

DOCUMENT OVERVIEW

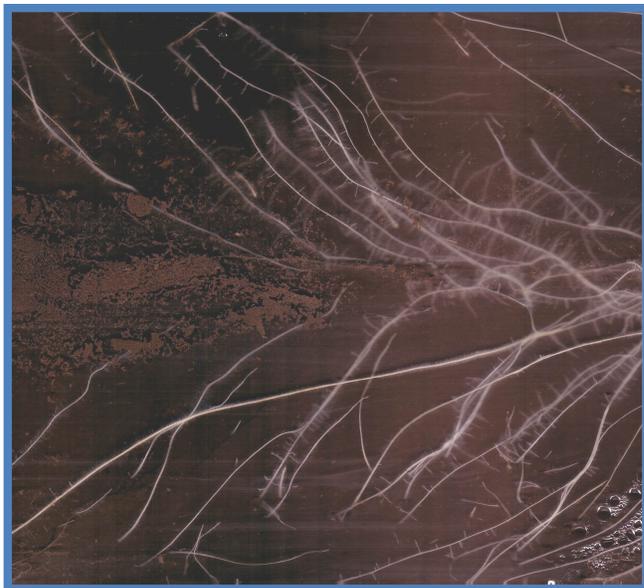
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INTRODUCTION

Observing a root system throughout a plant's life cycle is key to understanding overall plant behavior and health. The CI-600 In-Situ Root Imager is a minirhizotron that captures non-destructive, high resolution, digital images of living roots in soil to observe the development and function of plant root systems. The images collected by the CI-600 can be imported and analyzed with the included tablet and RootSnap! root image analysis software to easily calculate parameters including root length, area, volume, diameter, and branching angle.

The CI-600 features:

- Very portable and quick operation
- Linear scanning with no distortion
- High-resolution images up to 23.5 million pixels
- 360-degree scans (21.59 x 19.56 cm)
- 100, 300, and 600 DPI scanning resolutions
- Included tablet computer to power scanner, operate control software, and save images
- USB interface for laptop computer image storage
- Ability to observe root growth and behavior over multiple growing seasons



CI-600 root image courtesy of Dr. Dylan Fischer at The Evergreen State College, Washington, USA

Features & Specifications

CI-600 Specifications	
Image Size	21.59 × 19.56 cm (8.5" × 7.7")
Scan Speed	30-150 seconds depending on scanning resolution (100 DPI-600 DPI)
Image Resolution	100, 300, and 600 DPI*
Computer	Handheld tablet
Software	CI-600 Software and RootSnap!
Interface	USB Cable
Scan Head Dimensions	34.3 cm long × 6.35 cm diameter
Scanner Unit Weight	750g
System Requirements	Microsoft Windows XP, Vista, 7, 8, 10 1GB Memory/RAM 1GHZ+ Processor

Root Tube Dimensions	
Inner Diameter	2.5 in (6.35 cm)
Outer Diameter	2.75 in (7 cm)
Wall Thickness	0.12 in (3.2 mm)
Standard Length	41.3 in (105 cm)

This manual is written for CI-600 software version 4.04.57

How to Use the CI-600

1. Select a test site where you plan to evaluate plant roots using the minirhizotron and tube installation. The minirhizotron system will work with established plantings for long-term studies or can be installed before annual crops go into the soil. Tubes are very durable and can last up to 10 years in certain environments, allowing for analysis of roots over multiple growing seasons.
2. Determine number of tubes to be installed per treatment—6 tubes are included with purchase of the CI-600. A single imager can be used at sites with many different tubes.
3. Dig holes for tubes using a gas-powered auger or a hand-tool at the desired angle and depth—tubes are generally 1-meter-long, though 2 meter tubes are available.
4. Install transparent tubes into holes, with the watertight plug at the bottom and the insulated cap at the top. Allow soil and any established plant roots to settle around the tubes over the course of a few days to a few months. The plant roots will grow around and next to the transparent tube. Any roots and soil touching the exterior of the tube will be imaged by the minirhizotron
5. Once you are ready to begin scanning with the minirhizotron system, lower the imager down into the transparent tube using the indexing handle, making sure to line up the imager with the “home” position marked on the tube.
6. Using the included tablet computer, determine the desired image resolution and begin taking scans at various depths. The scan window on the imager will rotate to capture a nearly 360-degree image.

Note: It is recommended to **include overlap between scans** to ensure all roots are fully imaged. Overlap can easily be removed using RootSnap! analysis software.

Scanning time will depend on the DPI option chosen:

100 DPI image	30 - 45 seconds
300 DPI image	90 seconds
600 DPI image	150 seconds*

*Users may be able to achieve faster 600 DPI scans by finding the best setting for their own computer/600 software combination. Faster computers should be able to achieve faster scan times; laptops are faster than tablets.

7. Watch as images live-update on the screen to verify successful scan.

8. Once you have taken desired images, use our free RootSnap! Analysis Software on the included tablet or a separate PC to begin calculating parameters including root length, area, volume, diameter, and branching angle.

Unpacking

The CI-600 Root Growth Monitoring System includes the components listed below:

- **1 Scanner**
The CI-600 Root Scanner hardware.
- **1 Tablet Computer**
The tablet computer powers the root scanner, runs the software and saves root images.
- **6 Soil Tubes (105 cm) with Insulated Watertight Caps**
You may receive different quantities and lengths based on your order.
- **1 Calibration Tube**
See the Calibration section of this document for information on using this tube.
- **1 USB Cable**
This cable is used to connect the CI-600 to the computer running the CI-600 software.
- **1 Collapsible Slider Rod with Tube Cap**
This is used to lower, raise and hold the CI-600 in the root tube. The cap enables users to temporarily lock the rod in place for making multiple scans.
- **1 Allen Wrench**
This is used to secure the USB cable to the root scanner.
- **1 Software USB**
This contains the CI-600 Root Scanner software. See the Software/Driver Installation section of this document for information on using this software.
- **1 Carrying Case**

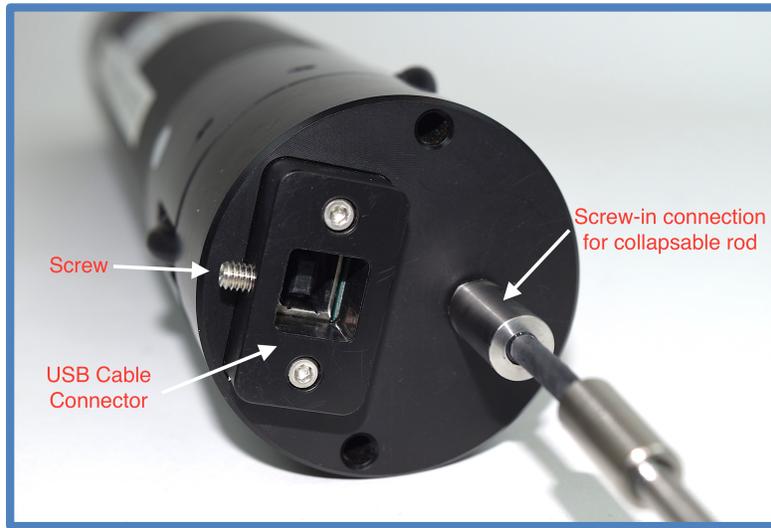
DURING UNPACKING IF ANY OF THESE ITEMS ARE NOT PRESENT PLEASE CONTACT CID IMMEDIATELY.

Note: Additional items, such as the RootSnap! root image analysis software may be included based upon your order.

HARDWARE ASSEMBLY

Please follow these important instructions on how to set up the CI-600 hardware.

1. Connect the USB cable to the CI-600's USB cable connector. Refer to the illustration below to locate the USB Cable connector



2. Use the Allen wrench to tighten the screw to hold the USB cable in place securely. **Do not over-tighten this screw.** This can cause damage to the USB cable.



3. Attach sections of the Collapsible Slider Rod by twisting or screwing each section into the others. The black knob is intended to be at the top of the collapsible slider rod to be used as a hand grip when inserting and removing the instrument from the root tube.



The slider rod can be used as a measuring rod, with each section of the collapsible scanner being the equivalent of the scan window length.

4. Connect the Collapsible Slider Rod to the scanner by screwing in the end of the rod into the hole next to the USB cable connection.

