



LI-3100C Area Meter

Instruction Manual

LI-COR[®]

Biosciences

LI-3100C Area Meter Instruction Manual

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Declaration of Conformity

Manufacturer's Name: LI-COR Inc.

Manufacturer's Address: 4421 Superior Street
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declares that the product

Product Name: Area Meter

Model Number(s): LI-3100C

Product Options: None

conforms to the following Product Specifications:

Safety: EN61010-1 : 1993
EN61010-1 : Amendment 1 : 1995

EMC: FCC CFR Part 15.109 Radiated Emissions, Class ?
FCC CFR Part 15.107 Conducted Emissions, Class ?

IEC 61326 : 1997/A2:2001 Radiated Emissions, Class ?
IEC 61326 : 1997/A2:2001 Conducted Emissions, Class ?
IEC 61000-4-2 : 1995/A2:2000: ESD, 8KV/15KV Contact/Air
IEC 61000-4-3 : 1995/A2:2000: Radiated RF Immunity, 10V/m
IEC 61000-4-4 : 1995/A2:2000: EFT/Burst

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC.



Dave Dilley
Director of Engineering

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December 1, 2003

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Specifications

Warranty



General Information

1.1 Instrument Function

The LI-3100C Area Meter is designed for biological, industrial, and other applications requiring rapid, precise area (length or width) measurements. Samples are placed between the guides on the lower transparent belt and allowed to pass through the instrument. As items travel under the 15 watt fluorescent light source, the object is reflected by a system of three mirrors to a solid state scanning camera within the rear housing.

Object width is sensed by the scanning camera. Length information is provided by the current frequency as related to the belt velocity.

Area integration is accomplished by components of the main printed circuit board mounted on the instrument rear plate (Figure 1).

Data are presented on the light emitting diode (LED) display. Decimal location on the display is changed to suit the 1.0 or 0.1 mm² resolution requirement (Section 4). Alternatively, data can be collected, displayed, and stored using a PC and the 3100-500 Windows Interface Software (Section 7).

1.2 Operational Features

The LI-3100C features interchangeable 1.0 mm² and 0.1 mm² resolution capability that is furnished with a single 28 mm camera lens. A 25 cm wide sample guide is provided for both 1.0 mm² and 0.1 mm² resolution configurations.

The upper belt assembly can be removed for operations hindered by the upper belt. Sample thickness can then be increased to 2.5 cm (Section 6.)



2

Pre-operation

The following procedures must be performed before using the LI-3100C for the first time:

- Tighten the transparent belts
- Install the 15 watt fluorescent tube
- Install the camera lens
- Set the voltage selector at the proper position and check to see if the correct fuse is installed

Each of these procedures is discussed below.

2.1 Rear Housing Removal

The rear housing must be removed in order to adjust the belt tension and to install the fluorescent tube. Using the 5/32" (4 mm) hexagonal key provided, remove the four retaining screws (one at each end, one at the center front edge on top, and one at the center bottom edge at the rear). Lift the housing from the instrument.

2.2 Transparent Belt Tension Adjustment

Perform the following steps to tighten the transparent belts:

- Loosen the large knurled knobs located on each sliding pulley bearing block. Rear sliding bearing blocks are visible in Figure 1. Front sliding bearing blocks are visible in Figure 2.
- Coarse adjustment is performed by simultaneously sliding both bearing blocks for one pulley. The knurled knobs can be tightened sufficiently by rotating them with the thumb and index finger while

holding tension on the bearing block with the remaining fingers of the same hand.

Fine adjustments are performed by twisting the block adjustment screw to push the sliding bearing block. The knurled knobs located on the pulley bearing blocks must be loosened to allow block movement.

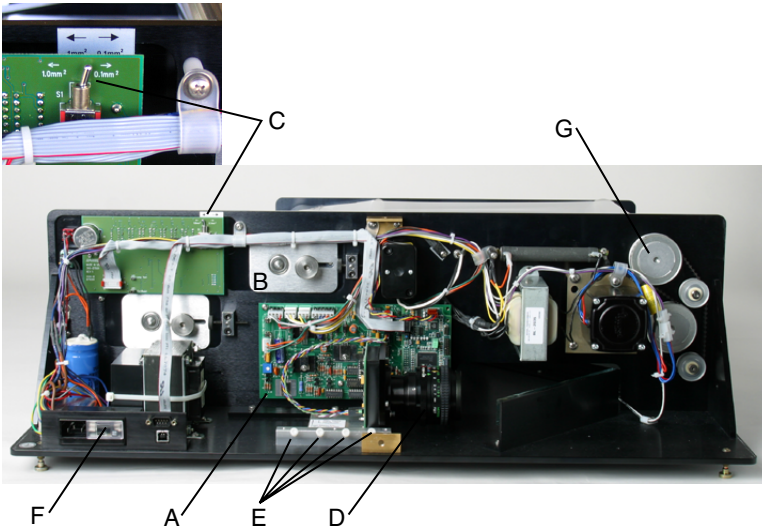


Figure 1. Area Meter with rear housing removed. (A) main printed circuit board, (B) rear sliding bearing blocks, (C) decimal selector switch set for 1.0 mm² or 0.1 mm² operation (inset), (D) 28 mm lens, (E) screws on the outer camera pressure rail, (F) slide this window to the left to inspect the voltage selector, (G) upper drive pulley gear.

2.3 Fluorescent Tube Installation

- Remove the rear tube connector housing by loosening the two recessed mounting screws (Figure 3).
- Hold the new tube vertically and gently tap it to cause any internal debris to collect at one end. Internal debris can cause spurious counting.

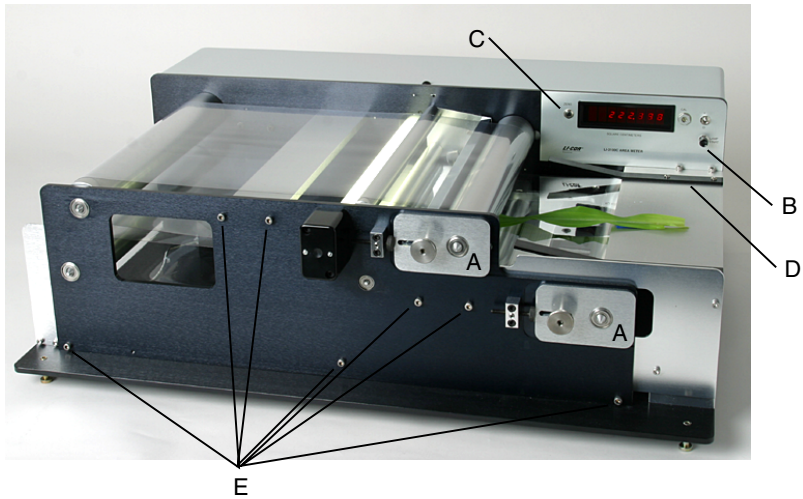


Figure 2. Area Meter in 0.1 mm² resolution configuration. (A) front sliding bearing blocks, (B) "Lamp Start" switch, (C) "Zero" button, (D) sample guides, (E) screws to be removed in order to detach the front panel.

- Slide the tube into the exposed hole in the instrument rear plate. Rotate the tube as needed until it seats in the front connector. Twist the tube slightly until it snaps into place. You may need to twist in either direction, depending on the tube's initial position in the front connector.
- Mount the rear connector housing over the exposed tube end.
- Gently twist the connector while holding the tube at the back edge of the upper belt. The rotation should be about 1/4 turn.

