

User Manual



We Provide Complete Survey Solutions

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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.

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Chapter 1: Introduction

Terravision II is GSSI's first truly One-Pass 3D system. This affords faster and more accurate data collection and target identification than has ever been available before. The design goal has been to assist you in detecting the location, depth and angle of pipes --- automatically.

The Terravision II let's you collect a six-foot wide ribbon of data at a range of speeds and resolutions that adapt to your application. It is designed to collect 1200 feet of data at three to four miles per hour. This will deliver the full resolution of one scan per inch. At this resolution, even rebar mesh is detectable. Going faster is no problem. As your speed increases, the Terravision II automatically drops resolution and correctly smoothes the data to accommodate. At the far extreme for example, if you wish to map soil layering, roadbed or geologic structure, speeds up to fifteen mph will still provide smoothed yet accurate results thanks of its built-in positioning system. The internal survey wheel will track your position, while the fixed relative position of the 14 internal antennas guarantees a six-foot swath of correctly spaced 3D data.

At typical speeds for locating pipes (3 to 5 mph) you can collect over a 1500-foot line in under five minutes. Anyone with experience collecting 3D data will recognize not only what a generational advance in technology this represents but also what a huge dataset you have just collected! With this in mind, the second important technology advance with this system lies in the way it helps you analyze your data.

Once the dataset is collected, it is transferred to our RADAN processing software for analysis. This can be done immediately after data collection, without leaving your ATV. Our new Auto Target Locator takes the 3D dataset and looks for hyperbolic patterns in all 14 transects. While some of these targets might be individual rocks or buried trash, pipes should get detected in each of the 14 transects. The 14 targets will be found to be linear and then automatically highlighted in the data. The result is a simple means of searching through an enormous amount of 3D data very quickly.

The results of your analysis are presented, edited and saved in an easy to use 3D interface that can be outputted to a CAD file. Whether you want to locate pipes to within a few inches, or map soil stratigraphy in 3D, Terravision II offers a simple and efficient means of getting answers fast. This manual is written to help you get the most out of your new system, to highlight its strengths and understand its limitations. Please read it through carefully to avoid confusion.

Overview of this Manual

Chapter 2 – Details the components and requirements of the hardware and setup

Chapter 3 – Steps through the procedure for acquiring data.

Chapter 4 – Explains what needs to be done to interpret your data.

Appendix A – FAQ.



Figure 1: One possible Terravision II configuration.

Chapter 2: Hardware Configuration

Let's begin with an overview of where the pieces go and how to hook them together.

Hardware Components

The main component is the two-wheeled cart. It contains the **frame and hitch** (in gold), the **antenna sled** (in white) and a right and left **antenna array** pair (in white). The Right antenna is the Master antenna and goes on the right side as you face forward. The Left antenna is the Slave antenna and goes on the left side as you face forward. The cart itself can be hooked up in either direction; just make sure that the Right and Left antennas are oriented properly with the direction of travel.

The hitch is connected to the **ATV** with a ball joint. Four handle clips on the frame allow the antenna to be pulled up off the ground. When the antenna is "up," an extra rail on top of the frame can be pinned to the hitch (as shown in Figure 1) to allow the antenna to be moved without dragging it on the ground.

On the back of the **ATV**, secure the **Battery** and the **Controller Box**. The **Laptop** sits in its own frame that clamps onto the front frame on the **ATV**. These are the only components; now let's look at how to hook them together.