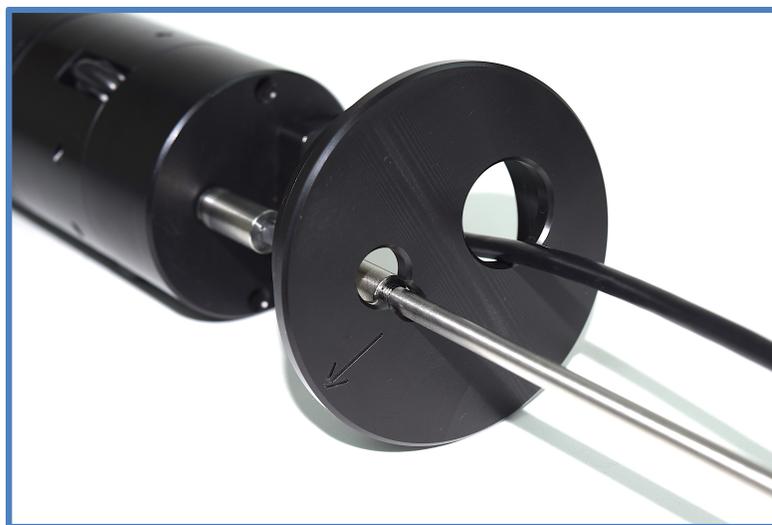


Note: CI-600 imaging units manufactured before March 2010 will have a U-Joint style connector instead of the more durable threaded screw connectors..

5. When ready to scan, unscrew the black knob from the end of the Collapsible Slider Rod and slide the Tube Cap onto the rod.



6. Replace the knob, slide the Tube Cap down the USB cable and Collapsible Slider Rod, slide the scanner into a soil or Calibration Tube and then twist the cap to secure it in place.



The Tube Cap features a 'lock in place' notch to hold the collapsible slider rod in place between image scans in one tube.

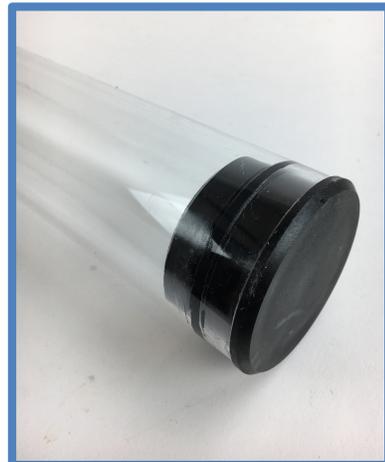
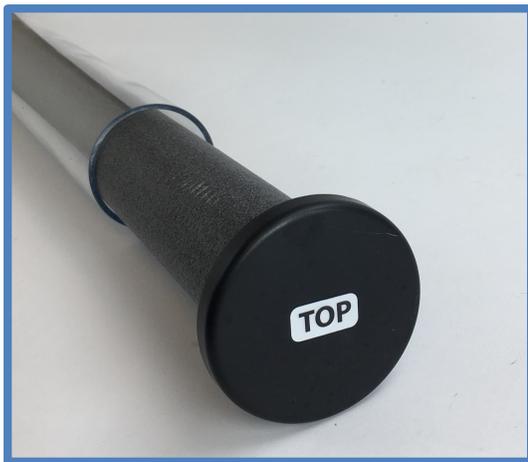


The Tube Cap

The cap is marked with an arrow as a visual aid to indicate alignment with your marked home position on your root tube. You may add your own 'home' position to a clear root tube—typically facing down if the tube is installed at an angle—this way the arrow will indicate 'this side up'. The root tube cap should be inserted into the root tube with the arrow pointing upwards in order to keep the slider rod in the proper orientation during imager operation.

THIS ARROW IS NOT AN INDICATOR FOR 'HOME' POSITION ON THE CALIBRATION TUBE- CONTINUE TO USE THE METHOD OF ALIGNING THE DOTS TO THE HOME POSITION DURING CALIBRATION.

- The acrylic root tubes included with the CI-600 feature insulated watertight top and bottom caps. The insulation on the top cap prevents stray light from affecting root growth. The bottom plug is watertight; **do not add extra sealant to the bottom plug, as glues can degrade the rubber O-ring and compromise the integrity of the tube.**



Scanner Home Position

The CI-600 begins a scan by rotating the scanner body to the “Home” position and then initiating the scan. This is referred to as the scanner “returning to Home.” If the instrument is already in the Home position, it will not need to rotate before starting to scan. Ensuring that the instrument is in the Home position before scanning can eliminate scanning unintended areas and save time. When calibrating the CI-600 in the white Calibration Tube, it is important to align the scanner to the Home position for proper calibration. Make sure to insert the scanner in the Calibration Tube properly.

Procedure to Return the CI-600 to Home

- Hold the scanner by the top and rotate the body of the scanner clockwise until you meet resistance.
- Do not force or overturn the scanner body!
- The labels on the top part of the scanner indicate the actual Home position (when the bottom is rotated clockwise and the top is rotated counter-clockwise until resistance is met.)
- If the CI-600 is not returned to Home, the scanner will first rotate itself into this position before scanning or calibrating.
- Return the CI-600 to Home **prior to sliding the scanner in a root tube and beginning a scanning sequence** in order to have images start at the same point for each window. This will help when lining up root images to envision the entire root tube.
- It may be helpful to label a point on each root tube that is the “Home” or “Start” position for all scans done in that tube.

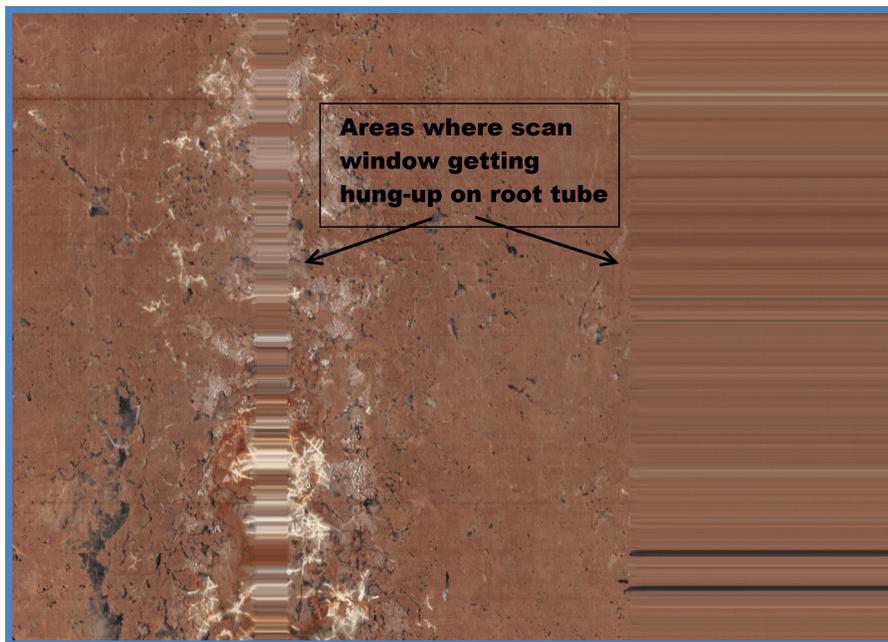


CI-600 Adjustable Scan Window

The CI-600 scan window is carefully set at the factory to provide the maximum focal length and best quality image in CID-provided tubes. In the event that a user is scanning images in tubes not supplied by CID, or if a tube is somehow damaged, there may be a need to adjust the focal point of the CI-600 scan window in order to obtain a clear image. For best clarity, the user should adjust to the maximum focal length that still allows the scanner to rotate smoothly.

