NEWTON
RESEARCH LABS

Software Component
Users Guide

S203-9400
Bottle Cap Defect Detection

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INTRODUCTION

Welcome to the Users Guide for your Newton Research Labs Software Component. You will find the simplicity and ease of use of this Software Component User Interface to be unparalleled in the machine vision field.

This guide covers the installation, set-up and use of Newton Labs Software Component **No. S203-9400**. The basic S203 Software Component has been optimized for Defect Detection with a Newton Labs Model 9000 series Vision System.

This Users Guide contains information on the following subjects:

STANDARD NEWTON LABS VISION SYSTEMS FEATURES

Settings for the **S203-9400** Software Component

IMPLEMENTED MODEL: 9400

Feature		Setting
Ethernet		*Not Implemented in this Software Component*
DB9 Serial RS232 Configuration Connector		Used in Set-up and Configuration Mode Need not be connected during operation
DB37 Digital Inputs		Inputs 1 – 3 for imager triggers
	Input 1	Imager 1 - Trigger
	Input 2	Imager 2 - Trigger
	Input 3	Imager 3 - Trigger
	Inputs 4-7	BCD switch inputs
DB37 Line Lock/Sync Input		*Not Implemented in this Software Component*
DB37 Digital Outputs		Used for reject signals
	Output 1	Reject output
DB37 Serial RS422 Data Output		*Not Implemented in this Software Component*
Newton Labs Imagers		Up to 3 Model 4160-IR Newton Labs Imagers
Imager Output		Up to 3 Imager Outputs available NTSC Format of raw video
Video Output		Shows vision system output **See Operator Control Page – Output Display Monitor**
Front Panel LEDs	Busy	Green after power on self-test
	Pass/Fail	Green after passed inspection, red after failed
	Sync/Trigger	Green when any trigger input is active

INSTALLATION AND SET-UP

SYSTEM REQUIREMENTS

Laptop or PC – Pentium 100 or faster, operating system Windows 95 or higher.

USER INTERFACE INSTALLATION

1. Start Windows.
2. Insert the Newton Labs Software Component CD-ROM into drive (*****).
3. Press Start on the Task bar and select Run.
4. From the Run dialog box, select (or type) (*****):\Setup and click OK.
5. Follow the screen instructions.

***** Insert your CD-ROM drive letter.

POWER UP DISPLAY

When the Newton Labs Vision System is first powered up, it will perform a self-test and feature detection. When the system has completed the self-test, the **BUSY** LED on the front panel will illuminate Green.

POWER FLUCTUATIONS

The Model 9400 Newton Labs Vision System requires relatively stable AC power. If the system is installed in an area where the AC power is not stable and is subject to severe fluctuations and/or discontinuity, the use of an Uninterruptable Power Supply may be required.

Should a rapid power fluctuation take place and the Newton Labs Vision System appears not to be operating correctly, turn off the main power switch on the front panel for 5 seconds and then turn the system back on.

QUICK START GUIDE

These directions assume use of a standard NTSC video monitor with BNC connector.

1. Connect laptop or PC to the Newton Labs Vision System and turn on the Vision System
2. Install Software Component on laptop or PC
3. Start Software Component

   The Software Component User Interface will automatically connect to the Newton Labs Vision System. If it does not connect:

   Go to *Connection Menu*

   1. Select **Configure–** Select Com Port.

   2. Select **Connect**

   3. If no connection is made after properly selecting the Com port, see Appendix A for help.

4. Go to the **Information Page**

   1. The Newton Labs Software Component will automatically confirm that the Software Component is the correct one for the connected Newton Labs Vision System
   2. If the information page does not show the correct serial number, you will not be able to continue. A display box will inform you of the conflict. Contact your Newton Labs Authorized Distributor to obtain the correct Software Component.

5. Attach and focus imagers

   1. Attach the imagers to Model 9400
   2. View the imager display in the **Configuration Page** for focus and imager placement.
   3. Alternatively, attach video monitor to the Imager Out connector. Use the monitor image to inspect imager output for focus and imager placement.

6. Go to the **Configuration Page**

   1. Select the first imager for set up.
   2. Select one of the four inspection parameters.
   3. Click on any one of the settings and note any highlighted yellow overlays on the image to the right (Cap Properties and Cap Location only).
   4. Type in values for each setting or click on the yellow overlays and drag the lines to the appropriate position. As needed, run known good and defective bottles through the system and note the values associated with each in order to attain proper settings.

7. Go to the **Operator Page**
    1. Select or deselect the desired inspections by clicking in the box for each.
    2. Select a preferred display
    3. Type in the desired delay and duration for the kick-out
    4. Set Cap Properties bridge per cap
    5. Set number of acceptable broken bridges

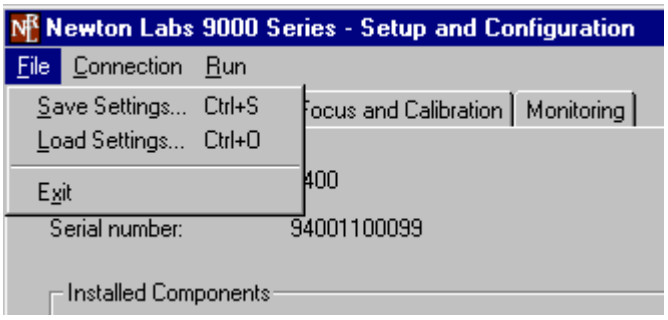
8. *File Menu* **Save Settings**

    Save to File

9. *Run Menu* **Start Running**
10. *Connection Menu* **Disconnect**
11. *File Menu* **Exit**

USER INTERFACE BASICS

FILE MENU

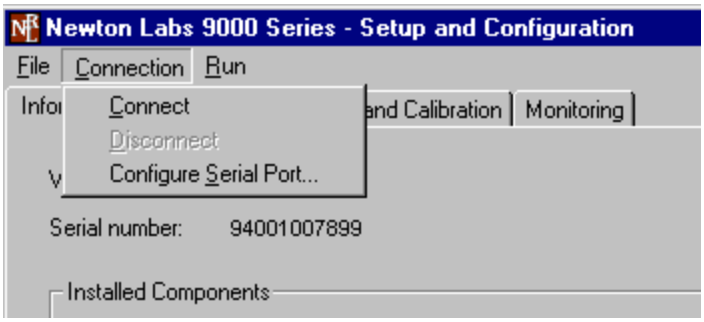


Save Settings–Saves currently selected settings to a file on the laptop or PC you are using. A dialog box will ask for a file name and location. It is highly recommended that you save the settings after a successful setup.