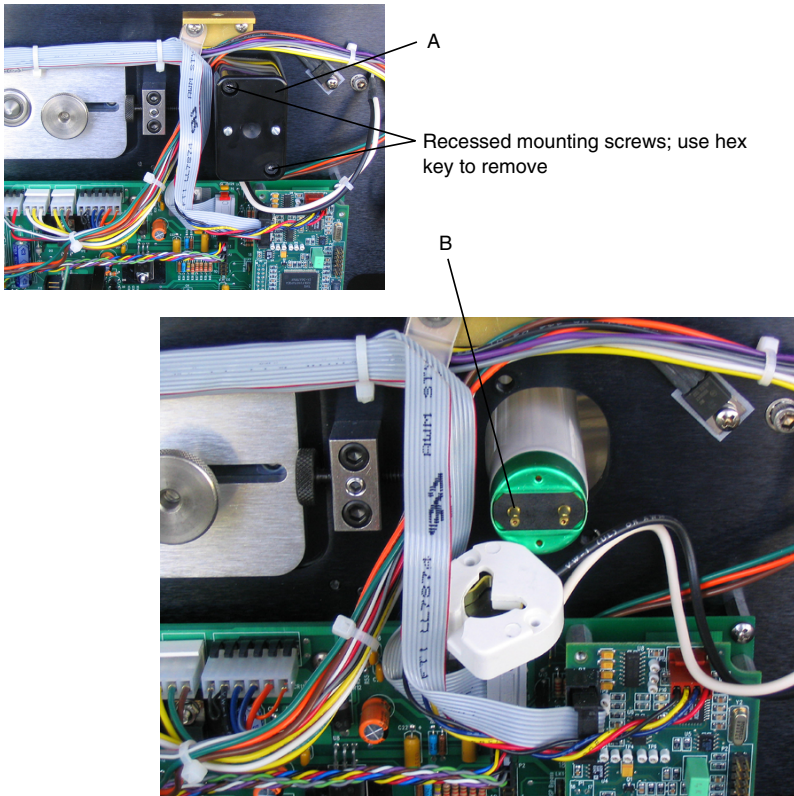


Figure 3. Area meter with fluorescent tube connector housing removed. (A) fluorescent tube connector housing. (B) fluorescent tube with exposed pins.

2.4 Camera Installation

- Unpack the camera. Do not remove the black light shield tape adjoining the camera circuit board.
- Loosen the outer camera pressure rail screws (Figure 1).
- Install the lens at the location appropriate to the resolution required. See Section 4 and Figures 2, 6 and 7.

2.5 Voltage Selector Operation and Characteristics

The voltage selector is located in the power connector module (Figure 1). The selector is inspected for proper voltage by sliding the clear plastic window to a position over the power connector. The visible number on the small printed circuit board located under the fuse indicates the selected voltage as follows:

either 100 or 120 V for 105-126 VAC operation
either 220 or 240 V for 210-252 VAC operation

Notice that the visible number is not the actual operating voltage. The instrument will *not* function on 100 VAC.

The voltage selector is changed by sliding the circuit board outward from its mount and repositioning it so that a different number is visible as appropriate to the available voltage.

The frequency usually changes from 60 to 50 Hz when the voltage is shifted from 120 to 240 VAC. This will change the instrument calibration approximately 0.5%. An instrument calibration should be performed after changing the voltage (Section 3.4).

At locations with fluctuating main current frequency, calibration should be checked often during operation.

The proper fuse selection is:
105-126 V, use 1 amp fuse
210-252 V, use 1/2 amp fuse



Operation

3.1 Instrument Activation

After reading and performing the procedures in Section 2, the following steps should be taken to activate the instrument:

- Connect the supplied power cord to the power input connector at the rear of the instrument. A grounded three prong wall connector is required for electrical service.
- Move the "ON/OFF" switch to "ON".
- Press the "Lamp Start" button (Figure 2) firmly and release after holding for approximately 2 seconds. If the fluorescent tube does not illuminate, repeat the procedure.
- Press the Zero button to clear the display (Figure 2).

3.2 Display Response

The display will rapidly accumulate numbers when the "ON/OFF" switch is placed in the "ON" position. This accumulation will continue until the fluorescent tube is activated. If numbers continue to accumulate, refer to Section 8.1 for possible remedies. Data accumulation may continue to occur if the fluorescent tube output is not sufficient, such as initial starting in extremely cold conditions. Excessively low line voltage is also a cause for continued rapid spurious counting. See Section 8.

3.3 Belt Tension and Tracking Adjustment

Belt tracking is adjusted by moving the sliding pulley bearing blocks (Figures 1 and 2). The belts likely will not maintain alignment without some adjustment. If a belt progresses toward one end of a pulley, then tighten that side of the belt. Fine adjustments are performed by twisting the block adjustment screw to push the sliding bearing block. The knurled knobs located on the pulley bearing blocks must be loosened to allow block movement.

3.4 Calibration

3.4.1 General Guidelines on the Need to Calibrate

- After installing a new lamp (let it run for several hours first)
- After replacing extremely worn or cloudy belts
- When a large change in ambient operating temperature occurs
- As a result of obvious misadjustment

CAUTION: Improper adjustment can seriously decrease the accuracy of finely detailed samples (see discussion below).

3.4.2 Some History

Two calibration discs were included with LI-3100 Area Meters so that users could make minor adjustments of area readout, using the CAL screw on the instrument front panel. The smaller disc was used with the high resolution option, as the larger disc would not fit between the 7.5 cm sample guides used for 0.1 mm² resolution. The calibration method involved repeatedly measuring the appropriate disc until the average error was less than 0.5 percent for high resolution, or 1 percent for low resolution.

Due to the optical characteristics of the lamp and lens, the discs read higher in the center of the measurement zone than nearer the sample guides, when the LI-3100 was configured for low resolution (1 mm²). However, samples that have a very high ratio of edge to area (i.e., conifer needles, small irregular leaves, roots, etc.) exhibited the

opposite effect. In addition, incorrect calibration resulted in larger errors with these samples.

The LI-3100C now uses the entire 25 cm measurement width for high resolution (0.1 mm²) mode, so it is important to compensate for the above-mentioned edge effect for the calibration procedure. While round discs like those previously used are simple to manufacture with a precise area, this shape has the least amount of edge (in this case circumference) compared to its area.

As a result, large changes could be made to the calibration adjustment with little effect on the resulting readout. A large adjustment that makes the average reading appear closer to the area of the round disc could now increase the errors in samples with a high ratio of edge to area.

To address this issue, LI-COR is providing a new style calibration plate with a higher edge to area ratio. The user will find that the calibration adjustment is very sensitive to small changes with this new calibration standard. This 10 cm² “edge-intensive” standard is run through the meter in a number of positions along the measurement width, after which the round calibration discs are run through in a similar fashion; the round discs should still produce results within the basic accuracy specifications. Thus, the user can view the response of the instrument to the different extremes of sample geometry, and is assured of a better calibration. In addition, for exacting measurements, the user can see which area of the measurement zone yields the highest precision and accuracy.

3.4.3 Calibration Procedure

1. Start the lamp and allow it to warm up for 5 minutes or more. Make sure that the camera position and lens settings match the marks indicated for 0.1 mm² resolution (see Section 4.2). If transparent belt flaws, or debris on the belt is causing spurious counts on the display, you may need to clean or replace the belt, as necessary.
2. Run the edge-intensive standard through the area meter at least 10 times, and average the readings. Repeat over all of the areas of the

sample width area. For example, use 5 zones from front to back, and repeat to total 10 readings. If the error exceeds 2%, carefully turn the CAL screw a small amount, clockwise to increase, or counterclockwise to decrease. Avoid changing the adjustment too much. It is better to perform several trials, as normal sampling statistics will cause each trial to vary slightly.

3. As a confirmation, perform the same 10 measurements with a round calibration disc. The errors should remain within the specified limits. It is not necessary to turn the CAL screw until the errors are zero; turning the screw more than a few degrees can actually increase errors in measurement accuracy.

3.5 Pressing Roller Adjustment

Curled leaves are effectively flattened and held rigidly between the transparent belts for more accurate measurements by use of the adjustable pressing roller. This is nearly essential for small grasses, legumes and aquatic plants.

In Figures 4 and 5, the front panel is removed to show mechanical details. The retracted position is for use with thick leaves. The fully raised position for use with the thinnest leaf types is shown in Figure 5.

To raise the pressing roller, the lower belt tension must be released to prevent stretching. To do this, simply loosen the knurled knobs on both sides of the sliding bearing blocks for the lower belt (Figures 1 and 2). Then loosen the knurled knobs on both sides of the pressing roller and raise to the desired position. After tightening the pressing roller, refer to Section 3.3 to adjust the lower belt to its proper tension and alignment.