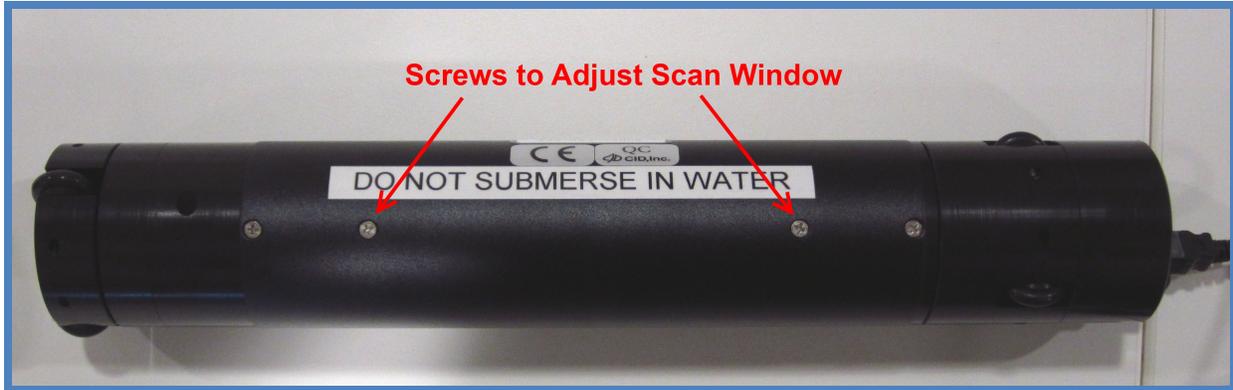
DO NOT ADJUST THE SCAN WINDOW UNLESS THERE IS A PROBLEM WITH THE SCANNER GETTING STUCK

Below is an example of an image from a tube where the scanning window gets caught twice during rotation. In this case, the fit between the scanner and the tube is too tight. The scan window should be lowered slightly and re-tested to see if it passes.



To adjust the scan window:

1. There are four screws along the bottom of the CI-600 housing. The inner 2 screws adjust the height of the scan window. The outer screws attach the upper and lower pieces to the scanner body. To raise or lower the scan window, use a screw-driver to slowly turn the 2 **inner screws**, one end at a time, until the desired height is reached.
2. Carefully watch the scan window during the rotation. If the scan window appears to be catching on the tube, remove the CI-600 and lower the scan window until it is able to rotate smoothly.



Once you have changed the height of the scan window, you will need to recalibrate the scanner before using it in CID tubes:

1. After you adjust the scan window, put the CI-600 into the Calibration Tube and take a test scan. Carefully watch the scan window during the rotation.
2. If the window appears to be catching on the Calibration Tube, remove the CI-600 and lower the scan window.
3. Repeat the test scan in the Calibration Tube to ensure that the scan window will not get caught on the wall of the root tube.

Please make sure the scan window is not catching on the tube when the scanner rotates. *This could cause damage to the scan window and gear assembly of the unit.*

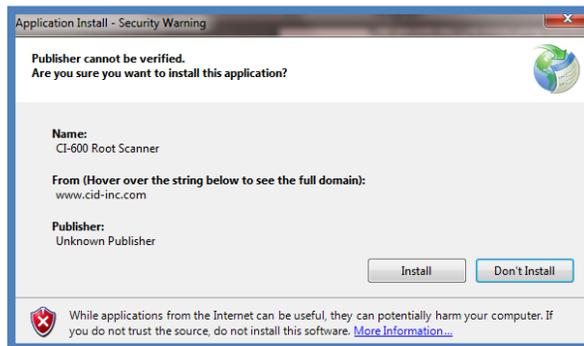
SOFTWARE/DRIVER INSTALLATION

The following steps to download and install the software and driver should be carried out on each computer used with the CI-600 Root Scanner. Version 4 software and driver are compatible with Windows 7, Windows 8, and Windows 10 (32 and 64 bit).

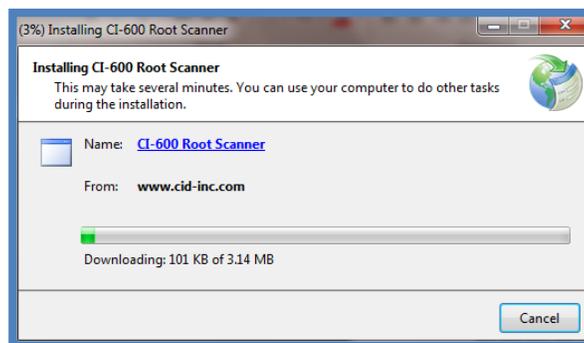
Version 3 software and driver is compatible with Windows Vista, Windows XP and Windows 7 (32 bit only). Please contact CID Bio-Science technical support (support@cid-inc.com) with any questions about software compatibility.

Software Installation

- This application requires the version 4.0 of the Microsoft .NET Framework. If this has not been installed on the computer, please download and install it.
- Insert the USB or navigate to <http://www.cid-inc.com/root-image/ci-600-software.php>
- Download or install the latest version by clicking setup.exe
- Choose to “run” or “install” the software anyways if a security warning appears indicating the publisher cannot be verified.



- When the application has finished installing, it will automatically open.



- A shortcut to the CI-600 software should be pinned to the taskbar or desktop.

Disabling UAC in Windows 7

User Access Control (UAC) is not compatible with the ClickOnce technology used by the CI-600 software and must be disabled. If you do not disable UAC the CI-600 software will not start, instead an error will appear. In the error details will be the message, "The requested operation requires elevation."

To disable the Windows User Account Control:

1. Press Start and type UAC in the search bar.
2. Select "Change User Access Control Settings" and move the slider bar to the bottom (Never Notify).
3. Re-start the computer for changes to take effect.

Remove the previous version of CI-600 Driver if necessary

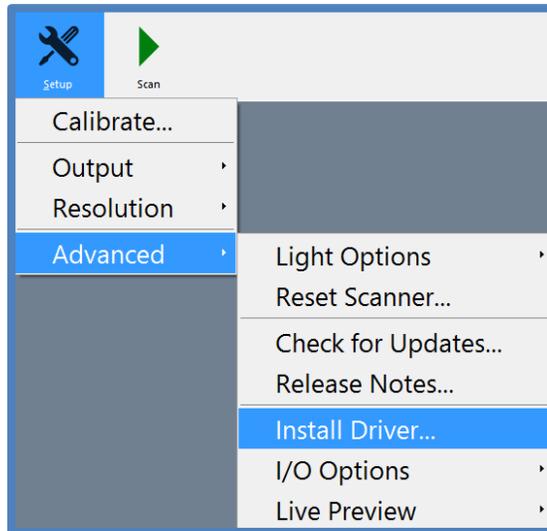
If a previous version of CI-600 driver was installed these steps must be followed before installing the latest driver:

- 1) Download and run the file located at this URL
<http://www.cid-inc.com/Software/CI-600/DelDrv.exe>
- 2) Choose "LiDE 20/30" when prompted and click OK to remove the old driver.

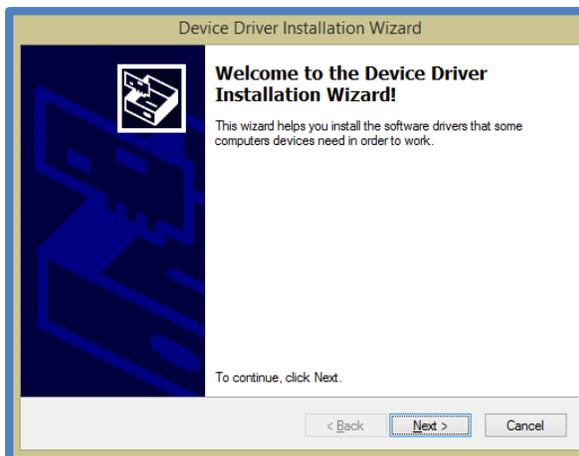
Driver Installation

The CI-600 driver is compatible with 32 and 64 bit versions of Windows 7, 8, and 10. To install the driver for the CI-600, first install the CI-600 In Situ Root Imager software version 4. Next:

1. Open the software with the CI-600 connected to the PC via USB.
2. Click on **Setup** in the tool bar.
3. Click **Advanced** and **Install Driver**.

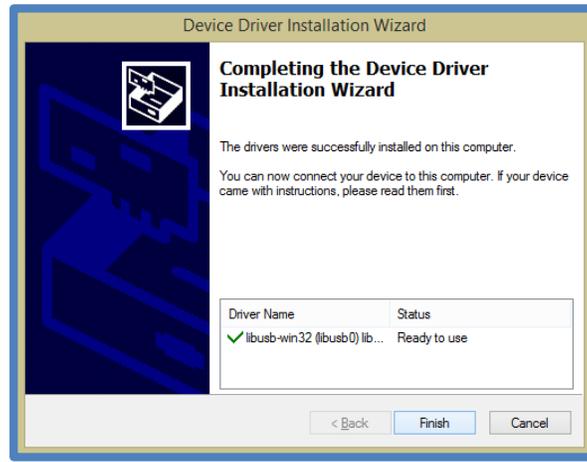


4. The **Device Driver Installation Wizard** tool (pictured below) will appear.



a.