Load Settings–Opens previously stored settings file and loads those settings into the User Interface.

Exit–Closes the Software Component User Interface

CONNECTION MENU

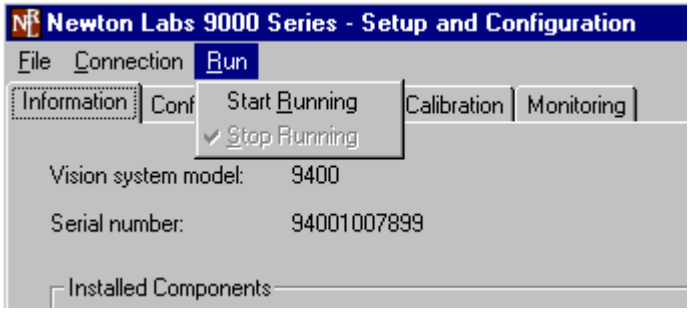


Connect–Connects the Newton Labs Software Component User Interface to a Newton Labs Vision System. *This option must be selected first in any setup session.*

Disconnect–Disconnects the Newton Labs Software Component User Interface from a Newton Labs Vision System.

Configure Serial Port–Select the communications port the Vision System is connected to.

RUN MENU



Start Running– Put the system in the running state. While running, the system will react to triggers by inspecting bottles.

Stop Running– Put the system in the not running state. While running, the system will not react to triggers. However, it will display real-time views from the three cameras on the video out monitor.

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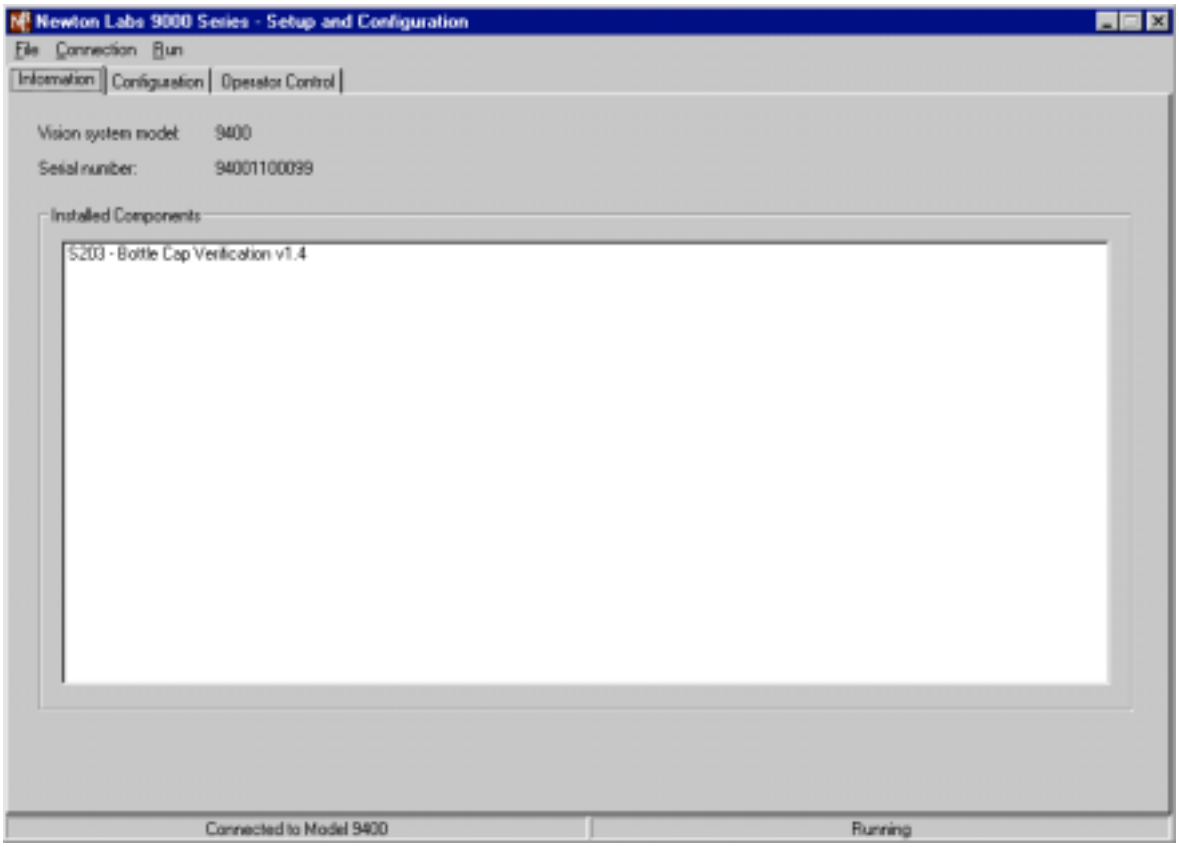
SYSTEM INFORMATION PAGE

- Vision System Model
- Serial Number
- Installed Components



Vision System Model

The Newton Labs Software Component User Interface reads and automatically identifies the Model number of Newton Labs Vision System to which it is connected.