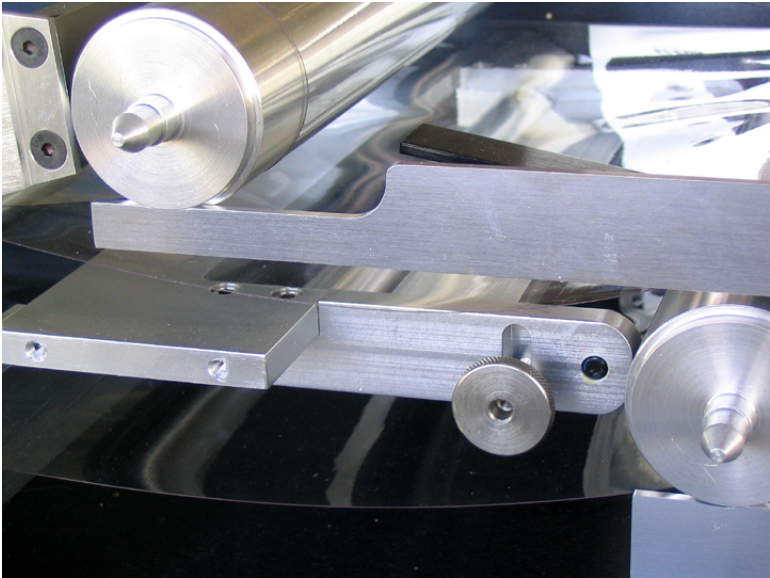


Figure 4. Adjustable press roller in the retracted position.

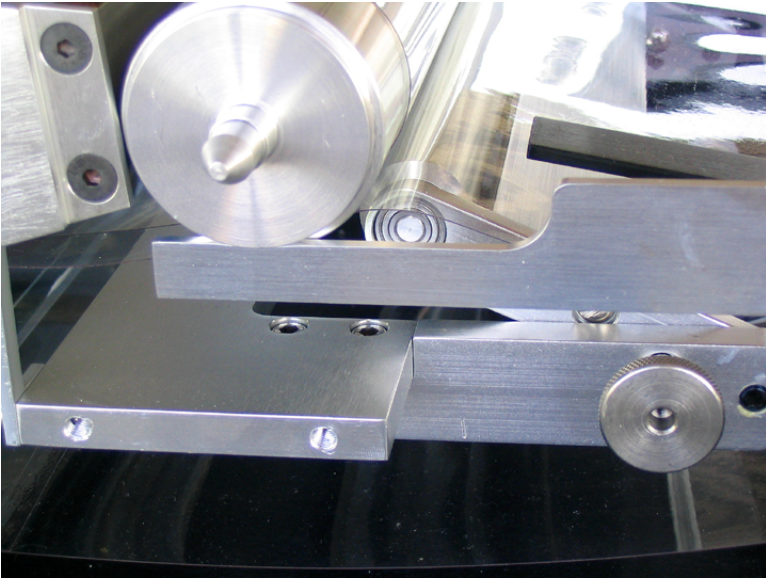


Figure 5. Press roller in position for use with thin leaves.



Changing Measurement Resolution

4.1 Choosing Measurement Resolution

The LI-3100C utilizes the full measurement width at all times, for both 0.1 and 1.0 mm² resolution. The 0.1 mm² resolution may be preferable, since it provides the best accuracy, particularly with small or complex shaped objects to 0.5 mm in width.

The 1.0 mm² resolution may be preferable where large samples are being measured, and the continuous buildup of debris on the belts causes excessive spurious counts.

4.2 Changing from 1.0 mm² to 0.1 mm² Resolution

The procedures for the resolution change are outlined in the following steps with Figures 1 and 6 as references.

- Disconnect the power.
- Remove the rear housing by removing the four retaining screws.
- Move the decimal selector switch to the 0.1 mm² position (labeled near the switch). This switch is located at the top right corner (as viewed from the rear of the display circuit board).
- Loosen all four set screws on the outer camera pressure rail.
- Align the red focus mark to the red lens index mark on the inner camera alignment rail.

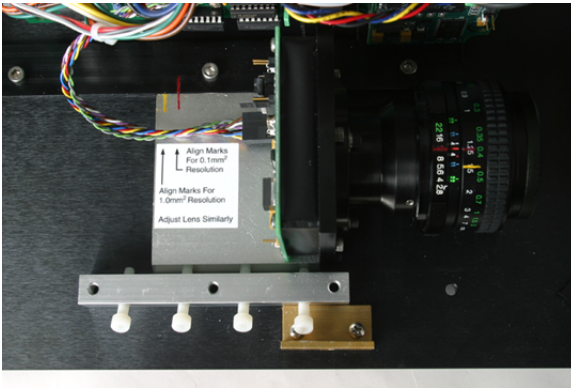


Figure 6. LI-3100C camera position configured for 0.1 mm² operation.

- Lightly tighten the set screws.
- Be sure that the lens cover has been removed and that no other obstruction is in the optical path.
- Replace the rear housing.
- Calibration should not be necessary; check the calibration if desired.

4.3 Changing from 0.1 mm² to 1.0 mm² Resolution

The procedures for resolution change are outlined in the following steps with Figures 1 and 7 as references.

- Disconnect the power.
- Remove the rear housing by removing the four retaining screws.
- Move the decimal selector switch to the 1.0 mm² position.
- Loosen all four set screws on the outer camera pressure rail.

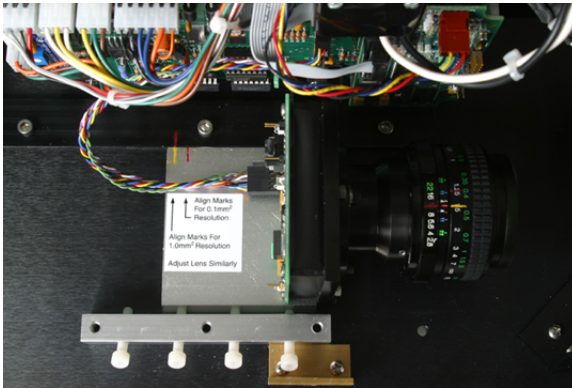


Figure 7. LI-3100C camera position configured for 1.0 mm² operation.

- Align the yellow focus mark to the red lens index mark.
- Lightly tighten the set screws.
- Be sure the lens cover has been removed and that no other obstruction is in the optical path.
- Replace the rear housing.
- Calibration should not be necessary; check the calibration if desired.



Maintenance

5.1 Changing the Fluorescent Tube

- Grasp the tube near each end by the edges of the upper transparent belt. Twist the tube 1/4 revolution to loosen it in the connectors.
- Remove the rear tube connector by loosening the two recessed mounting screws (Figure 3).
- Draw the tube out through the hole in the instrument rear plate.
- Install the replacement tube as described in Section 2.3.

5.2 Changing the Transparent Belts

5.2.1 Removing the Belts

The following steps are used to remove the transparent belts. An alternate technique is outlined below.

- Disconnect the power.
- Remove the rear housing (Section 2.2).
- Loosen the transparent belts (Section 2.3).
- Remove the fluorescent tube (Section 5.1).
- Separate the fluorescent tube power cord connector located near the instrument front plate and under the belt drive pulleys. This

connector may remain mated if the front plate can rest near the instrument without straining the cord (Figure 8).

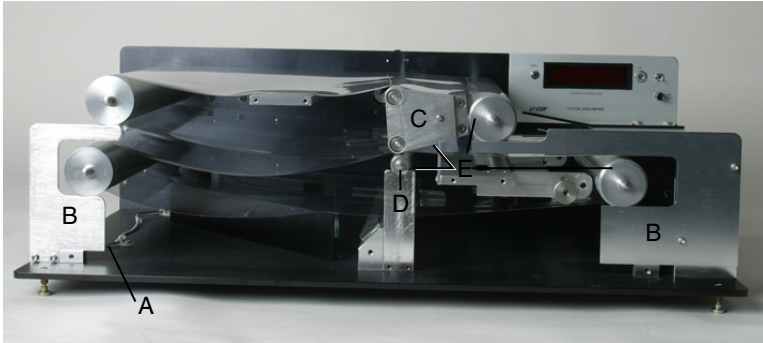


Figure 8. LI-3100C with front plate removed. (A) Fluorescent tube power connector, (B) pulley support brackets, (C) upper belt rocking idler, (D) lower belt idler, (E) proper location of pulley peripheral end grooves, lower belt idler peripheral end groove, and the end plate notch.