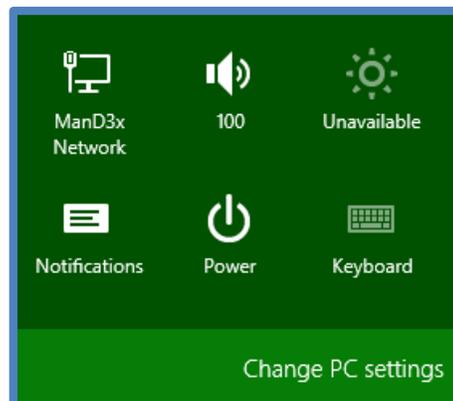
5. Complete the CI-600 driver installation using the device driver installation wizard and click **Finish**.



Windows Driver Signature Verification

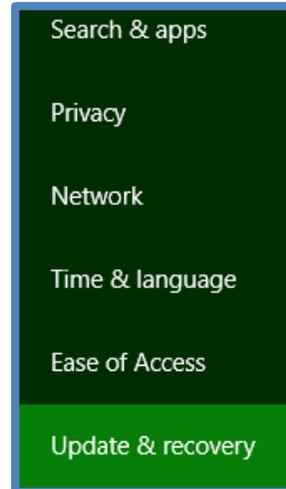
For Windows 10, 8 and all 64 bit Windows operating systems, the driver signature verification will need to be disabled before the CI-600 driver can be installed. This will allow an unsigned driver to be installed in Windows. A keyboard is required for this procedure (not a touchscreen keyboard on a tablet).

1. Press the Win + C keyboard combination to bring up the Charms Bar, then click on the Settings Charm.

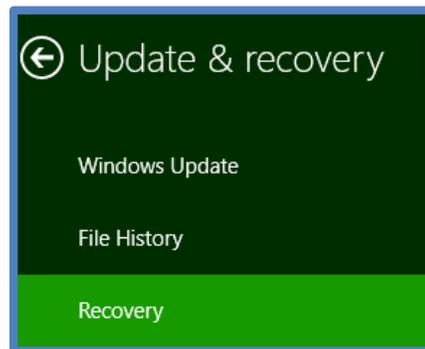


2. Click on the Change PC settings link and access the Modern Control Panel.

- When the Control Panel opens, select the "Update & recovery" section.



- Next, click on the Recovery option on the left-hand side



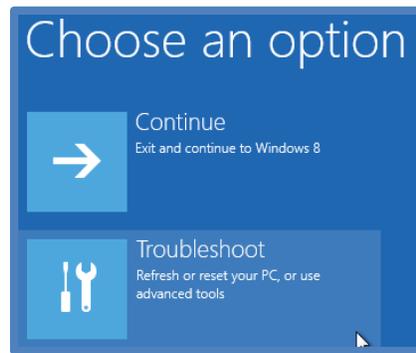
- Once selected, you will see an advanced startup section appear on the right-hand side. You will need to click on the "Restart now" button.

Advanced startup

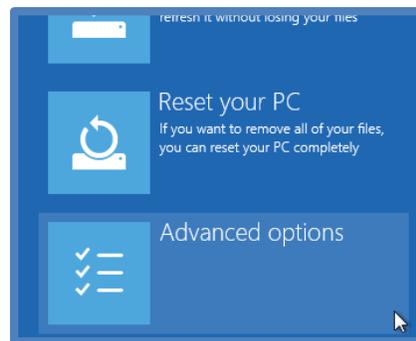
Start up from a device or disc (such as a USB drive or DVD), change Windows startup settings, or restore Windows from a system image. This will restart your PC.

Restart now

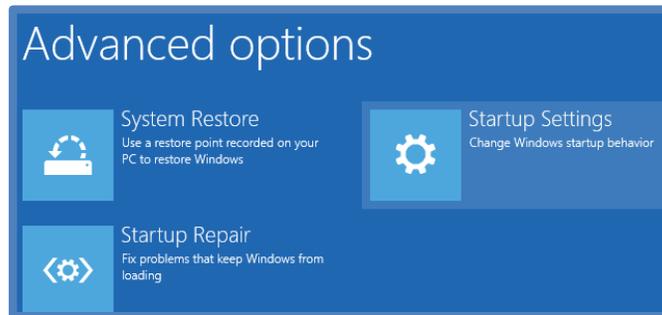
- Once your Computer has rebooted you will need to choose the Troubleshoot option.



- Then choose Advanced options.



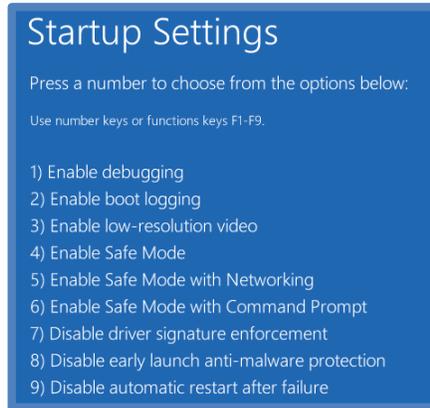
- Next choose Startup Settings.



- Since we are modifying boot time configuration settings, you will need to restart your Computer one last time.



- 10 Next you will be given a list of startup settings that you can change. The one you are looking for is “Disable driver signature enforcement”. To choose the setting, **you will need to press the F7 key**. This will require a keyboard as the touchscreen keyboard cannot be accessed while in Windows Bios.

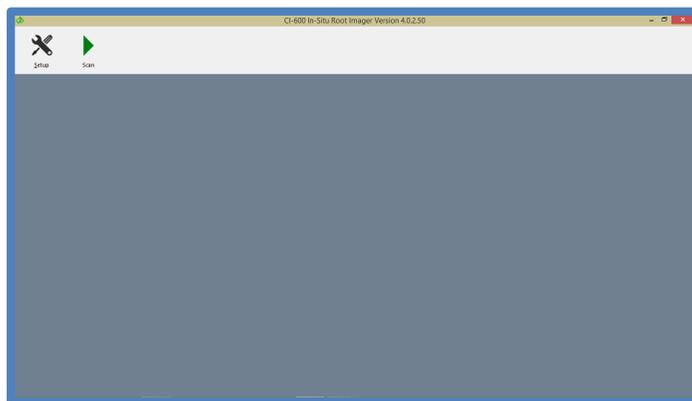


Press “F7”

11. Finally, reboot the PC and install unsigned drivers. Now your device is ready to install the CI-600 driver

OPERATING THE CI-600 SOFTWARE

To open the CI-600 software, click on the **Start** button, and select **CI-600 Root Scanner** from the **CID Bio-Science** folder. Or, click the icon on the desktop or taskbar. The dialog below will appear...



To begin using the CI-600 scanner:

1. Setup the hardware (See the Hardware Assembly section of this manual).
2. Install the software and driver.
3. Connect the CI-600 to the computer.
4. Open the CI-600 software.
5. Calibrate the instrument once at each resolution (100, 300 and 600 DPI) using the white Calibration Tube.
6. Set the image parameters and scan.

Calibration

Calibrating the CI-600 root imager is required after the software and driver are initially installed. Calibration is necessary at each resolution (100, 300 and 600 DPI) using the white Calibration Tube. Prior to each scan, the CI-600 software will verify the calibration data, eliminating the need to re-calibrate the root imager frequently in the field.

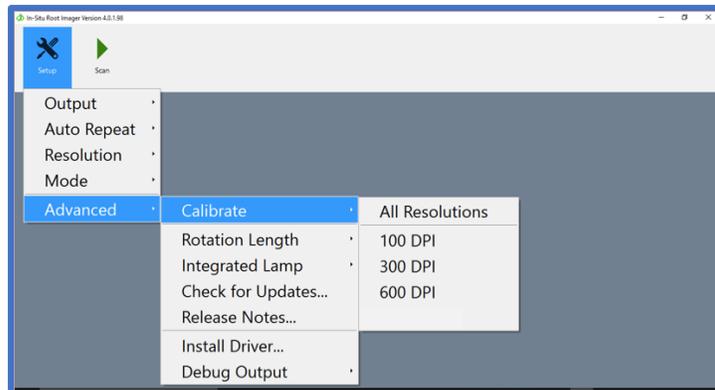
Calibration may also be necessary if the software prompts, asking you to insert the CI-600 in the white Calibration Tube and calibrate. All calibrations **MUST** be made in the CI-600 white Calibration Tube.

1. Install the CI-600 software and driver.
2. Attach the CI-600 Root Scanner's USB cable to the USB slot.

- Place the CI-600 Root Scanner in the white Calibration Tube with the scanner lined up at the Home Position.