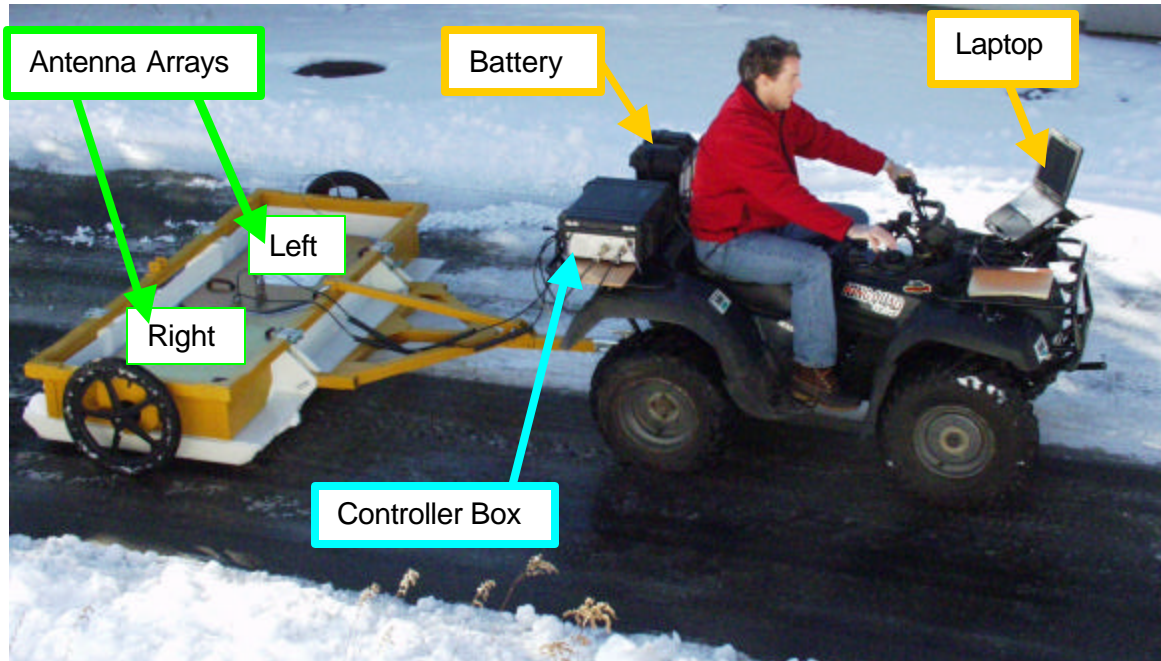


Figure 2: Hardware layout.

Cable Connections

Considering its complexity, it may be surprising that Terravision II has only a handful of connections.

- 1) The survey wheel has a cable coming out of the frame that gets hooked up to either antenna array.
- 2) A foot-long cable connects the two antenna arrays together.
- 3) Two identical cables go from the Antenna Array to the Controller Box.
Make sure to get the male and female ends right.
It doesn't matter which connection you use on the Controller Box; they are identical.
- 4) An Ethernet cable connects the Controller Box to the Laptop.
- 5) Battery power goes both to the Controller Box and to the AC/DC converter hidden under the Laptop mounting frame.

That's it.

Hooks and clips are located in logical places. Check your ATV for the best way to secure the cables. The connections that go to the laptop can usually be hidden safely under the seat.

A key on the side of the Controller Box is used to switch power on. It powers everything but the laptop.

Chapter 3: Data acquisition procedure

The data acquisition procedure is so simple that it is easy to make basic mistakes during data collection. But if everything is set up right, it is a four click process. Let's go through this first, and then get into the sometimes tricky details.

Data Collection

Step 1: Turn on the key to the Controller Box.

Since the two computers inside the Controller box need time to boot up, wait about 45 seconds after it is turned on before **Step 3**.

Step 2: Turn on the Laptop (slide switch on the back right).

If you get asked, User = Administrator Password = Administrator.
On the Controller box, the Green and Amber lights will start flashing.
Then just the green power light stays on.

Step 3: Double click on the TERRA 2 icon in the middle of the Windows 2000 desktop.

The laptop then checks if the Controller box is booted and running.

After maybe 10 seconds, the application logo should appear. Be patient!

Double clicking again does nothing

If the Controller Box is not ready, you will get an error message. Say ok and try again.