Serial Number

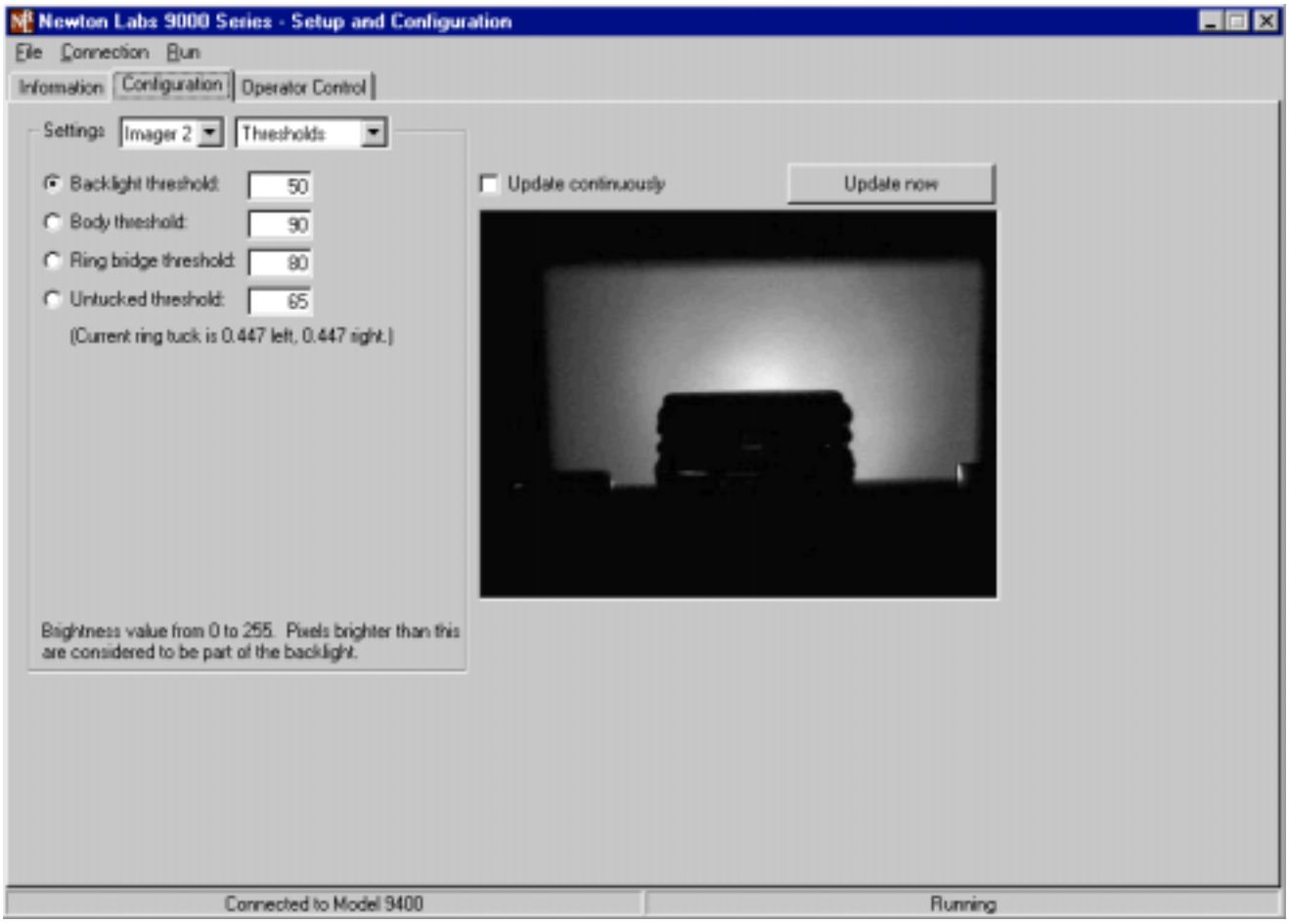
The Newton Labs Software Component User Interface reads and auto identifies the Serial number of Newton Labs Vision System to which it is connected. If the Software Component is not correct for that serial number, a display box will appear. Contact your Authorized Newton Labs Distributor for the correct Software Component.

Installed Components

Since many final applications require several Newton Labs Software Components, this table identifies which of the Newton Labs Software Components have been included in this application.

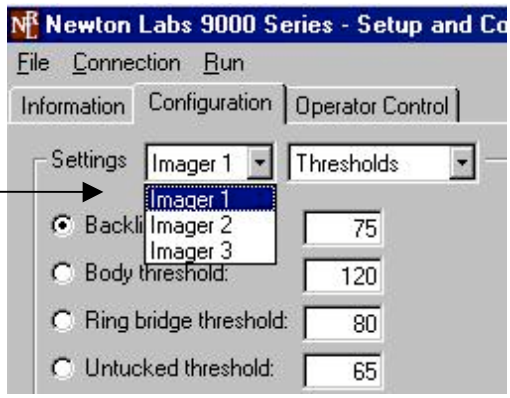
CONFIGURATION PAGE

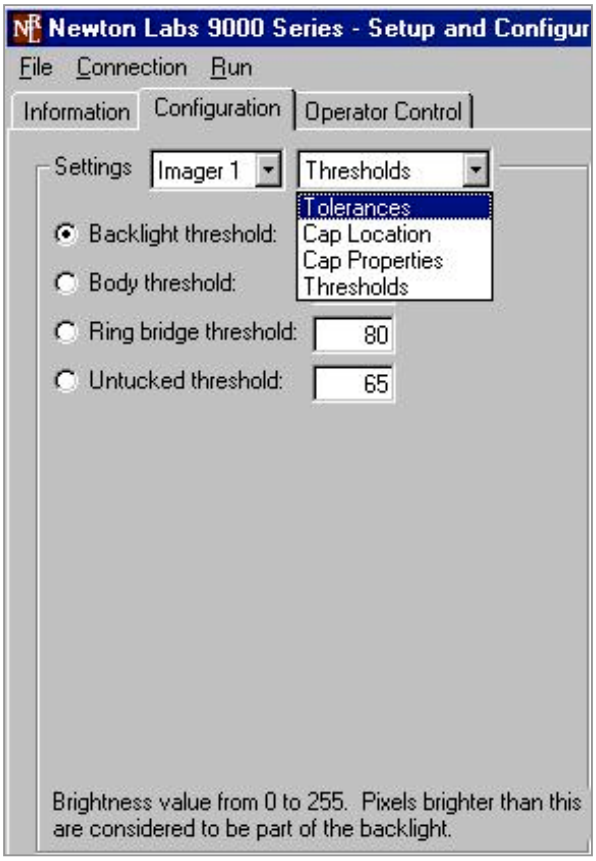
The Configuration Page allows the integrator to easily set up and define the inspection settings for each imager.



CONFIGURATION PAGE CONT.