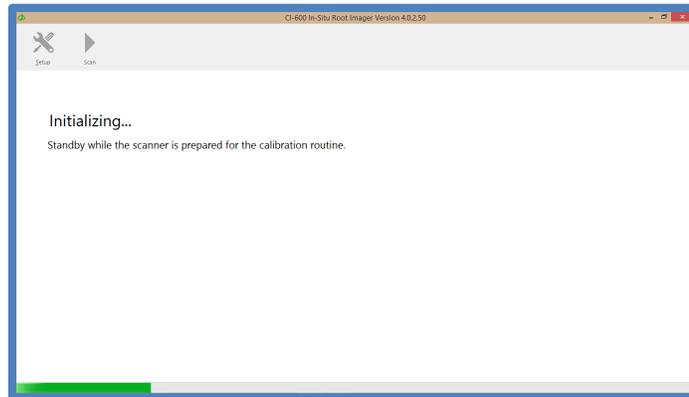


- Open the CI-600 software.
- Click on the Setup tool. Select 'Advanced'. Select the first resolution you wish to calibrate.

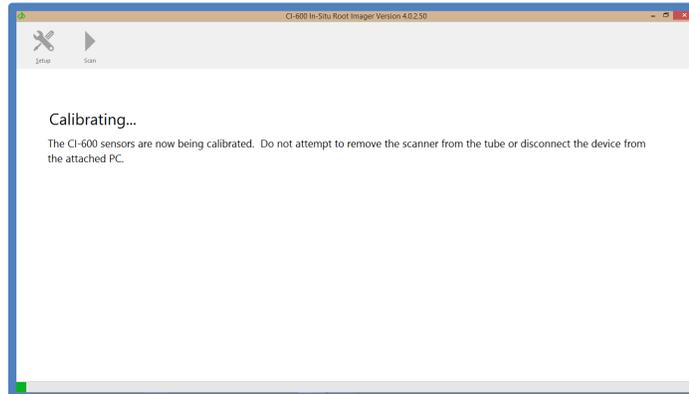


6.

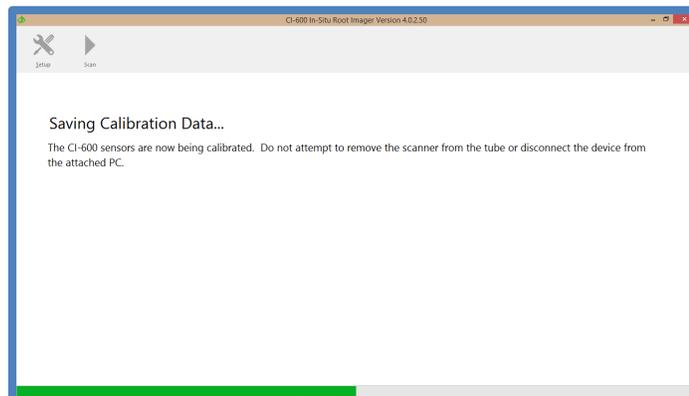
Select Setup>Calibrate. The software will indicate that the root imager is initializing.



7. Next, the software will indicate that the CI-600 root imager sensors are being calibrated.

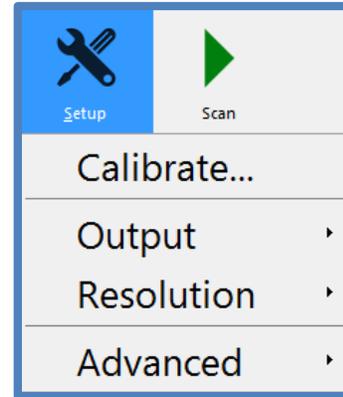


8. Finally, the calibration data will be saved and the software will exit to the opening screen.



Setup Menu

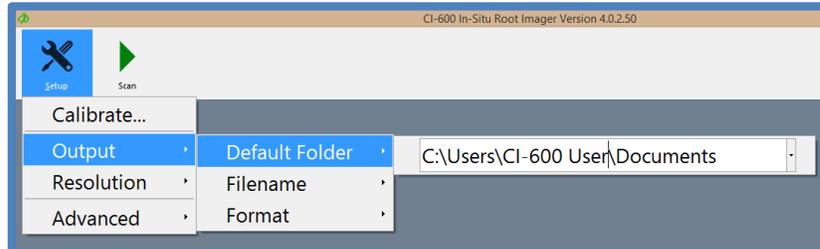
The CI-600 software is designed to be easy to operate with three buttons: Setup, Scan and Save (seen after an image is taken). The Setup Menu features user changeable parameters, such as where the image file is saved on the computer or the resolution of the scan.



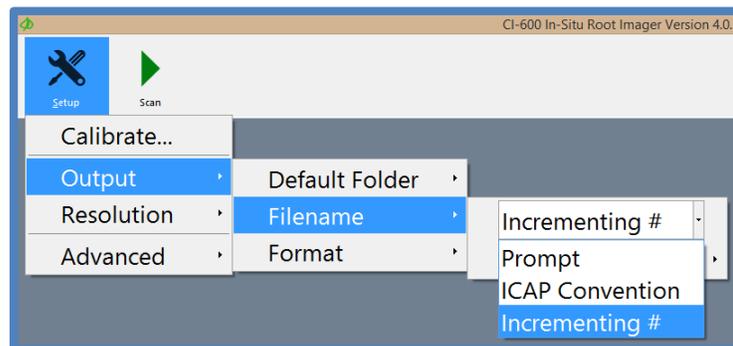
Setup>Output

The Setup>Output menu houses parameters that can be changed regarding the folder where images are saved (default folder), filename and file type.

Setup>Output>Default Folder is where the folder on the hard drive to which images are saved can be designated. Type in the folder location or use browse to navigate to the folder on the PC.

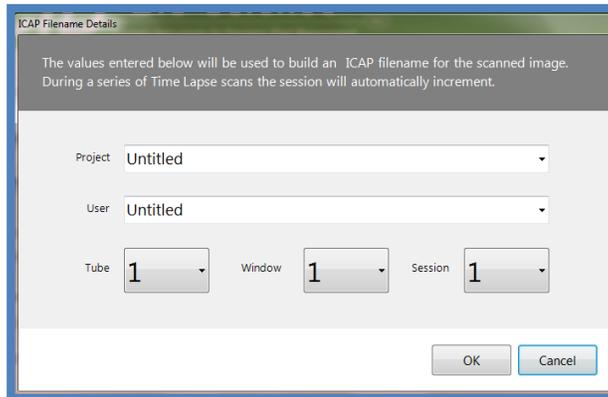


Setup>Output>Filename is where the assigned filename of the image can be changed. **Prompt** will open up the computer library and prompt the user to manually enter a filename each time the “Save” button is pressed.



Selecting **Incrementing #** will assign each filename the Prefix designated, followed by incrementing numbers. For example, if the prefix entered is Pineapple Root, the first filename will be Pineapple Root01.png.

The **ICAP Convention** file name is used to designate the Root Tube number, Window height and Session number, as well as the project and user. Using this filename convention will make images easier to import into RootSnap! for later analysis.

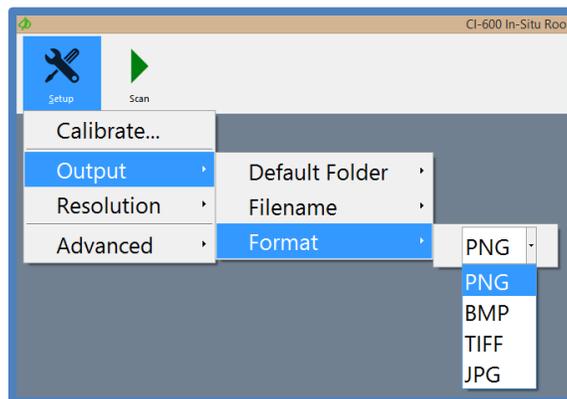


Using the ICAP Convention, each scan is saved with the following parameters:

Project Title; Tube Number; Window Number; Date (day/month/year); Time (hours/minutes/seconds); Session Number; and User in the following format:

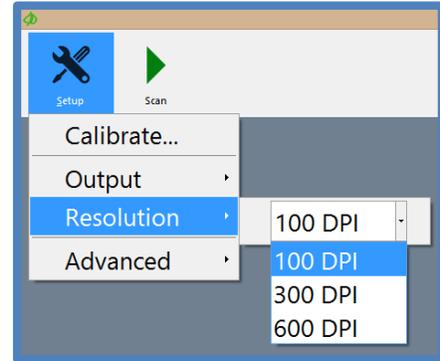
Tomato_T001_L001_22.03.17_111650_001_Jessica.png

Setup>Output>Format is where the file type of the saved image can be set at .png (recommended), .bmp, .tiff or .jpg.



