NEWTON
RESEARCH LABS

Software Component

Users Guide

S207-9400 Ring Measure

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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. S207-9400**.

The basic S207 Software Component has been optimized for Ring Measurement with a Newton Labs Model 9000 series Vision System.

This Users Guide contains information on the following subjects:

Newton Labs Software Component Installation and Set-Up

- System Requirements
- User Interface Installation

Standard Newton Labs Vision Systems features for this Software Component

Operation

- Quick Start Guide
- User Interface Basics
- System Information
- Views
- Inspections
- Rejects

Appendix A–Communication Troubleshooting

STANDARD NEWTON LABS VISION SYSTEMS FEATURES

Settings for the **S207-9400** 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 Disconnect for operation
DB37 Digital Inputs		Inputs 1 – 8 user definable for triggers (See **Views Page**)
DB37 Line Lock/Sync Input		*Not Implemented in this Software Component*
DB37 Digital Outputs		13 user definable outputs Used for output to PLC or reject mechanism (See **Rejects Page)**
DB37 Serial RS422 Data Output		*Not Implemented in this Software Component*
Newton Labs Imagers		Up to 4 Model 4160 Newton Labs Imagers
Imager Output		Up to 4 Imager Outputs available NTSC Format
Video Output		*Not implemented in this Software Component*
Front Panel LEDs	Busy	Green after power on self-test, red while processing
	Pass/Fail	Green when pass, red when fail
	Sync/Trigger	Green when opto-input is high or on.

IMPLEMENTED SOFTWARE TOOLS

View Definition	To set up/define specific views as a combination of a camera, illuminator and trigger
Line feature detection	*Not implemented in this Software Component*
Ellipse feature detection	For measuring circles and ellipses
Color matching	*Not implemented in this Software Component*
Edge detection	*Not implemented in this Software Component*
Color feature finding	For training on a desired color(s)
Reject rules	For setting tolerances and outputs

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

Your Model 9400 has been shipped preconfigured for O-ring inspection. It is set up to use two imagers, each with a Newton Labs ring light attached. You will have to adjust parameters to conform to your exact imager mounting setup.

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. Go to the **Views Page**

   A view defines an illuminator which is to be strobed when a trigger is activated, and an imager to capture the object illuminated. This system comes preconfigured with two views, one for each imager/illuminator combination. These views are set to trigger when digital input one is activated.

6. Attach and focus imagers

   1. Attach the imagers and illuminators to Model 9400 and mount them as described later in this document.
   2. View the imager display in the **Views** Page for focus and imager placement. Enable “update continuously” to maintain a live active image.

7. Go to the **Inspections Page**

   Your system comes preconfigured with ellipse inspections for both views. You will probably have to adjust the region of interest (ROI) and color calibration for your setup.

   1. Click on inspection 1 or 2 to see the details of the inspections.
   2. Set the region of interest (ROI) by typing in the boundaries or drawing on the image (red box). The red O-ring should be centered in the ROI.
   3. Select "color calibration" which will invoke a dialog box enabling color training. Click "show processed data" and "update continuously" to see the results of the color training. See the Color Calibration section of this document for more information.
   4. Place known good parts under the camera and note the measurement values displayed under "Inspection results" on the bottom right hand side of the Inspections Page. Take note of the measurements displayed for several known good parts to determine a tolerance range for good parts. Do the same for bad parts.

8. Go to **Rejects Page**

   1. Click on the "add" button to begin set up of a new reject
   2. Select an output and duration of the output signal
   3. Select the appropriate pass or fail measurement parameter. Note: this should be known after step 7 above (item 4 - Inspections Page)

9. *File Menu* **Save Settings**

   Save to File

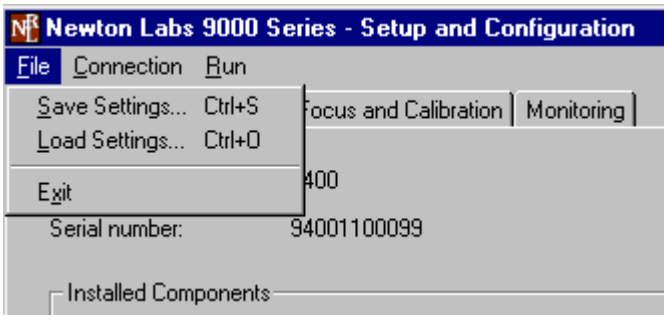
10. *Run Menu* **Start Running**

11. *Connection Menu* **Disconnect**

12. *File Menu* **Exit**

USER INTERFACE BASICS

FILE MENU

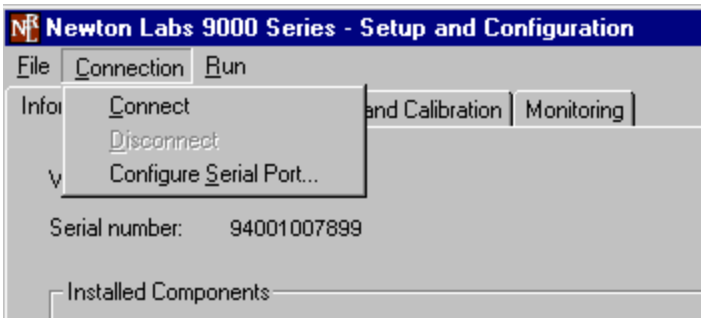


Save Settings–Saves currently selected settings to a file on the laptop or PC you are using. A dialog box will ask for a file name and location. It is highly recommended that you save the settings after a successful setup.