Specify one imager (of the three) at a time before adjusting settings for each



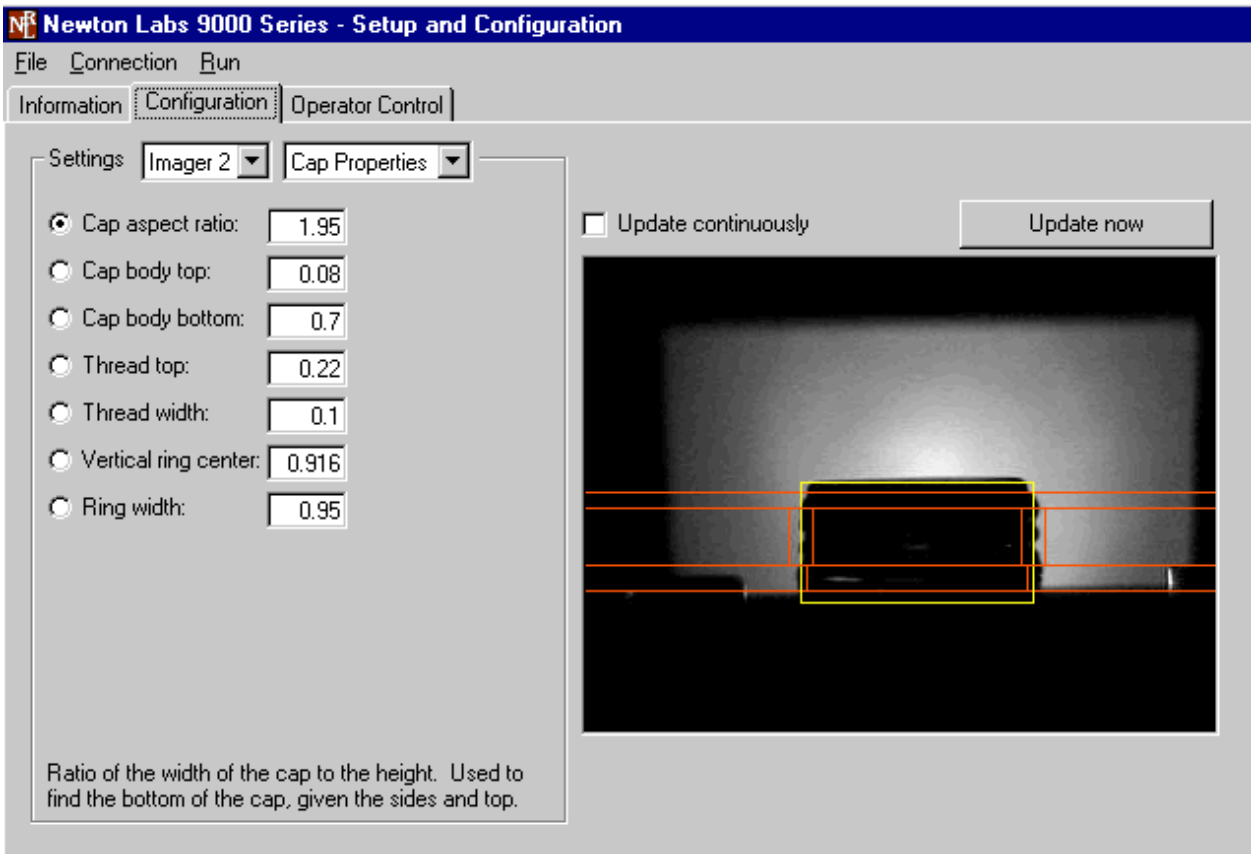


Select each of the four configuration parameters (one at a time) for each imager. Each page has a unique set of user definable settings values to set and adjust as needed for optimum performance.

The definition of each parameter setting is displayed here once selected

CONFIGURATION PAGE: CAP PROPERTIES

Cap Properties settings pertain to the proportions of the cap.
Red lines in the imager view indicate the extent of the settings on the current page, given the current imager view. The selected setting will be displayed in yellow; you can change this setting graphically by clicking and dragging in the imager view.



Cap Aspect Ratio is the ratio of the width of the cap to the height. It is used to find the bottom of the cap, given the sides and top. It affects the meaning of the other settings on the page, so ensure that the aspect ratio is correct before changing the other settings.

Cap Body Top is the Y coordinate (as a fraction of the cap height) of the top portion of the cap to inspect for cut threads. If this number is too small, reflections off the top edge of the cap or the profiled top edge of the cap may be interpreted as cut threads. If this number is too large, cut threads near the top of the cap may be missed.

Cap Body Bottom is the Y coordinate (as a fraction of the cap height) of the bottom portion of the cap to inspect for cut threads. This should be just above the tamper-evident ring. If this number is too large, the tamper evident ring slits may be interpreted as cut threads. If this number is too small, cut threads near the bottom of the cap may be missed.

CONFIGURATION PAGE: CAP PROPERTIES CONT.

Thread Top is the Y coordinate (as a fraction of the cap height) of the top of the threads to inspect for thread defects. This should be the top of the zone in which the threads are consistently formed.

Thread Width is the thread width as a fraction of cap width. This should be just wide enough to cover the entire thread region. It is used to find thread defects and to avoid looking for cut threads too near the edge of the cap. If thread width is set too small, normal threads may be misidentified as defective and the profile of the threads may be misinterpreted as cut threads. If this number is too large, cut threads near the edge of the cap view may be missed.