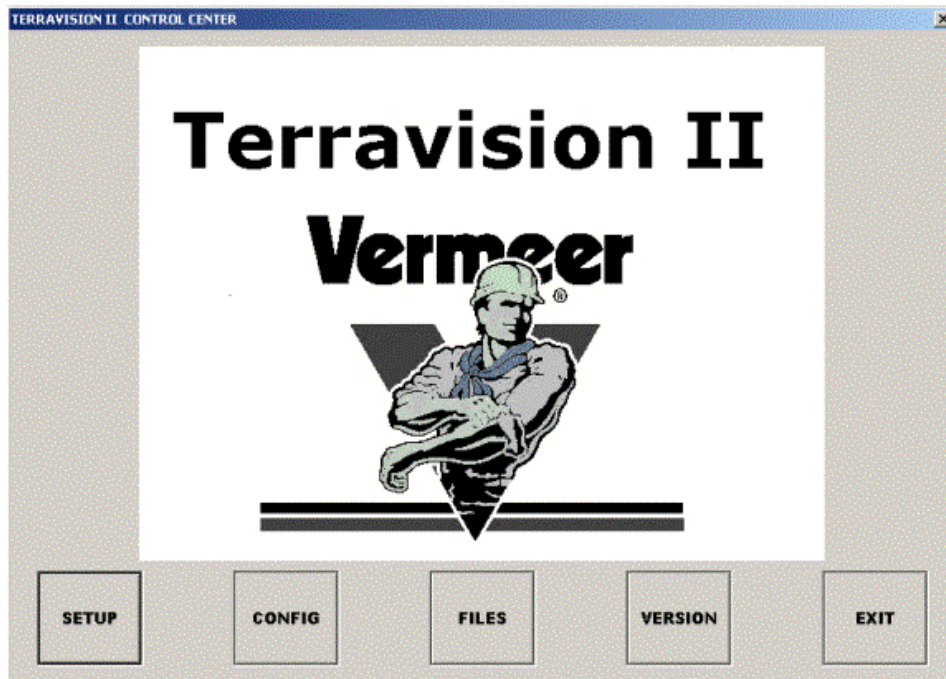


Figure 3: Main Screen.

Now you are ready to run the application.

Step 4: Hitting SETUP shows the next screen (Figure 4)

If you don't see any data in the O-Scope box on the right, then the application was started before the Controller Box was ready. Quit the application and try again.

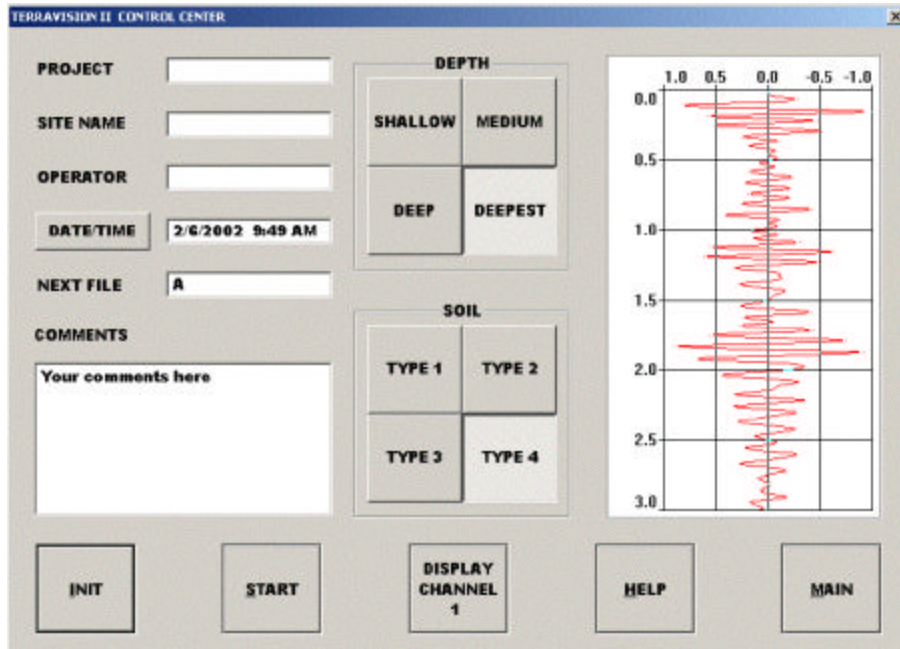


Figure 4: SETUP Screen.

Step 5: Hit INIT to initialize the gains on all fourteen antennas.
 When beeping stops, and when the O-Scope pattern on the right starts moving again, it is finished.

Step 6: Hit START.
 The next O-Scope screen will appear blank. It is waiting for you to move forward.
 It will not show data until you have moved forward about half the length of the antenna array (Figure 5).