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

Exit–Closes the Software Component User Interface

CONNECTION MENU

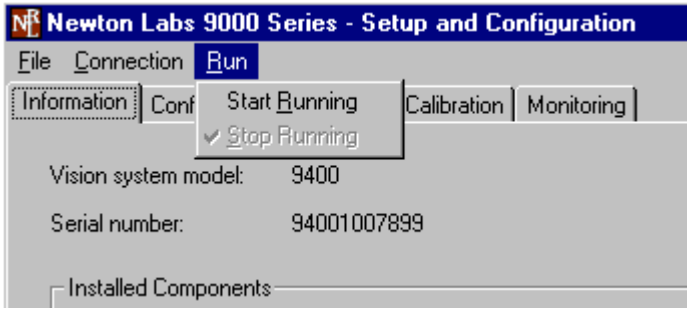


Connect–Connects the Newton Labs Software Component User Interface to a Newton Labs Vision System. *This option must be selected first in any setup session.*

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

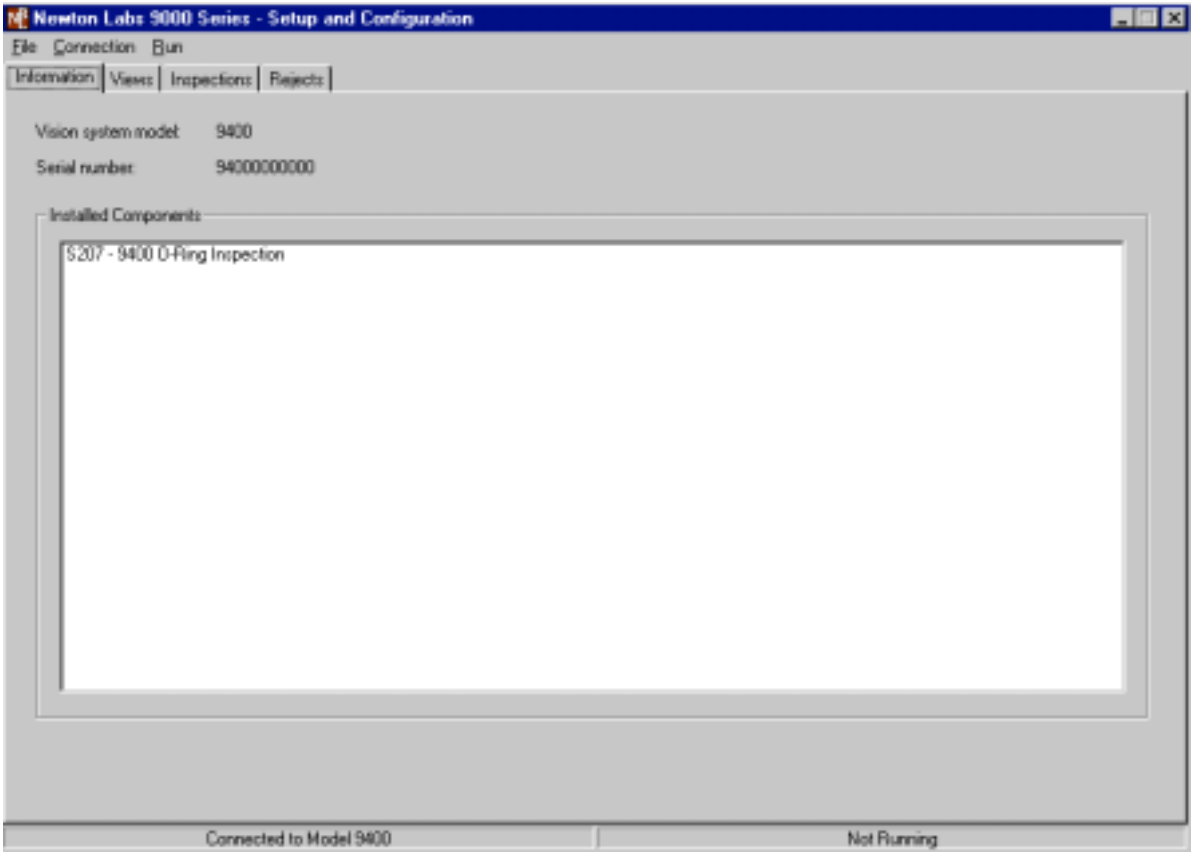


Start Running– To optimize performance, Start Running will automatically disable video out.