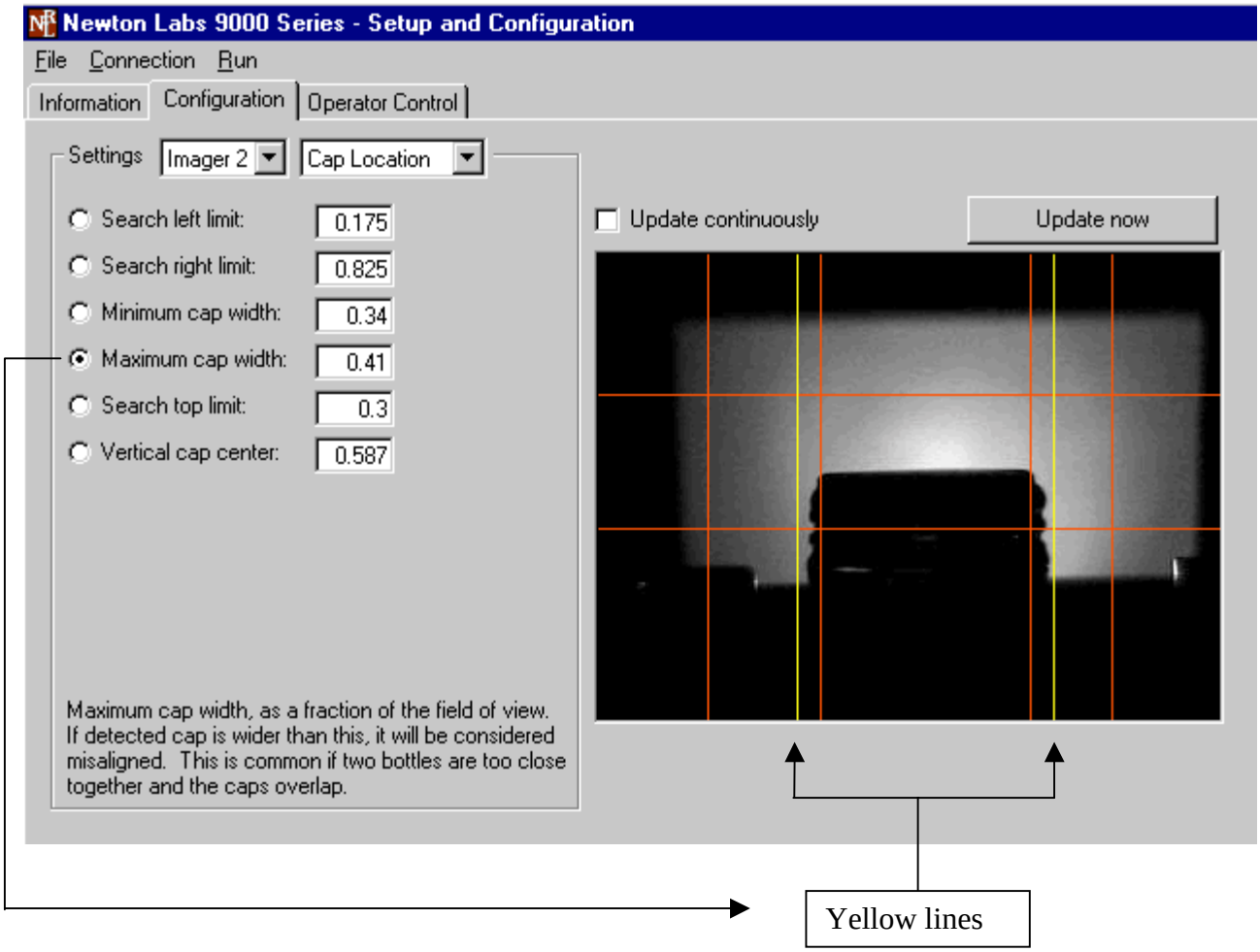
Vertical Ring Center is theY coordinate (as a fraction of the cap height) which lies in the middle of the tamper-evident ring. It must be fully below the tamper evident ring slits. If it is too high or too low, broken bridges may be misidentified.

Ring Width is the width (as a fraction of cap width) of the portion of the cap to inspect for broken bridges. This should be as wide as possible without possibly overlapping cap threads. If it is too small, broken bridges near the edge of the view may be missed. If it is too large, the profile of the cap threads may confuse the broken bridge inspection.

CONFIGURATION PAGE: CAP LOCATION

Cap Location pertains to the width and location aspects of the cap.

Red lines in the imager view indicate the extent of the settings on the current page, given the current imager view. The selected setting will be displayed in yellow; you can change this setting graphically by clicking and dragging in the imager view.



Search Left Limit is an X coordinate (as a fraction of the field of view) which will always be left of the left edge of the cap, but within the backlit region. If this coordinate is too large and overlaps the cap, the cap will be considered misaligned. If this coordinate is too small and extends outside the backlit area, valid caps may be considered misaligned.

Search Right Limit is an X coordinate (as a fraction of the field of view) which will always be right of the right edge of the cap, but within the backlit region.. If this coordinate is too small and overlaps the cap, the cap will be considered misaligned. If this coordinate is too large and extends outside the backlit area, valid caps may be considered misaligned.

CONFIGURATION PAGE: CAP LOCATION CONT.

Minimum Cap Width is the minimum width as a fraction of the field of view. If detected cap is narrower than this, it will be considered misaligned.

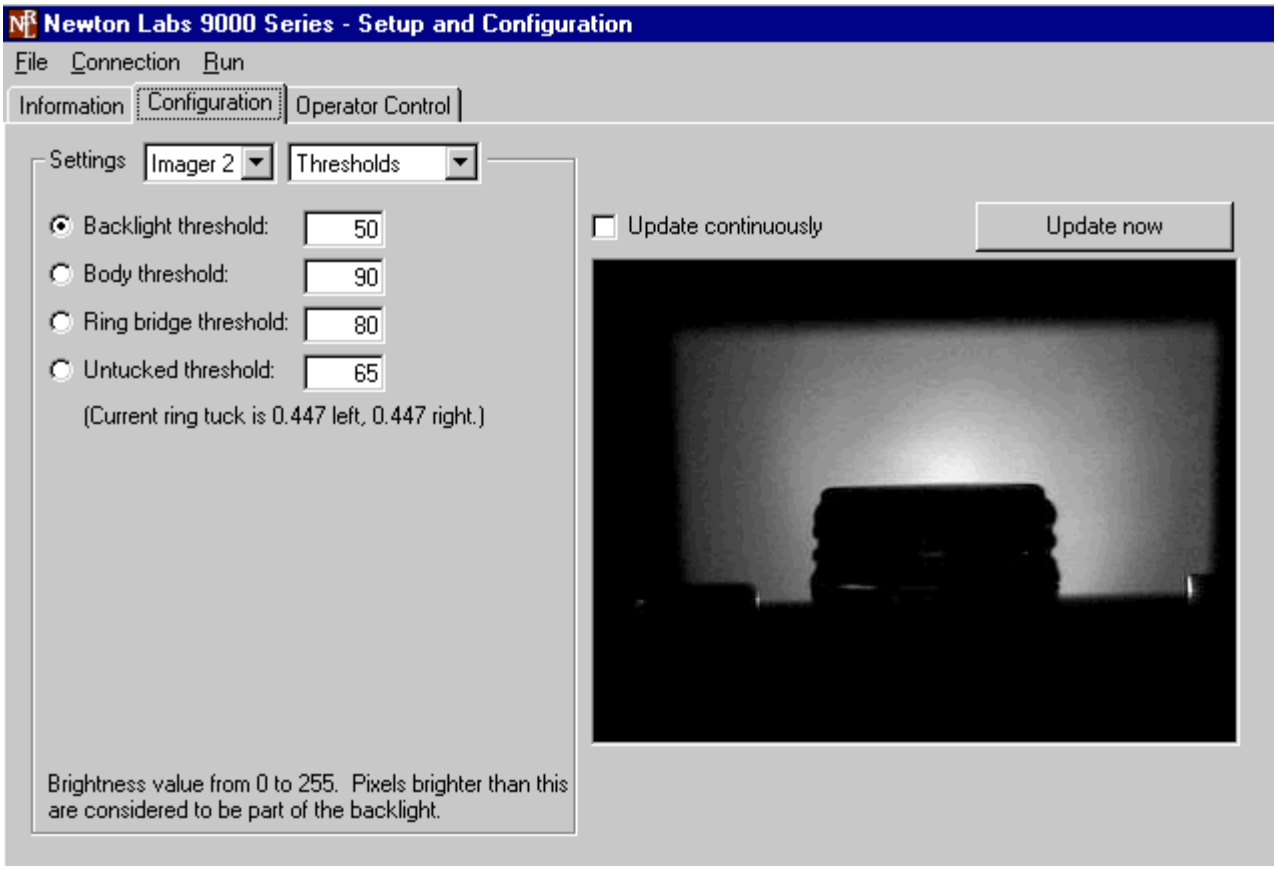
Maximum Cap Width is the maximum width as a fraction of the field of view. If the inspected cap is wider than this value, it will be considered misaligned. This can occur when two bottles are too close together and the caps overlap.