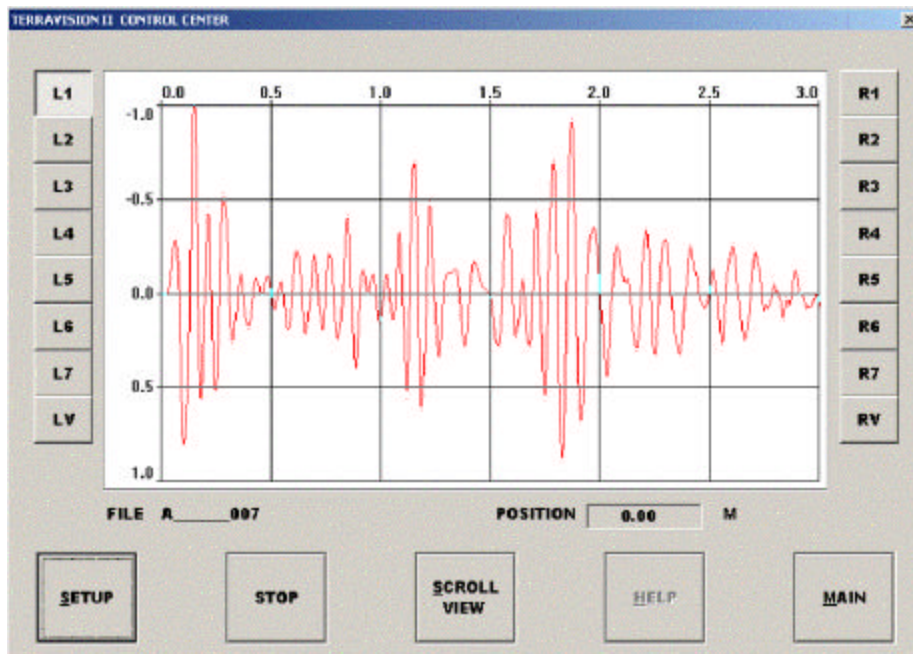


Figure 5: START Screen.

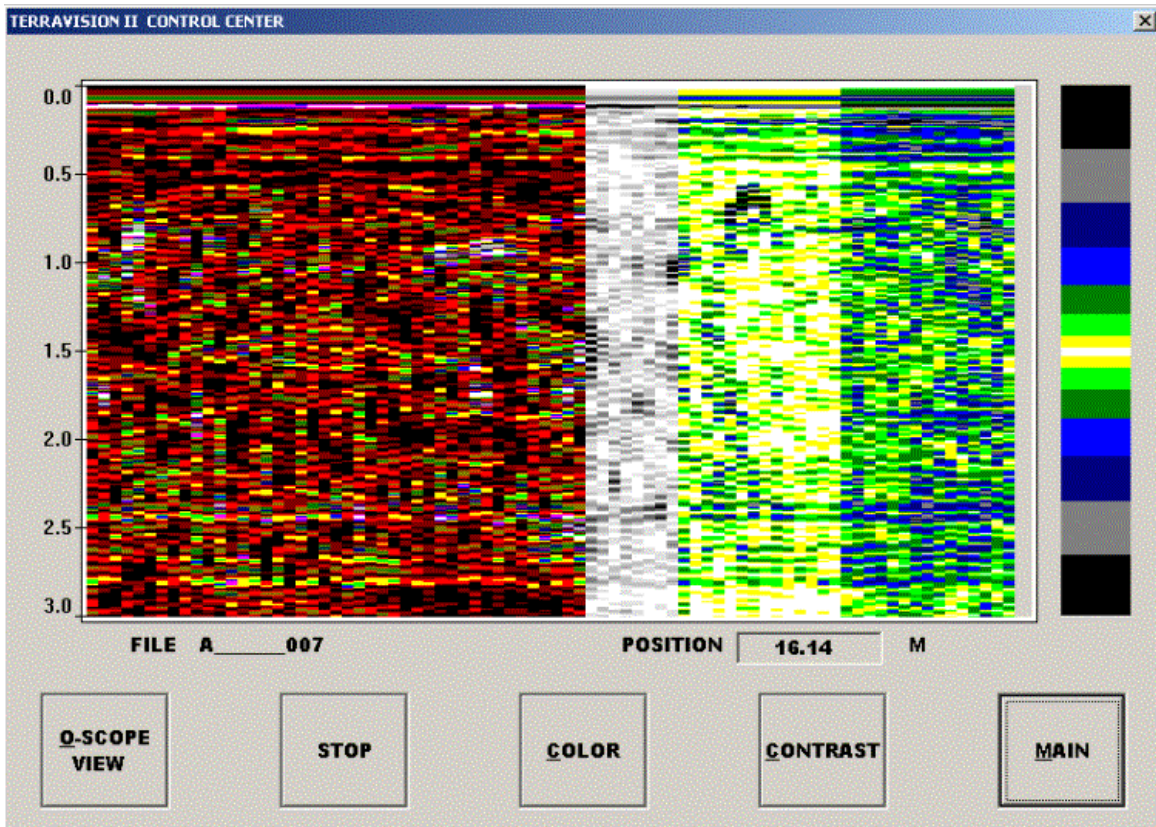


Figure 6: Scroll View Window has flexible display parameters.

The Scroll View (Figure 6) lets you preview the output during collection. Only every 16th scan is displayed (to not waste processing time) but it is enough to see general trends and pipes in the data.

Step 7: Hit STOP when you are finished the survey.
 Start the next survey by hitting START again (etc.).
 The filename increments automatically.

Acquisition Details

Positioning

A good survey requires accurate and repeatable positioning. There are three ways we try to help.

- 1) Mark your starting position in a way you can refer to, either with tape or spray-paint of a stick etc. The starting line on our antenna is the forward-most line marked on top of the antenna arrays. On this line, the position of the right-most antenna is defined as (0,0) (Figure 7). It is best to plan your survey with this in mind, especially if you want to make multiple passes and tile them all together in our Super3D Mode.

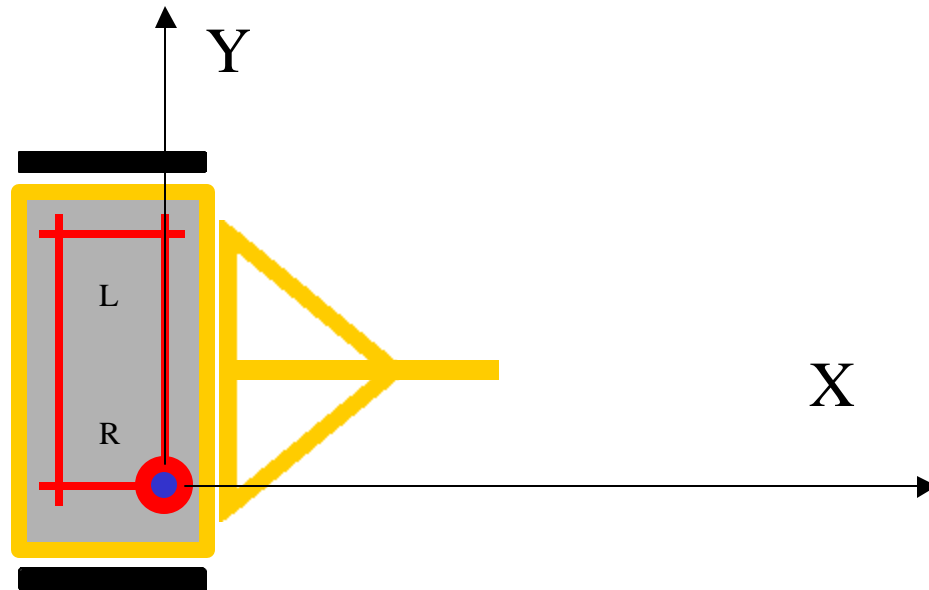
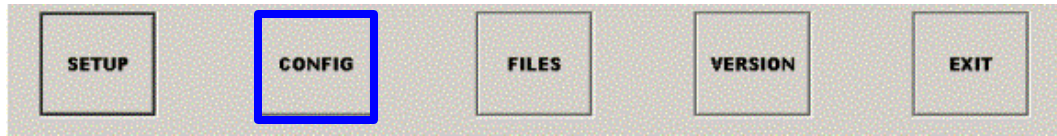


Figure 7: Data Orientation relative to cart.

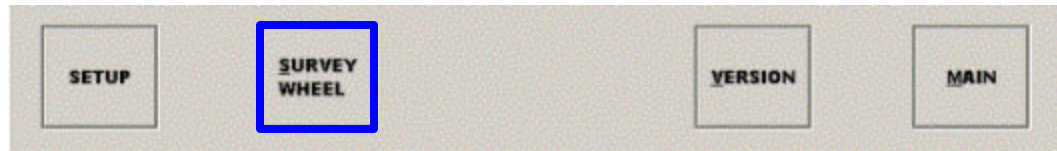
Backing up (other than being difficult with a trailed cart) is not a problem. During data collection, the survey wheel will remember its last forward progress and continue once you return to this point.

However, making turns must be done with full knowledge that the survey wheel is only on one side of the cart. Therefore, when measuring a distance to a pipe, you **MUST** measure along the track of the survey wheel, not along the center of the cart. This also means that our displayed distance of a survey will be longer for a right turn and shorter for a left turn. If this is fatal problem, our standard survey wheel can always be attached and dragged directly behind the antenna and connected to the units.

- 2) Make sure your Survey Wheel is calibrated properly. This procedure, once done carefully, should not need to be repeated (unless tire pressure changes, or you decide to switch units Metric/English).



The first menu (Main) hit CONFIG. In the next screen hit SURVEY WHEEL.



This pops up a dialog box with the internal numbers of the Right (Even) and Left (Odd) antenna arrays (Figure 8). We calibrate only one, and then copy the result to the other, making sure they are exactly the same. Select the even one and hit OK. The next dialog box gives instructions on how to calibrate. Hit START. Move forward the “Calibration Distance.” Hit Stop. The results, the number of Ticks Per Unit, are the number to copy to the odd antenna. Hitting save quits.

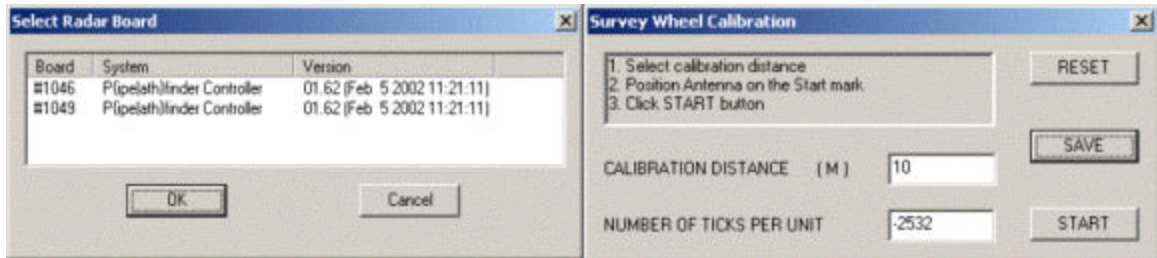


Figure 8: Survey Wheel Calibration Dialogs

Hit the SURVEY WHEEL button a second time. This time select the odd number and hit ok. Don't repeat the calibration. Instead just Paste (or copy in) the TICKS PER UNIT number you got from your calibration of the even side. Hit Save. Now they are both correct. Calibration is done.

Typical values for TICKS PER UNIT are Meters = 2533, Feet = 775 (+ or - depending on which direction the cart is pointed)

- 3) Keep good notes, either in our software or in a notebook.

The SETUP menu offers a place in which to write PROJECT Notes (Figure 9). These notes go with the created 3D File and can be viewed in the Header in RADAN during post-processing. If you do a subsequent survey the filename increments automatically, but the other information remains the same unless you change it.

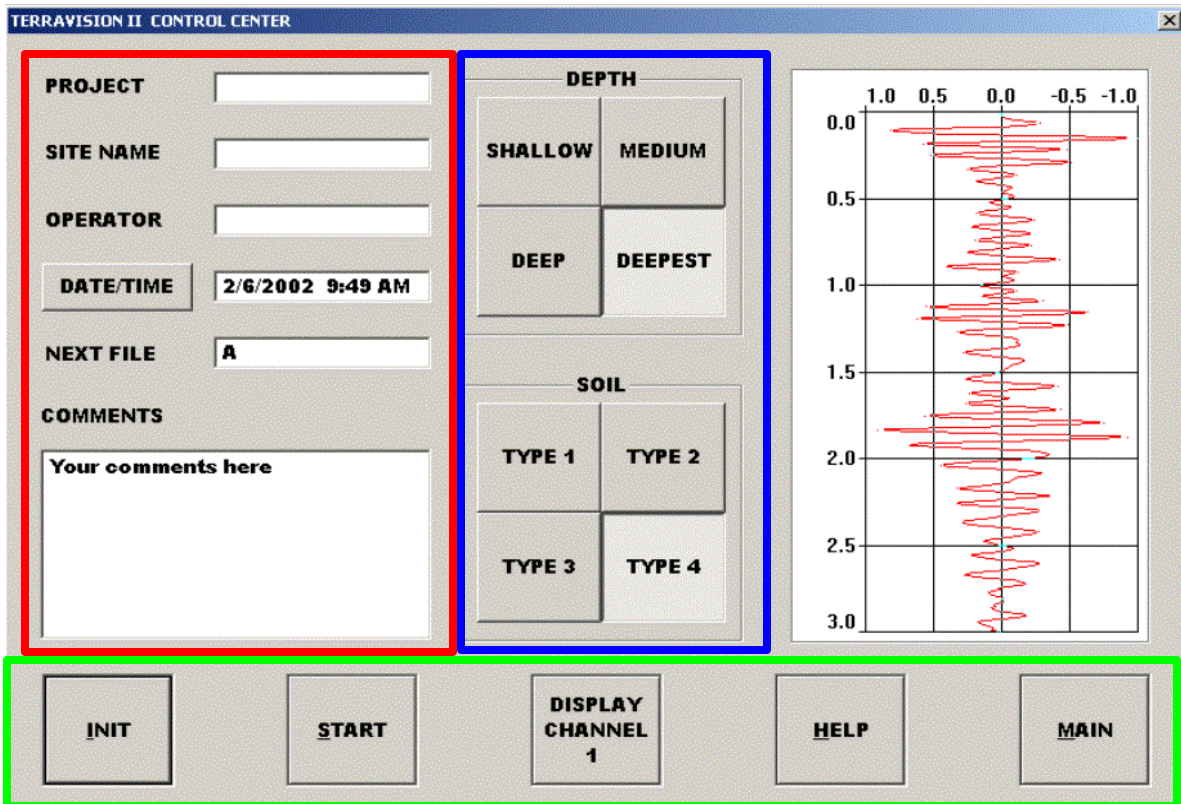


Figure 9: The SETUP screen has a section for taking notes

Depth Measurement

Before running a successful survey, you need to know two things:

- 1) How far down do you want to see.
- 2) What type of soil you are over. (i.e. what dielectric value should be set.)

If you don't know 2), we have tricks to help get you this information.

This is the information used to fill the CONFIG table (Figure 10).

SOIL	DIELECTRIC	DEPTH1	DEPTH2	DEPTH3	DEPTH4
TYPE1	1	3	4.5	6	7.5
TYPE2	4	2	3	4.5	6
TYPE3	9	1	2	3	4.5
TYPE4	16	0.5	1	2	3

Figure 10: Configuration Page

A typical matrix is shown above. However, if you happen to know the exact soil type, then you can enter the exact dielectric value in. You can also get the soil dielectric by surveying over a pipe and running the auto-target software (more on this later).

Chapter 4: Post-Processing Procedure

Transferring data to RADAN

Once the data is collected remember that it still resides only in the memory inside the antennas, not yet in the laptop. To transfer the data so you can look at it in RADAN, return to the main menu and hit FILES. The TII Control Center pops up which lets you transfer files to your laptop. Highlight the file(s) and hit COMBINE. This sorts the data into a standard 3D RADAN.DZT file

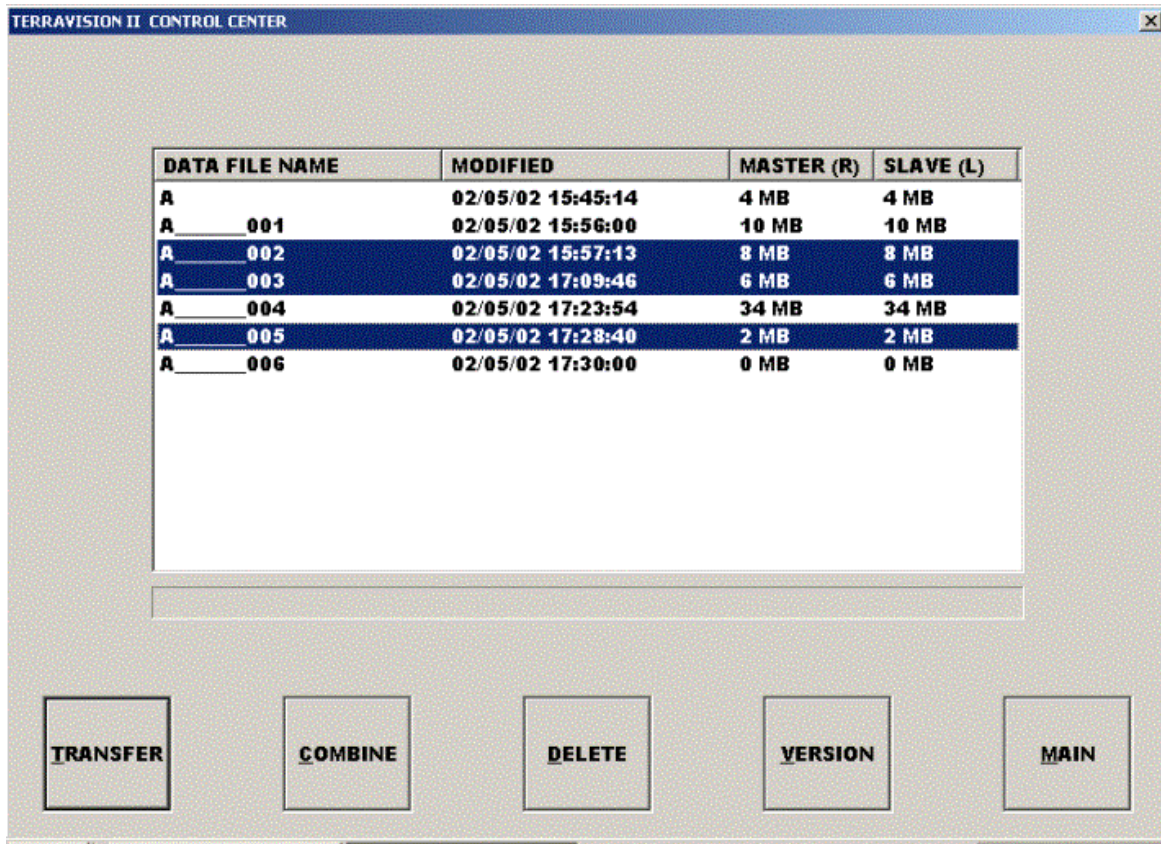


Figure 11: File transfer screen

You can now close the TII application and run our standard RADAN package for looking at the data.

Running RADAN

The data can now be opened in RADAN for viewing. To make it a 3D file

select PROCESS -> SORTING -. Sort 3D Data. This changes the file so that it can be viewed as a 3D file in 3D QuickDraw. Please refer to that manual for further details.

Appendix B: Troubleshooting Problems

Problem: Some lights don't turn on, or don't shut off

Solution: When unusual behavior appears there are usually only two culprits

- 1) Occasionally the antennas get confused about what state they are in. Try closing the TII program on the laptop, then shutting off the power to the CONTROL BOX. Turn it back on and then re-run the T2 application. Everything should now behave.
- 2) If this doesn't fix the problem, then the problem has always been that the battery power has fallen below useable levels. Swap out with a newly charged battery and try again.
- 3) If the problem persists, call us.

Problem: The distance is not correct.

Solution: Recalibrate the survey wheel. Make sure that the same number is loaded in both antennas.

Problem: We move and nothing appears on the screen.

Solution:

- 1) Check that the cables are screwed in correctly.
- 2) Make sure you see lights blinking on the Ethernet card inserted in the laptop. (else reboot)
- 3) Recalibrate the survey wheel. Make sure that the same number is loaded in both antennas.
- 4) The Survey encoder does not operate below 10 F.

Problem: RADAN-NT crashes while trying to write a file:

Solution: There are two possibilities:

1. Check to make sure there is enough disk space on the disk containing the Output file path. Allow for at least twice the combined space taken up by the input file (*.dzt) and the *.ind file.
2. Check to make sure the default output path exists. The output path is specified in the Customize menu item. See Appendix C for details on locating and setting the default output path.