Setup>Resolution

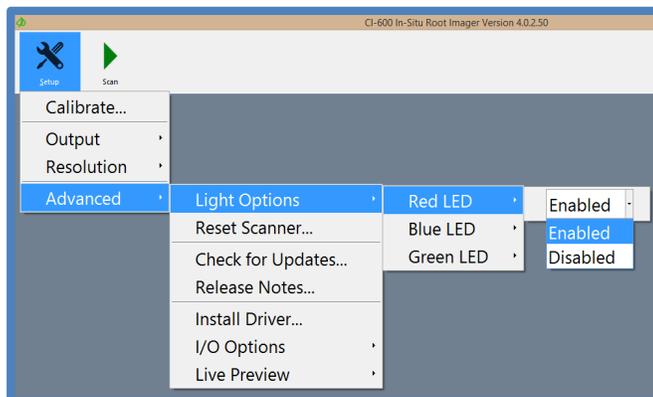
Select the resolution of the image. Available options are 100, 300, and 600 DPI (dots per inch). The higher the DPI, the longer the scan will take to complete. 100 DPI scans typically take 30 -45 seconds; 300 DPI scans take 90 seconds; 600 DPI scans take 2.5 minutes. Using a faster computer can yield faster scan times.



Setup>Advanced

The Setup>Advanced menu houses the light options for the scanner, as well as the reset, update check, release notes, driver installation, I/O options and live preview feature.

Setup>Advanced>Light Options allows the user to enable/disable each of the LED colors independently (red, blue and green). By default, all three LEDs are enabled.



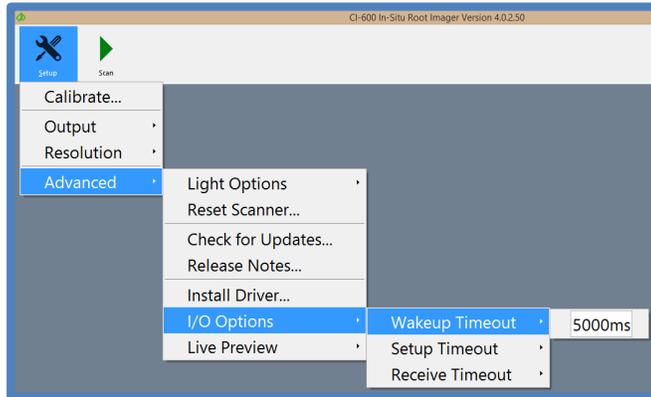
Setup>Advanced>Reset Scanner will restore the CI-600 software and hardware to the default settings.

Setup>Advanced>Check for updates will check the CI-600 webpage for any available software updates and prompt the user to download and install.

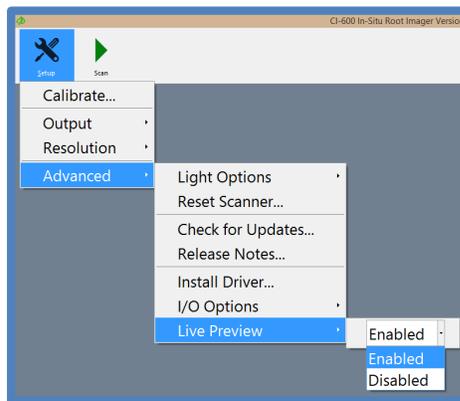
Setup>Advanced>Release Notes contains the notes from the programmer's last update to the CI-600 software and any known software bugs.

Setup>Advanced>Install Driver will open the Device Driver Installation Wizard to install the CI-600 driver.

Setup>Advanced>I/O Options is where the timeouts can be adjusted for different PC's. The timeout controls how long the computer waits for a response through the USB port from the CI-600 root imager. The timeouts are optimized for the tablet computer included with the root scanner.



Setup>Advanced>Live Preview is where the live preview feature can be enabled/disabled to see the image as it is scanned or wait until the scan is complete to see the image.

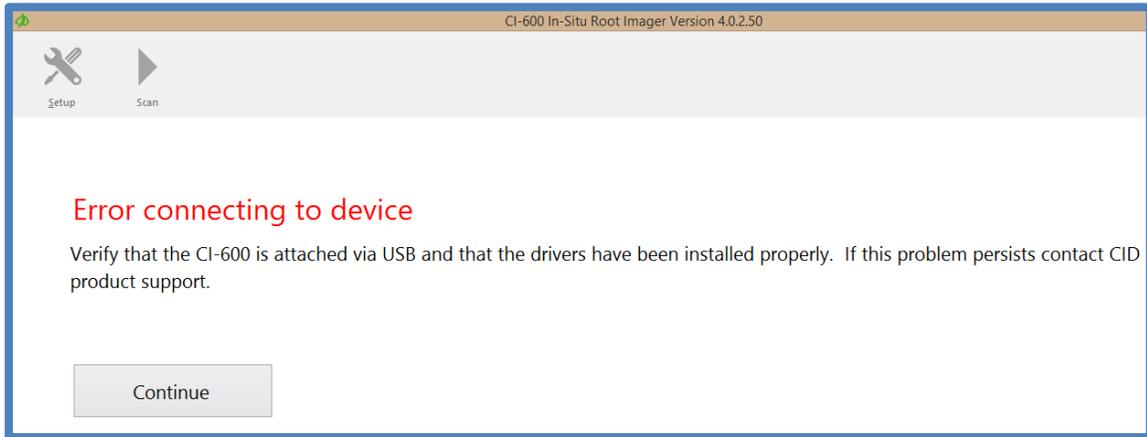


The most common error message that appears after hitting the scan button is that the instrument cannot be detected by the computer.

To fix this error message:

1. Disconnect and reconnect the CI-600.
2. If the error appears again, restart the computer.
3. Check the USB cable and connection of the instrument. Try a different USB port of the computer. **Try a new USB cable.**

4. Check that the software and driver are up-to-date and properly installed.



DEPLOYING ROOT TUBES

- Make sure the inside of the tube is clean (see the Cleaning & Maintenance section).
- The root tube is made of clear acrylic with two end caps. The end of the tube with the bottom watertight plug should be inserted into the soil. The other end, with the insulated removable cap, should be 5 to 8 cm above the ground. The removable cap should be left on at all times when not taking scans to avoid dirt, water/precipitation and other objects from getting into the tube. The tube(s) inner surface should be kept clean to protect the scanner head and for optimum image capture.
- The soil tube is typically installed at an angle (45-60°) to maximize root contact with the outer surface of the tube. The soil tubes may be installed in an upright vertical position as well as horizontal and/or various angular positions. To best prevent condensation from getting inside of the tube, install the tube at an angle if there is a chance of standing water collecting around the tubes.
- Temperature fluctuations may cause a normal amount of expansion and contraction in tubes and caps, potentially creating condensation. Condensation on the outside of the tube is reduced if the tube is almost completely underground (only about 1-cm above the ground surface). If noticeable condensation is forming on the inside of the root tube, consider putting a desiccant pack in the root tube.
- If necessary, to prevent sunlight from entering the tube and affecting root growth, users may paint or otherwise obscure the upper portion of the acrylic tube.
- The root tube should be inserted into the soil before crops are planted if you want to study root growth over a season. More tubes should be used in different locations of your experimental plot, depending on the purpose of your research.
- The slider rod connected to the scanner can be used as a measuring rod, with each section of the collapsible scanner being the equivalent of the scan window length. Using these marks, lower the scanner to the desired depth.
- In order to capture root images, the outer surface of the tube should be no greater than 8.0mm from the desired object being scanned. If the desired object is greater than 8.0mm from the outer surface of the tube, the image will be blurred or there will be a black image. This is the result of the image being beyond the scanner's focal range. In the case of the black image, the light from the scanner is not properly being reflected back to the scanner.

WARNING: ALWAYS PLACE THE CI-600 BACK INTO THE CARRYING CASE AFTER USE. DO NOT LEAVE THE UNIT IN TUBES, AS THIS WILL FLATTEN THE ROLLERS ON THE UNIT, CAUSING POSSIBLE MALFUNCTION..