Search Top Limit is the Y coordinate (as a fraction of the field of view) which will always be above the top of the cap. If this coordinate overlaps the cap or extends above the backlit area, the cap may be considered misaligned.

Vertical Cap Center is the Y coordinate (as a fraction of the field of view) which will always overlap the cap. If the cap does not overlap this coordinate, it will be considered misaligned. This coordinate should lie near the middle of the threaded region of the cap.

CONFIGURATION PAGE: THRESHOLDS

Thresholds pertains to the grayscale representation of the cap and background.



Backlight Threshold is a brightness value from 0 to 255. Pixels brighter than this value are considered to be part of the backlight. If this value is too low, the size of the cap may be incorrectly identified and valid caps may be reported as misaligned.

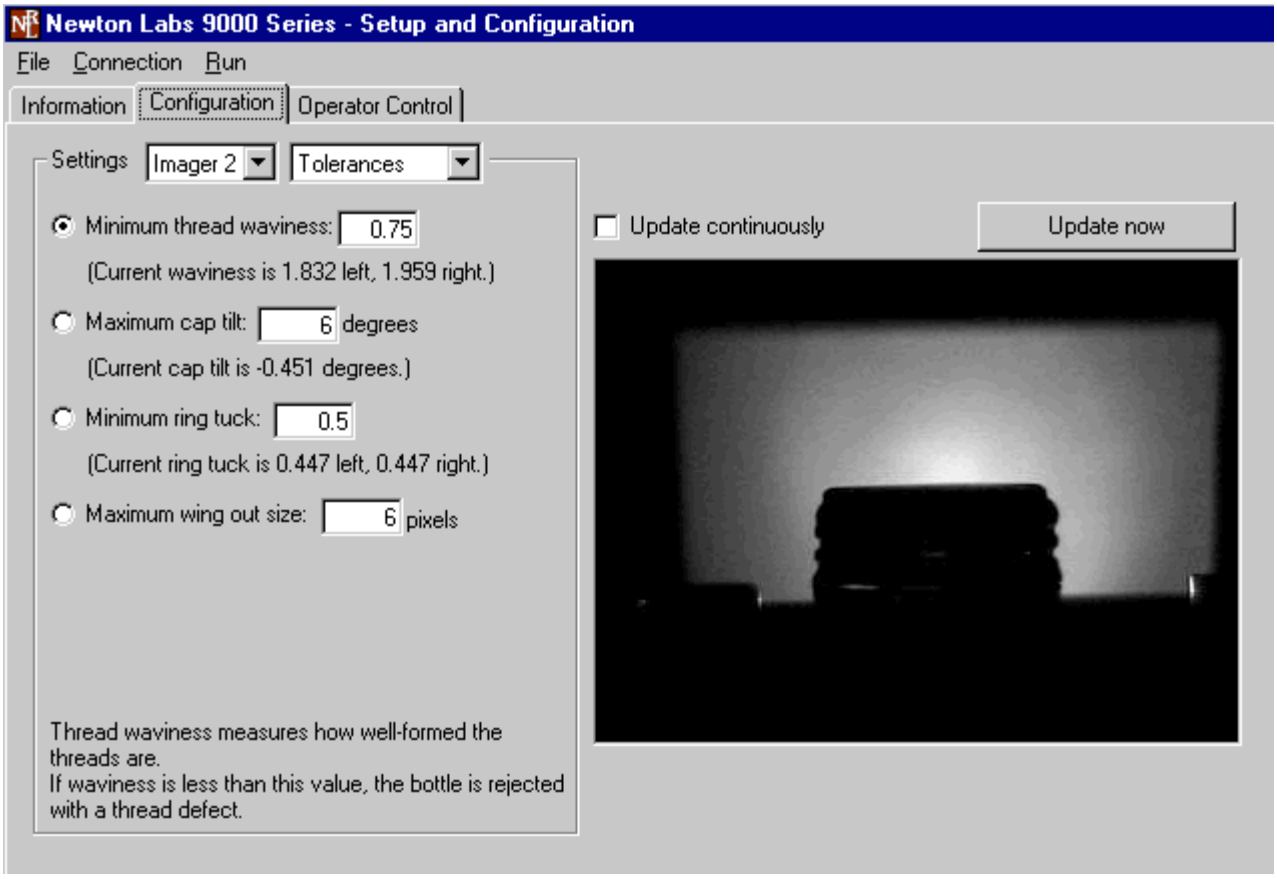
Body Threshold is a brightness value from 0 to 255. Pixels brighter than this within the cap are considered to be cut threads. If this value is too low, highlights or reflections on the cap may be misidentified as cut threads. If this value is too high, cut threads may be missed.

Ring Bridge Threshold is a brightness value from 0 to 255. Pixels brighter than this are considered to be part of the tamper-evident ring slits. If this value is too low, undamaged tamper evident rings may be rejected with broken bridges. If this value is too low, broken bridges may be missed.