Stop Running– This will re-enable the video out.

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

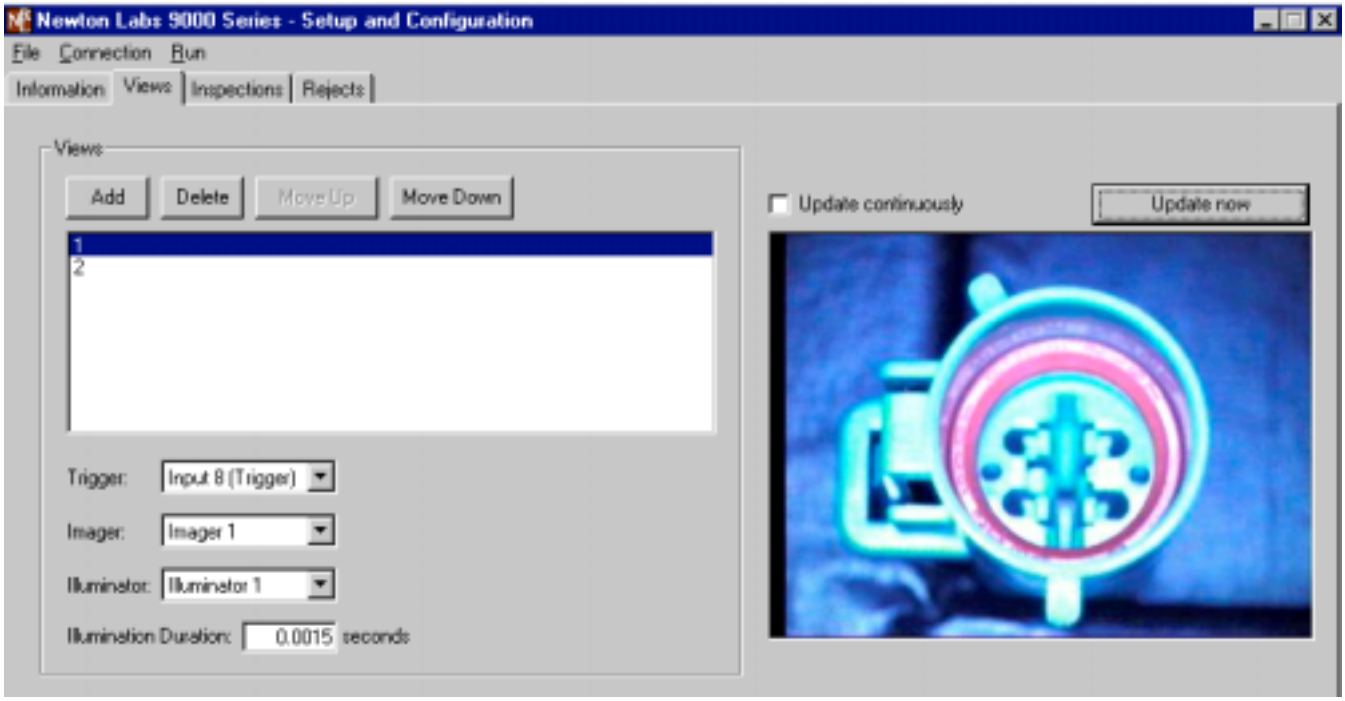
The Newton Labs Software Component User Interface reads and auto identifies the Serial number of Newton Labs Vision System to which it is connected. If the Software Component is not correct for that serial number, a display box will appear. Contact your Authorized Newton Labs Distributor for the correct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

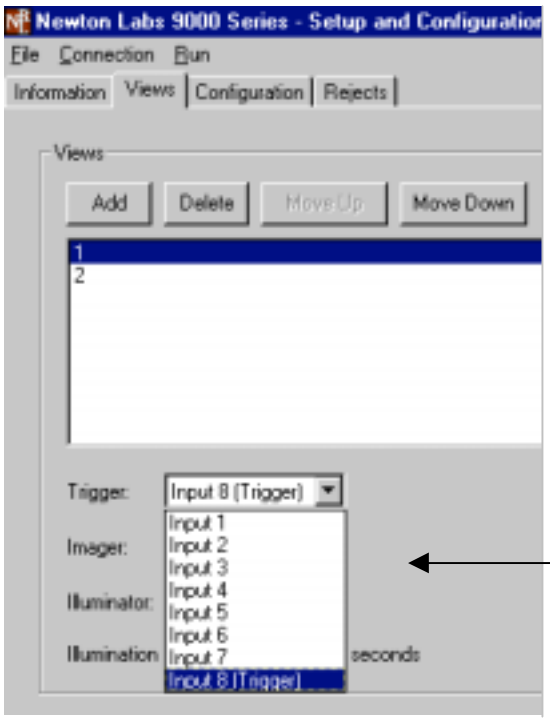
Installed Components

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.