- Remove the hexagonal socket screws (7 total) which are directly contacting the instrument plate (Figure 2). Other similar screws are visible on the front of the instrument which fasten the pulley support brackets (Figure 8). Do not loosen those screws.
- Remove the front plate slowly, keeping it parallel to prevent binding on the shafts. Be certain that all pulleys and idlers remain in place, resting on the support brackets. This is accomplished by repeatedly pressing the pulleys and idlers back into their rear plate bearings.

Caution: Do not allow the upper belt rocking idler or the lower belt idler to drop onto the mirror located directly beneath these components.

- Draw the upper belt rocking idler and the lower idler outward to remove them.
- Slide the belts outward to remove them (Figure 9).



Figure 9. Upper belt rocking idler and lower belt idler removed. To remove the belts, draw them outward.

Caution: Do not exert excessive upward pressure on the drive pulleys as the belts are removed. This will bend the gear shaft which extends through the rear plate bearing.

5.2.2 Alternate Belt Removal Technique

Follow steps in Section 5.2.1 and then proceed with the following two steps.

- After the upper belt rocking idler and lower belt idler are removed, then the upper and lower pulleys near the sample tray can be removed (do not remove the drive pulleys). Grasp each pulley near each end when they are being removed because they are heavy. Dropping one end may cause severe damage.

- After the belts are placed over the drive pulleys, slide the upper and lower pulleys through the belts and insert the pulley shaft into the rear plate bearing. Be sure that the peripheral end groove is toward the front and that it rests in the pulley support bracket (Figures 7 and 8).

5.2.3 Replacing the Transparent Belts

- Slide the lower belt onto the pulleys. This requires repeated manipulation at the support brackets because these brackets partially obstruct installation. Then slide the upper belt onto the upper pulleys.
- Replace the lower belt idler. Be certain that the peripheral end groove is toward the front and rests on the idler support bracket (Figure 7).
- Replace the upper belt rocking idler. Be certain that the notch on the idler end plate rests on the rocking idler support post (Figure 7).
- Connect the fluorescent tube power connector if it was separated when the belts were removed.
- Replace the front plate. This requires repeated manipulation at the pulley and idler shafts to insure proper alignment into the front plate bearings.
- Replace all front plate screws.
- Install the fluorescent tube (Section 2.4).
- Tighten the transparent belts (Section 2.3).

5.3 Cleaning the Transparent Belts

Clean the belts with water and a cloth or absorbent paper. A detergent may be used for persistent contamination but do not allow detergent to fall on the mirrors. Any scrubbing of the mirrors to remove detergent spots may damage the mirror surface. Access to the lower belt is

facilitated by momentarily activating the "ON/OFF" switch to rotate the belt so that you can clean the portion of the belt that is near the sample tray. The inner surfaces are cleaned by reaching into the access ports in the front plate. Loosen the belts to facilitate cleaning the pulley surfaces.

5.4 Cleaning the Mirror or Camera Lens

If the mirror or the camera lens have to be cleaned, use the "blow brush" provided with the instrument. If persistent dirt remains on the mirror, use water and a soft absorbent paper such as lens paper.

5.5 Cleaning the Interior of the Camera

Cleaning within the camera housing is discouraged unless there is evidence of debris on the scanner (spurious counts). Removing the lens requires two retaining set screws to be removed first. ***Do not remove the three screws holding the lens base to the square plate.*** Loosen the screws on the outer camera pressure plate (Figure 1) and lift the camera from the rails to more easily inspect the interior. The camera remains connected so do not apply tension to the connection.

The rectangular sensitive device (Reticon) is visible at the interior rear of the camera housing. Any speck of dirt on this sensor will cause spurious counting. Use the "blow brush" provided to remove dust. Do not use a moist cloth to clean within the camera housing, as the adhesive dust retaining tape surrounding the Reticon and printed circuit board can be damaged.

5.6 Cleaning the Motor and Belt Drive System

The motor and belt drive system requires no routine service or lubrication. If excessive debris becomes embedded into the belt, it can be removed with a small stiff brush.



Removing the Upper Belt Assembly

6.1 Purpose

Some sampling requirements are better served by single belt operation. Under some conditions, the upper belt pressure may damage samples, or the upper belt rocking idler may cause undesirable mechanical pressure. Removing the upper belt pulley, drive pulley, and rocking idler will provide a more obstruction-free path through the sensitive area. The fluorescent tube must remain in place so sample thickness is limited to 2.5 cm (increased from 2.0 cm with upper belt assembly intact).

6.2 Removal Procedure

- Disconnect the power.
- Remove the rear housing (Section 2.2).
- Loosen the transparent belts (Section 2.3).
- Remove the fluorescent tube (Section 5.1).
- Separate the fluorescent tube power cord connector located near the instrument front plate and under the belt drive pulleys. This connector may remain mated if the front plate can rest near the instrument without straining the cord (Figure 8).
- Remove the hexagonal socket screws (7 total) which are directly contacting the instrument plate (Figure 2). Other similar screws are

visible on the front of the instrument which fasten the pulley support brackets (Figure 8). Do not loosen those screws.

- Remove the front plate slowly. Be certain that all pulleys and idlers remain in place, resting on the support brackets (Figure 8). This is accomplished by repeatedly pressing the pulleys and idlers back into their rear plate bearings.

Caution: Do not allow the upper belt rocking idler or the lower belt idler to drop onto the mirror located directly beneath these components.

- Remove the upper belt rocking idler.
- Remove the upper pulley.
- Remove the upper belt.
- Remove the upper drive pulley gear (Figure 3). A 7/64" (.278 cm) hexagonal key is required for the socket set screw. This key is not provided with the instrument. Then remove the upper pulley.
- Replace the front plate, connect the fluorescent tube power connector and replace the fluorescent tube.



Using the Windows[®] Interface Software

The 3100-500 Windows Interface software allows the use of a computer to monitor and record data generated by the LI-3100C. The 3100-500 software features:

- Display of individual area, leaf length, average width, and maximum width.
- Indicator for resolution setting on LI-3100C.
- Area counter reset, independent of LI-3100C LCD display.
- Readings can be stored in a log file. Elements of the log file include: individual area, maximum width, average width, length, and a running subtotal for area. The user can also enter optional remarks for each logged area value. The resulting data file can be opened by most common text editor or spreadsheet programs.
- Supports serial and USB connections.

7.1 Installing the PC Interface Software

The 3100-500 software CD is included with the LI-3100C. The software will run on Windows 98/NT/2000/XP. Both serial and USB connections are supported by the software. However, USB connectivity is supported only by Windows 98 Second Edition, 2000, and XP. You will need to install the appropriate USB drivers as described in Section 7.3 only if you are using a USB cable to connect to the LI-3100C.

An installation menu starts when the CD is inserted into the computer's CD-ROM drive. Select *Install Software* from the menu and follow the instructions. If the installation does not start, select *Run* from the Windows Start menu, and select the executable setup file on the CD.

When the software has finished the installation procedure, a program icon will be placed in the Programs menu.

7.2 Connecting the LI-3100C to a Computer

7.2.1 Serial Connection

The RS-232 serial cable included has 9-pin connectors on both ends; either end plugs into the serial connector on the back panel of the LI-3100C. Use this cable to connect to your computer's 9-pin serial port. If you want to interface to a computer with a 25-pin serial port, a 9-pin to 25-pin adapter must be used.

Turn on the LI-3100C. Start the lamp by pressing and holding the lamp button for a few seconds and then releasing.

Click on the LI-3100C program icon to start the program. The LI-3100C main window appears. Select **Connect** from the Connection menu, or click on the connect icon in the toolbar beneath the Connection menu. A connection dialog box will appear. Check "Serial", select the proper communication port number, and click **Connect**. Commonly, the PC's serial port is assigned to COM 1.