Untucked Threshold is a brightness value from 0 to 255. Pixels darker than this are considered to be part of the cap when inspecting for untucked caps. If it is too high or low, untucked caps may be misidentified.

CONFIGURATION PAGE: TOLERANCES

Tolerances pertains to the minimum and maximum acceptable defect measurement.



Minimum Thread Waviness measures how well formed the threads must be. If waviness is less than this value, the bottle is rejected with a thread defect. Pass several good and defective bottles through the system and observe the current waviness values to determine a good minimum waviness.

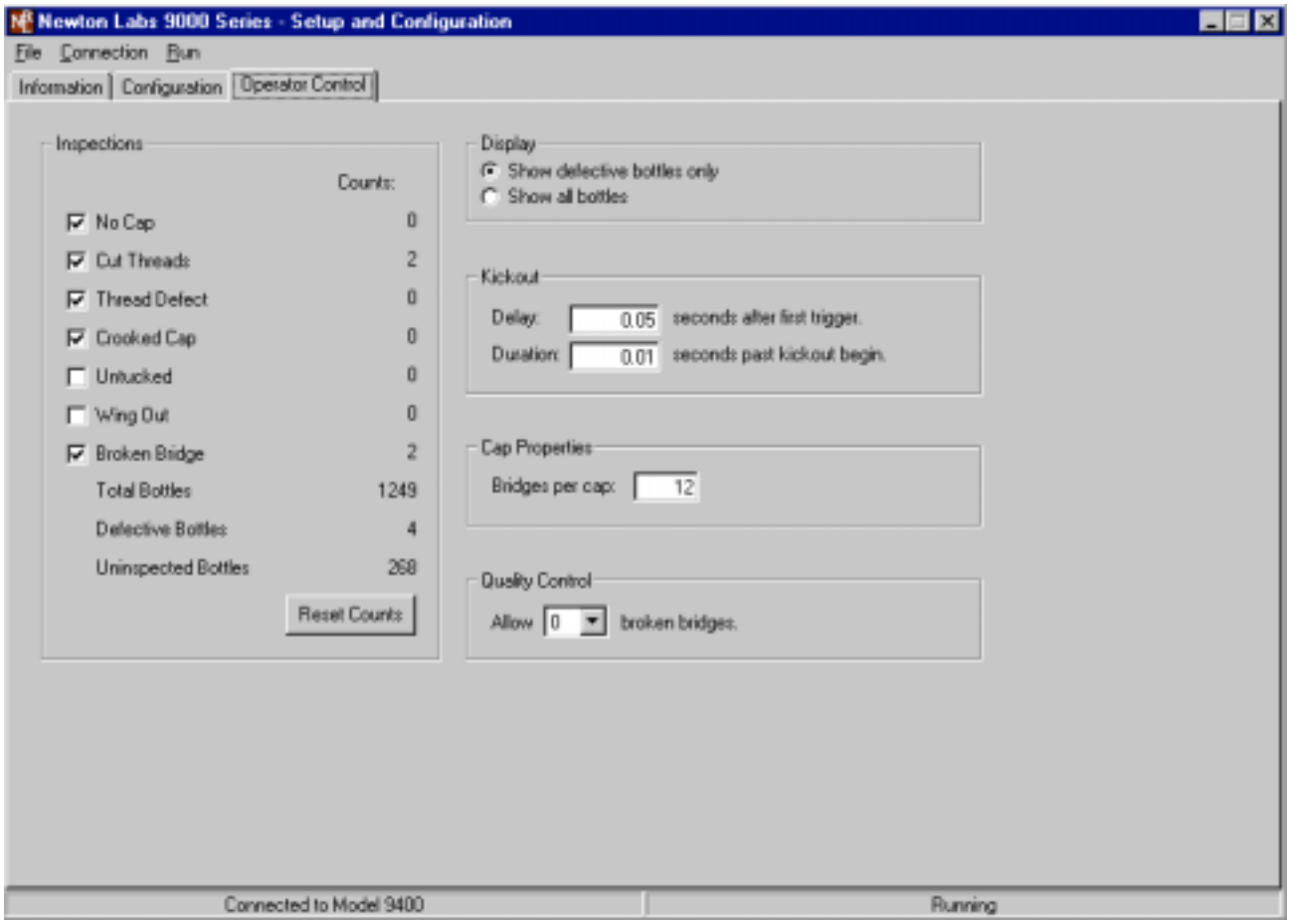
Maximum Cap Tilt measures the maximum angle of the top of the cap. If the cap tilt exceeds this value, the bottle is rejected as a crooked cap. Pass several good and defective bottles through the system and observe the current tilt values to determine a good maximum tilt.

Minimum Ring Tuck determines how rounded the corners of the tamper-evident ring must be. Ring tuck measures how well tucked the tamper-evident ring is by inspecting how rounded the bottom corners of the cap are. If ring tuck is less than the minimum, the bottle is rejected as untucked. Pass several good and defective bottles through the system and observe the current ring tuck values to determine a good minimum.

Maximum Wing Out Size is the number of pixels the edge of the tamper-evident ring can extend beyond expected before the bottle is rejected as a wing out. If too small, undamaged caps may be rejected as wing outs. If too high, wing outs may be missed.

OPERATOR CONTROL PAGE

The Operator Control Page allows the operator to easily view system status, and select the inspections, output, and quality control parameters of the system for a given production run.



Inspections**:** Each of the 8 inspections can be turned on or off by the operator by clicking in the appropriate box. Each active inspection appears with a green highlight on the output display monitor. As each inspection is turned off, it appears with a red highlight on the output display monitor. See Output Display Monitor – next page.

Reset Counts enables the operator to zero out all inspections at any time.

Display allows the operator to have either all bottles or only defective bottles display on the output display monitor.

OPERATOR CONTROL PAGE CONT.

Kickout is for the operator to set the output signal interval and duration for the kick-out mechanism. The Delay setting is an interval between the time that the input trigger signal occurs and the kick-out mechanism is activated. The Duration setting is the amount of time that the reject output is active. Note that a very small delay may not be possible, because the vision system must spend some time analyzing the camera image before it can activate the reject output. If the vision system takes longer for processing than the specified delay, then actual delay will be longer. The vision system spends less than 0.050 seconds performing processing.

Cap Properties is the setting to designate the number of bridges per cap. The bridges are the contact points between the cap and the tamper evident ring.