VIEWS PAGE

The Views Page allows the operator to easily set up and define a view consisting of a specific imager, trigger, and illuminator.

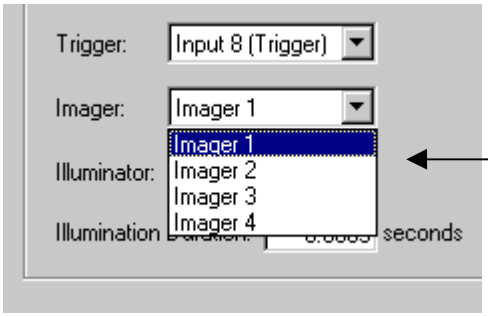




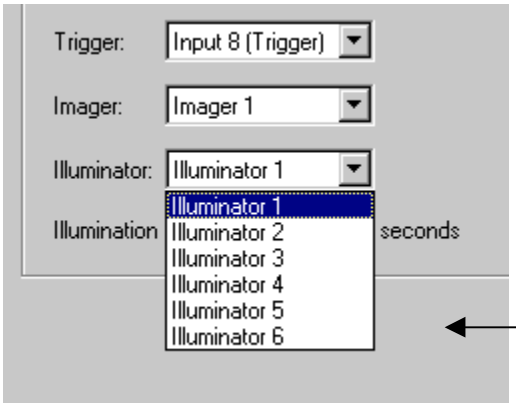
Select an input trigger for each view.

It is possible to have the same input trigger for more than one view as desirable such as when two imagers are mounted side by side doing identical inspections. It is possible to either use one trigger for both imagers or set up two triggers, one for each imager.

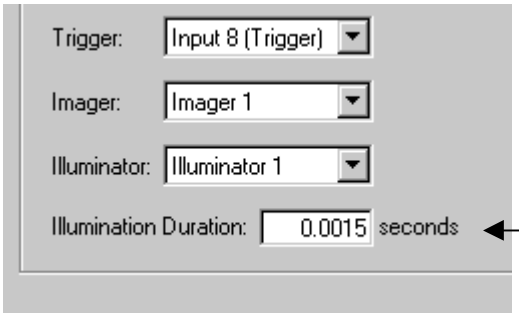
VIEWS PAGE CONT.



Select the desired imager (up to 4) one at a time for each view.



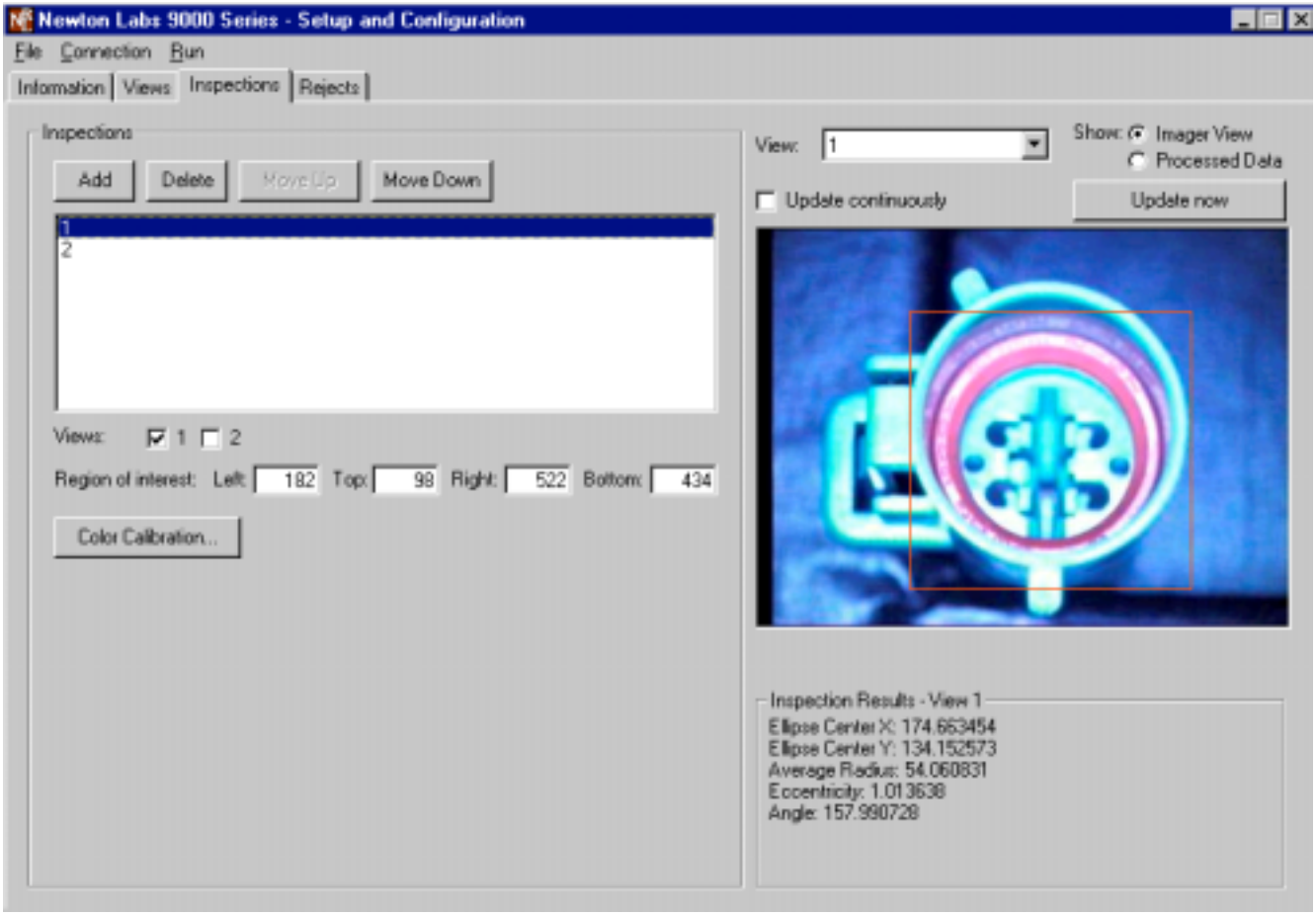
Select the desired illuminator (up to 6) one at a time for each view.



