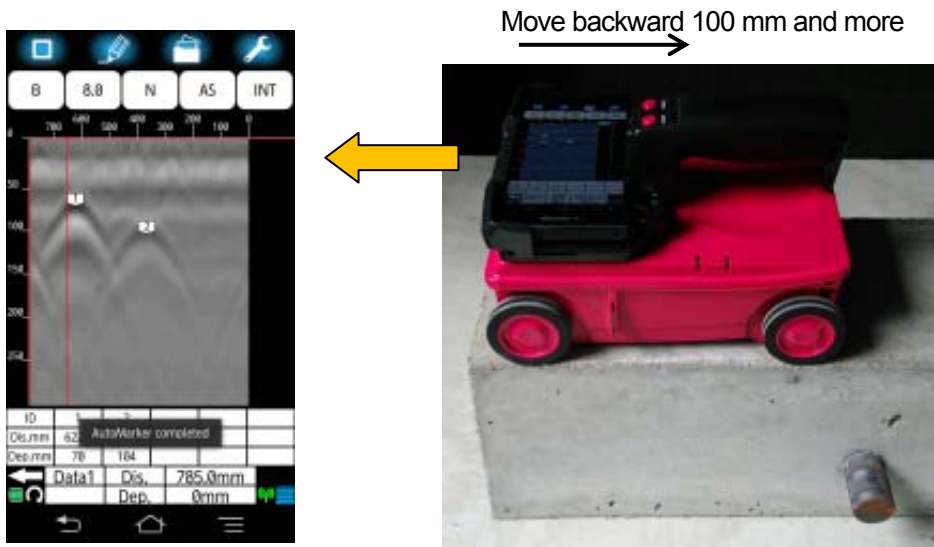


Figure 6-18 Moving backward 100 mm and more

- (4) Move the sensor unit forward and backward. Then Location notification function notifies the location of the rebar by beeping and lighting the rear LED when the fixed cursor superposes on a marker position. (When the scan direction is set to backward, this function lights the front LED light.)

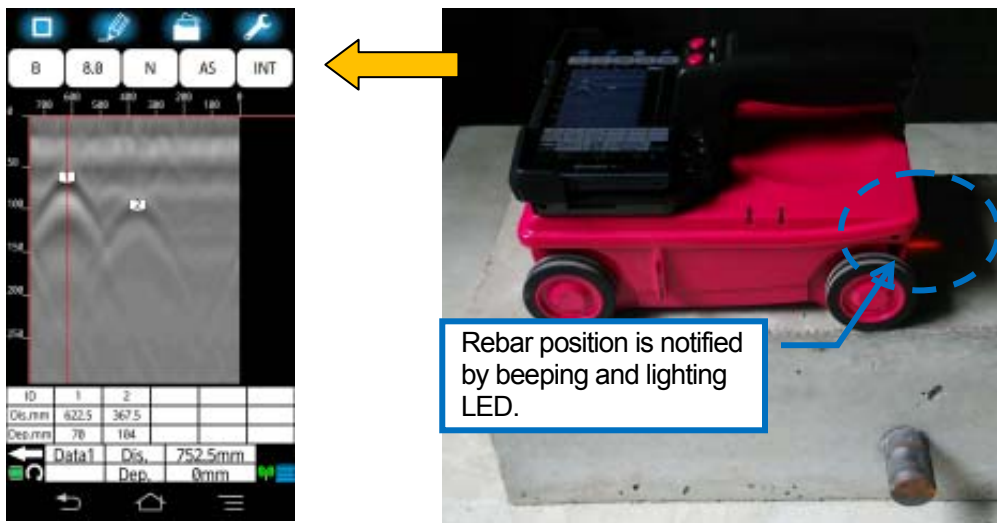


Figure 6-19 Location notification of rebars

- (5) When no rebar is detected, a message “**Any automatic marker is not detected.**” as shown in Figure 6-20 appears at the lower part of the screen, then disappears automatically.

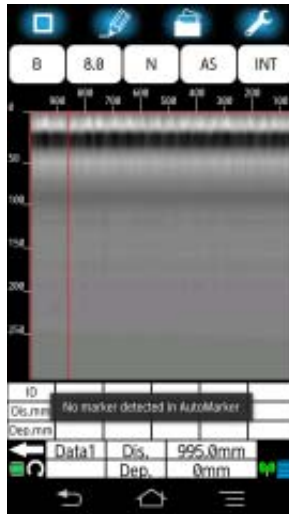


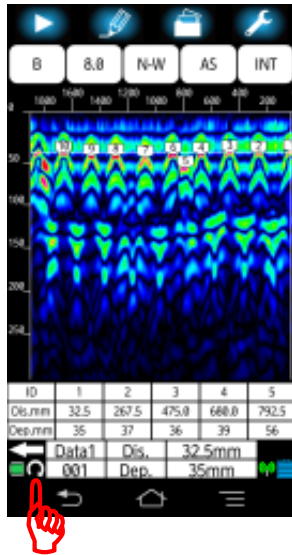
Figure 6-20 Message when no rebar is detected

Note

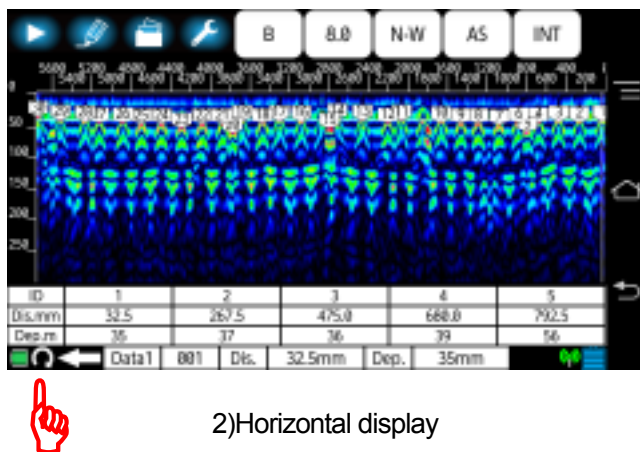
- In the state of Location notification activated, you can scan the concrete forward beyond the position where you moved the sensor backward to activate the function. After scanning a new part of the concrete, you can activate the function by moving the sensor backward 10 mm and more. All markers added previously by Location notification function are then removed.

6.5. Screen rotation

You can rotate the screen 90 degrees and show the scan result as shown in Figure Figure 6-21 by tapping **[Screen rotate]** icon. The horizontal display can show the scan result of 6 m distance on one screen and is helpful to grasp the entire rebar layout of the floor and ceiling.



1) Vertical display



2) Horizontal display

Figure 6-21 Screen rotation

6.6. Sort marker

Sort marker is the function which re-numbers ID numbers of all registered markers from the search start point or from the search end point. Marker operations (deletion or addition) may make marker numbers not sequential which is inconvenient in making a detection report. By using this function you can easily get sequential ID numbers for all registered markers.