Auger Usage

To create the hole for inserting the soil tube into the ground, use a gasoline powered auger, such as the EarthQuake Auger sourced by CID Bio-Science, Inc., or dig a hole by hand. Use the auger to remove just enough soil to slide the CI-600 root tube into the ground. Minimizing the soil disturbance directly around the root tube will decrease the length of time necessary to wait for soil and roots to grow around the tube.

CLEANING AND MAINTENANCE

To keep your CI-600 Root Scanner and computer clean, wipe the exterior with a slightly damp cloth. A mild detergent may be used if necessary. Do not use solvents of any kind. Clean the lens with a soft, non-abrasive cloth, using a small amount of commercial lens cleaning fluid if necessary.

WARNING: KEEP LIQUID, INCLUDING CLEANING FLUID, OUT OF THE LAPTOP COMPUTER'S KEYBOARD, SPEAKER GRILL, AND OTHER OPENINGS. NEVER SPRAY CLEANER DIRECTLY ONTO THE CI-600. NEVER USE HARSH OR CAUSTIC CHEMICAL PRODUCTS TO CLEAN THE CI-600.

PROTECT THE CI-600 BY AVOIDING THE FOLLOWING ENVIRONMENTAL HAZARDS...

- Dust and moisture.
- Liquids and corrosive chemicals.
- Equipment that generates a strong electromagnetic field, such as stereo speakers (other than speakers you have connected to the computer) or speakerphones.
- Rapid changes in temperature or humidity and sources of temperature changes such as air conditioner vents or heaters.
- Extreme heat, cold or humidity.

Root Tube Cleaning and Drying Accessory

The root tube should be dried of any condensation or moisture before the CI-600 root scanner is lowered into the tube. Clean and dry the tube using a microfiber cloth and the accessory attachment for the collapsible rod.

1. Twist the swab holder to the end of the collapsible slider rod and insert the cloth into the slot of the swab holder:



2. Lower the rod and cloth into the tube, ensuring that all sides of the tube are clean and dry.
3. Use as many sections of the rod as necessary to prevent any moisture from coming into contact with the CI-600.

USING ROOTSNAP! SOFTWARE

RootSnap! is a separate software program created at CID Bio-Science for root image analysis. It includes a user interface that employs a combination of advanced image analysis and a multi-touch LCD screen, which allows users to more quickly and easily trace roots using their fingers. Root tracing enhancements, such as the “Snap-to-Root” feature that “snaps” root tracing points to the center of the root automatically, removes hours of tedious point-by-point outlining of roots.

When the CI-600 is used to acquire images being analyzed with RootSnap!, there are several features that make the importing and analysis process easier and faster. First, always use the ICAP file-naming feature to save images. The ICAP naming system allows the user to scan, save and name images in any order and be organized for future analysis. Designating the root tube, window and session only takes a few seconds and automatically increased the session number when using the time lapse feature.

It is often asked whether to start taking root images at the top or the bottom of a root tube. It is recommended to start at the top of the root tube when taking images. First of all, this will allow the user to make the fewest possible scans while imaging to the lowest depth of the roots. Also, when images are imported into RootSnap, Window 1 is along the top layer of soil.

Make sure to always check the bottom of root tubes for standing water that could damage the CI-600 if lowered into it.

It is recommended to include overlap between scans to ensure all roots are fully imaged. Overlap can easily be removed using the RootSnap! analysis software. If using the collapsible indexing handle and tube cap to position the scanner depth, overlap will be included in images.

TROUBLESHOOTING

Technical Support

If you have a question about the CI-600 features or functions, first look in the CI-600 Operation Manual. There is also online support available for the CI-600 at <http://www.cid-inc.com/root-image/ci-600-support.php>. If you cannot find the answer, you can contact a Technical Support Representative located in your country. CID Bio-Science, Inc. is committed to provide customers with high quality, timely technical support. Technical support representatives are to answer your technical questions by phone or by e-mail at support@cid-inc.com.

Contact us at:

CID Bio-Science, Inc.
1554 NE 3rd Ave
Camas, WA 98607 USA

Phone: 800-767-0119 (U.S. and Canada)
360-833-8835
Fax: 360-833-1914

Internet: <http://www.cid-inc.com>
E-mail: support@cid-inc.com

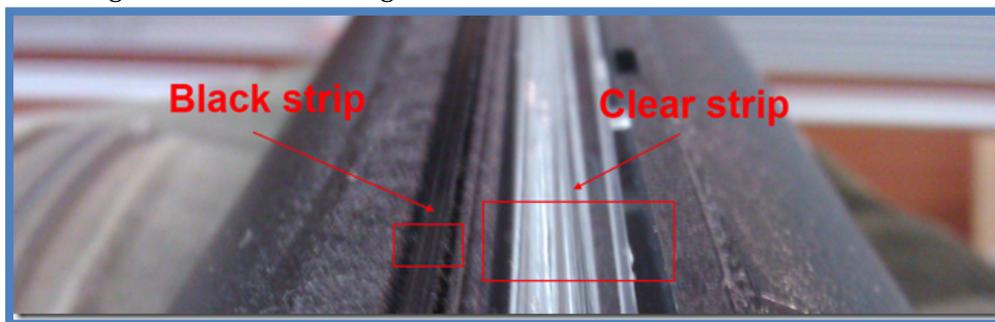
Customer Service

Customer Service Representatives answer questions about specifications and pricing, and sell all of the CID Bio-Science, Inc. products. Customers sometimes find that they need CID Bio-Science to upgrade, recalibrate or repair their system. In order for CID Bio-Science to offer these services, the customer must first contact us and obtain a Return Merchandise Authorization (RMA) number. Please contact a customer service representative for specific instructions when returning a product.

Frequently Asked Questions

If there are any questions about the CI-600, please check the Frequently Asked Questions below, as well as the CID Bio-Science support webpage at <http://cid-inc.com/support/ci-600-support>.

1. Where do I download the most current version of CI-600 software?
 - a. The latest version of software and the driver can be downloaded at <https://cid-inc.com/support/CI-600/software/>. Click the “Install” button to start the download. If prompted that the publisher is not verified, click Run or Install to continue the setup. Next, connect the CI-600 to the computer and install the driver in Setup>Advanced>Install Drivers.
 - b. Make sure to completely erase the old version of software and the driver before downloading version 4.
2. Where do I find a CI-600 64 bit driver?
 - a. The CI-600 driver is part of the software download for version 4.
3. Should the root tubes be installed vertically, horizontally or at an angle?
 - a. The angle the root tubes are installed will depend on the species and type of study (i.e. agriculture, forestry). Often, root tubes are installed at a 45° angle, especially when looking at fine root growth. However, a study by Villordon et al. (2011), found that vertically installed root tubes gave the best estimate of root growth and storage roots development in sweet potato, *Ipomoea batatas*.
4. Image Quality: What are the blurry lines in the root image?
 - a. Consistent image artifacts, such as blur lines, which do not disappear after calibration, are caused by physical artifacts. The scan head, including the black strip, should be carefully cleaned using a cloth and can of air. Also clean the root tube using the included cleaning accessories.



NOTE: Low battery life can also affect image quality. Ensure that battery power is adequate on the tablet or laptop you are using, as the LEDs on the scanner do not fully light up when battery life is low.

5. How often should I calibrate the CI-600?
 - a. The CI-600 requires calibration at least every 500 scans. However, it is recommended to calibrate the CI-600 using the white Calibration Tube if there is a

noticeable change in image quality. The CI-600 should always be calibrated in the white Calibration Tube after installing the software on a computer.