Type in the desired signal duration for each illuminator.

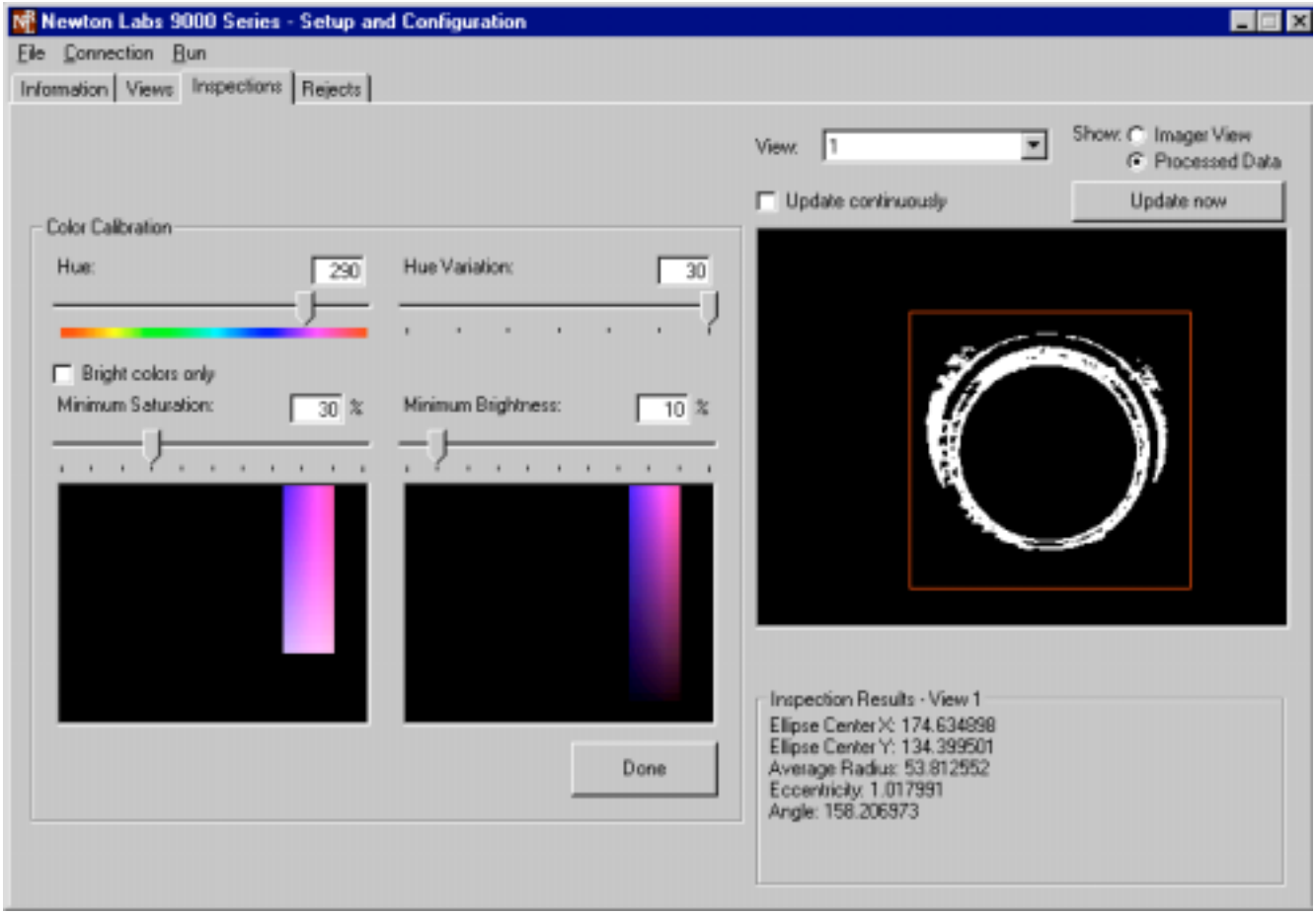
INSPECTIONS PAGE

The Inspections Page allows the operator to easily set up and define ellipse inspections. This page consists of region of interest and color calibration parameters to define. The software is designed to determine the inner edge of the ellipse of a specific color. The measurement data is displayed on the bottom right hand side of the dialog box.



1. Add an inspection by clicking on the "Add" button.
2. Select the appropriate view (specific configuration of imager, trigger, illuminator)
3. Select "Show imager view".
4. Set the region of interest (ROI). This can be done by either typing in the boundary values or drawing on the image (dragging the red box which denotes the ROI). Note: For best results, try to center the object (or the part of the object) which is the actual focus of the vision inspection within the ROI. This is depicted in the image above where the red o-ring (in the green plastic shell) is the focus of the vision inspection.
5. Invoke the Color Calibration dialog box by clicking on the Color Calibration button. (See next page for Color Calibration discussion). Train on the color of the ellipse.
6. Click on the "update continuously" tick box. Place known "good" parts under the camera (one at a time) and note the measurement values displayed under "Inspection results" on the bottom right hand side of the Inspections Page. Take note of the measurement data displayed (min & max radius, max eccentricity) for several known good parts to determine a tolerance range for "good parts". Conduct the same procedure for known "bad" parts to get a feel for how various defects affect and change the measurement values. Use this information when setting tolerances in the "Rejects Page".

INSPECTIONS PAGE CONT. – COLOR CALIBRATION

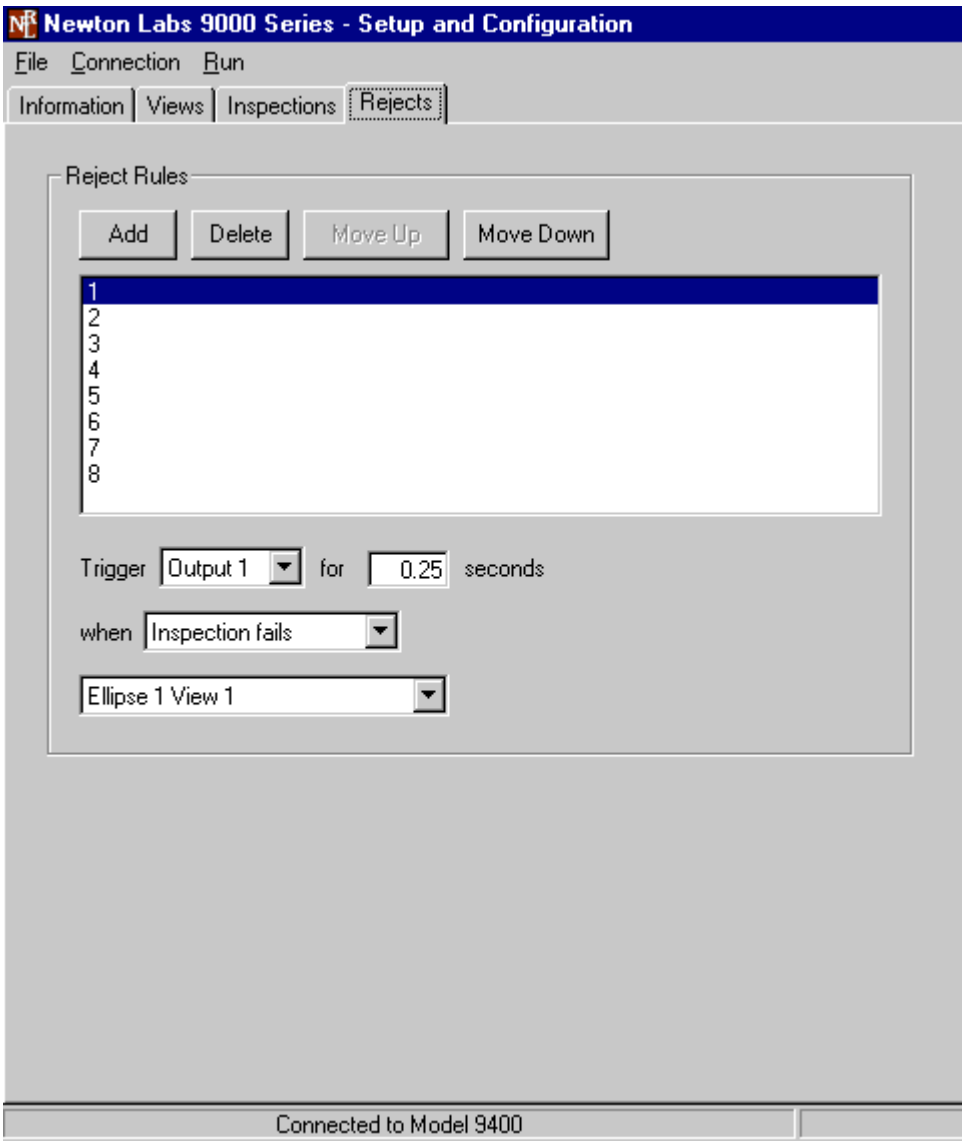


The Color Calibration Page allows setting the color range of the objects. Color selection is primarily performed by adjusting the *Hue* and *Hue Variation*. *Hue* sets the actual color, while *Hue Variation* configures how much the color can vary. Select *Processed Data* to display the training output in the right hand side of the page, or select *Imager View* to view the imager output. Adjust *Hue* and *Hue Variation* to try to get a solid training. An excellent training is achieved when the colored object is depicted as solid white. The goal is to end up as solid white as possible. In the case of the ellipse, the goal is to get a nice continuous inner edge as depicted above. The extraneous white fringe in the image above depicts reflection of the ring color, which the software algorithm ignores.

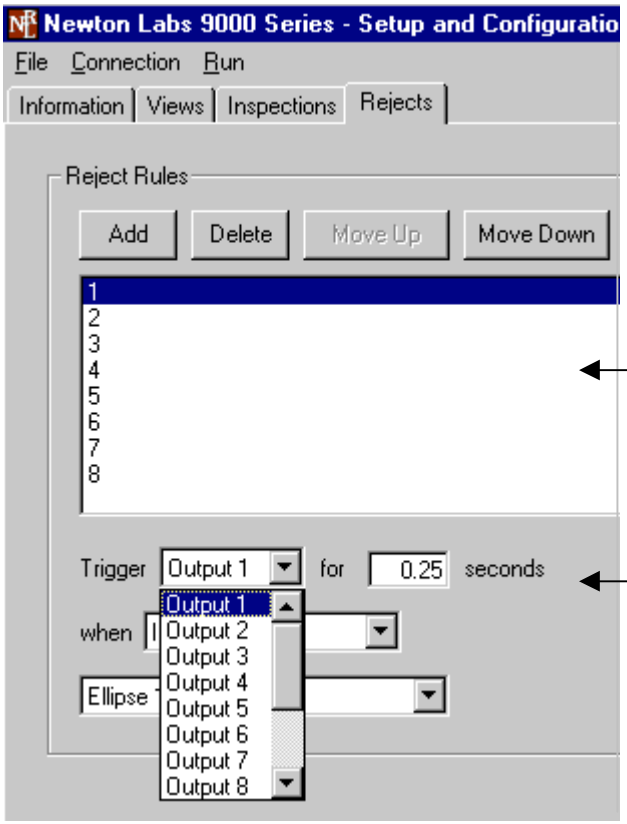
Usually, *Bright colors only* can be turned on, which configures the Saturation and Brightness ranges to their default values. If, however, Hue and Hue Variation are insufficient for obtaining a solid image, turn off *Bright colors only* and modify the Saturation and Brightness ranges. Saturation is the property of how "intense" versus how "washed out" a color is. For example, red is more saturated than pink, and pink is more saturated than white. You can get a good feel for these adjustments by watching the recognized color range under each slider.

REJECTS PAGE

The Rejects Page allows the operator to easily set up and define tolerances for pass fail outputs.

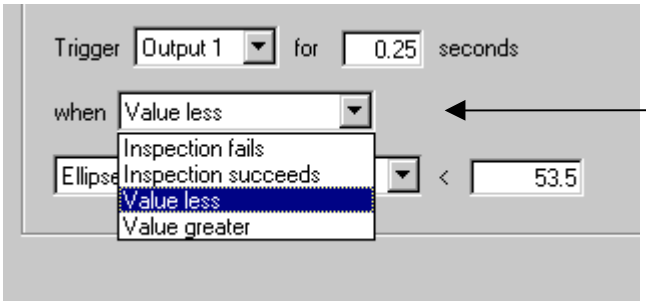


REJECTS PAGE CONT.



Establish a new reject rule by clicking "Add", or select an existing reject rule from the list in the window.