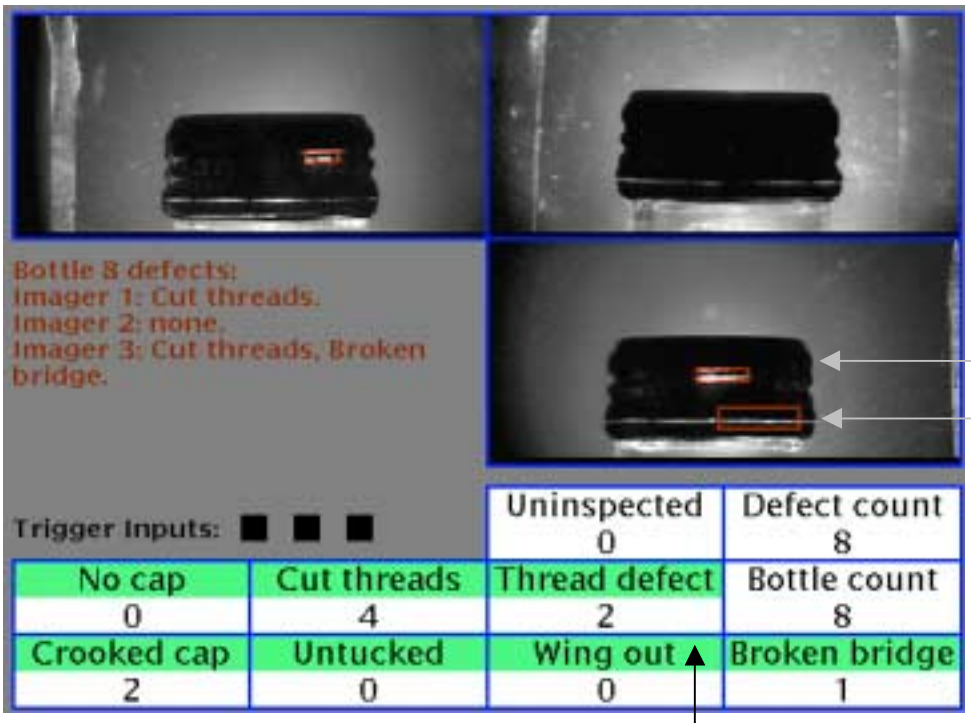
Quality Control allows the operator to specify the maximum acceptable number of broken bridges

OUTPUT DISPLAY MONITOR

The output display monitor mounted on the factory floor allows the operator to view a real time running total of each of the 7 defects, total bottles inspected, and total defects detected.

Each imager reports out either the defect detected or “none” per every bottle inspected.

The120 degree view from each imager is displayed in the three windows.



As each defect is detected, a red box appears around the defect to highlight it.

This provides a visual representation of each trigger as it is activated. In normal conditions, each of the three squares will flash yellow in sequence from left to right as each trigger fires. In this example, all three squares are black depicting no trigger activity.

In this example, All 7 inspections are activated and therefore highlighted in green. When the operator turns off an inspection, it remains displayed, but it is highlighted in red.

OPERATOR BCD INPUT

The BCD switch and button can be used to control some aspects of the system without a computer connected. The action performed when the button is pressed depends on the state of the BCD switch:

BCD Switch	Action
0	None
1	Switch system between the running and not running states.
2	Reset all defect counts.
3	Disable or enable the no cap inspection.
4	Disable or enable the cut threads inspection.
5	Disable or enable the thread defect inspection.
6	Disable or enable the crooked cap inspection.
7	Disable or enable the untucked inspection.
8	Disable or enable the wing out inspection.
9	Disable or enable the broken bridge inspection.

APPENDIX A - COMMUNICATION TROUBLESHOOTING

Problems Communicating with the 9000 Series	
♦ The user interface will not connect with the 9000 Series	Try the following first: ♦ Wait 30 seconds and try reconnecting. ♦ Check all connections. ♦ Make sure only one copy of the software component is running on the laptop or PC. ♦ Make sure that no other software (e.g. Palm Desktop) is using the serial port. ♦ Try to connect using another COM port. ♦ Turn off the computer, restart, and try again. If the above suggestions do not provide results, follow the procedures below to further troubleshoot communications: STEP 1: Establish communications via a communications terminal program. HyperTerminal can be used to debug system communications. You can use the HyperTerminal program as follows: Start HyperTerminal: Click the Start button, choose Run, type in Hypertrm.exe and click OK. A dialog box will appear with the words "Connection Description" in the title bar. Type NRL9000 in the name field. Under "Connect Using", click "Direct to Com ..." and choose the COM port you are using to connect to the 9000 Series. Try using COM 1, if you are using a PS-2 mouse. If you have a serial mouse, try COM 2. If you are not sure which COM port to use, repeat until you determine the right one. Select the appropriate communications port.

PROBLEMS COMMUNICATING WITH THE 9000 SERIES (CONTINUED)	
♦ The user interface will not connect with the 9000 Series (continued)	A dialog box will appear listing the properties for the com port selected. Set the com port properties to 115,200, 1 stop bit, Flow Control-Hardware The HyperTerminal program will display a white box. Press the space key (several times). An "OK" will appear each time you press space as long as the PC is communicating with the 9000 Series through HyperTerminal. If successful communications with the 9000 Series have been established, skip to Step 4. STEP 2: Check the wiring There may be a problem with the RS-232 cable or the laptop/PC. Make sure the wiring is correct. STEP 3: Make sure the computer is working properly If you are not able to obtain control over a COM port on the PC, check with your system administrator for help. If you are able to get control over a COM port, and you have checked all wiring and connections, go to Step 4. STEP 4: Power down the 9000 Series and power up again normally. STEP 5: Establish communications with the 9000 Series using the software component. Disconnect from the terminal mode in the program you are using. Use the software component to try to connect to the 9000 Series. If you still cannot establish communications using the terminal mode and/or the software component after reloading the software and establishing that there are no problems with the wiring or PC, go to Step 6. STEP 6: Call your Newton Labs Authorized Distributor Arrange with your local distributor to substitute a working 9000 Series and laptop to determine where the problem exists.

APPENDIX B – SET-UP & OPERATION TROUBLESHOOTING

False Rejects and False Positives	
♦ The system seems to be reporting false rejects and or false positives on any of the inspection tasks.	Try the following first:

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