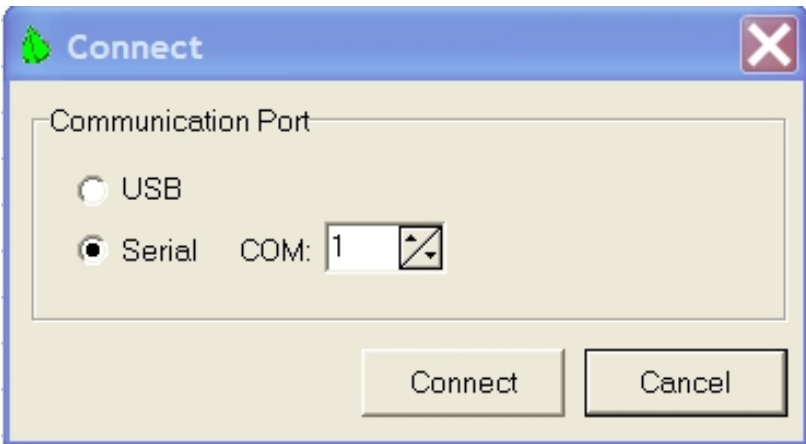


Figure 10. Connection dialog box.

If the instrument is connected properly, data will appear in the counter window when an object is passed through the meter.

7.2.2 USB Connection

Connect the USB cable (provided) to the LI-3100C USB port, located below the serial port on the back of the instrument. Connect the other end of the cable to the PC's USB port. Turn on the LI-3100C. Start the lamp by pressing and holding the lamp button for a few seconds and then releasing. The computer should find the new hardware and bring up a hardware installation wizard. Depending on the version of Windows operating system running on your computer, steps to navigate the New Hardware Wizard differ slightly. The following examples are for Windows XP, 2000, and 98:

Windows XP

1. Check "Install from a list or specific location." Click **Next** (Figure 11).

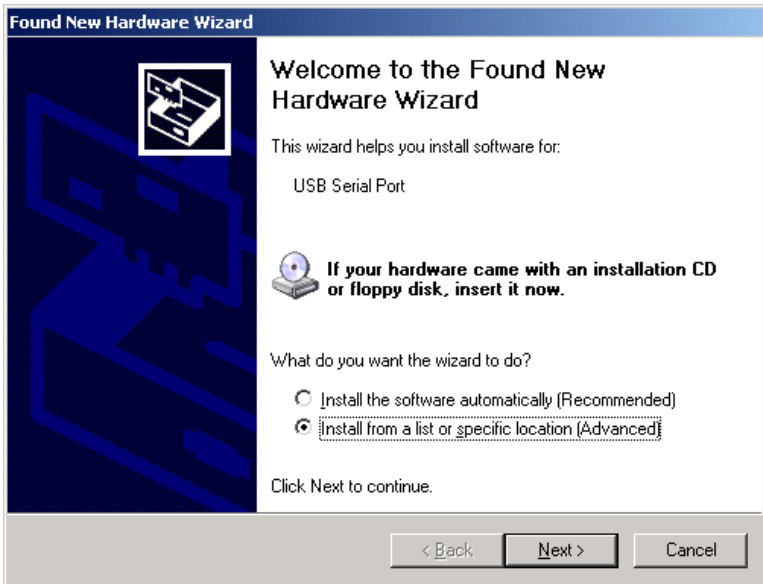


Figure 11. Windows XP New Hardware Wizard.

2. Check "Include this location in the search." Enter the path or browse to the drivers folder on the CD. (Figure 12).

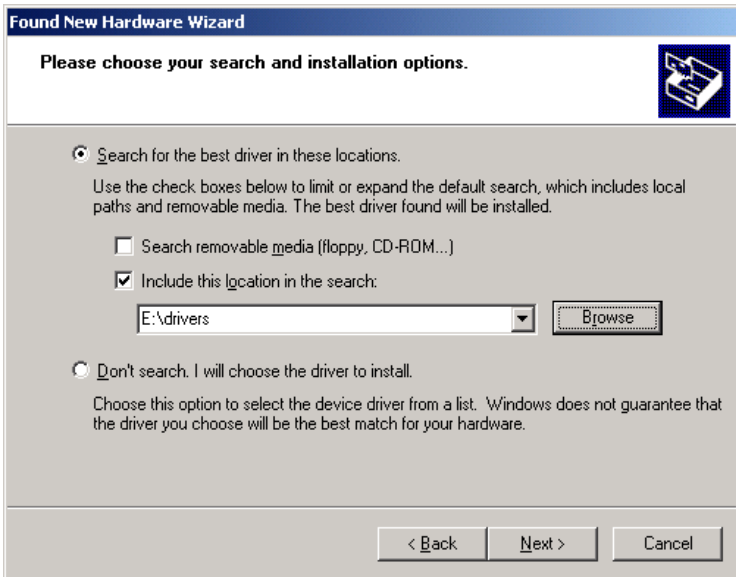


Figure 12. Specify location of driver.

3. When the warning window appears (Figure 13), click **Continue Anyway**.

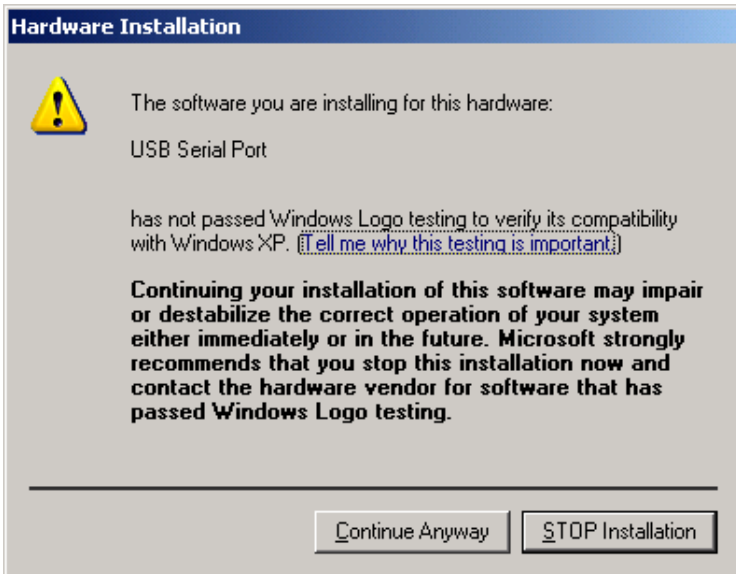


Figure 13. Compatibility warning window.

4. Click **Finish** to close the wizard (Figure 14).



Figure 14. Completion of Hardware Wizard.

5. Click on the LI-3100C program icon to start the program. The LI-3100C main window appears. Select **Connect** from the Connection menu, or click on the connect icon in the toolbar beneath the Connection menu. A connection dialog box will appear. Check "USB" and click **Connect**.

Windows 2000

1. New Hardware Wizard appears. Click **Next**. (Figure 15).



Figure 15. Windows 2000 New Hardware Wizard.

2. Check "Search for a suitable driver for my device." Click **Next**. (Figure 16).



Figure 16. Search for driver.

3. Check "Specify a location" (Figure 17).

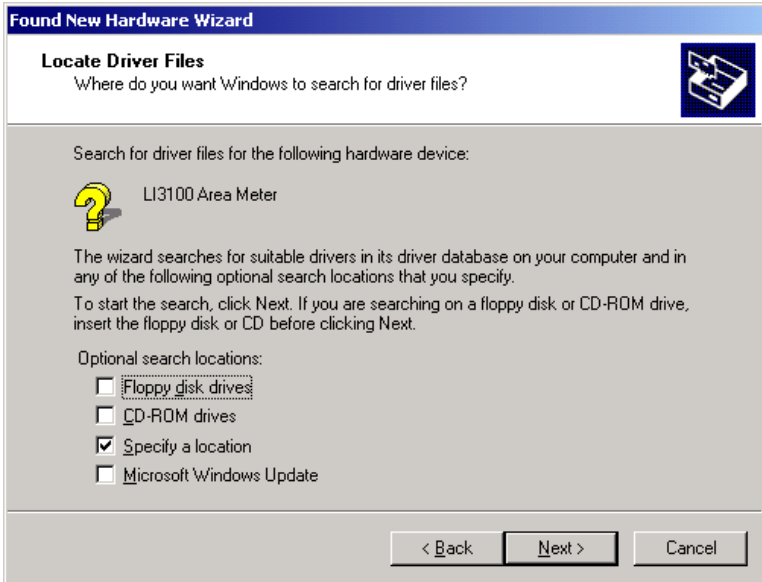


Figure 17. Specify location of driver.

4. Enter the path or browse to the Drivers folder on the 3100-500 CD. (Figure 18).

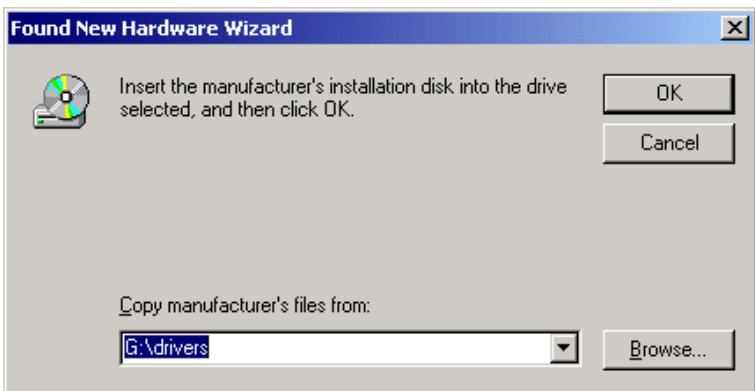


Figure 18. Enter path or browse CD.

5. Click **Next** (Figure 19).

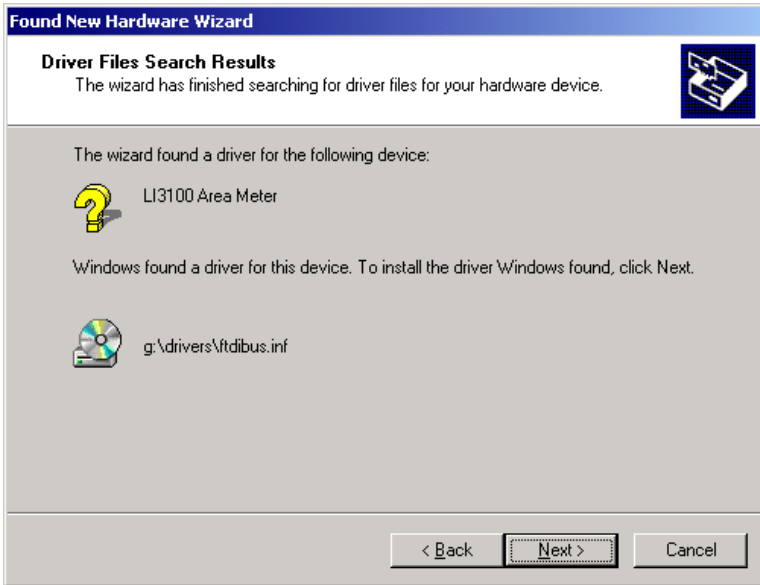


Figure 19. Driver search results.

6. Click **Finish** to close the wizard (Figure 20).



Figure 20. Completion of Hardware Wizard.

7. Click on the LI-3100C program icon to start the program. The LI-3100C main window appears. Select **Connect** from the Connection menu, or click on the connect icon in the toolbar beneath the Connection menu. A connection dialog box will appear. Check "USB" and click **Connect**.

Windows 98

1. New Hardware Wizard appears. Click **Next**. (Figure 21).

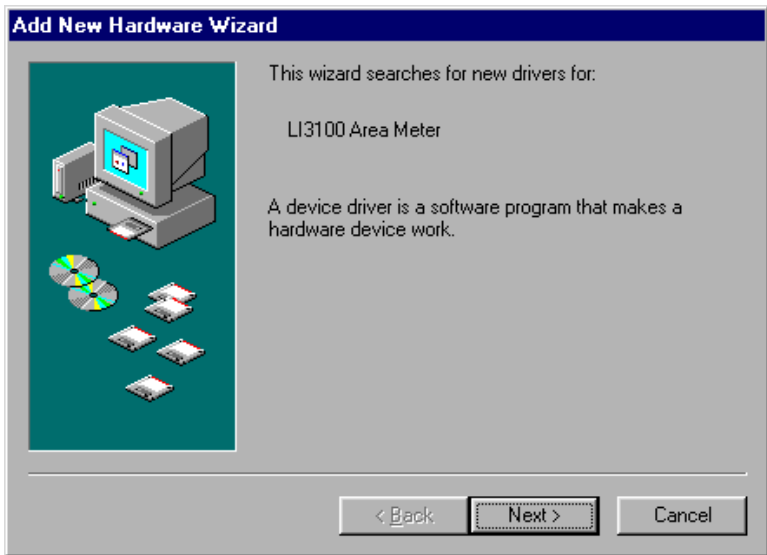


Figure 21. Windows 98 New Hardware Wizard.

2. Check "Search for the best driver for your device." Click Next. (Figure 22).



Figure 22. Search for driver.

3. Enter the path or browse to the *Drivers* folder on the 3100-500 CD. (Figure 23).



Figure 23. Specify location of driver.

4. Click **Finish** to close the wizard (Figure 24).



Figure 24. Completion of Hardware Wizard.

5. Click on the LI-3100C program icon to start the program. The LI-3100C main window appears. Select **Connect** from the Connection menu, or click on the connect icon in the toolbar beneath the Connection menu. A connection dialog box will appear. Check "USB" and click **Connect**.

If the instrument is connected properly, data will appear in the counter window when an object is passed through the meter.

7.3 Software Basics

The main window of the software features a real-time area display similar to the LCD display on the LI-3100C. Software also calculates maximum width, average width, and length of samples passed through the meter. These values are shown in the window to the left of the area counter, along with the selected resolution.

The PC area counter can be reset by the user - this also resets calculated values for width and length. Resetting the counter on the

software does not reset the counter on the LI-3100C. However, resetting the LI-3100C counter on the front instrument panel does reset the software counter.

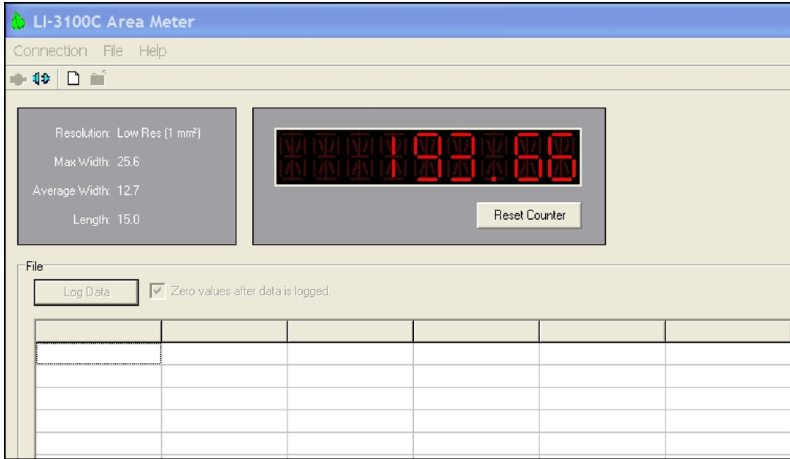


Figure 25. LI-3100C software, main window.

To disconnect the PC software from the LI-3100C, choose **Disconnect** from the Connection menu. Alternatively, click the Disconnect icon in the toolbar.

7.4 Creating a Log File

The logging feature writes data to a text file that can be opened by a text editor, or by a spreadsheet program such as Microsoft® Excel. To create a log file, select **Create new data file...** from the File menu, or click on the **New Data File** icon in the toolbar beneath the File menu.

A dialog box appears that requires a file name and path. Comments to be placed in the file header are optional. The user may choose to be prompted for up to three remarks each time an area is logged to the file. Columns for subtotal (of area), maximum width, average width, length, and average area may also be enabled. When all options have been selected, click on the **Create** button to open the data file.

Data File

File Name:

Destination: C:\Program Files\LI-3100C

Comments

Comments:

Data Fields

Prompt 1: Enable

Prompt 2: Enable

Prompt 3: Enable

Observation Number

Subtotal

Max Width

Average Width

Length

Average Area

Average the last observations.

Figure 26. New Data File dialog box.

The main window of the LI-3100C program contains a grid where a log file can be viewed as it is being created. Pressing the **Log Data** button will prompt the user for remarks (if enabled) and append a new row of data to the log file.

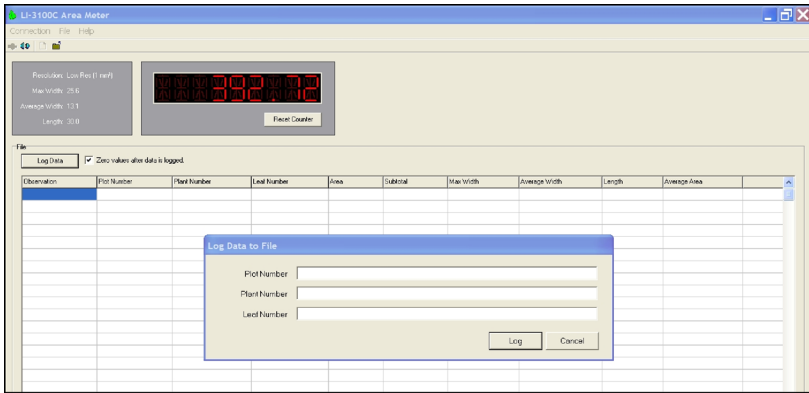


Figure 27. With prompts enabled, a prompt dialog box appears after the Log Data button is pressed.

Maximum width, average width, and length are calculated for the area of objects passed through the meter since the last time values were zeroed. The user may choose to zero the area counter and calculated values for width and length each time the **Log Data** button is pressed by checking the 'Zero values after Record' check box. Or, values can be manually zeroed by pressing the **Reset Counter** button under the software area counter.

The Subtotal column represents an accumulated value of all area values logged to the data file. The Average Area column shows the average for the last "n" area observations, selectable by the user in the New Data File dialog box.

| Plot Number | Plant Number | Lead Number | Area | Subtotal | Max Width | Average Width | Length | Average Area |
|-------------|--------------|-------------|---------|----------|-----------|---------------|--------|--------------|
| 1 | 4 | 1 | 274.992 | 458.546 | 12.7 | 12.1 | 22.6 | |
| 1 | 4 | 2 | 284.225 | 734.770 | 12.7 | 9.6 | 32.0 | |
| 1 | 4 | 3 | 175.865 | 910.635 | 9.7 | 4.6 | 38.9 | 245.0 |
| 1 | 4 | 4 | 230.230 | 1140.865 | 10.2 | 17.3 | 13.3 | |
| 1 | 4 | 5 | 389.275 | 1530.125 | 15.1 | 10.4 | 38.5 | |
| 1 | 4 | 6 | 88.169 | 1629.292 | 8.8 | 5.7 | 15.4 | 239.2 |

Figure 28. Grid on main window of the LI-3100C software, populated by data logged to an open log file.

To close the log file, select **Close data file** from the File menu, or click on the **Close Data File** icon in the toolbar beneath the File menu. The file is saved to the directory specified in the New Data File dialog box.

7.5 Missed Data Packets

Should there ever be a communication problem between the LI-3100C and the PC during operation, a red asterisk will appear to the right of the area display window on the LI-3100C software. This asterisk indicates that a data packet has been missed. The next time data is logged, a remark will be placed in the last column of the file indicating this. If the warning appears, it is best to disregard this row of data. Pressing **Log Data** or **Reset Counter** will remove the error warning, and measurements can continue as normal.

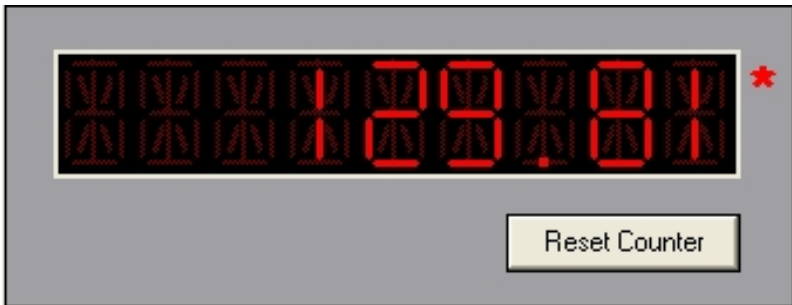


Figure 29. Red asterisk indicates a data packet has been missed.

7.6 Importing a Data File to a Spreadsheet

The data file can be imported into a spreadsheet such as Microsoft® Excel by using the Text Import Wizard. Excel will open a wizard dialog box when the LI-3100C data file is opened. The wizard prompts the user for information about the text file being opened. Be sure to indicate that the file is Tab Delimited, as shown in Figure 30.

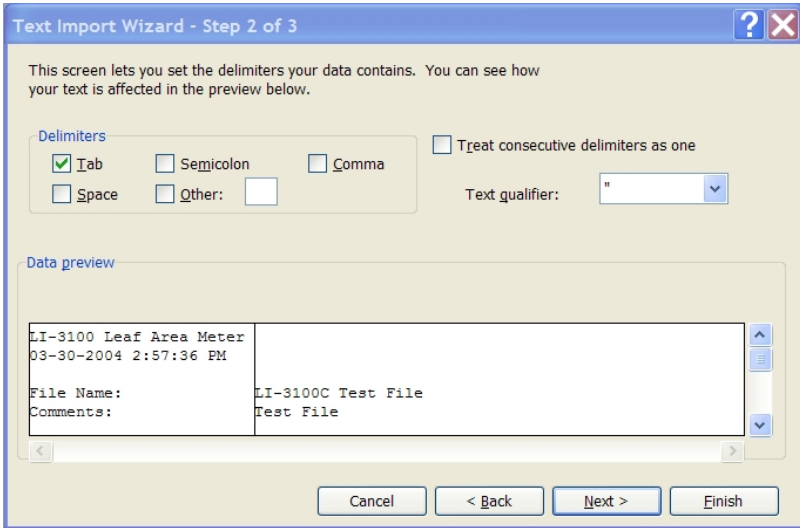


Figure 30. Microsoft Excel Text Import Wizard used to open LI-3100C data file.

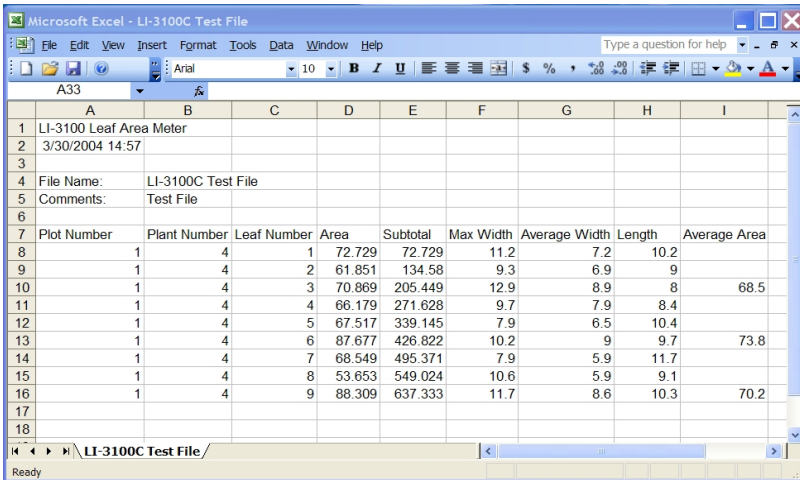


Figure 31. Example LI-3100C data file after being imported into a spreadsheet.

7.7 Using the LI-3000A Readout

The LI-3100C serial port can be converted to connect to the readout console of the LI-3000A Portable Area Meter for those users who desire this functionality (standard on earlier versions of the LI-3100). A gender-changing (male-female) straight-thru cable (not a null modem cable) connects the LI-3100C and 3000A-01. The ribbon cable plug on the serial communication daughter board must be moved to location P2 on the LI-3100C main circuit board. Contact LI-COR for details.



Troubleshooting

The sections below define several potential problems and lists several possible causes and their solutions.

8.1 Continuous Spurious Data Accumulation

- Lens cover has not been removed from the camera. Remove lens cover.
- Camera is at the wrong location. Check the actual camera position as described in Sections 4.1 and 4.2.
- Fluorescent tube not illuminated. Press "lamp start" switch and hold for 2 or more seconds.
- Fluorescent tube is cold. Wait until it warms up.
- Possible debris within the fluorescent tube. Remove the tube and perform the procedure in Section 2.4, step #2. Alternatively, tip the instrument to about 45° by raising the front end to slide the debris to the end of the tube.
- Low line voltage. Check it and provide proper voltage to the instrument.
- Belts are excessively dirty. Clean belts (Section 5.3).
- Mirror, camera, or detector (reticon) need cleaning. Clean according to Sections 5.4, 5.5.

- Obstruction in the optical pathway. Inspect the pathway and remove the obstruction.
- Calibration screw adjusted to be excessively sensitive. Note the original position of the screw and turn the screw counterclockwise until the displayed numbers remain constant. Return to the original position. Perform calibration as described in Section 3.4. If counts continue at an unacceptable rate, contact LI-COR.

8.2 Belts not Tracking Properly

If a transparent belt travels to one side of the pulley during operation, then the sliding pulley bearing blocks must be adjusted. Tighten the side toward which the belt is moving.

8.3 Fluorescent Tube Fails to Illuminate

- Not properly twisted into the connector. Twist into the connector (Section 2.4).
- Front tube power connector is not mated. Mate the connector (Figure 8).

8.4 Excessive Data Variability

- If samples are small or finely detailed, be sure to use 0.1 mm² resolution.
- Improper camera location. Check Sections 4.1 and 4.2 against the actual camera position.
- Intermittent obstruction causes spurious counting. See Section 8.1.

- Portions of the sample protrude beyond the sensitive zone as defined by the sample guides. Be sure that samples remain within the sensitive zone.
- Static electricity may be causing movement of dry samples. Wipe the belts with a damp cloth. Enclose the samples in a transparent sheath.
- Samples are not pressed adequately by the upper belt. Enclose samples in a transparent sheath. See Section 3.5.
- Low ambient temperature. Readings should stabilize within 1-2 minutes of instrument activation.
- The lens must be rotated to the entire extent of the screw threads. Attempt further rotation to insure proper mounting.
- A loose lower belt may not support the sample at the correct position. Check to see that the lower belt contacts the lower idler but does not sag on both sides of the idler.
- If the instrument is operated with the rear cover removed, an intense stray light beam may focus on the reticon sensor. In order for this to occur, an unlikely series of reflections must occur after light enters through some location on the camera housing.

8.5 Miscellaneous Malfunctions

Various types of problems occur if any of the connectors throughout the instrument lose contact. Inspect the connectors and press them together for better contact if necessary. Avoid reverse installation of connectors. Pin #1 is marked for installation into socket #1 of each connector.

Note that there is a 'Lamp Test' function on the display board that can be activated by connecting the 2 pins together momentarily.

8.6 Laboratory Conditions

Do not allow exposure to corrosive vapor. Many laboratory procedures cause excessive corrosive vapor concentrations as indicated by corroded connectors and other visible parts on many instruments in such laboratories. Malfunction due to such corrosion is not covered by warranty.

In conditions of very high electrical noise on the AC Mains power circuit, or improper chassis grounding (the 3rd terminal of the power cord), the auxiliary computer display and the LI-3100C display may differ by a small amount, for less than the basic accuracy.



Specifications

Resolution

1 mm² or 0.1 mm² (user-selectable).

Scanning Area

1 mm² Resolution: 1 mm × 1 mm.

0.1 mm² Resolution: 0.300 mm L × 0.33 mm W.

Accuracy

| | <u>Sample Area</u> | | | |
|---------------------|--------------------|-------------------|-------------------|---------------------|
| <u>Resolution</u> | 10 cm ² | 3 cm ² | 1 cm ² | 0.3 cm ² |
| 1 mm ² | ± 2% | ± 3% | ± 6% | ± 10% |
| 0.1 mm ² | ± 1% | ± 1.5% | ± 3% | ± 5% |

Combined accuracy and precision to 99% confidence with correct calibration on verifiable shapes. Accuracy can be increased by calibrating and using in a specific zone of measurement (e.g. the center). Samples with a high proportion of edges, such as conifers, roots, wires, etc. will raise uncertainties to 5% and more. Use only 0.1 mm² resolution for these types of samples.

Display Capacity

1 mm² Resolution: 999,999.99 cm²

0.1 mm² Resolution: 99,999.999 cm²

Display: Full 8-digit LED (light emitting diode).

Sample Dimensions

Width: 25.4 cm maximum; 1.5 to 3 mm minimum.

Thickness: Up to 2 cm, expandable to 2.5 cm by the user.

Length: Unlimited.

Conveyer Belt Speed: 8.0 cm s⁻¹ at 60 Hz; 6.7 cm s⁻¹ at 50 Hz.

Transparent Belts: Rugged clear vinyl.

Light Source: 15 watt fluorescent tube.

Power Requirement: 108-126/216-252 VAC, 48-66 Hz, 100 W max.

Operating Temperature: +15 to 55 °C.

Storage Temperature: -20 to 65 °C.

Size: 25.0 H × 60.0 W × 73.0 cm L (9.8" × 323.6 × 28.7")

Weight: 43 kg (95 lb.).

Warranty

Each LI-COR, inc. instrument is warranted by LI-COR, inc. to be free from defects in material and workmanship; however, LI-COR, inc.'s sole obligation under this warranty shall be to repair or replace any part of the instrument which LI-COR, inc.'s examination discloses to have been defective in material or workmanship without charge and only under the following conditions, which are:

1. The defects are called to the attention of LI-COR, inc. in Lincoln, Nebraska, in writing within one year after the shipping date of the instrument.
2. The instrument has not been maintained, repaired or altered by anyone who was not approved by LI-COR, inc.
3. The instrument was used in the normal, proper and ordinary manner and has not been abused, altered, misused, neglected, involved in an accident or damaged by act of God or other casualty.
4. The purchaser, whether it is a DISTRIBUTOR or direct customer of LI-COR or a DISTRIBUTOR'S customer, packs and ships or delivers the instrument to LI-COR, inc. at LI-COR inc.'s factory in Lincoln, Nebraska, U.S.A. within 30 days after LI-COR, inc. has received written notice of the defect. Unless other arrangements have been made in writing, transportation to LI-COR, inc. (by air unless otherwise authorized by LI-COR, inc.) is at customer expense.
5. No-charge repair parts may be sent at LI-COR, inc.'s sole discretion to the purchaser for installation by purchaser.
6. LI-COR, inc.'s liability is limited to repair or replace any part of the instrument without charge if LI-COR, inc.'s examination disclosed that part to have been defective in material or workmanship.

There are no warranties, express or implied, including but not limited to any implied warranty of merchantability of fitness for a particular purpose on underwater cables or on expendables such as batteries and lamps.

Other than the obligation of LI-COR, inc. expressly set forth herein, LI-COR, inc. disclaims all warranties of merchantability or fitness for a

particular purpose. The foregoing constitutes LI-COR, inc.'s sole obligation and liability with respect to damages resulting from the use or performance of the instrument and in no event shall LI-COR, inc. or its representatives be liable for damages beyond the price paid for the instrument, or for direct, incidental or consequential damages.

The laws of some locations may not allow the exclusion or limitation on implied warranties or on incidental or consequential damages, so the limitations herein may not apply directly. This warranty gives you specific legal rights, and you may already have other rights which vary from state to state. All warranties that apply, whether included by this contract or by law, are limited to the time period of this warranty which is a twelve-month period commencing from the date the instrument is shipped to a user who is a customer or eighteen months from the date of shipment to LI-COR, inc.'s authorized distributor, whichever is earlier.

This warranty supersedes all warranties for products purchased prior to June 1, 1984, unless this warranty is later superseded.

DISTRIBUTOR or the DISTRIBUTOR's customers may ship the instruments directly to LI-COR if they are unable to repair the instrument themselves even though the DISTRIBUTOR has been approved for making such repairs and has agreed with the customer to make such repairs as covered by this limited warranty.

Further information concerning this warranty may be obtained by writing or telephoning Warranty manager at LI-COR, inc.

IMPORTANT: Please return the User Registration Card enclosed with your shipment so that we have an accurate record of your address. Thank you.

LI-COR[®]

Biosciences

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