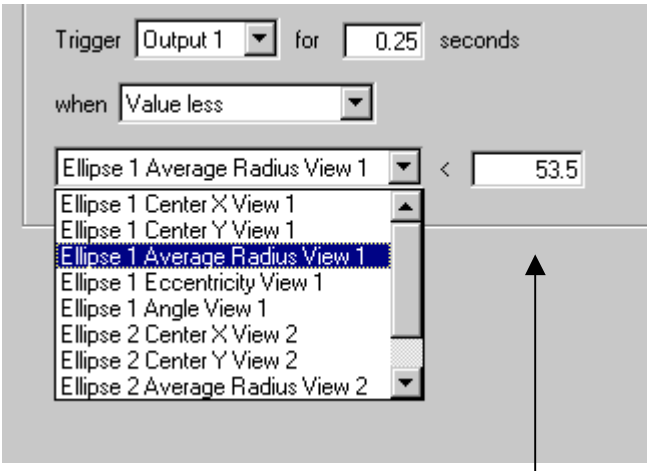
Select an output and a duration for the output signal.



Select one of the four reject conditions which will associate with the selected output (established above) and specific measurement (next step below).

REJECTS PAGE CONT.

Select the specific measurement (associated with a specific view) to coordinate with the reject condition and value.



Type in the tolerance value achieved earlier by testing both good and bad parts in the Inspections Page set up.

In this example, an ellipse (in view 1) with an average radius of less than 53.5 will be reiected.

O-RING APPLICATION NOTES

This application identifies crooked and doubled O-rings in plastic connectors. See the diagram following for the recommended fixture setup to hold the imager and the connector being inspected. Setup for this application is critical, as the variations being measured are very small. The fixture must hold the imager and the connector rigid, since a small change in the angle of the imager or of the connector may result in significant changes to the inspection results.

The imager is angled relative to the connector such that when a connector has two o-rings, the imager sees the inside edge of the bottom o-ring on the far side of the connector and the inside edge of the top o-ring on the near side. This results in a higher eccentricity reading, distinguishing the doubled o-ring from a single o-ring. Because proper angles are so critical to the proper functioning of the vision system, we recommend that the fixture allow adjustment of the imager angle. It should also allow adjustment of imager position so that the connector can be centered in the imager's view.

The system is not very sensitive to ambient light, since the LED light flashes much brighter than typical room lighting. However it is important that the imager and connector are shielded from sunlight or bright room lights,

Recommended fixture setup/calibration procedure:

1. Connect both imagers and light to vision system. It is important to connect both imagers, as the vision system will not function correctly with only one imager connected.
2. Set up imagers with the recommended 10° angle.
3. Adjust imager position and focus. If an NTSC monitor is readily available, you may want to connect the monitor to the Imager Out connectors on the vision system and shine a bright light on the connectors for positioning and focusing. Otherwise you can use the Views page of the lost software and check "Update continuously" for a real-time imager view.
   Make sure that the o-ring within the connector is roughly centered on the screen. The imagers should be shipped with correct focus, but if the o-ring is out of focus you will have to refocus on the o-ring.
   The imager view of the connector should be similar to the one shown on page 14 of this manual (Views Page). In particular, the bottom edge of a correctly seated o-ring should be just visible past the edge of the connector housing.
4. Calibrate inspection setup. Go to the Inspections Page of the hose software. For each inspection, make sure that the region of interest (the red box in the imager view) surrounds the o-ring, and the o-ring is centered in the ROI. Also make sure that the processed data view identifies the red o-ring well. If not, you may have to adjust the color calibration settings. Make sure that the o-ring is identified well for all color variations of o-ring. If the closer inside edge of the o-ring is not consistently identified, the imager angle may be too high. Decrease it a few degrees and go back to step 3.
5. For each imager, experimentally determine good limits for minimum and maximum radius and maximum eccentricity. On the Inspections Page, select the appropriate inspection and check "Update continuously". When you place a connector with o-ring in the fixture, radius and eccentricity should be displayed, along with other measurements. Place a variety of connectors with well-seated o-rings in the fixture, keeping track of the lowest and highest

observed values of radius and highest values of eccentricity. Leave each connector in the fixture long enough for several measurements, as results will vary slightly with each measurement. Also observe measurements for connectors with improperly seated o-rings, and with double o-rings.
Double o-ring connectors should always display a higher eccentricity than single o-ring connectors. If there is not enough eccentricity difference to reliably distinguish double o-rings, the imager angle may be too small. Increase it a few degrees and go back to step 3.

6. Go to the Rejects Page. Based on the results of step 5, set limits for radius and eccentricity for each inspection.
7. Make sure that the triggers and reject outputs are set up as desired. By default, Input 1 triggers both imagers, and a reject on imager 1 raises output 1 for 250 ms, while a reject on imager 2 raises output 2 for 250 ms. You can easily change these settings on the Views Page and Rejects Page.

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.

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