This section provides an example using Sort marker to re-number non-sequential marker ID numbers which is caused by adding a marker manually at the rebar not detected by AutoMark function.

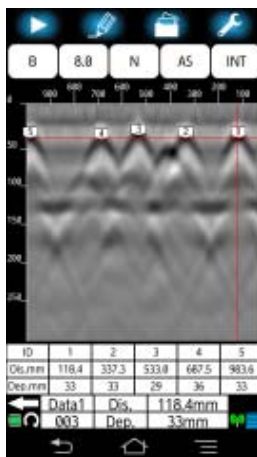
Caution

- After executing Sort marker, you cannot restore the marker ID numbers into the previous state. If you need to refer later to the scan data with the marker ID numbers before sorting, save the scan data into the file and execute Sort marker function.

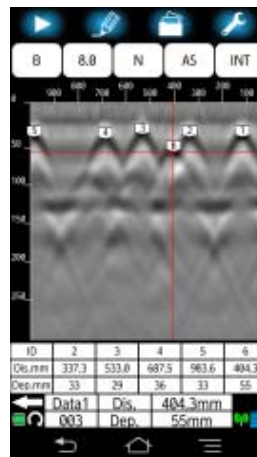
Note

- When two markers are located at the same distance, Sort marker assigns the ID number from the marker at the shallower area.
- Marker ID numbers obtained by Sort marker are reflected to the marker list and the detailed marker list.

(1) Add a marker manually on the rebar which is not detected by AutoMark function.



1)After AutoMark



2)Add a marker ID 6

Figure 6-22 Marker addition after AutoMark

- (2) Long tap **[Mark]** icon to show the marker operation screen and tap **[Sort marker]** menu in the marker operation screen. Then the sort marker screen appears.

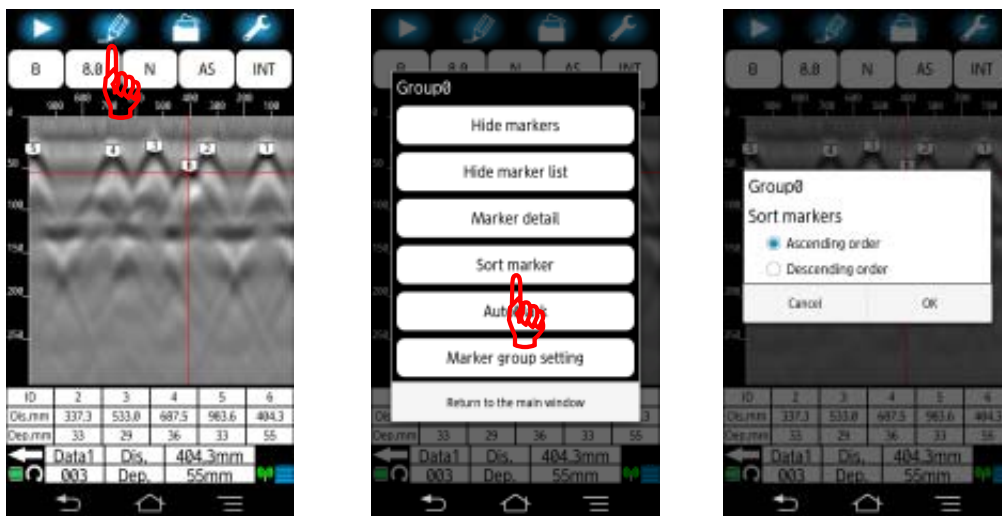
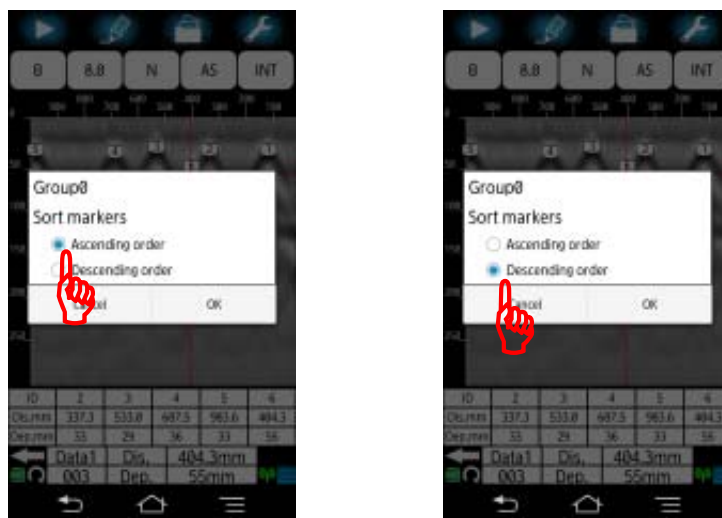


Figure 6-23 Sort marker screen

- (3) Tap **[Ascending order]** to sort marker ID numbers from the scan start position. To sort from the scan end position, tap **[Descending order]**. Confirm the ● mark is attached to the selected order.

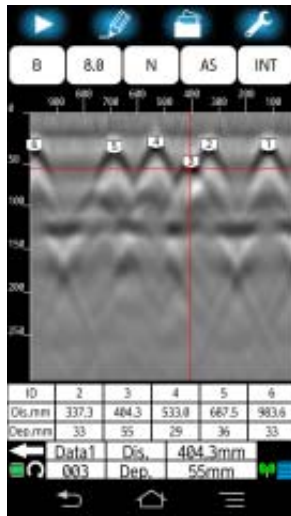


1) Ascending order

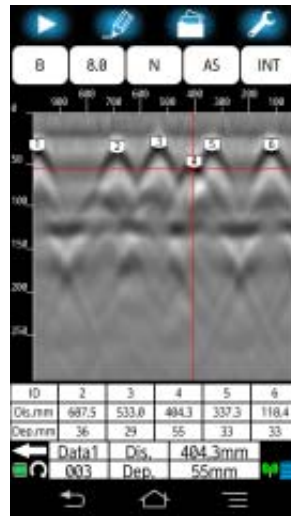
2) Descending order

Figure 6-24 Sort order setup

- (4) Tap **[OK]** to return to the main screen. To cancel Sort marker, tap **[Cancel]**, then the screen returns to the main screen.



1) Ascending order



2) Descending order

Figure 6-25 Sort marker result

6.7. Communication channel setup

The communications channel sets the channel used by the wireless LAN communication between the sensor unit and Smartphone. When the wireless LAN communication between Smart phone and the sensor unit is not established or drops frequently, change the communication channel. The available channels are 0 to 11. When setting a channel 0, the sensor unit sets a channel randomly (The factory setting of the communication channel is 0.)

You can set the communication channel with the following procedure.

- (1) Long tap **[Parameter]** icon. The parameter setup screen appears.
- (2) Tap **[Channel]** menu. Then the channel setup screen shown in Figure 6-26 appears and shows the current channel selected.
- (3) Tap the channel number (in the case of Figure 6-26, tap 0). Then the list of the available channel numbers appears.
- (4) Tap a number in the list as the communication channel used. Then confirm the selected channel number is shown in the channel setup screen.
- (5) Tap **[OK]** to return to the parameter setup screen. To cancel the channel change, tap **[Cancel]**, then the screen returns to the parameter setup screen.
- (6) Tap **[Return to the main window]** to return to the main screen.

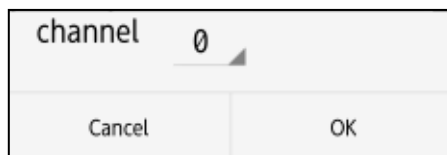


Figure 6-26 Channel setup screen

Caution

- The communication channel setup is available only when the communication between Smartphone and the sensor unit is established. When tapping **[Channel]** menu when no communication is established, the channel setup screen does not appear.
- The changed communication channel becomes valid when NJJ-200 application boots up at the next time.

6.8. Distance error correction

In using this product, eventual wear of the tires may cause distance error. This product has the capability to measure the moving distance by measuring the rotation of the wheel. When the distance error occurs, perform the distance error correction in accordance with the following procedure.

- (1) Scan the concrete of 1 m distance (actual length). Then stop the scan.
- (2) Long tap **[Parameter]** icon to show the parameter setup screen.
- (3) Tap **[Distance correction]** menu to show the distance correction screen.
- (4) Tap the shown distance correction value. Then the list of the available distance correction values appears.
- (5) Tap a value in the list as the distance correction value.
- (6) Repeat Steps (4) and (5) so as to get the distance value shown at the right of the distance correction screen being nearest to 1 m.
- (7) Tap **[OK]** to return to the parameter setup screen. Then tap **[Return to the main window]**, then the screen returns to the main screen.

Note

- The measured distance at the scan end line is shown at the left of the correction value. When changing the correction value, the distance value is recalculated and changes. You can use this distance value for the distance error correction.
- The distance correction value become effective from the next new scan, but not reflected to the exiting scan results.
- For the scan data of the distance more than 10 m scanned with the distance correction ≥ 13 , when printing it in Wide ("W") view range (Shallow W, Normal W, Depth W), the printed image may be difficult to recognize.

6.9. Software version up

6.9.1. Smartphone application version up

You can update the version for NJJ-200 application software by using Smartphone function. The function to update the application version depends on the model of Smartphone. For the details of the procedure, refer to the Smartphone manual. This section describes an example of the setup procedure of Smartphone for NJJ-200 application software version upgrade.

- (1) Uninstall NJJ-200 application software from Smartphone by performing the following procedure.
 - a) Tap **[Settings]**, **[Device settings]**, **[Application]** to show the all list of the installed applications.
 - b) Tap **[NJJ-200]** shown in the downloaded application list. Then the application information screen of NJJ-200 application software appears.
 - c) Tap **[Uninstall]** in the application information screen. Then a message “**Do you want uninstall this application?**” **[Cancel]** **[OK]** appears.
 - d) Tap **[OK]** to uninstall the application. After completing the uninstalling, the screen returns to the downloaded application screen.
 - e) Tap the home button, then the screen returns to the home screen. (Refer to Figure 6-27.)

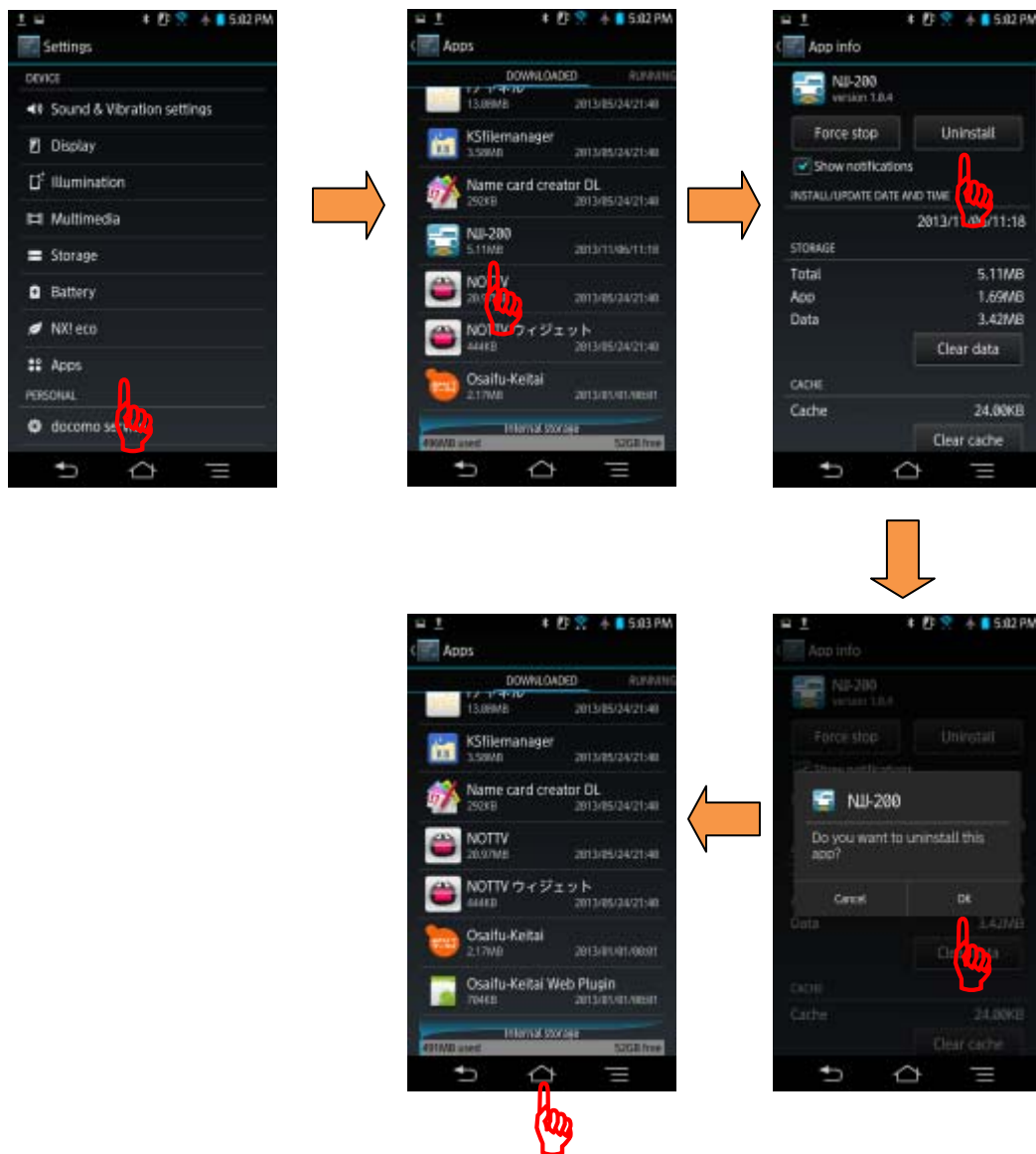


Figure 6-27 Uninstall NJJ-200 application

- (2) Copy NJJ-200 application software files of the new version from the PC to Smartphone by performing the following procedure.

NJJ-200 application file is provided in the CD-R furnished with this product. By connecting Smartphone and a PC by using a USB cable (or a micro USB cable), Smartphone can be recognized and mounted as a removal data drive on the PC, then the file copy operation of drag and drop becomes available. By using this capability, you can copy NJJ-200 application from the PC to Smartphone.

- a) On Smartphone, enable the file operation on Smartphone's memory card from the PC by setting Smartphone into **Card reader mode** or **File transfer mode (MSC)**. For the detailed procedure, refer to the manual attached to Smartphone.
Example: Tap **[Setting]**, **[Device setting]**, **[External Connection]**, **[USB Connection]**, then **[Card reader mode]**.
- b) Connect Smartphone to a USB port of the PC by using a micro USB cable.
- c) On Smartphone, tap **[Turn on USB Storage]**.
- d) On the PC, Confirm that Smartphone's data storage is recognized and mounted as a removal data drive on the PC.
- e) Create the folder "NJJ200" in Smartphone data drive mounted in steps above.
- f) Insert the furnished CD-R into the CD-R Drive of the PC.
- g) Copy NJJ-200 application file (File name: "NJJ-200.apk") on the CD-R to the folder "NJJ200" on Smartphone by using the drag and drop capability.
- h) Remove the drive of Smartphone from the PC by using the PC function of the safety hardware removal.
- i) On Smartphone, tap **[Turn off USB storage]**.

- (3) Install NJJ-200 application into Smartphone with the following procedure.
- At the security setting in Smartphone, set the setting so as to allow the installation of applications from the unknown sources. For the detailed procedure, refer to the manual attached to Smartphone.
Example: Tap **[Setting]**, **[Device setting]**, **[Lock & Security]**, and tap **[Unknown source]**.
 - Activate the file management application (**Contents manager**, **File commander**, etc.) in Smartphone. Then install NJJ-200 application by tapping **[NJJ-200]** which was copied into the memory card of Smartphone.

Make sure **[NJJ-200]** icon is registered in **[Downloaded]** at **[Application]** screen on Smartphone. If the icon is not registered, check if steps (1) and (2) above have been completed correctly



Figure 6-28 Application installation (1/3)

From the previous page

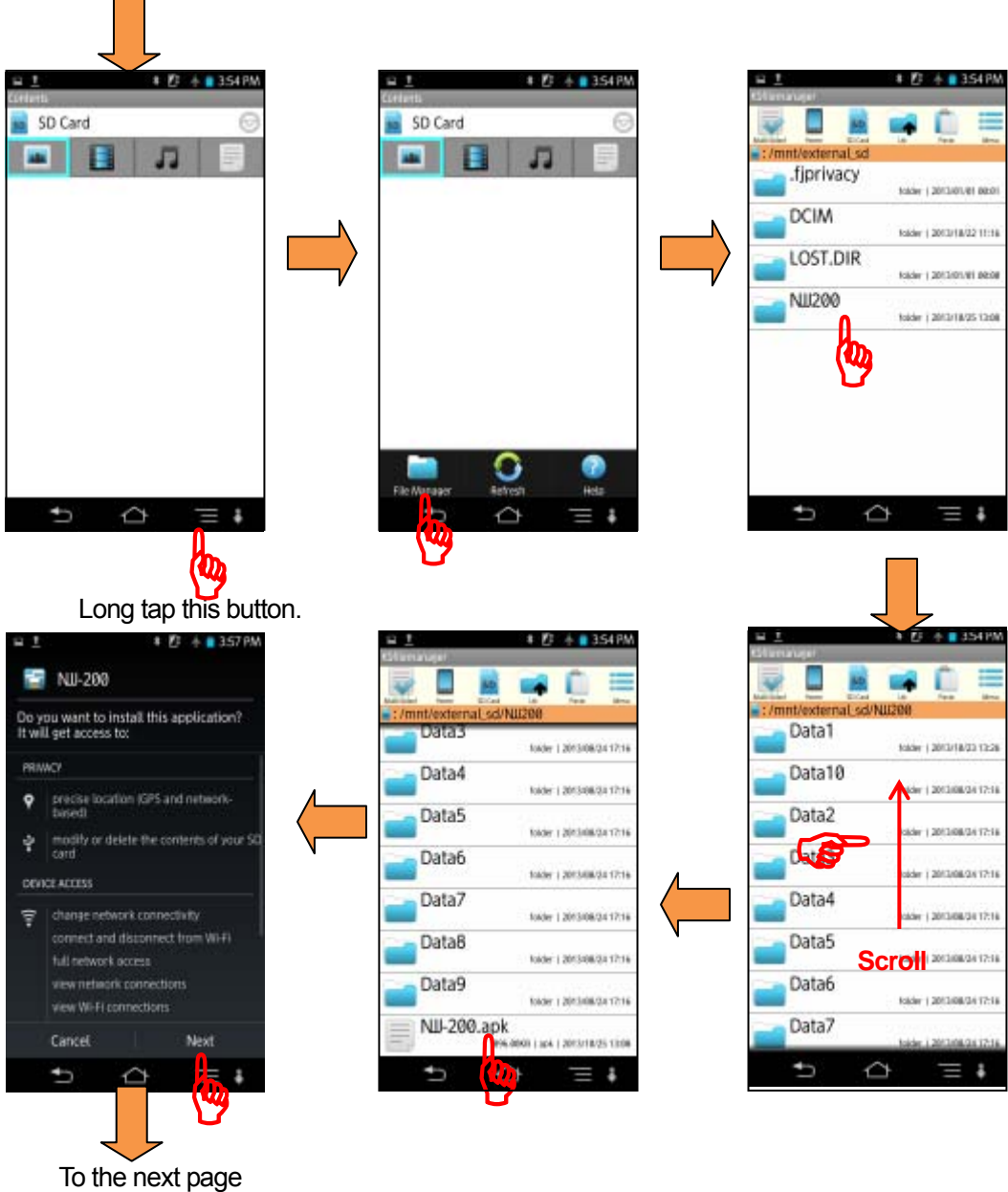


Figure 6-28 Application installation (2/3)

From the previous page

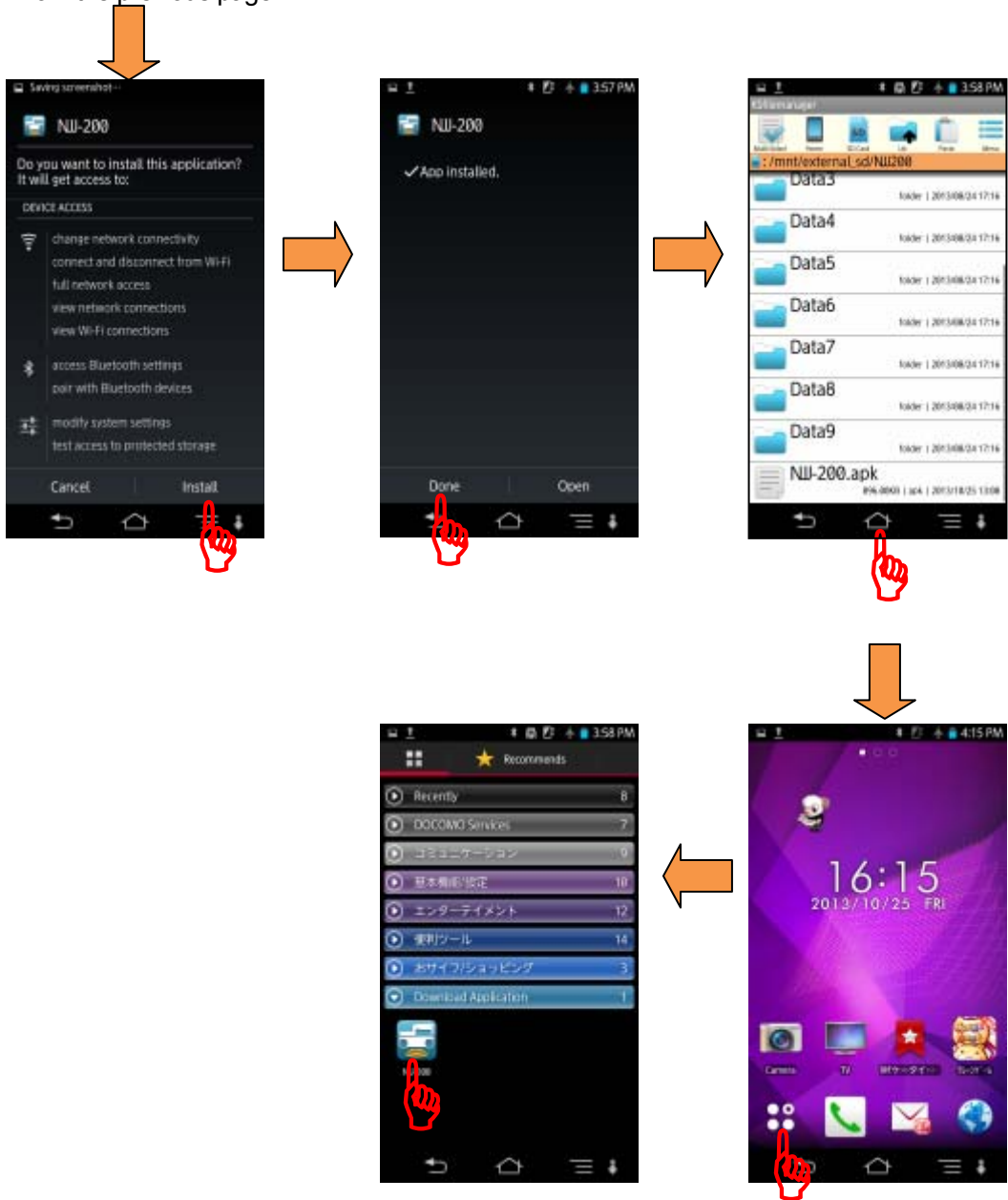


Figure 6-28 Application installation (3/3)

6.9.2. Software version up for Sensor unit

You can update the software inside the sensor unit by using NJJ-200 application through the wireless LAN. The procedure is provided below.

- (1) Copy the sensor unit's new software file from PC to Smartphone by performing the following steps.

By connecting Smartphone and a PC by using micro USB cable, Smartphone can be recognized and mounted as a removal data drive on the PC, then the file copy operation of drag and drop becomes available. By using this capability, copy NJJ-200 application file from the PC to Smartphone.

In advance, prepare the sensor unit software file in the PC.

- a) On Smartphone, enable the file operation on Smartphone's memory card from the PC by setting Smartphone into **Card reader mode** or **File transfer mode (MSC)**. For the detailed procedure, refer to the manual attached to Smartphone.
Example: Tap **[Setting]**, **[Device setting]**, **[External Connection]**, **[USB Connection]**, then **[Card reader mode]**.
- b) Connect Smartphone to a USB port of the PC by using a micro USB cable.
- c) On Smartphone, tap **[Turn on USB Storage]**.
- d) On the PC, Confirm that Smartphone's data storage is recognized and mounted as a removal data drive on the PC.
- e) Create the folder "NJJ200" in Smartphone data drive mounted in steps above.
- f) Copy the sensor unit software file (File name: "NJJ-200_FIRM1.BIN/NJJ-200_FIRM2.BIN") on the PC to the folder "NJJ200" on Smartphone by using Drag and Drop capability. If the file of the same name exists on the folder "NJJ-200" on Smartphone, copy the file at overwriting.
- g) Remove the drive of Smartphone from the PC by using the PC function of the safety drive removal.
- h) On Smartphone, tap **[Turn off USB storage]**.

(2) Update the sensor unit software

You can update the sensor unit software with the following procedure.

- a) Turn on the sensor unit and boot up NJJ-200 application on Smartphone, then establish the wireless LAN communication between the sensor unit and Smartphone.
- b) Log tap **[Parameter]** icon, then tap **[Version]** menu. Then the version management screen appears.



Figure 6-29 Version management screen

c) Confirm the new software version, then update the version

The version screen shows the current version of the sensor unit in the first message. (Figure 6-30 shows the example of the version “Ver1.0.0”).

Confirm that the version shown in the second message “**You can update the sensor unit software to Ver1.02**” is matched with the targeted version you want to update. If the version is not matched with the targeted version, confirm the software file prepared in Step (1)

Tap [Update] menu, then a message “**Updating the software. Wait a while.**” appears. Then the software update is executed. After completing the software update, a message “**The sensor software updates completed successfully.**” [OK] Appears. Then tap [OK] to return to the parameter setup screen. After the software update, the sensor unit is automatically reset. (When the sensor unit is resetting, the wireless communication with Smartphone drops.)

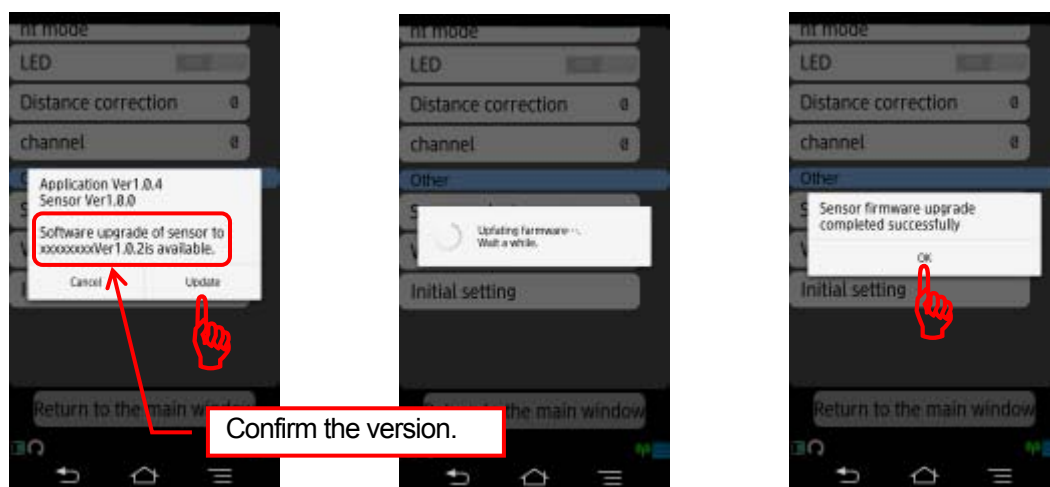


Figure 6-30 Sensor software update

d) Confirm the updated software version

Display the current software version with the same manner of Step c) after the wireless communication is established. Then confirm that the sensor software version displayed at the first message in the version screen is matched with the targeted version. (In the example of Figure 6-31,, it is Version 1.0.2.) If it is different from the targeted version, repeat the procedure from step a).



Figure 6-31 Version confirmation





Caution

- Do not turn off the sensor unit and Smartphone and do not terminate NJJ-200 application during updating the sensor unit software. Otherwise the update will not be completed successfully. If the the sensor unit or Smartphone is turned off or the termination of NJJ-200 application happened during the update, restart the procedure from Section 6.9.2 (2).
- Do not drop the wireless communication between the sensor unit and Smartphone during updating the sensor unit software. Otherwise the update will not be completed successfully. If the drop of the communication happened during the update, restart the procedure from Section 6.9.2 (2).

Note

- The software update is executed even when the targeted version is same as the current software version.
- The software update is executed even when the targeted version is older that the current software version.

7. Battery pack and battery charger

 WARNING	
	<p>Do not use any battery pack other than the recommended battery packs. Doing so may cause fire, electric shock, or breakdown.</p>
	<p>Do not short-circuit the terminals of the battery charger or battery pack. Doing so could cause fire, explosion, or breakdown.</p>
	<p>Do not disassemble, modify, heat, or throw the battery pack on fire. Doing so could cause fire, explosion, or breakdown.</p>
	<p>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.</p>
	<p>Do not connect/disconnect the plug while your hands are wet. Doing so could cause an electric shock.</p>
	<p>Stop using this product 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 (See Section 14), sales outlet, or service station. Use of this product in abnormal state could cause fire or breakdown.</p>
	<p>Should this product 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 (See Section 14), sales outlet, or service station. Use of this product in abnormal state could cause fire, electric shock, or breakdown.</p>

7.1. Battery pack HST30002

The battery pack HST30002 is used only for the Handy Search and contains a rechargeable lithium ion battery. When the battery pack is fully charged, you can operate this product for about 7 hours.

(1) Attaching/Detaching the battery pack

For the procedure for attaching/detaching the battery pack to the sensor unit, refer to Sections 2.6 Attachment of the battery pack and 2.7 Detachment of the battery pack.

(2) Battery pack remaining capacity

For the remained capacity of the battery pack, refer to Section 3.2 Battery capacity check.

Note

- The battery pack is charged just enough for this product'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 a cool location 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 it 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 Figure 3-37 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.

7.2. Battery charger PPT20003

The battery charger PPT20003 is exclusively used with the battery pack HST30002. When the battery pack is in the remaining capacity of zero state, charging will take about 240 minutes. Use the battery charger with the following procedure.

(1) Mount the battery in the charger

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 battery pack is locked to the charger.

(2) 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 (red) on the charger will light indicating the start of charging.

(3) 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.

(4) 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.

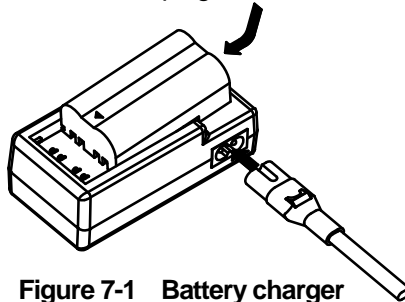


Figure 7-1 Battery charger

Caution

- 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 40°C 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 after the charging is completed.

Note

- 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.

8. Theory

The principle of this product 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 8-1. The electromagnetic waves are reflected by an interface with the reflecting objects (e.g., rebars 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 product is designed to probe objects with high resolution that are near from the surface of concrete, it transmits electromagnetic waves with the very narrow pulse width of about one nanosecond (one-billionth of a second) or less.

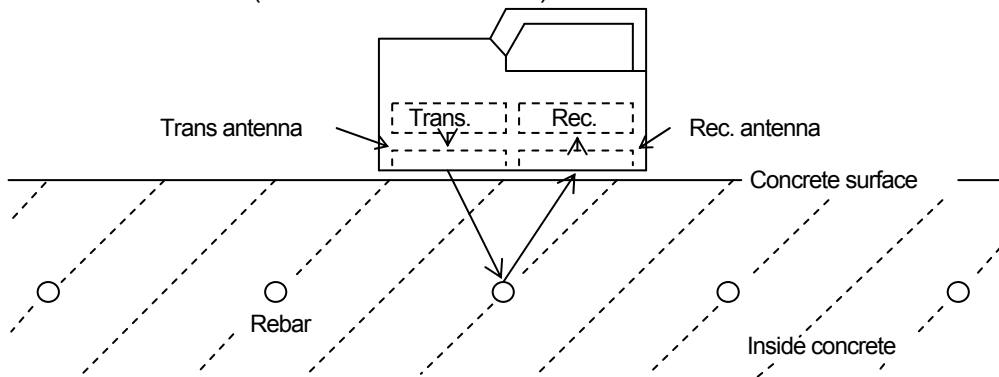


Figure 8-1 Theory of operation

Figure 8-2 shows a wave reflected by a rebar or the like in a concrete structure, which is obtained by this product.

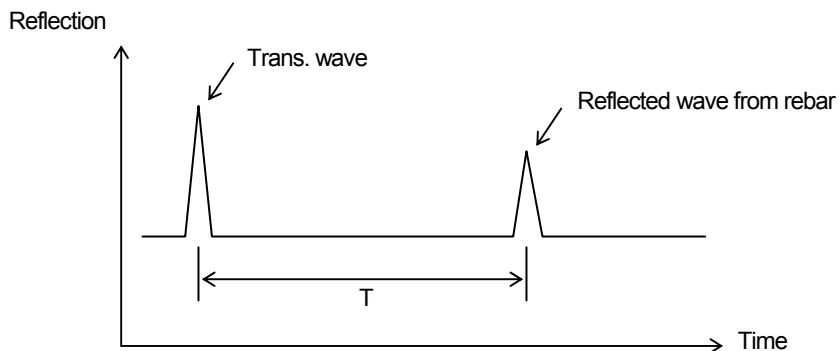


Figure 8-2 Sample of reflected waveform

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

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

Where

C : Velocity of electromagnetic waves in vacuum (in air) (3×10^8 m/s)

ϵ_r : Relative dielectric constant of concrete (2 to 20 in the example)

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

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

8.1. Applicable condition

(1) Applicable measuring conditions

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

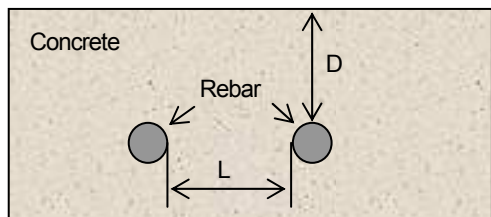
- Search depth (covering depth) within 0.5 to 30 cm (for concrete with a relative dielectric constant = 6.2 everywhere and the top rebar of diameter ≥ 6 mm)
- Objects to be probed that are located at a depth of less than 75 mm have an interval spacing of at least 15 mm.
- For objects at the depth greater than 75 mm, the interval spacing of the objects is more than the depth times 0.2.
- Quality of concrete: Uniform
- Direction of reinforcing steel: Orthogonal to this product's traveling direction

(2) Inapplicable measuring conditions

- Scan of reinforcing steel or the like in concrete whose surface contains objects such as metal that reflects radio waves
- Presence of rebars that are parallel to this product's traveling direction
- Objects has a narrow (pitch) arrangement for the interval of rebars in the horizontal direction.






At the depth less than 75 mm and the interval between rebars less than 15 mm

At the depth greater than 75 mm and the interval of rebars less than depth times 0.2



$$\left. \begin{array}{l} D < 75\text{mm} \rightarrow L \leq 15\text{mm} \\ D \geq 75\text{mm} \rightarrow L \leq D \times 0.2 \end{array} \right\} \text{Inapplicable}$$

9. Maintenance and inspection

 WARNING	
	Do not attempt to disassemble, modify, or repair this product. Doing so could 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 (See Section 9), sales outlet, or service station for a replacement power cord. Use of a damaged power cord may cause fire or electric shock.
	Stop using this product immediately when a sign of malfunctioning is detected, and follow only the instruction described in Section 9.3 Troubleshooting. If it cannot be restored to normal operation, contact our nearest branch office (See Section 14), sales outlet, or service station. Use of this product in an abnormal state could cause fire or breakdown.
	Should this product 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 (See Section 14), sales outlet, or service station. Use of this product in abnormal state could cause fire, electric shock, or breakdown.

9.1. Daily inspection

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

9.2. Daily maintenance

Users are not to carry out any maintenance except for cleaning of this product'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 this product with a dry cloth again. Do not use solvents such as thinner, benzine, and alcohol because they may damage the top finish of this product.

9.3. Troubleshooting

This product's behaviors listed below are not always a sign of trouble. Please re-check this product again before asking for repair.

Table 9-1 Troubleshooting (1/2)

Behavior	Check items and recommended actions
The sensor unit cannot be turned on. Power LED does not light.	<ul style="list-style-type: none"> • Check if the battery pack is mounted. →Mount a fully charged battery pack in accordance with Section 2.6 Attachment of the battery pack. • Check if the battery pack is exhausted. →Mount a fully charged battery pack in accordance with Section 2.6 Attachment of the battery pack.
The battery pack is exhausted rapidly.	<ul style="list-style-type: none"> • Check if the battery pack is charged sufficiently. →Charge the battery pack fully in accordance with Section 7.2 Battery charger PPT20003 . • Has the battery pack itself reached the end of its life? → Replace it for a new battery pack that is fully charged.
Wireless LAN communication between the sensor unit and Smartphone is not established.	<ul style="list-style-type: none"> • Is Smartphone set to Airplane mode? →Set Smartphone to be in Airplane mode in accordance with Section 2.8 Communication setup. • Is the sensor unit selected correctly? →Select the used sensor unit in accordance with Section 4.11.19 Other: [Sensor select] menu.
Wireless LAN communication between the sensor unit and Smartphone drops.	<ul style="list-style-type: none"> • Is the other radio equipment operating nearby? →Change the channel in accordance with Section 4.11.18 Sensor setting: [Channel] menu.
Smartphone does not beep at the start of scanning.	<ul style="list-style-type: none"> • Is the sound of Smartphone turned off? →Turn the sound of Smartphone on in accordance with Section 4.11.9 Device setting: [Sound] menu. • Is Smartphone set in the manner mode? →Release the manner mode of Smartphone in accordance with the manual of Smartphone.
The B-mode display moves forward when simply tapping [START] icon without moving the sensor.	<ul style="list-style-type: none"> • Is the measurement method set to Time? →Set the measurement mode to be in Distance in accordance with Section 4.11.15 Sensor setting: [Measurement mode] menu.

Table 9-1 Troubleshooting (1/2)

State	Check items and recommended actions
When doing any file operations, a message “No SD card” appears.	<ul style="list-style-type: none"> • Is the SD card attached correctly into Smartphone? →Turn Smartphone off, and confirm the SD card attached correctly into Smartphone. • Is the memory card mounted correctly on Smartphone? →Mount the memory card in accordance with the manual of Smartphone.
When tapping [File/Print] icon, any printer is not detected.	<ul style="list-style-type: none"> • Is the printer setup completed correctly? →Perform the printer setup correctly in accordance with Section 5.8.1 Preparation for the printer. • Is the pairing of Smartphone and the printer completed correctly? →Execute the pairing in accordance with Section 5.8.2 Bluetooth pairing.
When tapping [File/Print] icon, a message “Cycle the printer power” appears.	<ul style="list-style-type: none"> • Is the printer initialized? →Cycle the power of the printer, then try again to print out by tapping [File/Print] icon. →Set up the printer correctly in accordance with the manual of the printer.
When tapping [File/Print] icon, a message “Charge the printer battery.” Appears.	<ul style="list-style-type: none"> • Check if the printer battery pack is exhausted. →Mount a fully charged battery pack, and tap [File/Print] icon again to start printing.
When tapping [File/Print] icon, a message “No printing paper” appears.	<ul style="list-style-type: none"> • Is the printer in out of paper? →Load a new paper roll, and tap [File/Print] icon again to start printing.
When tapping [File/Print] icon, a message “Printer error” appears.	<ul style="list-style-type: none"> • Check if the printer displays an error message. →Eliminate the cause of the printer error in accordance with the manual of the printer.
Continuous use warms the casing.	<ul style="list-style-type: none"> →This is a normal phenomenon.



10. After sales service

When this product does not work as expected, check this product again in accordance with Section 9.3 Troubleshooting. If this product 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. For the contact information, see Section 14 Where to contact.

11. 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.

11.1. Disposal of the used battery pack

The used battery pack (lithium ion battery) can be recyclable. Insulate the charging terminals by a non-conductive tape or the equivalence, and then bring it to the nearest store providing rechargeable battery recycling service.

If the rechargeable battery disposal rule of a local governing body is different, contact your local government for details.

11.2. Disposal of this product

Dispose of this product in accordance with the local regulations.

12. Regulation Note

12.1. FCC/IC Caution

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

12.1 IC Caution

This product complies with RSS-220 of Industry Canada "IC"

Operation is subject to the following two conditions:

- (1) This product may not cause harmful interference, and
- (2) This product must accept any interference, including interference that may cause undesired operation of the product.

When used as Ground Penetrating Radar Device it shall be operated only when in contact with or within 1 m of the ground.

When used as In-wall Radar Imaging Device it shall be operated where the product is directed at the wall and in contact with or within 20 cm of the wall surface.

This product shall be operated only by law enforcement agencies, scientific research institutes, commercial mining companies, construction companies, and emergency rescue or firefighting organizations.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

12.2. FCC Notice (for U.S. Customers):

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two 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.

Caution:

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- Operation of this device is limited to GPRs and wall imaging systems operated for purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction.

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 operational areas to the FCC Office of Engineering and Technology, which 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(s) of operation, and the FCC ID number and other nomenclature of the UWB device. If the imaging device is intended to be used for mobile applications, the geographical area(s) of operation may be the state(s) or county(ies) in which the equipment will be operated. The operator of an imaging system used for fixed operation shall supply a specific geographical location or the address at which the equipment will be operated. This material shall be submitted to Frequency Coordination Branch, OET, Federal Communications Commission, 445 12th Street, SW, Washington, D.C. 20554, Attn: UWB Coordination.
- (c) The manufacturers, or their authorized sales agents, must inform purchasers and users of their systems of the requirement to undertake detailed coordination of operational areas with the FCC prior to the equipment being operated.
- (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 FCC/NTIA coordination report shall identify those geographical areas within which the operation of an imaging system requires additional coordination or within which the operation of an imaging system is prohibited. If additional coordination is required for operation within specific geographical areas, a local coordination contact will be provided. Except for operation within these designated areas, once the information requested on the UWB imaging system is submitted to the FCC no additional coordination with the FCC is required provided the reported areas of operation do not change. If the area of operation changes, updated information shall be submitted to the FCC following the procedure in paragraph (b) of this section.
- (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 § 2.405(a) through (e) of this chapter (Part 2 of the FCC Rules), is followed by the UWB equipment user.

Note: Above information is provided for reference only and may not reflect the most current information as provided by the FCC. For the most recent updated information, please refer to the FCC website.

13. Specifications

13.1. Handy Search NJJ-200

Item	Specifications
Search method	Electromagnetic wave radar method
Search object	Rebar, Polyvinyl-chloride pipe, Cavity, etc.
Search depth	5~300mm for concrete having a relative dielectric constant 6.2 and the top rebar of the diameter ≥ 6 mm
Horizontal discrimination pitch	≥ 75 mm for the scanned object located at depth < 75 mm \geq Depth of the scanned object located at depth ≥ 75 mm ※Typical performance for the reference concrete provides discrimination between two rebars of the interval 15 mm at depth 75 mm and of the interval 40 mm at depth 175 mm.
Horizontal distance resolution	2.5mm
Display mode	B-mode (Vertical Cross Section) and BA-mode(Vertical Cross Section and Reflection Waveform Graph)
Image processing (When scanning)	Real time auto surface wave processing, Real time manual deduction processing, Real time user surface wave processing
(At th eidle state)	Fixed surface wave processing, User surface wave processing, Deduction processing, Manual surface wave processing, Average wave processing, Peak processing, Original image
Relative permittivity range	2.0 to 20.0 0.1step
Max scan speed	Approx. 40 cm/s, Over speed alarm capability
Control function	Cursor marker (Max 297 points), Battery capacity indicator, Screen rotation, AutoMark function, Location notification function, File operations, Image data processing, Display functions (color, etc)

Output function	Printing to the dedicated printer
Wireless LAN	IEEE802.11 b/g (2.4GHz)
Frequency selection controls	Not supported
Frequency programming capability	Not supported
Data storage function	Saving data to/reading data from the memory card built-in Smartphone
Operating temperature range	0~ +50°C
Power source	Dedicated battery pack
Continuous operating time	More than 7 hours (For a fully charged battery pack, at normal temperature, not including Smartphone)
Dustproof/water proof	IP54
Size	149±2.5(W) × 203±2.5(D) × 134.5±2.5(H)mm (Including the handle and wheels)
Weight	Approx. 1kg and less (including the battery pack, but not including Smartphone)

13.2. Battery pack HST30002

Item	Specifications
Battery Type	Lithium Ion Rechargeable Battery
Typical Capacity	2450mA/h
Typical Voltage	7.4 V
Temperature Range at charging	0~+50 °C
Temperature Range at discharging)	-10~+60 °C
Dimension	Approx. 70×40×23 mm
Weight	Approx. 115 g

13.3. Battery charger PPT20003

Item	Specifications
Power	AC100~240V,50/60Hz
Output Voltage	DC8.4V
Output Current	0.85A
Time to charge fully	Approx. 240 minutes
Temperature Range	0~+40 °C
Size	Approx. 110×57×37 mm
Weight	Approx. 100 g

13.4. Smartphone

Item	Specifications
Display (LCD)	Pixel 800×480 dots and more, Touch panel supported Size Max : 140×70×13 mm and less Min : 110×50×6 mm and more
OS	Android Ver 4.0 and above
Wireless LAN	IEEE 802.11b,g
Bluetooth	Ver2.1+EDR and above
External memory	microSD supported
Other	Application installable from PC through USB interface

14. Where to contact

For inquiries and repair about this product, contact our main office below, the nearest branch office, sales outlet, or service station.

- **Customer service group**
1-1, Shimorenjaku 5-chome , Mitaka-shi, Tokyo 181-8510, Japan
TEL : 0422-45-9015
- **Seattle Branch**
1011 SW Klickitat Way, Suite 201B, Seattle, WA98134, U.S.A.
TEL : +1-206-654-5644
- **New Jersey Office**
1099 Wall Street West, Suite 141, Lyndhurst, NJ 07071, U.S.A.
TEL : +1-201-242-1882
- **Amsterdam Branch**
Cessnalaan 40-42, 1119 NL, Schiphol-Rijk, The Netherlands
TEL : +31-20-6580750
- **Philippines Branch**
Unit 603, Liberty Center 104 H.V.Dela, Costa Street, Salcedo Village, Makati City,
Manila, Philippines
TEL : +63-2-886-4185,+63-2-884-8767



Main Office Fujisawa bldg. 30-16, Ogikubo 4-chome
Suginami-ku, Tokyo 160-8328, Japan
Tel : +81-3-6832-1740
(Group 2, Business Department,
Communications Product Division)
Fax : +81-3-6832-1841

Mitaka Plant 1-1, Shimorenjaku 5-chome,
Mitaka-shi, Tokyo 181-8510, Japan
Tel. : +81-422-45- 9111
Fax : +81-422-45-9110