6. How do I check the calibration?
 - a. After calibrating the scanner in the white Calibration Tube, take a scan of the Calibration Tube. The image should be solid white and not have any blurred sections or lines.
7. Can the CI-600 be moved while it is scanning or calibrating?
 - a. It is NOT recommended to move the scanner ever when it is scanning, calibrating or when the motor is making noise. Always wait until the scanner is settled or completely done with the scan and has rotated to its original Home position before moving the CI-600.
8. Could I use the CI-600 to image root nodules?
 - a. The ability to quantify nodulation rate would depend on the size of the nodules. As long as the nodules are at least the size of fine roots, 1-2 mm, CI-600 will be able to detect them. Since the CI-600 images roots in direct contact with the root tube, the same would be true for nodules. The color contrast between roots, nodules and background soil will also affect the quality of images.
9. Could I cut the root tubes to my own custom length?
 - a. Be aware that to create a proper cut, you will need to have the tube cut using an electric miter saw. Hand cutting is not recommended as it results in cracks in the tubes. Cracks can allow moisture into the tube, which can harm the CI-600 and also affect image quality. Further, after proper cutting, at CID we use hand tools to polish the ends of the tubes to allow for a proper seating of the watertight end caps. For custom tube lengths, contact CID Bio-Science.
10. How do I access the log files for the CI-600 software?
 - a. To access the Log Files:
 - 1) Start the CI-600 software.
 - 2) Press Control + Escape at the same time (this launches the Task Manager).
 - 3) From the Task Manager, click on the Processes tab.
 - 4) Right click on CID.CI600.exe and select Open File Location (this launches the file browser)
 - 5) You should see several ApplicationLog and ErrorLog files.
11. How do I get my scans to line up in the tube?
 - a. The Tube Cap is marked with an arrow as a visual aid to indicate alignment with your marked home position on your root tube. You can mark your own 'Home' position on a clear root tube—typically facing down if the tube is installed at an angle—then the arrow will indicate 'this side up'.

- b. Make sure your scanner is rotated to the "HOME" position before inserting it in the root tube. The CI-600 begins a scan by rotating the scanner body to the "Home" position and then initiating the scan, and rotates back to the Home position after each scan (see the section in this manual). If the instrument is already in the Home position, it will not need to rotate before starting to scan. Ensuring that the instrument is in the Home position before scanning can eliminate scanning unintended areas and save time.
 - c. When calibrating the CI-600 in the white Calibration Tube, it is important to use the Home position for a proper calibration. Make sure to insert the scanner in the Calibration Tube properly by aligning the dots marking "Home".
12. What does it mean when I get an error with the error summary message in the .txt file: "The requested operation requires elevation"?
- a. Any errors with "The requested operation requires elevation" message means the user needs to turn off UAC. This is a work-around for a bug in the way the ClickOnce technology handles the requirement for administrator privileges. To do this:
 1. Press Start and type UAC in the search bar.
 2. Select "Change User Access Control Settings" and move the slider bar to the bottom (Never Notify).
 3. Restart the computer.
13. Where can I find the CI-600 driver?
- a. The CI-600 driver is part of the software download for version 4. If you have a Canon Driver installed, you will need to remove it with using the CanoScan utility at <http://www.cid-inc.com/Software/CI-600/DelDrv.exe>. You should choose Run and LiDE 20/30 when prompted.
14. What is the Windows 7 Run as Admin Fix for Software Version 3.1.21.1086?
- a. This issue has been fixed with version 3.1.22. Please upgrade your software.
 - b. There is a known problem with our automatic upgrade solution for the CI-600 for version 3.1.21. Due to changes in Windows our CI-600 app requires admin access. Without administrator access the calibration files cannot be written properly. Administrator privileges must be set manually on the CI-600 app's executable file. This can be done (on Windows 7) by following these instructions:
 - 1) Start the CI-600 app.
 - 2) Press Control+Shift+Escape at the same time to start the Task Manager.
 - 3) Click on the Processes tab.
 - 4) Right click on CID.CI600.exe in the list of Processes.
 - 5) Select Open File Location
 - 6) Right click on CID.CI600.exe and select Properties.
 - 7) Click on the Compatibility tab and check "Run this program as an

administrator”

8) Click OK.

15. My instrument keeps asking to be calibrated...
- If your instrument repeatedly asks to be calibrated or you notice a decrease in the number of scans taken between calibrations, first check the software version. Are you running the most current version (4) of software? If not, it is recommended to download and install the latest version of software and update the driver. Remember to uninstall the old software and driver first.
 - Disconnect and reconnect the instrument. Restart the computer. Calibrate the scanner.
 - Check the USB cable connection and cord. USB cables typically last only a few years, so replacing an old cable can affect scanner function. Is the USB cable connection on the instrument bent, crushed or corroded? Has it been exposed to moisture or condensation?
 - If there is not an improvement, contact support@cid-inc.com.
16. What does the “release the lock switch” error indicate?
- If you receive an error asking you to release the lock switch, you should update the software and driver of the CI-600. This error does not exist in new software and with new driver and calibration, the unit should function properly.
17. Where can I find a list of published articles referencing the CI-600?
- <https://cid-inc.com/applications/publication/>
18. If my CI-600 breaks, does CID Bio-Science provide loaner units during repair?
- If you are located within the United States, CID Bio-Science would be happy to provide a loaner CI-600 for use during any necessary repair. Please contact support@cid-inc.com for repair and loaner unit information. International loaner units will be provided on a case by case basis, depending on shipping costs and customs regulations.

Warranty Information

Seller's Warranty and Liability:

CID Bio-Science warrants new equipment of its own manufacturing against defective workmanship and materials for a period of one year from date of sale. The results of ordinary wear and tear, neglect, misuse, accident and excessive deterioration due to corrosion from any cause is not to be considered a defect.

CID Bio-Science's liability for repairing or replacing defective parts during the warranty period is contingent on examination by a CID Bio-Science authorized representative. Felix Instruments liability will not extend beyond repairing or replacing parts from the factory where they were originally manufactured. Repair or alteration by an unauthorized technician voids warranty.

Material and equipment which is not manufactured by CID Bio-Science is to be covered only by the warranty of its manufacturer. CID Bio-Science will not be liable to the Buyer for loss, damage, or injury to persons or to property by the use of equipment manufactured by other companies.

Buyer accepts the terms of warranty through use of this instrument and any accessory equipment. There are no understandings, representations, or warranties of any kind, express, implied, statutory, or otherwise (including, but without limitation, the implied warranties of merchantability and fitness for a particular purpose), not expressly set forth herein.

All instrument repairs or replacement covered under warranty require a Returned Material Authorization (RMA) number. Please contact CID Bio-Science technical support department at support@cid-inc.com to obtain an RMA number before shipping instrument to CID Bio-Science, Inc.

Buyer is responsible for shipping charges to CID Bio-Science headquarters:

1554 NE 3rd Ave.
Camas, WA 98607
USA

CID Bio-Science is responsible for return shipping charges on repairs and/or replacement covered by warranty.

PRODUCT TEST CHECK SHEET

CI-600 Serial Number:
RMA #
Computer Serial Number:
Computer Model No:
Windows Version:

Testing Function	Final
Clear Image Scanned	
Image Size Set: 8.5 x 7.7	
USB Cable Tested	
Scan Window Clean	

CI-600 Scanner Software Version:	Verified By:
Final Test Date:	Tested By:

Comments

WARRANTY REGISTRATION CARD



1554 NE 3rd Ave, Camas, WA 98607, USA
 Phone: (360) 833-8835 Fax: (360) 833-1914 e-mail: sales@cid-inc.com Web: www.cid-inc.com

PRODUCT REGISTRATION CARD

Please complete and return this form to CID within 30 days to validate your Warranty on Parts and Labor.

Registration Information:

Your Name: _____ Title: _____
 Company/University: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Country: _____ Email: _____
 Phone: _____ Fax: _____
 CID Serial Number(s): _____
 Purchase Date: _____ Purchase Price: _____

FOLD ON DOTTED LINE

Your opinions will help improve our service. Please answer the following questions.

1. What was the basis of your product selection?

- | | |
|--|---|
| <input type="checkbox"/> Representative Recommendation | <input type="checkbox"/> Price |
| <input type="checkbox"/> Product Features | <input type="checkbox"/> Product Design |
| <input type="checkbox"/> Technical Specifications | <input type="checkbox"/> Brand Name |
| <input type="checkbox"/> Warranty | <input type="checkbox"/> Service |
| <input type="checkbox"/> Other _____ | |

2. What other competing brands did you consider? _____

3. Where did you first learn of this product?

- | | |
|---|---|
| <input type="checkbox"/> Advertisement in _____ | <input type="checkbox"/> Representative |
| <input type="checkbox"/> Friend/Colleague | <input type="checkbox"/> Exhibit |
| <input type="checkbox"/> Other _____ | |

4. Who selected this product?

- | | |
|--|---|
| <input type="checkbox"/> I did | <input type="checkbox"/> Research Group |
| <input type="checkbox"/> University Department | <input type="checkbox"/> Purchasing |
| <input type="checkbox"/> Other _____ | |

5. Comments/Suggestions:

