User's Guide

High Power Test System
LRS-9550

ILX Lightwave®
A Newport Company

TABLE OF CONTENTS

Chapter 1   Introduction and Specifications

Chapter 2   Installation

Chapter 3   System Fundamentals

Chapter 4   Fixtures

Chapter 5   ReliaTest Software

Chapter 6   Configuring and Running Tests

Chapter 10 Troubleshooting

Appendix A Changing the Computer Log on Passwords

Appendix B Facility Preparation Guide

Appendix C Custom Components

Appendix D Specifications

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LIST OF FIGURES

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SAFETY AND WARRANTY INFORMATION

The Safety and Warranty Information section provides details about cautionary symbols used in the manual, safety markings used on the instrument, and information about the Warranty including Customer Service contact information.

Safety Information and the Manual

Throughout this manual, you will see the words *Caution* and *Warning* indicating potentially dangerous or hazardous situations which, if not avoided, could result in death, serious or minor injury, or damage to the product. Specifically:

⚠ CAUTION

Caution indicates a potentially hazardous situation which can result in minor or moderate injury or damage to the product or equipment.

⚠ WARNING

Warning indicates a potentially dangerous situation which can result in serious injury or death.

☀ WARNING

Visible and/or invisible laser radiation. Avoid direct exposure to the beam.

General Safety Considerations

If any of the following conditions exist, or are even suspected, do not use the system until safe operation can be verified by trained service personnel:

- Visible damage

- Severe transport stress

- Prolonged storage under adverse conditions

- Failure to perform intended measurements or functions

If necessary, contact ILX Lightwave or the authorized local ILX Lightwave distributor, for information on how the appropriate system components should be removed and sent back to ILX for servicing. (see the contact information on page xii).

All components returned to ILX Lightwave are required to have a Return Authorization Number assigned by an official representative of ILX Lightwave Corporation. See Claims for Shipping Damage on page xi for more information.

SAFETY SYMBOLS

This section describes the safety symbols and classifications.

Technical specifications including electrical ratings and weight are included within the manual. See the Table of Contents to locate the specifications and other product information. The following classifications are standard across all ILX Lightwave products:

- Indoor use only
- Ordinary Protection: This product is NOT protected against the harmful ingress of moisture.
- Class I Equipment (grounded type)
- Mains supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.
- Pollution Degree II
- Installation (overvoltage) Category II for transient overvoltages
- Maximum Relative Humidity: <80% RH, non-condensing
- Operating temperature range of 23°C ± 5°C
- Storage and transportation temperature of –25°C to 65°C
- Maximum altitude: 3000 m (9843 ft.)
- This equipment is suitable for continuous operation.

Safety Marking Symbols

This section provides a description of the safety marking symbols that appear on the instrument. These symbols provide information about potentially dangerous situations which can result in death, injury, or damage to the instrument and other components.

	Caution, refer to manual		Earth ground Terminal		Alternating current		Visible and/or invisible laser radiation
	Caution, risk of electric shock		Protective Conductor Terminal		Caution, hot surface		Frame or chassis Terminal
or (I)	On: In position of a bistable push control. The slash (I) only denotes that mains are on.			or (O)	Off: Out position of a bistable push control. The circle (O) only denotes that mains are off.		

WARRANTY

ILX Lightwave Corporation warrants this instrument to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, ILX will repair or replace the unit, at our option, without charge.

Limitations

This warranty does not apply to fuses, lamps, defects caused by abuse, modifications, or the use of the product for which it was not intended.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose. ILX Lightwave Corporation shall not be liable for any incidental, special, or consequential damages.

If a problem occurs, please contact ILX Lightwave Corporation with the instrument's serial number, and thoroughly describe the nature of the problem.

Claims for Shipping Damage

When you receive the system, inspect it immediately for any damage or shortages on the packing list. If the system is damaged, file a claim with the carrier. The factory will supply you with a quotation for estimated costs of repair. You must negotiate and settle with the carrier for the amount of damage.

Comments, Suggestions, and Problems

To ensure that you get the most out of your ILX Lightwave product, we ask that you direct any product operation or service related questions or comments to ILX Lightwave Customer Support. You may contact us in whatever way is most convenient:

Phone . . . . (800) 459-9459 or (406) 586-1244

Fax . . . . (406) 586-9405

On the web at: . . . . ilx.custhelp.com

Or mail to:

ILX Lightwave Corporation
P. O. Box 6310
Bozeman, Montana, U.S.A 59771
www.ilxlightwave.com

When you contact us, please have the following information:

Model Number:	
Serial Number:	
End-user Name:	
Company:	
Phone:	
Fax:	
Description of what is connected to the ILX Lightwave instrument:	
Description of the problem:	

If ILX Lightwave determines that a return to the factory is necessary, you will be issued a Return Authorization (RA) number. Please mark this number on the outside of the shipping box. You or your shipping service are responsible for any shipping damage when returning the instrument to ILX Lightwave; ILX recommends you insure the shipment. Be sure to use enough packing material to prevent shipping damage.

We look forward to serving you even better in the future!

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INTRODUCTION AND SPECIFICATIONS

This chapter is an introduction to the LRS-9550 High Power Laser Burn-In System and contains unpacking information, instructions on how to install and apply power, maintenance information, and specifications.

Product Overview

The LRS-9550 is a high density, high power laser diode burn-in system. Depending on the system configuration, this system is capable of burning in a maximum of 512 devices simultaneously. The system can be configured to test up to eight shelves with up to four fixtures per shelf and with each fixture capable of holding up to 16 high power devices. The temperature and test configuration of each shelf is independently controllable. Burn-in tests are run in ACC (constant current) mode.

A computer is connected to the system via an Ethernet port to allow test control and data storage. The ReliaTest control software comes pre-configured to operate the computer and rack as a stand alone system.

Initial Inspection

When you receive the LRS-9550 system, verify that the following items were shipped:

- LRS-9550 system rack

- Boxes containing the following:

  - The electronics Control-Measure Modules

  - The water cooled fixture shelves

  - The test fixtures

- LRS-9550 System Notebook

- A box containing the system control computer, USB - Ethernet adapter, mouse, and 2 Ethernet cables

Installing the LRS-9550 System

The LRS-9550 System normally requires a representative from ILX Lightwave to be on-site to install the system and conduct acceptance testing. Preparation of your facility prior to installation will ensure the installation goes smoothly and quickly. Please refer to the Facility Preparation Document that was sent prior to system shipment for specifics to your order.

Physical Requirements

A corridor with minimum dimensions of 4 feet (122 cm) wide by 6.5 feet (198 cm) high is required from the dock where the system arrives to the location where the system will be installed.

Because the system weighs approximately 1100 lbs (500 kg), flooring capable of supporting such a weight is required. In addition, a total of five people are required to lift the system rack off its pallet. It is recommended that the rack be positioned in its final location prior to system installation.

Electrical Requirements

The 9550-1200 system rack requires 208VAC 50/60 Hz, 3Ø, and 70A. The 9550-1202 system rack requires 400VAC, 50/60 Hz, 3Ø, 4 pole, 5 wire, and 40A. 120 - 240 VAC, 50/60 Hz single phase power is required for the computer. The computer voltage is auto-switching.

WARNING

The system rack requires a true Earth Ground for the 5-wire input power connection.

To avoid electrical shock hazard, connect the system only to a properly earth-grounded electrical receptacle. Failure to observe this precaution can result in severe injury or death.

Computer Network Requirements

While the LRS-9550 system is designed for standalone operation and does not require a connection to a facility network, a network connection will be beneficial for data backup and Internet based service support. In order to connect the system to your network, a user account specific to the system should be set up with limited network permissions and a non expiring password. Expired passwords will stop the computer from starting automatically following a power failure. Please refer to the Facility Preparation Document for details.

Tour of the LRS-9550 System

The LRS-9550 is a high-density, burn-in test system for high power laser diodes. Several different test scenarios (profiles) can be run simultaneously in the system. A comprehensive and easy-to-use software package called ReliaTest gives you full control over all aspects of the system. ReliaTest allows you to easily configure and manage tests and has graphical data display features so you can easily monitor devices throughout the test process.

Figure 1.1 shows a cutaway diagram of the LRS-9550 High Power Laser Burn-In System. At the time of delivery, the system is configured with up to eight independently operable shelves. Each shelf can accept up to four fixtures. Depending on the model of the fixture, each fixture can hold eight or sixteen high power laser diodes mounted in C-mount carriers. The front of the system rack incorporates the shelves which contain cold plates, beam dumps or photodetectors, and pneumatics for clamping the fixtures in place. The back of the system rack contains the control-measure modules. The lower part of the rack contains the service entry connections, cooling water distribution manifold, leak sensor, water cutoff valve, 48V power supplies, and an Ethernet router. The top of the rack contains the System Control Module and electrical power distribution panel.

In operation, the control-measure modules need not be accessed. The rear door of the system rack is only necessary for shipment and should be removed prior to operation.

System Control Module

Shelf with Cold Plate

Control-Measure Electronics Module

Fixture

48V TEC Power Supplies

Water and Air Inlet and Distribution

Front View

Side View
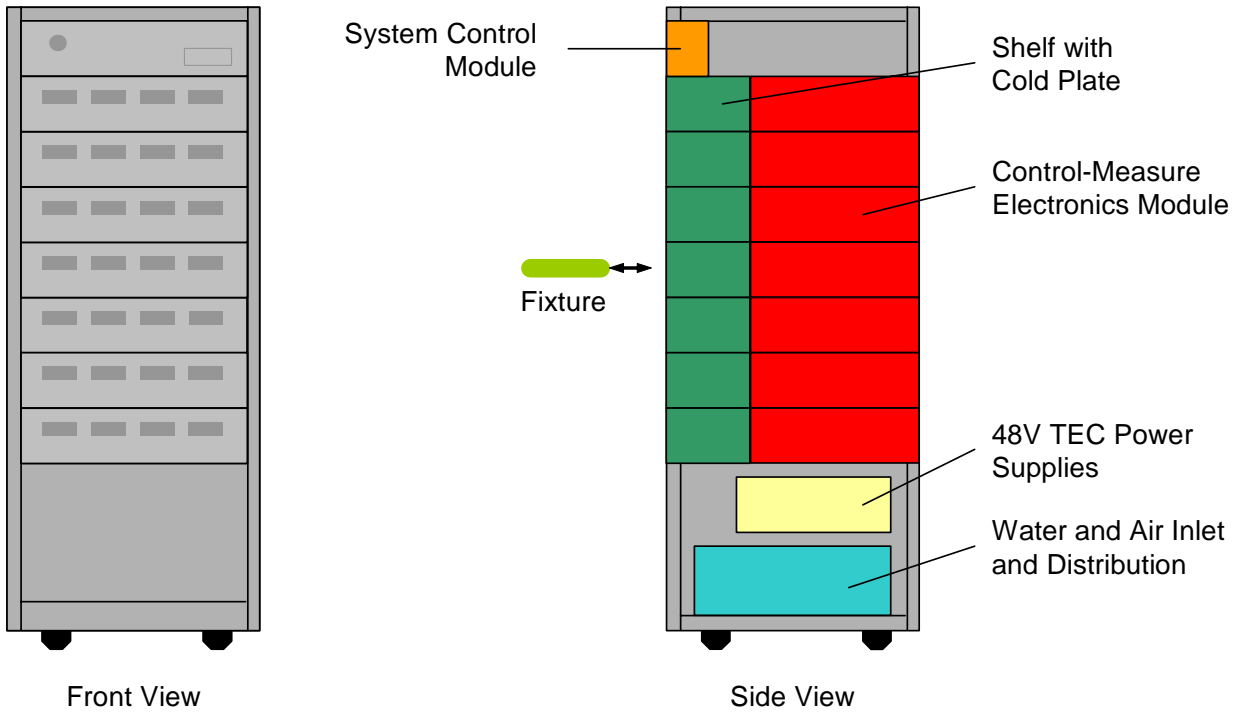
Figure 1.1 LRS-9550 Cutaway Diagram

Figure 1.2 shows the front and rear of the LRS-9550 system. The System Control Unit at the top of the front of the rack has LEDs that indicate when power is applied to the system and if a fault condition is present.

Figure 1.2 Front and Rear of the LRS-9550

Circuit Breaker

Power Reset Switch

Figure 1.3 Upper Rear View of System Rack

Compressed Air

Condensation Detector

Water Inlet

Water Inlet
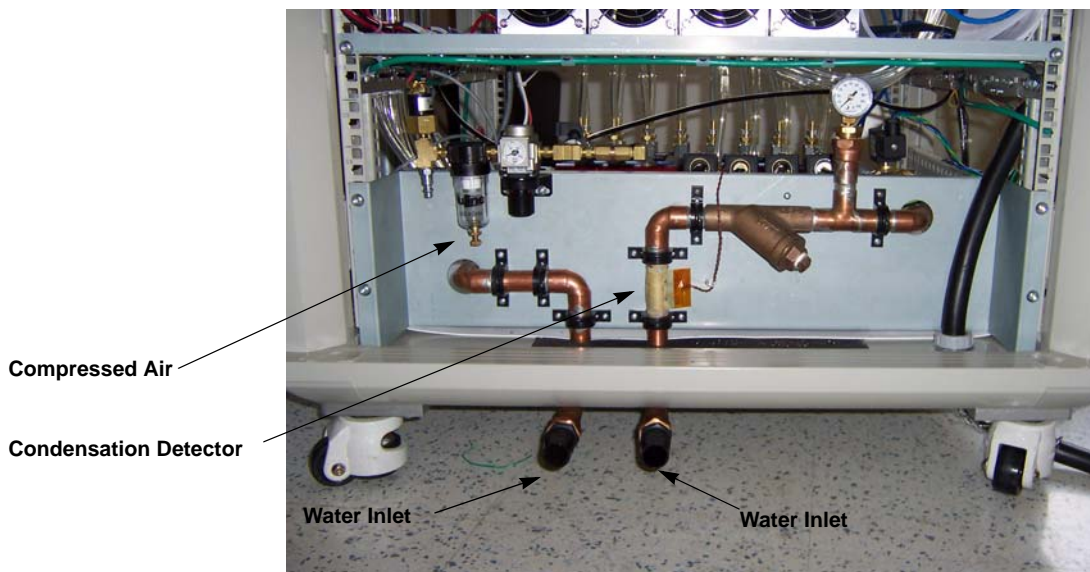
Figure 1.4 Lower Rear View of System Rack

Figures 1.3 and 1.4 show the rear of the system rack. Power, cooling water, air, and network connection services enter through the rear bottom of the system rack. As shown, there is a main AC power breaker that must be engaged to allow the system to operate. At the time of system delivery, the AC power cord is unterminated to allow direct connection to the facility's main AC power. Cooling water inlet and outlet services are connected to the system via ¾" NPT connections located at the bottom rear of the system rack. Compressed air service is connected via a ¼" male coupling also located at the bottom rear of the system rack. Ethernet connection from the system control computer is connected to the system rack via the RJ45 connector located in the router located in the bottom rear of the system rack.

Figure 1.5 System Control Module

Figure 1.5 shows the System Control Module. The system Control Module contains emergency stop and LED indicators for AC power, water, air, and leak.

Features

The LRS-9550 High Power Test System incorporates the following features:

- High density system capable of burning in up to 512 devices simultaneously

- Constant current burn-in with laser drive current up to 20 A

- Burn-in temperature range from 25°C to 85°C with accuracy of ±2°C

- Pneumatic clamping for easy device loading and unloading

- Different burn-in scenarios may be simultaneously run on different shelves or all shelves may be configured to run an single burn-in scenario

- Continuous recording of laser voltage, current, optical power and base temperature

- Real-time viewing of currently running test data with simultaneous viewing of completed tests

- Intuitive graphical interface for viewing system and test status

- Graceful handling of power blackouts and brownouts

- In-situ LIV tests

Safety Considerations

Throughout this manual, important symbols are used to indicate potential hazards that may be experienced while operating the LRS-9550 System. These symbols are defined below.

Definition of Symbols

⚠	Important operating and service/maintenance instructions	⚡	Risk of electrical shock
⚠	Static sensitive device; use proper grounding provisions	☀	Risk of exposure to visible or invisible laser radiation

Cautions and Warnings

The LRS-9550 system is designed to be very easy to operate, with a minimal number of moving parts, no operator-accessible electronics, or other potentially dangerous components.

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⚠ **CAUTION**

The rear door of the LRS-9550 system rack is to be opened only to repair, replace, upgrade, or maintain electronic components, and only by qualified service personnel or with specific instructions from ILX Lightwave.

⚡ **WARNING**

Lethal AC voltages are present when the rear door of the system rack is opened. The rear of the system rack should be accessed only by qualified service personnel.

⚠ **CAUTION**

Users should be aware that fixture handles may be hot to the touch, and should observe proper precautions to prevent burns.

INSTALLATION

This chapter describes the steps that must be followed before you can begin using your system for normal operations. Normally, an ILX Lightwave representative should be present to manage the installation, system validation, and training at your site.

Installation Requirements

The 9550-1200 system rack requires 208VAC 50/60 Hz, 3Ø, and 70A. The 9550-1202 system rack requires 400VAC, 50/60 Hz, 3Ø, 4 pole, 5 wire, and 40A. The service connector should be located within 1 meter (3') of the center base of the LRS-9550 system. The power cord exits the back of the system rack base.

The following physical clearances are required for the LRS-9550 system rack.

• Minimum Side Clearance: 2.5 cm (1") on each side

• Minimum Back Clearance: 30 cm (12")

• Minimum Front Clearance: 100 cm (39")

• Minimum Top Clearance: 2.5 cm (1")

The specified back-clearance is for operation of the LRS-9550. If maintenance or upgrades need to be performed on the instrument, a minimum of 100 cm (39") is required to access the electronics bay.

Installation Procedure

Unpacking and Inspection

Carefully remove the packing from around the LRS-9550 system rack and inspect it for any signs of physical damage or impact. Next, unbolt the system rack from the pallet, install the feet and place the system near its final location. The feet are packaged with the system accessories. The system rack in its final location must be within 1 meter (3') of the AC supply circuit connector.

Open the boxes containing the control-measure modules (CMMs) and shelves. Inspect the components and packaging for any signs of breakage or damage. Next, open the boxes containing the fixtures. Remove each fixture and inspect for signs of breakage or damage. Finally, open all boxes containing the system control computer. Inspect all boxes and components for damage.

If any damaged containers or system components are found, notify the shipping courier and ILX Lightwave immediately.

System Rack Installation

The LRS-9550 system should be placed at its final location at this point. ILX Lightwave recommends that the system installation be performed only by an ILX Lightwave field service engineer. If you are installing a new system, please have the system rack and boxes at the final location point with the necessary facility power, water, and air services provided and working. The ILX Lightwave field service engineer will unbox and setup the system and perform the standard system power-up test sequence.

Next, make sure the main AC power circuit breakers, located in the upper back side of the system rack, are in the OFF position, then connect the unterminated system power cord to the facility AC power. This power cord should be a direct connection to facility power for safety reasons.

Connecting AC Power, Water, and Air Services

Prior to connecting AC power, ensure that the circuit breaker located at the top rear of the system rack is in the OFF position. Next, connect the provided AC power cable to an appropriate source of AC power. Connect facility water to the ¾" NPT water inlet and outlet connections located at the bottom rear of the system rack. Finally, connect compressed air service via the ¼" male coupling also located at the bottom rear of the system rack.

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Shelf Installation

Prior to installing each shelf, turn off the system power and the system water. Ensure that the water and air hoses on the left and right sides of the system rack are easily accessible. Next install the shelves into the front of the system rack by sliding them one at a time in along one of the pairs of rails. Use caution in lifting and installing each shelf into the system rack since each weighs approximately 60 lbs (27 Kg).

When installing each shelf, start by sliding it in approximately half way. Next connect the water and air hose connections on each side of the shelf by inserting the tubing ends into the appropriate quick connect fittings located on the bottom side of the shelf. Finally slide the shelf in the rest of the way and secure it using two M6 button head cap screws.

Control-Measure Module Installation

Install the Control-Measure Modules one at a time into the rear of the system rack by sliding them in along one of the pairs of rails. Carefully seat each CMM as its connectors mate with the corresponding connectors on the rear of the shelves. Secure each CMM to the system rack using four M6 button head cap screws. Connect system cables in the following order:

1 On the right side of the CMM install the Ethernet cable and system control cable

2 On the left side of the CMM install the 48V power cable

3 On the left side of the CMM install the AC power cable

Computer Installation

Assemble the computer by first locating the components in their installation locations, then connect the computer components together per the instructions included with the computer. Connect an Ethernet cable from the LRS-9550 system rack to the computer using one of the available Ethernet ports located at the lower back of the system rack. Connect the other end of the cable to the computer's integrated jack. It is recommended that internet access be provided by connecting a network cable from the facility's network to the computer's additional network port. Network access will allow the user to permit ILX to remotely access the system for troubleshooting.

Only the computer that is supplied with the LRS-9550 system can be used to control the system. It has been configured at the factory with the proper control software and operating system configurations. If any other computer is used to control the chamber, the results may be unpredictable and the software may not function correctly.

It is advisable to use only the software supplied with the computer. Installing other software can create conflicts with the correct operation of ReliaTest. Please contact ILX for questions about compatibility with other software applications.

Powering the System On

It is recommended that the system should be first powered on by an ILX Lightwave field service engineer. Prior to powering the system on, open the facility valve to supply water to the system. Visually inspect the system from the rear to ensure that no water or air leaks are evident.

Prior to turning on AC power ensure proper seating of all electrical connections located on the rear of the CMMs. Next, switch the circuit breaker located at the top rear of the system rack to the ON position. Finally, power the system on by momentarily pressing the on switch located under the circuit breaker. Observe the indicator lights on the System Control Unit located at the front top of the system rack. The three AC power LEDs should be illuminated. None of the fault indicator LEDs should be illuminated. The system will detect three faults on power up: AC, water flow, and water leak. Pressing the RESET button will clear these faults. If a fault persists, diagnose the problem before continuing with the installation.

Turn on the system computer. The computer will automatically log onto Microsoft® Windows and launch the ReliaTest software.

System Validation

Once the ReliaTest software is running you will be able to begin system validation. Normally system testing and validation is performed by an ILX Lightwave engineer. The exact validation process will vary, and is based on your test system design and functional requirements.

A typical validation procedure will verify that laser control and measurement functions are operating properly and within specification and all temperature control circuits work properly.

SYSTEM FUNDAMENTALS

This chapter is written as a general guide to the LRS-9550 system rack, electronics, fixtures, and software operation. Detailed information on using the laser diode fixtures is found in Chapter 4; software information is located in Chapters 5 through 8; and system maintenance and troubleshooting information are in Chapters 9 and 10.

Detailed system specifications are located in Appendix C.

Powering On the System

System Rack and Electronics

The system is powered on by switching the main breaker, located at the top rear of the system rack, to the ON position as shown in Figure 1.5.

> **Note:** The Emergency Stop button must be pulled out to power on the system.

Once the system is powered on, the three green LEDs labeled AC and located on the System Control Module at the top front of the rack will illuminate. Once AC power is applied, the system is enabled by pressing the RESET button on the System Control Module. The system requires approximately 3 minutes to boot up the firmware in the CMMs after power is enabled.

After turning on the computer, the Microsoft® Windows operating system will boot and automatically start the ReliaTest control software. You can also manually start the software by double-clicking on the ReliaTest icon located on the computer desktop.

Operation of Control-Measure Electronics Modules

The control-measure electronics modules (CMMs) contain the laser current sources, precision measurement, and temperature control circuits. The CMMs can only be controlled via computer using the ReliaTest software. Each CMM is an independent test instrument. Each shelf can run a different test independent from all others. This flexibility allows each shelf to be at a different temperature, and tests can be started and stopped independently.

Laser Diode Fixtures

The laser diode fixtures provided with the LRS-9550 system are designed for long useful lifetimes with a minimum of maintenance. An EEPROM on each fixture stores temperature sensor, other fixture calibration data, ILX-assigned serial number, and a user-defined identifier. This information is automatically read by the control-measure electronics modules when the fixture is loaded into the system rack, and is then uploaded by the system control software.

To load a fixture, first load devices as described in Chapter 4. Prior to inserting the fixture into the shelf, wipe the bottom surface free of dirt and other particles. Insert the fixture into the shelf and activate the pneumatic clamp. Please refer to the "Fixture" chapter for more detailed instructions.

Once the pneumatic clamp is activated, a pair of LEDs located on the front of each fixture provide a visual indication of the fixture status as described in the table below. The fixture status LEDs are shown in Figure 3.1.

Ready LED

Test in Progress LED

Pneumatic Switch
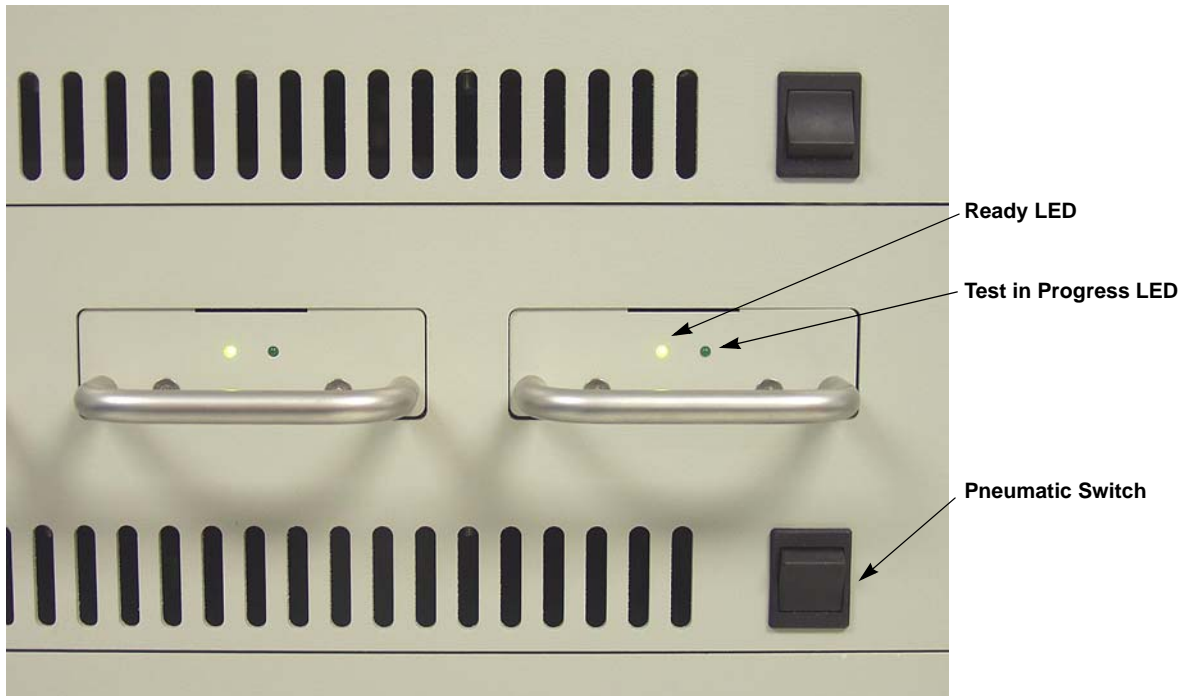
Figure 3.1 Fixture Status LEDs

Ready LED State	Indicates
Flashing	Fixture is properly connected and ready for use
Off	Fixture is not properly connected or pneumatics are raised and cannot be used
Steady On	Fixture is connected, but might have a problem and cannot be used. Remove fixture and reinsert. If problem persists, contact ILX Lightwave.

Test in Progress LED State	Indicates
On	Test is in progress and fixture should not be removed; do not raise the pneumatic clamp
Off	Test is not executing and fixture can be safely removed

⚠ **CAUTION**

Do not remove the fixture if the Test In Progress LED indicates a test is currently running. This will cause the hardware to abruptly shut down the current sources and ReliaTest will stop running the current test.

Shelf Temperature Control

The LRS-9550 system provides comprehensive temperature control functions that allow you to maximize the efficiency of your test process.

Controlling Device Temperatures

Some versions of the LRS-9550 have TECs on the fixtures and other versions have TECs on the shelves for controlling temperature. Additionally, each fixture has four AD590 temperature sensors for temperature measurement and four small heater elements which are used to balance the thermal load on the fixture and ensure temperature uniformity across all device locations.

Software Fundamentals

When launched, the ReliaTest system control software will automatically connect to the available control-measure electronics modules and identify them according to their serial numbers and present operational status.

The ReliaTest software allows you to create device types, create and view test profiles (scenarios), view currently running tests with their operational parameters, view data from current tests, and view historical data.

Additionally, the software allows you to enter functional limits for devices under test (DUTs), so that if any DUT falls outside the prescribed parameters the user will be notified. This feature makes test monitoring as quick as a glance at the computer screen to look for fixtures or devices that are flashing red.

Storing and Viewing Data

Data can be viewed in real-time while tests are running so you can decide if devices are running within expected parameters. You can also retrieve historical data and view it at any time. Chapter 7 discusses the data viewing and storage features of ReliaTest.

Events, Alarms, and Power Failures

If power to the LRS-9550 system is lost, hardware and firmware in the system quickly detect the event and shut down the devices under test in a controlled sequence designed to provide protection and data continuity. Additionally the system control software will log the event. When the system power is manually restored, the software will resume the test scenarios that were running.

The control-measure modules (CMMs) can operate independently of the system control computer. In the event that the computer fails or is rebooted the CMMs will continue to store data on-board until communications with the computer are restored. Memory capacity is available for a minimum of 3 days of data storage depending on test conditions.

The ReliaTest system software also performs system diagnostic tests, and will notify the user if power supply faults are detected, a system fault is triggered, or if communications are lost with the CMMs.

FIXTURES

▪ ▪

This chapter describes the device under test (DUT) fixtures that are used in the LRS-9550 High Power Test System. These fixtures are designed for ease of use and a long service life.

Mechanical Overview

Figure 4.1 shows the C-mount burn-in fixture. The fixture consists of a nickel-plated base plate which houses the main PCB, top current-carrying PCB, rear connector, and front plate with handle.
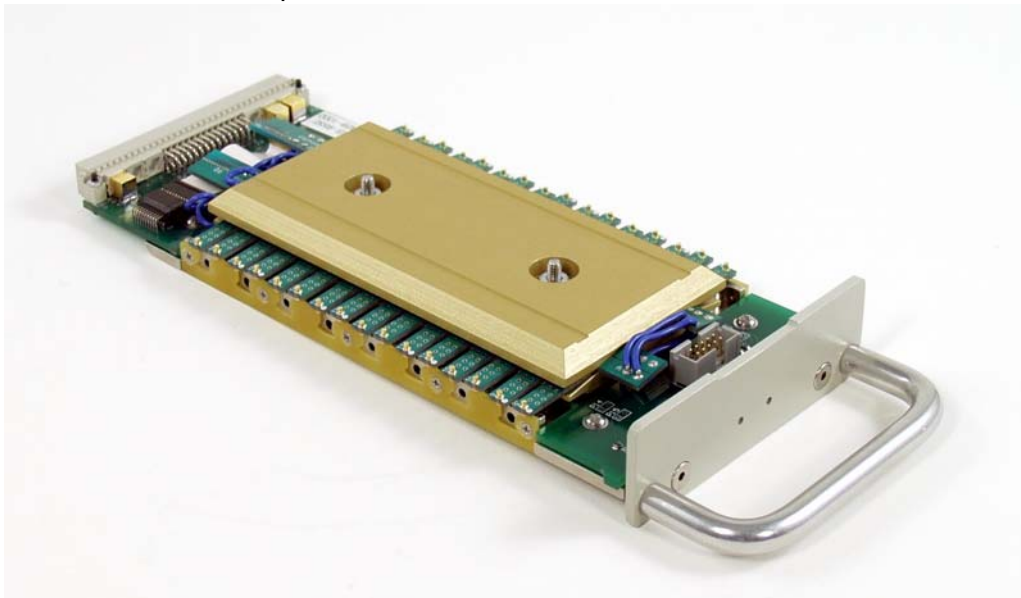
Figure 4.1 16-Device C-Mount Fixture

The top cover and PCB provides drive current to the devices via probe pins. This top assembly is spring mounted and lowers the probe pins to make contact with the C-block and the flying lead of the laser. The fixture has an EEPROM to store information specific to each fixture such as a serial number and calibration data.

Loading Fixtures with Devices

⚠ WARNING

Static sensitive device, use proper grounding provisions.

ILX Lightwave recommends that the following operations be performed at an ESD-safe work station.

C-Mount Fixture

The fixture is designed to test eight or sixteen C-mount devices. the LRS-9550 system can be configured with control measure modules (CMMs) which provide up to 10A or up to 20A. A 10A CMM can drive eight or sixteen devices while the 20A CMM can drive only eight devices. The devices are powered in series, therefore all eight or sixteen devices must be present for operation (dummy loads may be substituted if less than eight devices are to be tested). The 10A CMM contains two current sources per fixture. Both current sources on the 10A CMM are utilized to test sixteen devices while only one current source is utilized to test eight devices. The diagram in Figure 4.2 describes the loading pattern when loading only eight devices.
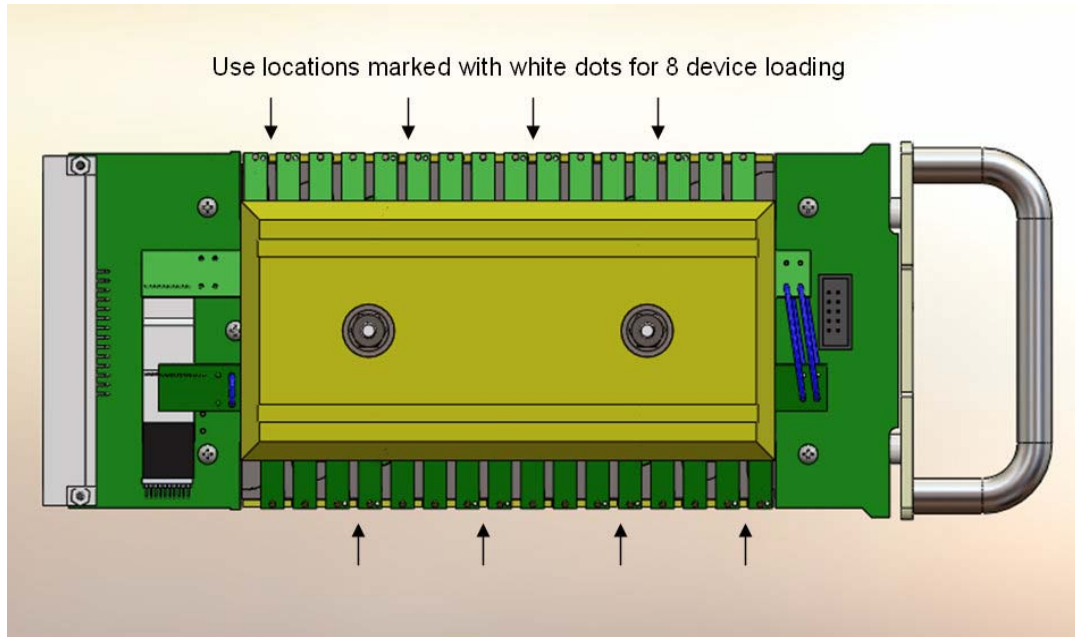
Figure 4.2 Loading Eight Devices
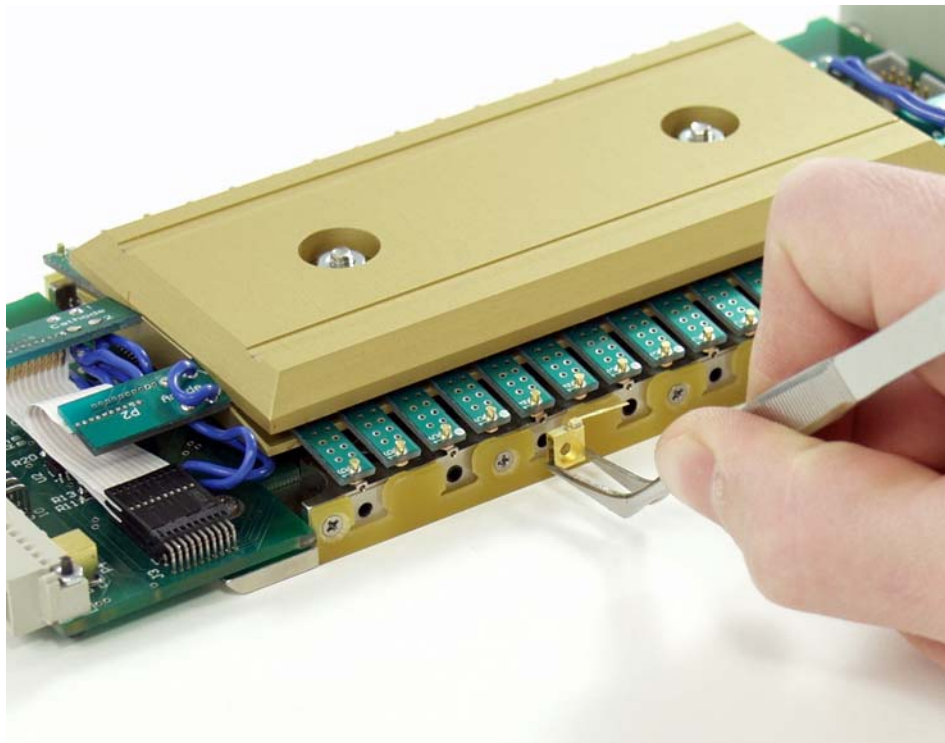
Figure 4.3 Inserting a Device

⚠ **CAUTION**

Failure to completely tighten the cover nuts can result in unreliable fixture-to-device electrical contact.

Inserting a Device

To load devices, first loosen the two cover nuts four turns each with an 11/32" nut driver to raise the probe pins. Use tweezers to carefully place devices into their slots. Secure devices with provided 2-56 x 3/4" button-head cap screws (torque to 0.5 in*lb). When all devices are installed, inspect flying leads to be sure they are aligned parallel to the edge of the fixture. Tighten the lid nuts until they bottom out on their stops, bringing the probe pins down onto the devices. Failure to completely tighten the cover nuts can result in unreliable fixture-to-device electrical contact.

Loading/Unloading Fixtures into the Chamber

Fixtures are loaded and unloaded from the system without using tools. The system contains up to eight modular shelves, each of which will accept four fixtures. Figure 4.4 shows the front of the system with shelves installed. Figure 4.5 displays a close-up of a single shelf. Each shelf consists of a liquid-cooled cold plate, thermoelectric (TEC) modules, a pneumatically operated clamp, and beam stops. The LRS-9550 system can be factory configured with integrating spheres and light detection circuitry on the shelf to allow the monitoring of external power.

Figure 4.4 System with Shelves Installed and Fixtures Loaded
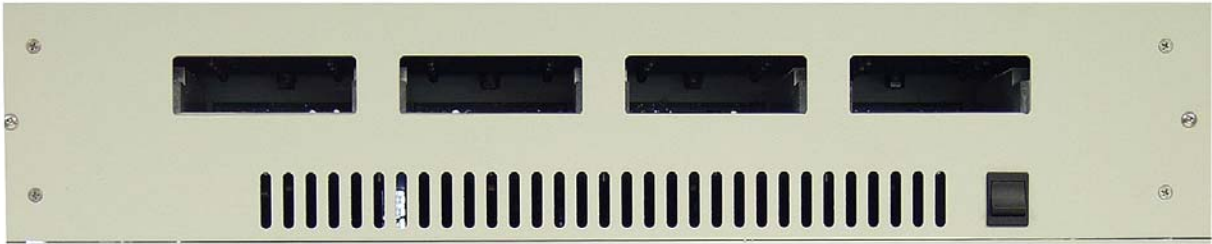
Figure 4.5 Close Up of Shelf

The pneumatic clamp is operated with a rocker switch located at the right side of the shelf. Depress the bottom of the rocker switch to engage the clamp. To disengage the clamp, depress the top of the rocker switch.

⚠ CAUTION

Do not place hands into the fixture slots at any time.

Before installing a fixture, it must be cleaned to guarantee a good thermal interface. See the section below for cleaning instructions. To install a fixture, first verify that the shelf clamp is in the up (disengaged) position. The base of the fixture should face downward in order to mate with the cold plate. Carefully insert the fixture into a fixture slot until the front plate is flush with the front panel of the shelf (see Figure 4.6). Resistance will be felt as the rear connector mates. Insert the remaining three fixtures into the shelf, and then engage the pneumatic clamp. After several seconds the "Ready" LED on each fixture will blink, indicating that the fixtures are ready to test.

> **Note:** It is possible to operate the shelf with one to four fixtures in any location on the shelf.
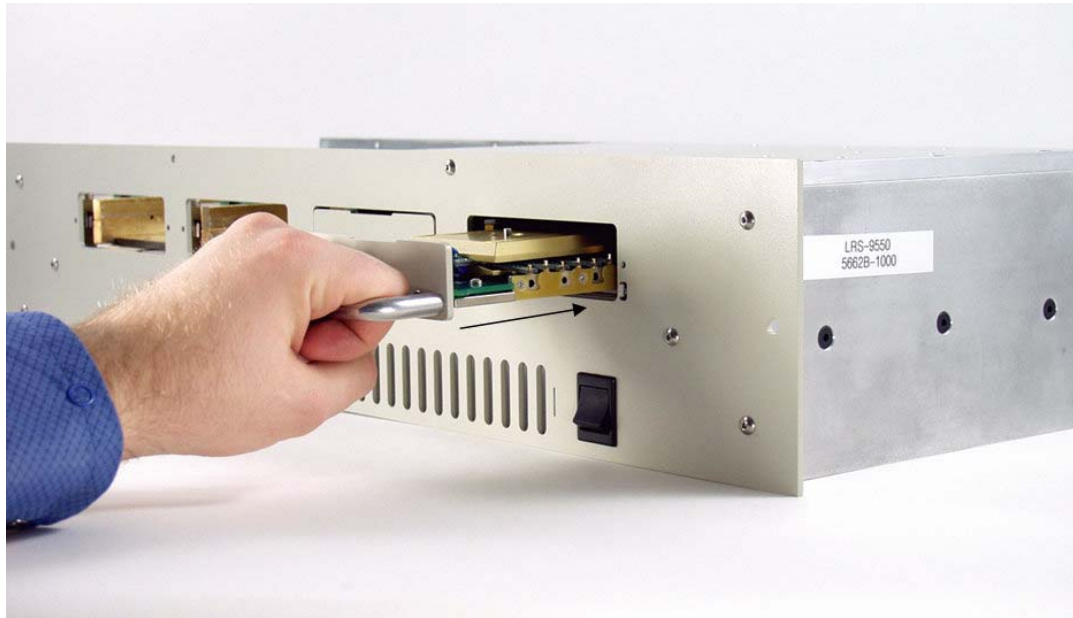
Figure 4.6 Inserting a Fixture

To remove a fixture, first verify that no tests are in progress. If the "Test in Progress" LED is illuminated, pause or terminate the test before attempting to remove the fixture. Disengage the clamp using the rocker switch on the right side of the shelf. Gently but firmly pull on the fixture handle to disengage the rear connector and remove the fixture.

⚠ **CAUTION**

The fixture front plates and handles can be very hot during and immediately after a test. Take care when removing a fixture immediately following the completion of a test to avoid burns.

Cleaning the Fixtures and Cold Plate

The LRS-9550 High Power Test System uses high-performance cold plates to remove up to several hundred watts of heat from each fixture. At these high power levels even a slight increase in thermal resistance of the fixture-to-cold plate interface will significantly decrease fixture thermal performance. The surface of the cold plates and the fixture bases must be kept free of particulate at all times.

Device Temperature Control

Device temperature control is handled primarily through the ReliaTest control software. Using the software, you can set the temperature set points of individual shelves at different temperatures. Each shelf operates in parallel with other shelves thermally, so any combination of temperatures (within the specified temperature range) can be run on different shelves, with no possibility of cross-talk between shelves.

Each shelf contains thermoelectric modules (TECs) which are used to heat or cool the fixture. The heat generated by both the devices under test (DUTs) and the TECs is removed by a cold plate which flows facility water. The TEC drive current is varied to achieve the desired device temperature set point. Additionally, small resistive trim heaters are embedded into the fixture base plate near each DUT to provide fine resolution temperature control, aiding in fixture uniformity.

RELIATEST SOFTWARE

■ ■

This chapter describes the screens and functions that are accessed when configuring tests, fixtures, and devices for tests using the ReliaTest system control software. The process that must be followed to configure a test is described in Chapter 6, Configuring and Running Tests.

Software Terms and Fundamentals

The software is easy to use once the basics are well understood, and a few terms that are helpful to know are listed in the table below.

Device	Laser or other device-under-test (DUT)
Device Type	A set of configuration instructions that define a particular device type; includes current limits, temperature limits, and laser safety-off criteria
Test Step	A single step of a test scenario, such as an LIV or burn-in
Test Scenario	A sequence of test steps which, when combined, create an entire test sequence
Events	Any occurrence that causes the software to generate an alarm or alert message
Control Measure Module	The enclosure containing the electronics and power supplies for driving current sources and taking measurements for either Life-Test or Burn-in. The Control Measure Module (CMM) is inserted into one shelf of the system rack and communicates directly to ReliaTest via TCP/IP Ethernet.

Starting the Computer and Software

The computer is configured to automatically power up when AC power is applied. It will automatically log onto your facility's network, start the ReliaTest control software, and connect to the LRS-9550. Refer to Appendix A for instructions on changing the log on passwords.

Once the computer has booted, the ReliaTest control software will automatically start and will connect to the available control-measure modules (CMMs). The software may be manually started by double-clicking on the ReliaTest icon located on the computer desktop.

The startup process is logged in the Initialization Log, and can be viewed by clicking **Events → View Initialization Log** in the menu at the top of the main window.

Navigating the Software

The software is primarily navigated using a Graphical User Interface (GUI) consisting of views and windows, on-screen buttons, and dialogue boxes. At the top of the screen is a text-based menu system that can be used in lieu of the on-screen buttons; this manual discusses the GUI navigation methods.

The ReliaTest interface has two modes of operation: the Engineering Interface and the Operations Interface. The Engineering Interface provides full access to all areas of the software, including all configuration screens. The Operations Interface provides a slimmed down interface displaying only the necessary information to enable rapid and repeatable operation. A password can be configured to restrict access to the Engineering Interface from the Operations Interface.

Most sections in this manual will focus on the Engineering Interface. Please refer to the section at the end of Chapter 5 for a more detailed description of the Operations Interface.

There are three main sections, or views, to the software screen shown in Figure 5.1; the **Control View**, the **System View**, and the **Test View**. Generally, these sections each focus on the functions for which they are named.

ILX Lightwave
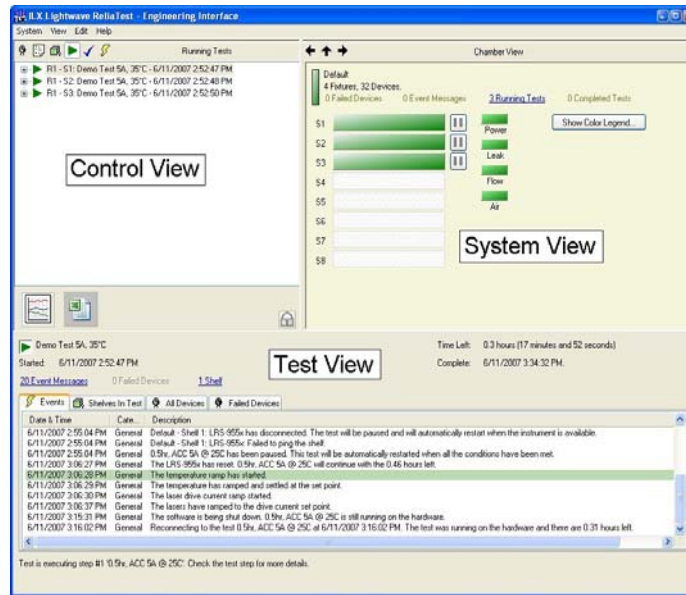
Figure 5.1 Software Main Screen

Control View

The **Control View** in the upper left side of the main screen displays information relative to controlling the system. The six buttons in the top-left corner of the **Control View** are used to access the different functions described below.

Device Type Configuration

Test Configuration

Instrument Information

Running Tests

Historical Test Data

Events and Alarms

System View

The **System View** presents specific information on the entire rack, each shelf, each fixture, and each device. Instruments can be viewed in detail by double-clicking them, or the three arrow buttons at the top of the **System View** can be used to step through devices and fixtures.

Test View

The **Test View**, at the bottom of the screen, presents information on the test scenario or step that is highlighted in the **Control View**. Information can be viewed for test configurations that are not running **(Configured Tests)**, current running test scenarios **(Running Tests)**, and test scenarios that have finished running **(Historical Tests)**.

Using the System View

You can view specific details on each shelf, fixture, or device by "diving down" through the hierarchy in the **System View** area. Simply double-click on the subcomponent - shelf, fixture, or device - you wish to examine in detail.

The system view hierarchy is shown in Figure 5.2. As the system view changes, the **Control View** also updates to display the location in the hierarchy "tree" that you are examining.

When an Event occurs, the affected instrument will flash red to get your attention. You can navigate in the **System View** to the affected instrument to find the event message. More information on events is in Chapter 8.
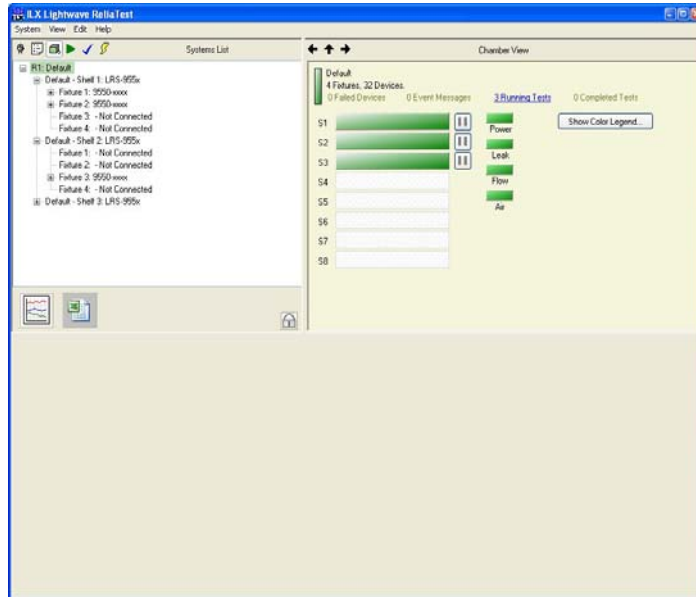
Figure 5.2 System View Hierarchy

Chamber View

From the **Chamber View**, one can see all the fixtures and control measure modules (CMMs) that are installed within a single rack. As shown in Figure 5.3, any shelf that is not populated with a CMM is lightly hatched. In this figure, shelves 1, 2 and 3 are the only positions with CMMs installed. Any shelf with an installed CMM but with no fixtures will be colored orange.
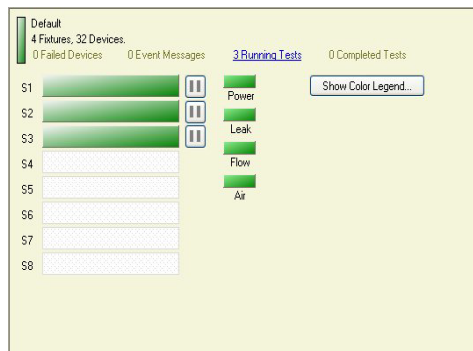
Figure 5.3 Chamber View

Shelf View
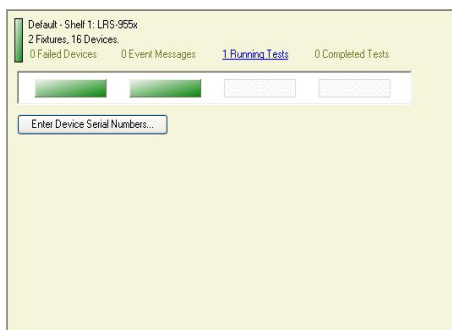
Figure 5.4 Shelf View

Fixture View

Double clicking on a fixture from the **Shelf View**, or clicking on a fixture within the connected instruments tree from the **Control View** will bring up a view similar to that shown in Figure 5.5. The ReliaTest software identifies fixtures through the use of a serial number and fixture ID stored within the EEPROM located on the fixture circuit board. The fixture ID can be a name as descriptive as required and can be changed by clicking on the **Assign ID** button. If a fixture will only be used with a certain device type, the fixture ID can be modified to show what types of devices are loaded into the fixture.

The fixture ID can only be changed when the fixture is not being used in a currently running test. If the fixture is in use, the **Assign ID** button will be grayed out and unavailable.
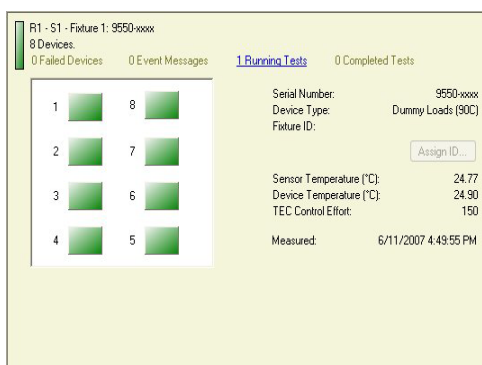
Figure 5.5 Fixture View

The **Fixture View** also displays the average temperature at the base of the devices as well as the TEC control effort. A timestamp shows how recent the measurement is.

⦚⦚⦚ ILX Lightwave

Device View

Double-clicking on any device shown in a **Fixture View**, or clicking on a device within the connected instruments tree from the **Control View** will bring up a **Device View** similar to that shown in Figure 5.6. From this view, current status and limit information for a specific device may be viewed. The left and right arrows allow the view to cycle between all the device positions within a fixture.
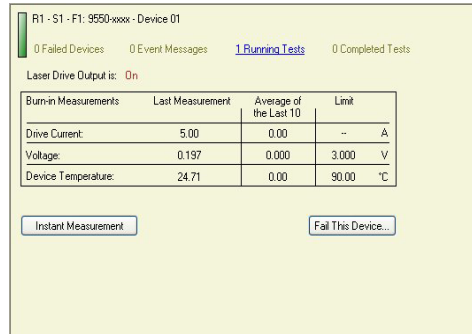
Figure 5.6 Device View

During a test, a device may fail due to an open or short circuit, or due to exceeding one or more of the limits set for the device. This information will be displayed in the **Device View**. Clicking the **Fail This Device** button will shut off all eight devices that are driven by the same current source.

Using the Control View

The system hierarchy is shown in a "tree" fashion in the **Control View** when the View Connected Instruments display is active. Figure 5.7 shows an example of the tree.
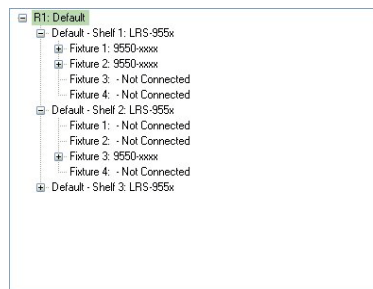
Figure 5.7 System Hierarchy in the Control View

To navigate through the tree, simply click on the instrument you wish to view. This method also allows you to view individual fixtures and DUTs, and the Test View updates accordingly. The **System View** on the right side of the screen also updates as you click down through the tree.

Using the Test View

The **Test View** is at the bottom of the main screen and displays information about the test that is currently highlighted in the **Control View**. Tests can be selected from the View Configured Tests, View Running Tests, and View Historical Data sections of the Control View.

When a scenario name is highlighted, the **Test View** shows which instruments are assigned to that test as shown in Figure 5.8. Shelves can be assigned and removed from Tests using the **Add Selected Shelves** and **Delete Shelves** buttons at the bottom of the test view.
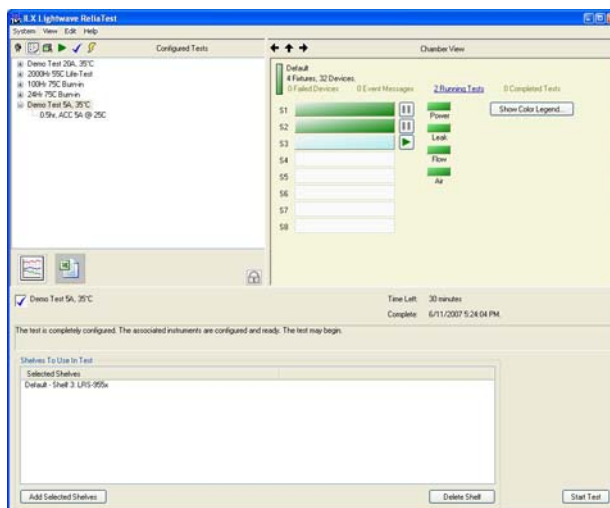
Figure 5.8 Test View Scenario Information

Status Color Codes

As you navigate through the instrument hierarchy, shelves, fixtures, and DUTs change color to indicate their status. A color code list is viewable from the **Chamber View** by clicking on the **Show Color Legend** button. The color codes are explained in Figure 5.9.
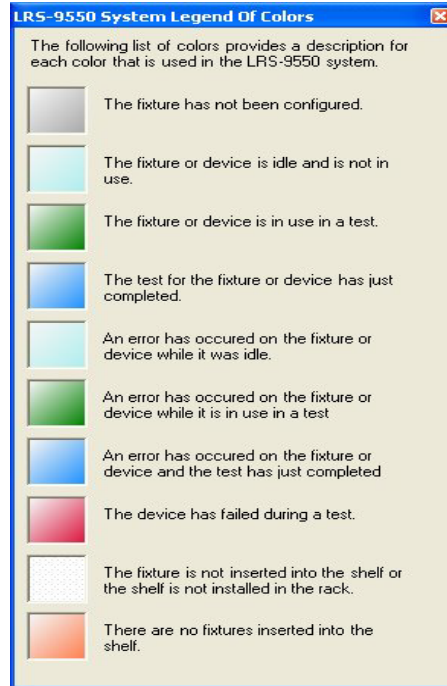
Figure 5.9 Status Color Codes

Operations Interface

The Operations Interface provides a simple, clean interface for repeatable, every-day use of the software. Where the Engineering Interface allows full access to the **Device Configuration** and the **Test Configuration** windows, the Operations Interface is designed purely for starting and stopping tests that have already been configured. The Operations Interface is very similar to the Engineering Interface with a few minor differences.

Access between the Operations Interface and the Engineering Interface is provided through the pad-lock icon on the main screen.

Running Tests List Differences

In the Operations Interface, the **Running Test** list contains only the tests that are actively running in the system. Tests which have been recently paused or aborted stay in the **Running Test** list for one hour. In the Engineering Interface, the tests in the **Running Test** list are listed in the order that they are started. The tests in the Operations Interface **Running Test** list are listed in the order of the shelves that they are running on.

Test View Differences

In the Operations Interface, the **Test View** may be hidden or displayed by the user. If the **Test View** is displayed, it will only contain the test scenario status. The status information for the test steps is not displayed. This is intended to keep the interface simple and easy to understand. If the user clicks on the test step, only the test scenario status is displayed in the **Test View**.

Restricted Areas

The Operations Interface may be configured to restrict the user's access only to the areas of the software that are required for operating the system. Areas of the software that are used to configure the system may be inaccessible.
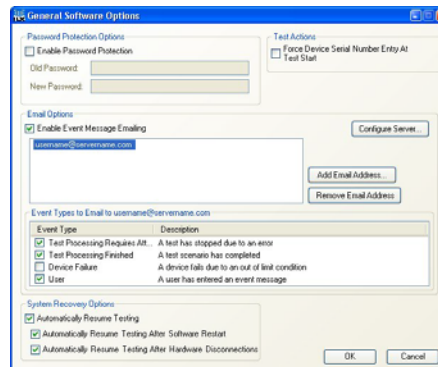
Figure 5.10 General Software Options

From the Engineering Interface, choose **System->Options** to access the **General Software Options**. By checking **Enable Password Protection**, the Operations Interface will be restricted to "operation-only" screens and information. To access the restricted areas, the user must enter the Engineering Interface. If password protection is enabled, the user will be prompted for the password to enter the Engineering Interface. If the incorrect password is entered, ReliaTest will log an event message to signify that an attempt to gain access was blocked.

The following areas or options are inaccessible from the Operations Interface:

- The Database Configurations Dialog

- The General Software Options Dialog

- The Test Configuration Dialog

- The Device Type Configuration Dialog

- The Device Types Control View

- The Existing Tests Control View

- The Connected Instruments Control View

- The Default Running Tests Control View

- The Historic Tests Control View

- The System Events Control View

- Deletion of Tests (Singular and Multiples)

- Restarting a Test From the Beginning

CONFIGURING AND RUNNING TESTS

· · · · · · · · · · · · · · · · · ·

This chapter describes the steps required to configure and start a test. This chapter refers frequently to Chapter 5, which describes each of the screens and functions in detail.

Refer to Chapter 8 for instructions on viewing the test data once the test has started.

Device Type Configuration

The Device Type Configuration screen is used to set the attributes for DUTs. Click the View Device Types button in the top left corner of the **Control View** to activate the Devices control view.

To create a new device type, right-click in the **Control View** area and select **New Device** to bring up the window shown in Figure 6.1. Fill in the device type attributes to configure the device. Click **OK** when the page is complete.

To edit an existing device type, right-click on the device you want to modify and select **Edit Device Type**. Modify the attributes described below, and then click OK.
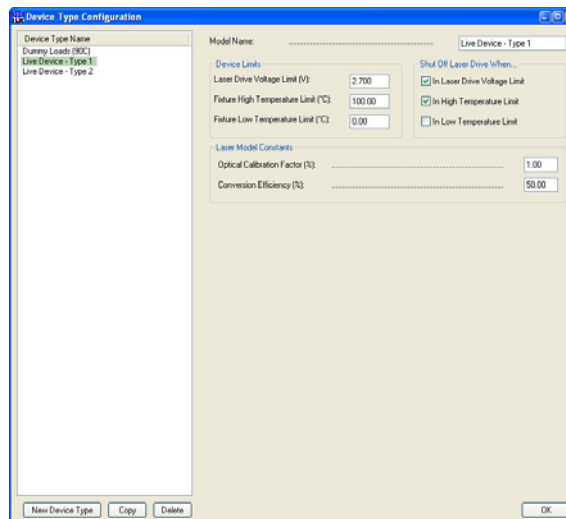
Figure 6.1 Device Type Configuration

Devices attributes that must be configured are:

*   **Model Name** - The name of this device type, typically the model of the laser that this information represents.

*   **Device Limits** - Operational limits that define the extremes of the device's expected performance.

*   **Shut Off Laser Drive When…** - Enables shutting off the device when one of the adjacent limits has been met or exceeded.

*   **Optical Calibration Factor** - A percentage applied as a multiple of the measured output power of the device. The value assists in compensating for variations in laser output between devices. For example: An **Optical Calibration Factor** of 90 will adjust the recorded optical power down by 10% of the originally measured optical power.

*   **Conversion Efficiency** - The expected percentage of the power that exits the laser as optical power. This value is used by the system to calculate the temperature at the base of the device by compensating for the amount of power is converted to thermal energy.

Device types can be assigned to a test scenario as the default device type for that test. After editing a default device type, the Test Scenario will reset the default device type to "none".

Test Scenario Definition

Click the View Configured Test button in the top left corner of the **Control View** to activate the **Configured Tests List**. To create a new test scenario, right-click in the Control View area and select **New Test** to bring up the **Test Configuration** window shown in Figure 6.2.
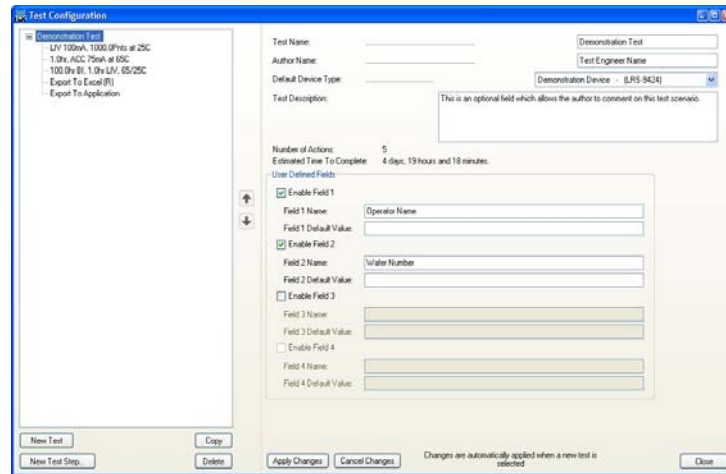
Figure 6.2 Test Configuration Window

- **New Test** - Creates a new test scenario.

- **New Test Step** - Creates a new test step in an existing test scenario. Possible test steps include monitored burn-in tests and LIV tests.

- **Copy** - Copies the highlighted test scenario or test step. The copy is placed adjacent to the highlighted item.

- **Delete** - Deletes the highlighted test scenario (and any associated test steps) or the highlighted test step.

- Up and Down Arrow Buttons - Allows test steps to be reordered within a test scenario or test steps may be moved from one test scenario to another.

Click the **New Test** button in the bottom left corner to create a new test scenario. A new test scenario item will be inserted at the top of the list of test. Click on this new test scenario to display the related configuration information in the left side of the screen.

- **Test Name** - The user-defined name of this test scenario. This name must be unique among all of the predefined test scenarios. This field is limited to 30 characters.

- **Author Name** - The optional name of the author of this test scenario. This field is limited to 256 characters.

- **Default Device Type** - The optional default device type to utilize when this test runs. A device type must be assigned in order for this test to be started from the Operations Interface.

- **Test Description** - The optional description of this test. This information is displayed in the Operations Interface in the **Select A Test** dialog when the operator is starting a test on a shelf. This field is limited to 512 characters.

- **Number of Actions** - The number of test steps that are contained by this test scenario.

- **Estimated Time To Complete** - The estimated time that this test scenario requires to finish.

- **User Defined Fields** - Customizable fields that will be displayed to the operator when this test starts. The operator is required to enter a value into each active field before the test will start. Typical use of these fields maybe to prompt for the operator's name, the batch number of the devices in test, or perhaps the sales order number for the devices under test. This information is always available after the test has started in the **Custom User Information** tab within the **Test View**. This information is exported to the test scenario CSV file.

Editing Test Scenarios

To edit an existing test scenario from the **Control View**, right-click the test scenario you want to modify, and then select **Edit Test**.

Test scenarios can also be edited by clicking on the test name in the **Test Configuration** window. The right side of the **Test Configuration** window will show the information relevant to the selected test.

Creating New Test Steps

To add a test step to a scenario, first click on the test scenario name. Click the **New Test Step** button in the bottom left corner of the **Test Configuration** window; the **Adding a New Test Step Type** window will appear (Figure 6.3). Click to select the type of test you want to execute in that test step:

• Execute Command Line

• Monitored Burn-In

• LIV test

• Export to Microsoft ® Excel

• Run Support Application

When you have selected the type of test you want to create, click **OK**. The right side of the **Test Configuration** window will change according to the type of test you select, and each is described below.
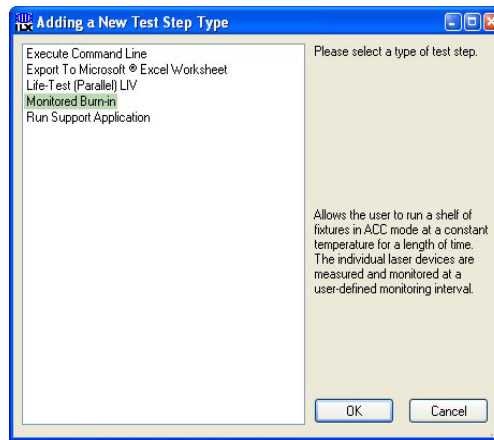
Figure 6.3 Adding a New Test Step Type

Execute Command Line

The Execute Command Line configuration screen is shown in Figure 6.4. This feature is used to open or run any file, including external application programs. You can choose to wait until the other program has been closed before moving on to the next step, or the next step can begin immediately after the external application program is called. This function can be used to run an external program to analyze test data, print a data file or report, or perform other analysis or system control functions.
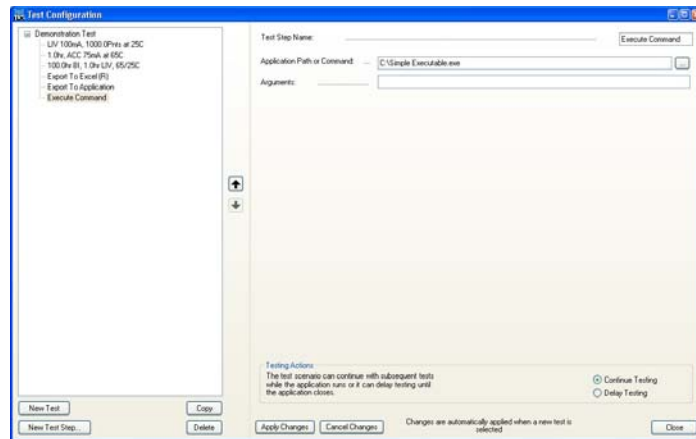
Figure 6.4 Execute Command Line Configuration

LIV

An LIV test is a method of characterizing laser diodes. It is a test where laser forward current (I) is ramped from zero (typically) to another current within the laser's operating range. While the current is being ramped, the laser's forward voltage (V) and optical light (L) outputs are recorded. The data is typically plotted with I as the independent variable and L and V as dependent variables to produce an LIV graph.

The operational parameters of lasing threshold and slope efficiency are calculated from the resultant data. Several different methods may be used to determine threshold and slope efficiency. Each method is available from within the LIV configuration screen shown in Figure 6.5.

The LRS-9550 LIV operation is performed on all devices in the test at the same time. The LIV ramp ensures that each device has achieved the set point temperature at each point in the ramp before taking a measurement. The user may specify the desired temperature accuracy at each point. The system will typically take 30 minutes to perform an LIV on 32 devices.
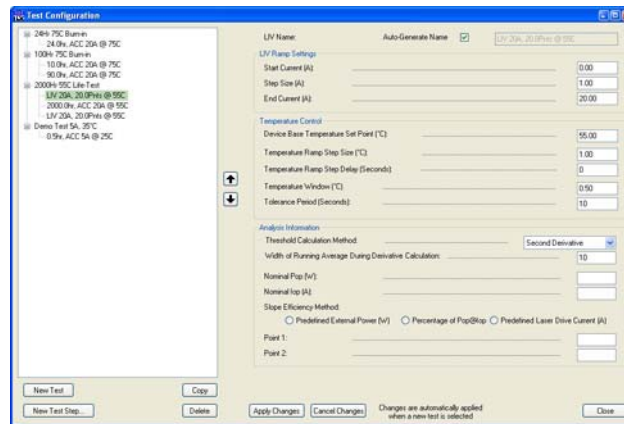
Figure 6.5 LIV Configuration

Fill in each of the data fields on the screen to complete the LIV test configuration.

- **LIV Name** - The user-defined name of this test step. This name does not need to be unique. This field is limited to 30 characters.

- **Auto-Generate Name** - When selected, this option will automatically generate a consistent name based on the parameters entered into this test step.

- **LIV Ramp Settings** - The **Start Current**, **Step Size**, and **End Current** that define the current ramp of the LIV. The values entered here cannot create a ramp that has more than 1000 steps.

- **Device Base Temperature Set Point** - The temperature set point as measured at the base of the device.

- **Individual Measurement Temperature Tolerance** - The temperature tolerance range within which valid measurements will be taken.

- **Temperature Ramp Step Size** and **Temperature Ramp Step Delay** - The step size and timing of the temperature ramp. A value of zero seconds will ensure that the temperature ramps as fast as thermally possible.

- **Temperature Window** and **Tolerance Period** - The temperature settling size and timing that define the when the test will begin. The temperature must be stabilized within the **Temperature Window** for the entire duration of the **Tolerance Period** before the lasers will turn on.

- **Threshold Calculation Method** - The method used by the software to calculate the threshold of the laser. The first three are based on Telcordia GR-468-CORE and GR-3010-CORE.

  - **Second Derivative** - This method uses the peak of the second derivative for the threshold point.

  - **First Derivative** - This method uses the point where the first derivative reaches 1/2 of its peak value as the threshold point.

  - **Two-Segment Line-Fit** - This method extrapolates the two linear portions of the L/I curve and uses the point where these lines intersect as the threshold point.

- **Single Line-Fit** - This method extrapolates the linear portion of the L/I curve above the knee to the zero optical power point, which is considered to be the point of threshold. This method is not recognized by Telcordia.

- **Width of Running Average During Derivative Calculation** - The size of the moving average (low-pass filter) used to smooth the data before calculating a derivative (first or second order). Larger running-average values will create a smoother data profile, but will limit the resolution on the threshold calculation. The default width is 10 points, but trial and error may be required to discover the best value to enter for your devices and test requirements. As a guideline, use approximately 1% of the total number of points as the average width.

- **Nominal Pop** - The optional field denoting the expected power at the typical operating current. The Iop of the laser will be calculated based on this value.

- **Nominal Iop** - The optional field denoting the typical operating current of the device. The Pop of the laser will be calculated based on this value.

- **Slope Efficiency Method**, **Point 1**, and **Point 2** - The optional information used to determine the slope efficiency of the laser. The points entered define the line with the slope of the laser's Light versus Current data.

- **Predefined External Power** - Points are entered in terms of optical power (Watts).

- **Percentage of Pop@Iop** - Points are entered as a percentage of the calculated Pop@Iop.

- **Predefined Laser Drive Current** - Points are entered in terms of the drive current.

Monitored Burn-in

A monitored burn-in test drives the devices at a constant predefined current for a predefined length of time. The voltage, temperature, optical power (Life-Test only), and TEC control effort are measured at set intervals.

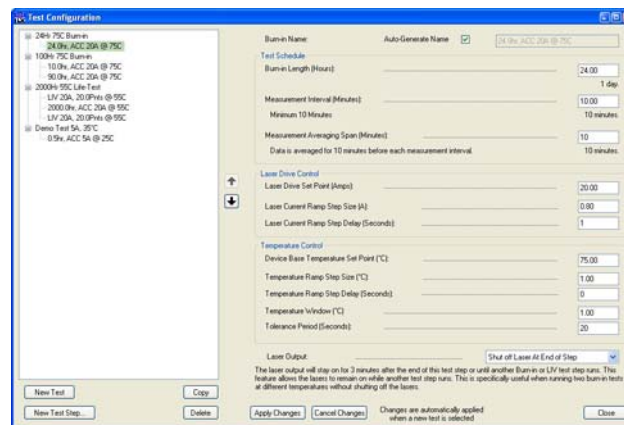The Monitored Burn-in configuration screen is shown in Figure 6.6.

Figure 6.6 Burn-in Configuration

ILX Lightwave

- **Burn-In Name** - The user-defined name of this test step. This name does not need to be unique. This field is limited to 30 characters.

- **Auto-Generate Name** - When selected, this option will automatically generate a consistent name based on the parameters entered into this test step.

- **Burn-in Length** - The time, in hours, that the devices in test will be at the laser drive set point; time is displayed in "days, hours, minutes, seconds" below.

- **Measurement Interval** - The interval, in minutes, at which the measured parameters are reported; minimum of ten minutes.

- **Measurement Averaging Span** - The time span, in minutes, over which data is averaged. The averaged data is reported at each measurement interval.

- **Laser Drive Set Point** - The drive current that the devices under test are supplied.

- **Laser Current Ramp Step Size** and **Laser Current Ramp Step Delay** - The step size and timing of the drive current ramp. The optimal ramp speed can vary between devices and the amount of voltage they require. ILX Lightwave recommends starting with a step size of 0.8 amps and a delay of one second. Faster ramps may be possible, however if the devices are shutting off while they are ramping to current, a smaller ramp step size is recommended.

- **Device Base Temperature Set Point** - The temperature set point as measured near the base of the device.

- **Temperature Ramp Step Size** and **Temperature Ramp Step Delay** - The step size and timing of the temperature ramp. A value of zero seconds will ensure that the temperature ramps as fast as thermally possible.

- **Temperature Window** and **Tolerance Period** - The temperature settling size and timing that define the when the test will begin. The temperature must be stabilized within the **Temperature Window** for the entire duration of the **Tolerance Period** before the lasers will turn on.

- **Laser Output** - Configures the lasers to shut off or remain on after the end of the test. The lasers maybe configured to remain on up to 3 minutes after the burn-in test length has expired. This option may be useful when running multiple burn-in tests in succession. With this option set to **Leave Lasers On After End Of Step**, the lasers will remain on as the next test step commences. This option allows a string of test data to be recorded at different measurement intervals or temperatures without shutting the lasers down between tests.

Export to Microsoft® Excel

The Export to Microsoft® Excel test step copies test CSV files directly into an existing Microsoft® Excel workbook. This Export to Microsoft® Excel test step can only export tests that are part of the same test scenario as the test step. An installed copy of the Microsoft ® Excel software application is required for this test step to operate correctly; the Microsoft ® Excel software application is not supplied with ReliaTest.

The Export to Microsoft® Excel test step exports the assigned tests to temporary CSV files. The temporary CSV files are copied into the assigned workbook. A worksheet is created for each test's CSV file. The first test CSV file is copied into a worksheet named "ReliaTestData_1", the second to "ReliaTestData_2" and so on. If a worksheet already exists with this name, the data in the worksheet is deleted when the new data is copied into the worksheet. Once all of the CSV files have

been copied into the workbook, ReliaTest automatically runs a Macro named "ReliaTest_AutoRun". If the Macro does not exist, ReliaTest ignores this option. ReliaTest leaves the Microsoft ® Excel workbook open when it finishes.
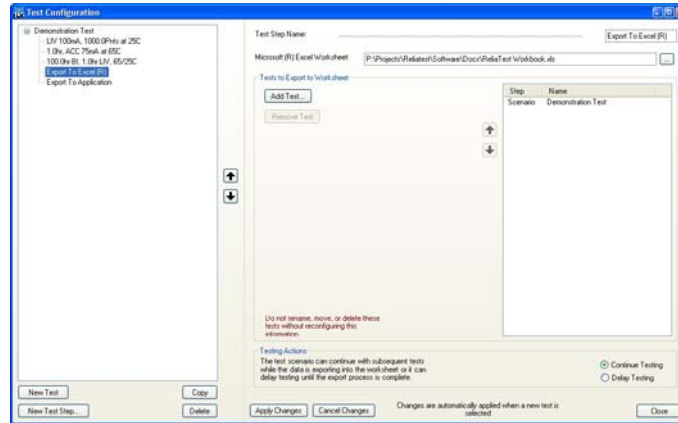

Figure 6.7 Export to Microsoft® Excel Test Step Configuration

• **Test Step Name** - The user-defined name of this test step. This name does not need to be unique. This field is limited to 30 characters.

• **Microsoft ® Excel Worksheet** - The full directory path to a preexisting Microsoft ® Excel worksheet. The test CSV data is copied into the predefined sheets of this worksheet. See Chapter 7 for more information.

• **Tests to Export to Worksheet** - The list of test steps which are copied into the worksheet. The test steps must be a part of the same test scenario as the active Export to Microsoft ® Excel test step. The test steps may be added, removed, and the order maybe rearranged.

  - The test scenario may be assigned to export. If so, all of the test steps in the test scenario will be exported and copied into the workbook.

• **Testing Actions** - The test scenario may be configured to continue testing while the CSV data is copied to the worksheet and while the optional worksheet macro is executing. The test scenario may also be configured to delay at this test step until the CSV data has been copied to the worksheet and until after the worksheet macro has completed.

The power of this test step is in the ability to automatically export test data out of ReliaTest. A Microsoft® Excel macro may be created to save the workbook to a predefined location and close the workbook. A Microsoft® Excel workbook can be preconfigured to perform mathematical calculations on the raw data from the test CSV files. This provides for tremendous expansion of analysis capabilities that may be quickly configured and modified as needs change.

Run Support Application

A support application is another program written to extract elements of a burn-in or LIV test and possibly perform analysis on the data. Besides performing numerical analysis, a support application could be designed to convert the data into another database format.

The Run Support Application test step requires the specification of the path to the application that is to be run and the test step(s) containing the data that is to be used. Only test steps within the scenario containing the support application step may be specified. When run, the Run Support Application test step will execute the specified application from the command line and pass as arguments, SQL parameters corresponding to the specified test steps. With these pointers, the support application may query the database and directly extract. Figure 6.8 illustrates the Run Support Application test step.
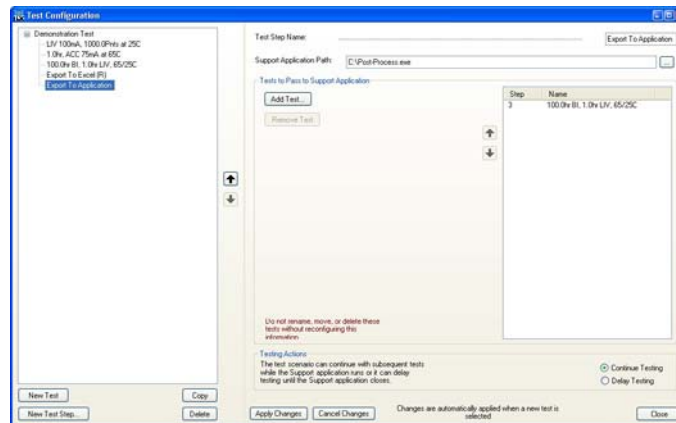
Figure 6.8 Run Support Application

- **Test Step Name** - Enter a name appropriate for the test step being configured.

- **Support Application Path** - Click on the browse button to navigate to the location of the support application to be run.

- **Tests to Pass to Support Application** - Click the Add Test button to select the test (test data) to be made available to the support application. If the data must be sent in a specific order, highlight the appropriate test step and use the up and down arrow buttons to rearrange the test order.

- **Testing Actions** - If the support application can be run in parallel with ReliaTest, select the **Continue Testing** radio button. Otherwise, select **Delay Testing**.

Assign Device Types to Shelves

A device type must be assigned to either the test scenario or the shelf prior to starting a test. This process joins the device type configuration with a specific shelf and the lasers that have been inserted into that shelf.

The default device type may be configured in the test scenario configuration screen. If the default device type is not specified, the user must manually assign the desired device type to the shelf before that test may be started on the test. Prior to assigning a device type to the shelf, the fixtures must be inserted into the shelf and detected by the software.

To assign a device type to a shelf, change the **Control View** to show the list of device types and change the **System View** to display the **Chamber View**. The screen should appear similar to Figure 6.10. Click and drag the device type to the shelf you are configuring. Each shelf can be assigned only a single device type, but the same device type can be assigned to many shelves. After a device has been assigned to a shelf, the shelf will change to light blue in color.
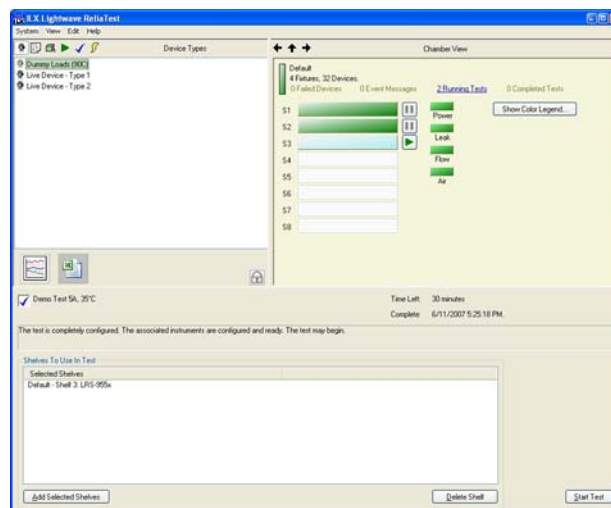

Figure 6.9 Device List and Chamber View

ILX Lightwave

Starting a Test Scenario on a Shelf

Once the device under test have been inserted into the shelf, the system is ready to start testing the devices. The shelf maybe assigned to the desired test scenario and the test scenario may be started on that shelf.

Prior to starting a test scenario, if the test scenario does not have a default device type configured in the test scenario settings, the device type must be assigned to the shelf.

The test may be started with two methods. One method is to click on the green play icon next to the shelf. This method opens a list of tests that may be started. Select the desired test and enter any optional user information presented. Click the Start Test button to start the test. The user may then be prompted with the device serial numbers and custom user information if ReliaTest is configured to require them.

The second method is to select the **Existing Tests** lists in the **Control View** and click on the desired test scenario. With the test scenario selected, highlight test desired shelf with the mouse and click the **Add Selected Shelves** button. Click the **Start Test** button to start the test. If the test scenario requires any optional user information, a screen is presented for the user to enter the information. The user may then be prompted with the device serial numbers if ReliaTest is configured to require them.

Only one test scenario can be run on any given shelf at a time, but the same test scenario configuration can be run simultaneously on as many shelves as needed.

Pausing, Aborting, and Resuming Tests

Pausing a Test

Any running test scenario may be paused. There are two methods to pause a test. One method is to right-click on the test scenario or any of the test steps within the test scenario and select the option **Pause Test**. The second method is to click on the pause icon.

Pausing a test scenario does not immediately shut off the lasers. After pausing a test scenario, the currently running test will ramp the lasers to zero amps before disabling the current source.

Aborting a Test

Any running test scenario may be aborted. Test scenarios that are in the process of pausing (the lasers are ramping off) may also be immediately aborted. Right-click on the test scenario or any of the test steps within the test scenario and select the option **Abort Test**.

Aborting a test immediately shuts off the laser current sources and TEC drive current. The only functional difference between pausing and aborting a test is the immediacy of the test shutdown

Resuming a Paused or Aborted Test

Any test that has been paused or aborted may be resumed. Tests may be resumed from the point at which it was paused or restarted completely from the beginning. Tests that have been aborted by either the user or by a system error may also be resumed. Completed tests cannot be resumed.

Right-click on the test name and select **Resume From Pause** or **Restart Test From Beginning**. Resuming from the paused point will resume the test at the same point it was paused or aborted; restarting from the beginning will resume from the beginning of the entire test scenario and delete any data already stored in the database. While the test is resuming, the restart icon (shown on the left) will appear next to the test name. Once the test is successfully restarted, the icon will change to the running icon again.

Completing a Test

When a test has completed, the Running icon changes to the Test Complete icon shown on the left. The completed test scenario remains listed in the **Running Tests** view for 24 hours after the test has completed.

When this time has elapsed, the test is removed from the **Running Tests** view and moved to the **Historical Tests** view. Tests that have been moved may be viewed by clicking on the **View Historical Test** button. Any test that has been manually paused or stopped due to an error will not be automatically moved from the **Running Tests View**. Such tests maybe manually moved to the **Historical Tests** list. Once a test has been moved to Historical Tests it cannot be resumed or restarted.

Any completed, paused, or aborted test scenario in the **Running Tests** view may be manually moved to the **Historical Test List**. This is possible by right-clicking on the test scenario and selecting the **Move To Historic Test List** menu option.

Loading a Shelf or Fixture Incompletely

The ReliaTest software dynamically detects which fixtures are inserted into the system. A test scenario may be run on a shelf that contains from one to four fixtures in any location.

The ReliaTest software assumes that each fixture is fully loaded with devices at the beginning of a test scenario. Once the test begins, the empty device positions will fail as open circuits and the software will no longer record data on those positions. The "failed devices" will flash red and an error event will be logged. Clearing the logged events or marking them as read will cease the flashing indicators; refer to Chapter 8 for more information on clearing logged events. All devices positions in a fixture must be loaded with test devices or a dummy load. Since the fixture consists of a serial laser drive current to each device, if a device position is not populated in the fixture, none of the devices in the fixture will operate. Please refer to Chapter 4 for information on how to partially load the C-mount fixtures.

VIEWING DATA AND DATA MANAGEMENT

■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■

The ReliaTest software offers a variety of methods for viewing and reporting the data generated during LIV or burn-in tests. ReliaTest normally records test data to a database and includes a graphing feature for tracking device performance while tests are running, but also allows you to export the data to a Microsoft $^{®}$ Excel file or to a CSV-format file. Once the data is stored in the database, other programs can be used to access the data or run reports.

Graphing Test Data
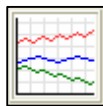
The graphing button is on the left side of the main window, between the **Control View** and the **Test View** sections. The graphing functions are accessed by clicking the graph button in the lower-left corner of the **Control View**.

Selecting Test Scenarios or Test Steps to Graph

You can use the graphing feature to examine data in currently running tests and historical data on tests that have terminated. The procedure for generating the graphs is the same, but the location of the raw data is different. For data on a currently running test, select tests from the **Running Tests** screen in the **Control View**. To view historical data, select tests from the **Historical Tests** screen in the **Control View**.

To select data to graph, right-click on the test that you wish to graph, then select **Add To Graph**. Tests may be added to the graph by clicking and dragging them to the graph icon. The number in the graph button on the **Control View** will increment to indicate the number of tests that have data loaded into the graphing routine. Both individual test steps and whole scenarios may be graphed.

Click the graph button to open the **Graph** window as shown in Figure 7.1.
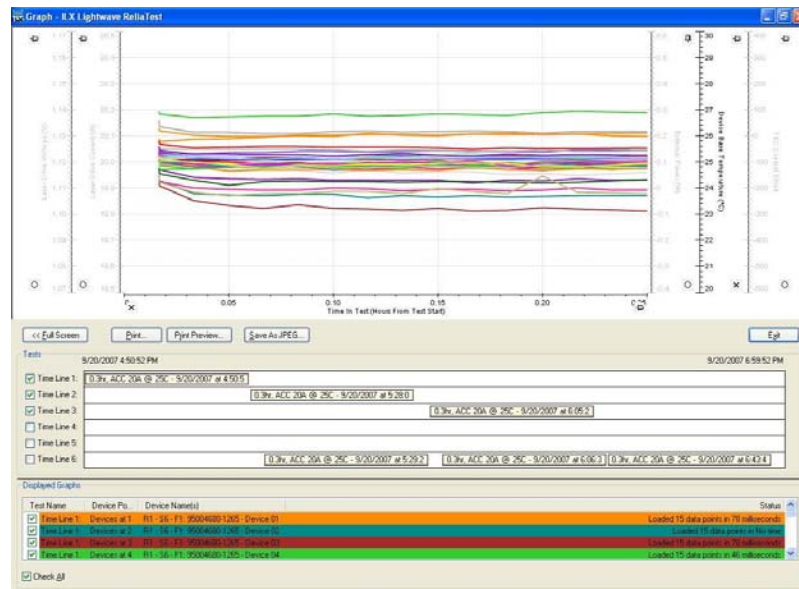
Figure 7.1 Graph Window

Tests and Timelines

Tests that have been added to the graph are represented graphically in the **Test Timeline** section. The **Test Timeline** section contains a timeline for each test that was added to the graph.
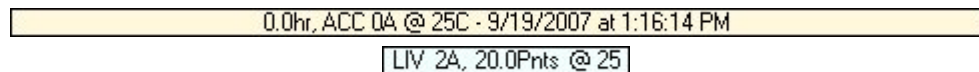
Figure 7.2 Test Graphical Objects - Burn-In and LIV

The light blue and light beige bars in the **Test Timeline** section represent the tests which have been added to the graph. These bars may be moved between timelines. Tests that share a timeline are graphed consecutively. Tests that do not share timelines are overlaid on top of each other. For burn-in tests, the graphical data is plotted with **Time In Tests** as the X-axis. For tests that share the same timeline, the start of the second test coincides with the end of the first test.

Graphing two or more tests on the same timeline is only useful for appending data for the same set of lasers from multiple different tests. The **Test Timeline** section organizes the tests horizontally based on the date and time that they started and finished. A test that started at the time as another test appears in the same horizontal location as the other test. In this way, tests that were executing at the

same time as another test may not share the same timeline. Tests that were executing at different times may share the same timeline.
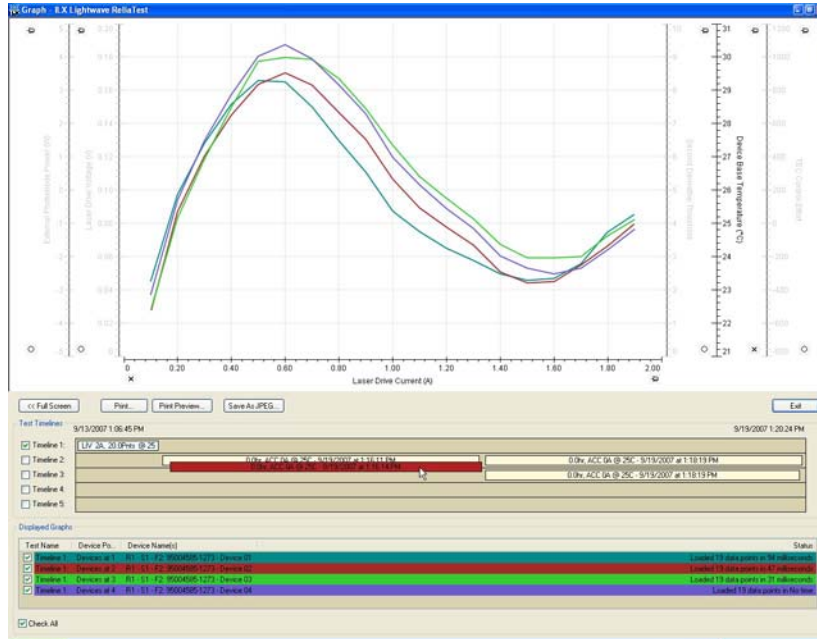
Figure 7.3 Test Colors

In Figure 7.3, the red test bar indicates that the test may not be placed on that timeline. The light beige bar indicates a burn-in test. The light blue bar indicates an LIV test. LIV and burn-in tests may not share the same timeline.

A Note on Appending Data

When appending data from two tests in the same timeline, ReliaTest must relate the data from the first test to the data in the second. In Figure 7.4, there are two fixtures that were used in the same two consecutive burn-in tests. ReliaTest uses the fixture's identity number to match the data from **Fixture 1-1320** in the first test to **Fixture 1-1320** in the second test. ReliaTest also matches **Fixture 2-1307** between the first and second tests.

Figure 7.4 One Timeline, Two Fixtures

A more complex situation occurs where **Fixture 1-1320**, for some reason, cannot be used in the second test. In this example, assume the lasers were removed from **Fixture 1-1320** and pla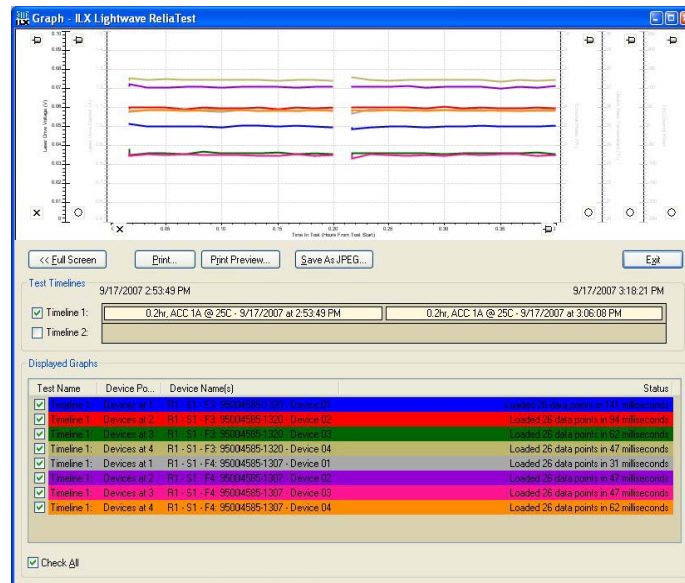ced into **Fixture 2-1321**. These lasers were tested in the first test in **Fixture 1-1320** but tested in **Fixture 2-1321** in the second test. ReliaTest first automatically matches **Fixture 2-1307** between the two tests. ReliaTest then assumes that **Fixture 1-1320** and **Fixture 2-1321** should be matched together.

The fixture identity number is, by default, the fixture's model and serial number. The user may apply a user identity number which would then be used by the graph to match the fixtures. If ReliaTest cannot match the fixtures using the fixture ID, it matches fixtures based on location in the shelf. If two fixtures share the same physical location (positions 1 through 4), ReliaTest matches the fixtures and append the data. ReliaTest also matches data between tests that were run on different shelves, following the same rules as noted above.

Displayed Graphs

The check box preceding each timeline allows the timeline to be graphed. The test data from the tests in the timeline are organized into the **Displayed Graphs** section. Each item in the **Displayed Graphs** section represents a set of graph data for one device.

The check box on each graph item line enables the graph data for that device. Enabled graphs are provided a color to help identify them in the graph screen.

Disabling and re-enabling a graph applies a new color for that graph. The mouse cursor may be moved over any graph to display on the data for that graph. This allows for rapid searching through all of the graphs that are enabled in the **Displayed Graph** section.

The mouse cursor may be moved over any of the graph axes to display the data for that axis. For example, in the burn-in data, there are four sets of data per devices that are plotted against **Time in Test**; voltage, current, temperature, and TEC control effort. When the mouse is positioned over the **Device Base Temperature (^{o}C)** axis, only the temperature versus time in test data is displayed. Each axis may be completely turned off and on by right-clicking on the axis or by changing the status of the check box by the axis.

Printing and Saving Graphs

The **Print** and **Print Preview** buttons print the currently displayed graphs to the printer. The computer must already be configured to use a printer in order for this option to function. A list of the displayed graphs is included with the printed graph to help identify the data. The **Save As JPEG** button saves the graph to a JPEG image on the computer. The JPEG image also contains a list of the displayed graphs to help identify the data.

Exporting Tests to CSV Files

Test data may be exported from the database to a CSV (comma-separated variable) file. A CSV file is created for each fixture and for each test step. A CSV file is created for the test scenario which contains a list of the events that occurred during the test. To export the test data, right-click on the test scenario or test step and select **Export to CSV** from the drop-down menu. Choose a destination folder for the CSV data and ReliaTest exports the data. Using this method, the data for the entire test scenario or only the data from the single test step may be exported.

CSV File Format

The CSV file format is a comma-separated file. The file is specifically formatted to assist with automated file parsing. The format of the file (such as positions of labels and values) will be maintained as strictly as possible as ReliaTest is upgraded in the future. This is done to prevent such changes from affecting any

customer-configured file parsers. An example of a CSV formatted file is shown in Figure 7.5.

Figure 7.5 CSV Formatted Data File

The CSV-formatted files are automatically recognized by Microsoft ® Excel. If Microsoft ® Excel is installed; double-clicking the file will open Microsoft ® Excel. Each label or value is parsed into individual cells in the worksheet.

Manually Exporting Tests to Microsoft ® Excel

The CSV data from any ReliaTest test may be exported directly to a Microsoft ® Excel workbook. The data for each test is placed respectively in individual worksheets in the workbook. ReliaTest offers two methods to export test data to a Microsoft ® Excel workbook, the first method is by the Export to Microsoft ® Excel test step as described in Chapter 6. The second method is in manually dragging tests into the Microsoft ® Excel Export icon on the main window. The Microsoft ® Excel software application is required for this test step to operate correctly; the Microsoft ® Excel software application is not supplied with ReliaTest.

The Microsoft ® Excel icon on the main ReliaTest window may be used to configure the manual export ability.

Tests steps may be dropped onto the icon by clicking on the test and dragging it to the Microsoft ® Excel icon. In this example, three test steps have been assigned to the icon.

Once tests have been assigned to the icon, left-clicking on the icon opens the dialog to select the desired Microsoft ® Excel workbook. After the workbook has been selected, ReliaTest exports the tests to temporary CSV files. The exported CSV files are then copied into the workbook. Each CSV file is copied into an individual worksheet. The first CSV file is copied into a worksheet named "ReliaTestData_1"; the second CSV file is copied into "ReliaTestData_2", and so on. The tests are copied into the workbook in the order they were placed onto the Microsoft ® Excel icon. All data on the "ReliaTestData_X" worksheets are erased when the new data are copied into the worksheet. After the export process is complete, ReliaTest automatically runs a Microsoft® Excel Macro with the name "ReliaTest_AutoRun", if it exists. ReliaTest leaves the workbook open to allow the user to save or print the workbook.

The intent of this process is to allow data to be placed into a preconfigured Microsoft ® Excel workbook. A workbook may be created to analyze the expected ReliaTest data to create reports or perform other test post-processing. The Macro may be utilized to automatically save, print, and close the Microsoft ® Excel workbook upon completion of the post-processing analysis.

Database Management

ReliaTest is compatible with MSDE (Microsoft Database Engine) and SQL Server. The control computer is configured at ILX Lightwave with a SQL Express database installed on the computer. This database is the "primary" database that is used by the software to store all of the configuration and test data. This database also stores the device and test configurations as well as the data from completed tests (historical data). The database configuration window is shown in Figure 7.6 and is accessed by selecting the **File/Database Configurations**... menu item and clicking on the **Advanced>>** button.
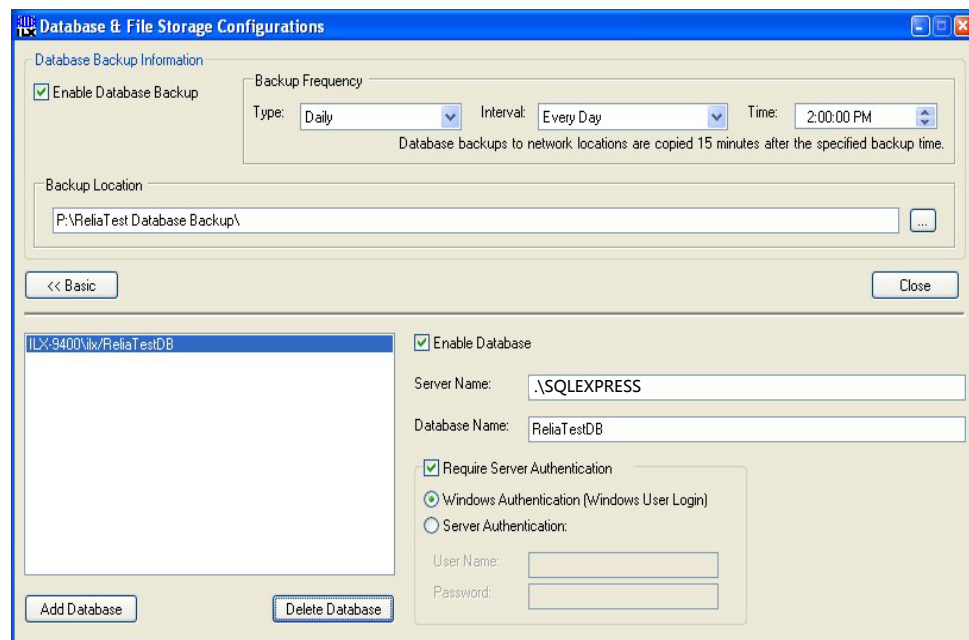
Figure 7.6 Database Configuration Window

User Authentication and Licensing

The database server requires user authentication in order to be accessed. Authentication may be either SQL Server-based or Windows login-based. If SQL Server is used, you must have proper licensing arrangements in order for ReliaTest to access the database. Enter the **User Name** and **Password** in the areas provided in this window.

To enable multiple users to utilize ReliaTest, configure the server to use a User Name and Password. This can be configured using the SQL Management Studio that is provided with the system computer.

If the secondary database is Windows-based, the user name and password that are used to log into the computer will be sent to the server and used for authentication. By default, the **Windows Authentication** method should be selected.

Creating a New Database

ReliaTest is designed to operate with a single database. The database must be located on the computer on which ReliaTest is installed.

If data is to be stored in a database other than the default, a new database must be created. From the **Database Configuration** window, disable the existing database by unchecking the **Enable Database** option. Click on the **Add Database** button, select the **SQL Server or MSDE Database** option and click OK. Enter the server name in the box provided. The default **Server Name** is ".\SQLExpress". Next, enter a new database name in the box provided. The database name may be anything descriptive. Figure 7.6 shows how the server and database names are divided. Next, make sure **Enable Database** and **Require Server Authentication** are checked. Close the window and then close and restart ReliaTest. Once ReliaTest is running, the new database should be enabled.

Deleting a Database

Databases may be deleted at any time by selecting the database name from the list shown and clicking **Delete Database**. This function will only delete the ReliaTest reference to the database. The data files still reside on the computer - the data is never deleted by using the **Delete Database** function. Data will no longer be stored to database references that have been deleted.

You cannot remove the primary database. If the primary database becomes unavailable, either because it is deleted, is full, or for some other reason, then the software will not be able to run tests until the primary database is restored.

Reviewing Historical Data

Historical data is accessible by clicking the View Historical Test Data button ✓ at the top of the **Control View** section of the main screen. All tests for which data is available will be displayed. You can graph the data or export it to a CSV file. The procedure for these tasks is the same as for currently-running tests.

Database Storage Format

The database may be accessed directly outside of ReliaTest. The following scheme of the ReliaTest database design is provided to assist with such database access.
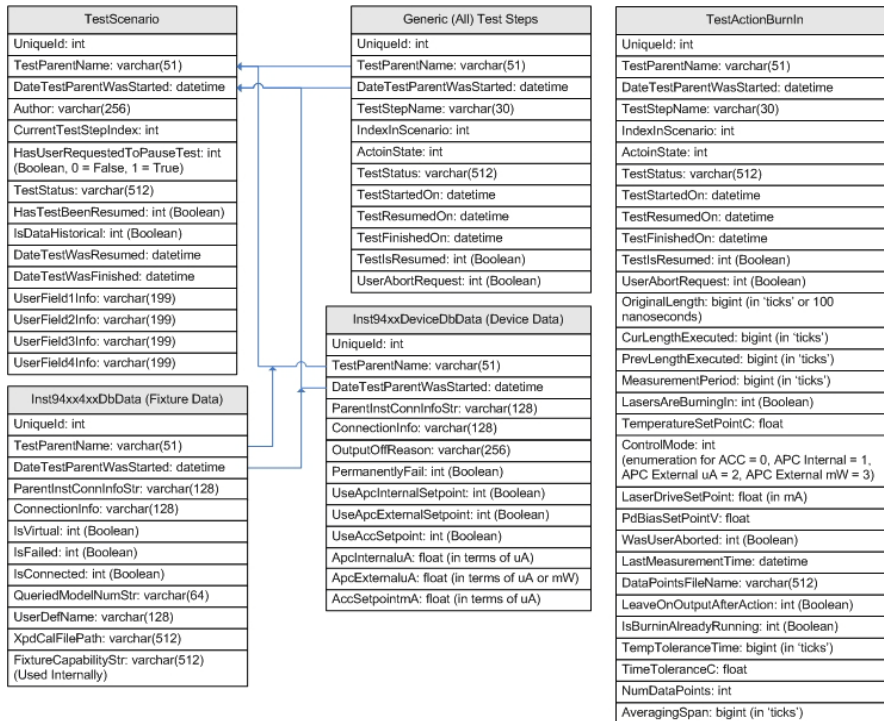
Figure 7.7 Database Schema

ILX Lightwave

Test Scenarios: Configured, Running, Historical

The difference between a Configured test and a Running or Historical test is that *DateTestParentWasStarted* contains a valid date.

The difference between a Running and Historic test is the value of *IsDataHistorical*.

SQL Query for Only Configured Tests:
    SELECT * FROM TestScenario WHERE
        (DateTestParentWasStarted = '1900-01-01 00:00:00')

SQL Query for Only Running Tests:
    SELECT * FROM TestScenario WHERE
        ((NOT (DateTestParentWasStarted = '1900-01-01 00:00:00'))
        AND
        (IsDataHistorical = 0))

SQL Query for Only Historic Tests:
    SELECT * FROM TestScenario WHERE
        ((NOT (DateTestParentWasStarted = '1900-01-01 00:00:00'))
        AND
        (IsDataHistorical = 1))

Loading Test Steps and Fixture/Device Data

All Test Steps and Fixture/Device Data tables contain two fields which allow for selecting the rows which apply to a specific Test Scenario.

A) TestParentName
B) DateTestParentWasStarted

There cannot exist two Test Scenarios with the same name AND start date.

There will exist multiple entries of scenarios with the same name as these represent different running/historic instances of the same configured test.

There will exist multiple entries of scenarios with the same start date. All Configured scenarios have a default 'invalid' start date of 1/1/1900.

SQL Query for Fixture Data:
    SELECT * FROM Inst94xx4xxDbData WHERE
        ((TestParentName LIKE 'K17LA Characterization')
        AND
        (DateTestParentWasStarted = '2005-09-29 12:34:58'))

Modify the table name in the above SQL query to load the test steps for this Scenario. Each test step table must be queried.

Test Step Tables

The basic version of ReliaTest contains six test steps. Each step is listed here with the respective table in parenthesis: Burn-in (TestActionBurnin), LIV (TestActionLIV), System Check (TestActionSystemCheck), Export To Excel (TAExportToExcel), Support Application (TARunSidekick), Execute Program (TAExeCmdLine).

Figure 7.8 SQL References

Database Maintenance

To prevent the system computer from slowing down or lagging, routing database maintenance should be performed. This involves removing old tests from the running and historic test lists. If the data is critical, it is recommended that the test is exported to CSV or Excel for future analysis. Proper maintenance of the database will help improve the speed of ReliaTest and will increase the overall system performance.

SOFTWARE EVENTS AND ALARMS

The software records and reports information on events that may impact
the test data or test performance. The events can be divided into two major
groups, system events and test events. The system event log can be
viewed by clicking the View Events button in the upper left portion of the
screen. The test event log is viewed by first selecting a test scenario from
either the currently running test list or the historical test list and then
selecting the **Events** tab. Each test event is time stamped for reference.
Test events are not visible if an individual test step is highlighted. Examples
of system events and test events are shown in Figure 8.1.

Software Events and Alarms
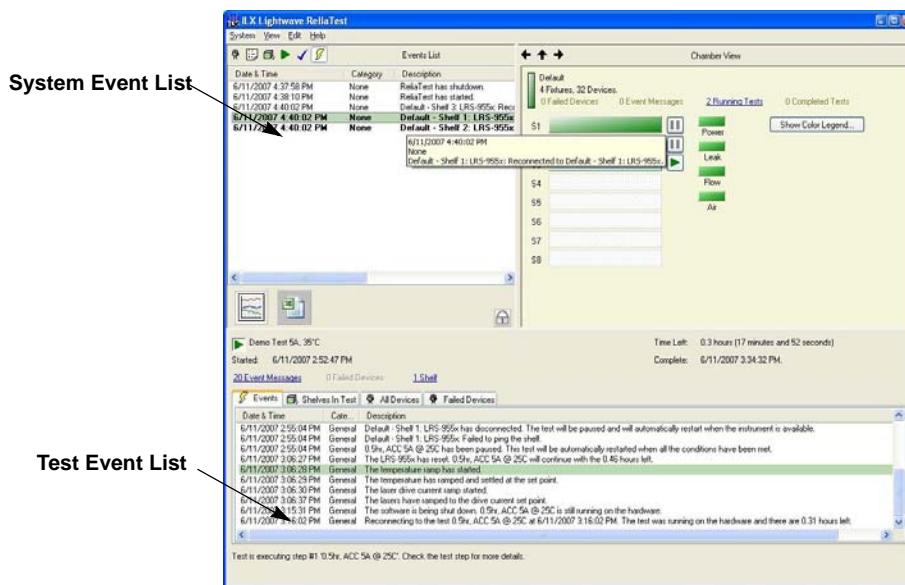
Figure 8.1 Event List

System Events

The system event log is accessible by clicking the View Events button in the **Control View**. Events may be recorded at any time, regardless of whether a test is running. In the **Chamber**, **Fixture** or **Device View**, the vertical colored status bar will flash red to indicate a new event has occurred. The lightning bolt in the View Events button will also flash yellow. When the system event log is accessed, any new event will be in bold type. To clear the new event status, any new event must be marked as read or deleted through the use of the right-click menu. Right clicking on any event will allow the options of marking all or a single event as read (or unread, as appropriate) as well as deleting a single event or all events. Once all new events have been read or deleted, the colored status bar will stop flashing.

System events fall under these categories:

- Power Failures - event messages generated when the computer or chamber power fails
- Software Events - caused by starting or stopping ReliaTest or general program errors
- Control-Measure Module Events - caused when the electronic hardware experiences a problem such as a processor error or system fault
- Communications Events - caused when the control computer is no longer able to communicate with the CMMs

Power Failures

The LRS-9550 system is designed to handle power failures without loss of data and no damage to the devices being tested.

Computer Power Failure

To prevent database corruption due to power failure, the computer is capable of running off of battery power for several minutes. Monitoring software runs in the background watching for power failures. If a power failure occurs, the monitor software will gracefully shut the computer down after one to two minutes. If the computer fails while tests are running, the data for each test is retained in the CMM on-board volatile RAM. With 10-minute data collection intervals, the CMM has enough capacity for a minimum of three days of data storage. The CMM will continue running the burn-in test even if the ReliaTest software is not running. The CMMs will shut the lasers off at the end of the burn-in test without software intervention.

If an LIV test step was running when the computer power failed, ReliaTest will resume testing the same device when the power is restored.

When the computer is restarted, ReliaTest will resume all of the tests that are running in the system. ReliaTest will log an event message indicating that the software was restarted.

> ⚠️ **CAUTION**
>
> **Do not close ReliaTest while it is restoring tests. If the software is closed while it is downloading stored data from the CMMs some data will be lost and cannot be recovered.**
>
> **Refer to Appendix A for information on setting network and computer user names and passwords so that the auto-restart feature functions properly on your network.**

Rack / Electronics Power Failure

The CMMs have built-in power failure detection circuitry and will ramp down and short the laser current sources within 20 ms after detecting a power failure. The system will also pause the test scenarios if a power brownout is detected.

If power to the system is lost then the computer will log the event and generate an event message in the test event log of any tests that are being run. The software will pause execution of any running tests that are affected by the power failure.

When the system power is restored, the digital system power supply is restored first. The CMM processors are re-enabled and resume communications with the control computer.

Database Events

ReliaTest will post event messages if the database communications are lost or disrupted. If communication with the primary database is lost, all running tests will be paused and a system event message generated.

CMM Processor Failure

In the event the processor on the CMM fails, independent sensing circuitry will shut off the current sources and TECs within 50 ms. This feature ensures that the current sources are monitored at all times and the lasers are not unintentionally driven beyond the limits configured in the device setup.

Communications Events

A communication failure is treated the same way as a power failure; if communication with the system is lost, the software logs the event. Once the software is able to communicate with the system, it determines the status of any tests that had been running and, if necessary, resumes them. If the system was running and storing data during the communications failure, the software will download the data and store it in the database.

Test Events

Test events cause the test to halt when it is running or when the software has just started the test. The ReliaTest software will state the cause of the error. Some examples of test events include:

- Mismatched device parameters - If the drive current set point is greater than the current limit in ACC mode, the software will halt the test prior to starting.

- The pneumatic bar is raised while a test is running - The software will generate an event message and abort the test that is running on that fixture.

- A shelf assigned to a test is already running in another test - ReliaTest will not allow the new test to start, and will generate an error message stating that one of the fixtures is already under the control of a different test.

- Failed devices - Whenever a device under test fails due to open or short circuit, or due to being shut off for reaching a limit value, an event message is logged indicating this. If all devices fail in the test, the test will stop.

In any case, the software will generate an event message and record the event in the database log for that test. Also, the fixture image on the monitor will flash red to alert you to a problem on that fixture. The error can be investigated by double-clicking on the fixture, then the individual device, which will also be flashing red.

For serially current driven fixtures, shutting off one device will shut off the current source and thus all of the other devices driven by that current source will be shut off. For fixtures driven in parallel, each device may be individually shut off. Click on the **Fail This Device** button in the **Device View** shown in Figure 8.2 and enter the reason to fail the device to manually fail the device. The user-specified device failure is handled in the exact same manner as a failure detected by the software. If all devices fail, the test scenario will fail and be stopped.

Events Email Configuration

ReliaTest can be configured to send email messages when specific types of events occur. This configuration is found in the **General Software Options** screen in the **System** -> **Options** menu.
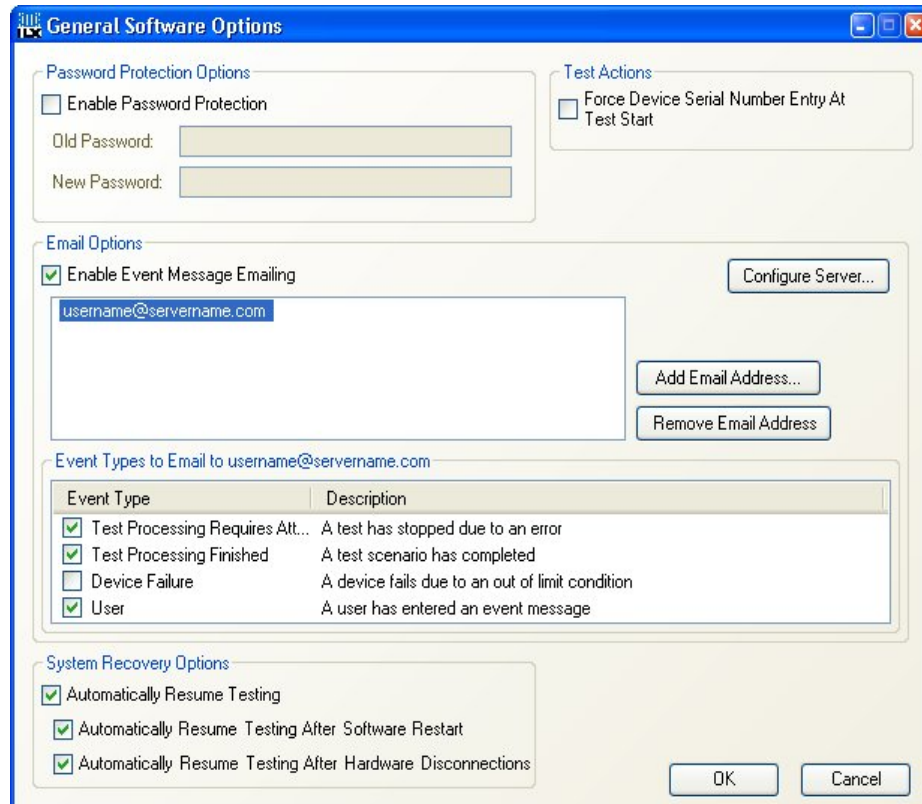
Figure 8.2 - General Software Options

In the **Email Options** section, check **Enable Event Message Emailing**. ReliaTest allows multiple email addresses to be added to list of recipients. Use the **Add Email Address**… and **Remove Email Address** buttons to manage the list of recipients.

Each email address can be configured to receive up to four different types of event messages. When an email address is selected, the four types are displayed in the **Event Types to Email to** list box. The following list describes each event category in detail and when it might occur in ReliaTest:

- **Test Processing Requires Attention** - This event category contains events which unexpectedly halt a running test. This would occur during power failures, hardware communication issues, and ReliaTest shutdown events. This event is only expected during abnormal or system error conditions.

- **Test Processing Finish** - This event category contains events which occur when a test has finished. This event is expected under normal operation. This message will indicate to the email recipient that the test is complete and a new test maybe started in that test fixture location.

- **Device Failure** - This event category contains events which occur when a device has been marked as 'failed' by the system or a user. Some devices may reach an out-of-limit condition during normal operation, depending on the device type configuration.

- **User** - This event category contains events which are entered by the user. This only contains event messages which the user specifically enters.

Email Server Configuration

Currently, ReliaTest supports a non-authenticated SMTP connection. ReliaTest does not support SSL connections.

Figure 8.3 - SMTP Server Configuration

The settings in the SMTP Server Configuration screen will be very similar to the settings found in most email software clients (such as Microsoft ® Outlook). Use the **Address Information** fields to configure the 'From' information in future ReliaTest emails. Here, the email address can be any email address, even a fake or nonexistent address, in a valid format however, it is recommended to change the 'servername' section of the **Email Address** field to the SMTP email server name from which the emails will be sent. It is further recommended to leave 'ReliaTest' in the **Name** field so that emails from ReliaTest are listed as such from within any standard email client.

SYSTEM MAINTENANCE AND UPGRADES

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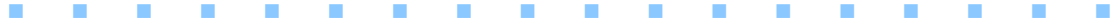
Routine System Maintenance

The following routine maintenance schedule is recommended by ILX Lightwave.

Maintenance Task	Frequency	Performed By	Notes
Calibrate CMMs and Fixtures	Annual	ILX Lightwave	Send CMMs to ILX or purchase the LRS-9580 calibration system
Clean cold plate surfaces	Before every use	Customer	Use tool provided by ILX; see Chapter 4
Clean water inlet strainer	Monthly, or as needed	Customer	Frequency depends on inlet water quality
Drain air inlet moisture trap	As needed	Customer	Drain moisture trap when water is present in the glass bowl
Remove old tests from the running or historic lists	As needed	Customer	Ensures that ReliaTest operates efficiently
Inspect fixture (C-Mount Insulator)	Before every use	Customer	Small inserts are used to insulate the C-mount devide from the fixture. Over time, these insulators can become damaged and will not provide electrical insulation for the C-mount device. Visually inspect and/or use a voltmeter to test conductivity of the insulator to the base.
Descale cold plates	Yearly or as needed	Customer or ILX Lightwave	Frequency depends on inlet water quality; see ILX technical note "LRS-9550 Water Quality Guidelines".

Routine Fixture Maintenance

Temperature Sensor Calibration

It is recommended that the fixture temperature sensors be recalibrated on an annual basis. This may be accomplished by returning the fixture to ILX Lightwave.

Cleaning

See Chapter 4 for fixture and shelf cleaning instructions.

TROUBLESHOOTING

System Diagnostics Screen

The system **Diagnostics** screen is used to view the status of the system power supplies, shelf loading, and chamber statistics. A **Diagnostics** screen is available for each CMM and may be accessed from the **Help** menu. Each connected CMM will be listed by name and IP address. The window shown in Figure 10.1 will appear when a CMM is selected.
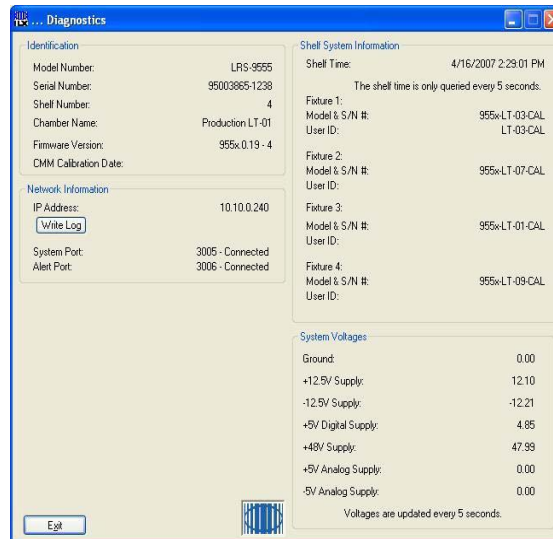
Figure 10.1 System Diagnostics Screen

Troubleshooting Procedures

Most of the errors that occur with the LRS-9550 system will be logged by the software. The error messages give an indication of the nature of the error, and may provide clues to help resolve the problem.

Problem/Symptom	Possible Causes	Action
System does not power up	System power cord is not wired properly	Check AC wiring to system
	EMO button is depressed	Reset EMO switch
Open Circuit detected	Bad device	Replace the bad device
	Poor electrical contact to device	Ensure that the gold-plated current contacts are making contact with the devices
Poor temperature uniformity	Varying thermal output from different devices	Check to see that devices are dissipating a normal amount of power; shorted devices should be loaded alternately with live devices to aid in uniformity
	Contaminated fixture base to cold plate interface	Clean fixture base and cold plate surface
	Bad TEC	Contact ILX for shelf service
Pneumatics make hissing noise	Pressure regulator set too low	Make sure the pressure regulator at the rack air inlet is set to 60 psi
	Solenoid valve is stuck in between open and closed states	Actuate the valve with the rocker switch; wait at least 5 seconds to allow valve to fully open or close
	Actuator leak	Contact ILX for shelf service
Pneumatics won't operate	Inadequate air supply	Check the air pressure regulator to be sure 60 psi is present
	48V is not present to the shelf	Check that the 48V DC cable is plugged into the CMM
Software can't communicate with shelf	CMM is not powered up	Be sure that the AC supply cable is plugged into the CMM
	Ethernet cable is faulty or disconnected	Check that the Ethernet cable is good and is properly connected to the CMM Check cable to computer

ILX Lightwave

Problem/Symptom	Possible Causes	Action
New loaded fixture not recognized by the software	Fixture is not inserted correctly	Remove and re-insert the fixture
	Pneumatics are up	Lower the pneumatics
	CMM is disconnected from software	See above: software can't communicate with shelf
Fixture Ready LED doesn't blink when fixture is inserted	Fixture is not inserted correctly	Remove and re-insert the fixture
	Pneumatics are up	Lower the pneumatics
	Fixture EEPROM is corrupt	If the EEPROM is corrupt, the Ready LED will be on constant, and not blinking. Move the fixture to a new location and try again; return the fixture to ILX Lightwave for repair
All lasers fail	Devices have reached a user-set limit	Check the device operating limits in the Device Type configuration
No front-facet power measurement	Front facet power measurement is not provided in the Burn-In system	The front-facet power measurement feature is factory configurable. Please check your order to ensure your system has this capability.
Fixture will not maintain the temperature set point	Fixture temperature set point is beyond the operating specifications	Double-check the test settings and the operating specifications
	Water temperature is incorrect	Check to see that water inlet temperature is within the specified range
	System water flow/pressure is below the specified flow/pressure	Use a flow meter to ensure adequate water flow
	Shelf cold-plate or fixture bottom may need cleaning	Clean the shelf cold-plate and the fixture bottom
	A TEC has failed	Contact ILX for service

Test won't start in ReliaTest	No fixtures in the shelf	Check the test scenario and test step status for information on why the test could not start
	No device type assigned to the shelf or the test	The system events may contain further information
	Device type limits are outside the test parameters	
"Air" fault indicated on system control panel	Compressed air disconnected from the system	Connect air supply to system
	In sufficient air pressure to system	Make sure that the air supply is at least 50 psi
	Air leak in system	Try to locate the source of the leak by sound; contact ILX for service.
"Water" fault indicated on system control panel	Insufficient water supply	Make sure the water supply to the system is connected and capable of providing at least 5 GPM
	Condensation present	Check the condensation detector on the rack water inlet for moisture. If present, adjust water or room air so that the circulating water temperature is higher than ambient dew point.
"Leak" fault indicated on system control panel	Moisture present on leak detector	Locate the source of the leak and repair. Dry the leak detector and press the "reset" button on the system control panel.
	Leak detector contaiminated with dirt or grime	Clean the leak detector wi alcohol and a lint free wipe.

ILX Lightwave

Returning Components for Repair

If troubleshooting has failed to remedy the problem, return of one or more components of the system for repair may be required. Before returning parts or equipment, a Return Material Authorization (RMA) number must be obtained from ILX Lightwave. The equipment must be shipped in the original packing carton or one that will provide equivalent protection with freight and insurance prepaid by the customer. The equipment should be sent to the factory at the address below, referencing the Return Material Authorization number.

ILX Lightwave Corporation
ATTN: RA# _____
31950 East Frontage Road
Bozeman, MT 59715 USA

Repairs are warranted for the remainder of the original warranty or for 90 days from repair, whichever is greater.

ILX Lightwave

CHANGING THE COMPUTER LOG ON PASSWORDS

The system control computer is configured at ILX Lightwave to automatically reboot after a power failure. This section contains information on changing the log on passwords so that the computer can automatically log into your local networks on startup and so that you can change the password to match your convention.

Configuring Computer to Automatically Boot Into Windows

The LRS-9550 control computer is configured to automatically resume all of the running tests after a power failure. This feature happens in four separate steps:

1. The computer automatically boots when the power is available and the master switch on the back of the computer is ON

2. The computer automatically logs into Windows and your local network

3. The computer automatically starts the ReliaTest software application

4. ReliaTest automatically resumes each test that was running prior to the power outage

Automatically Booting Computer

The computer is configured at ILX Lightwave to automatically boot when the power is available. This feature is enabled in the computer BIOS. If the computer is manually shut down, it must be manually restarted.

Automatically Logging Into Computer and Network

The computer must use a user name and password that can authenticate to the network and the computer. Follow the steps below to configure the computer to use an existing account.

1. Click **Start**, click **Run**, type regedit, and then click **OK** to start **Registry Editor**.

2. Locate the following registry key:

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\WindowsNT\CurrentVersion\Winlogon

3. Using your account name and password, double-click the **DefaultUserName** entry, type your user name, and then click OK.

4. Double-click the **DefaultPassword** entry, type your password under the value data box, and then click OK.

If there is no **DefaultPassword** value, follow these steps to create the value:

 a. On the **Registry Editor** menu, click **Edit**, click **New**, and then click **String Value**.

 b. Type **DefaultPassword** as the value name, and then press ENTER.

 c. Double-click the newly created key, and then type your password in the **Value Data** box.

If no **DefaultPassword** string is specified, Windows automatically changes the value of the **AutoAdminLogon** key from 1 (true) to 0 (false) to disable the **AutoAdminLogon** feature.

5. Double-click the **AutoAdminLogon** entry, type 1 in the **Value Data** box, and then click OK.

If there is no **AutoAdminLogon** entry, follow these steps to create the entry:

 d On the **Registry Editor** menu, click **Edit**, click **New**, and then click **String Value**.

 e. Type **AutoAdminLogon** as the value name, and then press ENTER.

 f. Double-click the newly created key, and then type 1 in the **Value Data** box.

6. Double-click the **DefaultDomainName** entry, type the network domain that the computer will use the user account to authenticate on.

7. To enforce this setting for all future logoffs, set the following registry key:

KEY_LOCAL_MACHINE\SOFTWARE\Microsoft\WindowsNT\CurrentVersion\Winlogon

Value:**ForceAutoLogon**

Type: REG_SZ

Data: 1

8. Quit **Registry Editor**.

9. You must restart the computer in order for the changes to take affect.

10. After your computer restarts and Windows starts, the computer will log on automatically.

Automatically Starting ReliaTest

The computer is configured at ILX Lightwave to automatically start ReliaTest when Windows starts. This feature is enabled by placing a shortcut to the ReliaTest application in the **Start Menu** -> **Programs** -> **Startup** menu of the user account that was used above.

Automatically Resuming Tests in ReliaTest

When the ReliaTest software application starts, all tests that were previously running will be restarted. ReliaTest waits for thirty seconds before resuming the tests to allow the user a chance to cancel the automatic resume feature. After each test resumes, any data that was stored on the instrument will be read by the software and stored with the test in the database. The test resumes and finishes the rest of the test procedure.

FACILITY PREPARATION GUIDE

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This document has been designed to help you prepare your facility for the arrival of your new LRS-9550 system. Taking care of these details prior to system arrival will allow installation to proceed smoothly and quickly. This in turn will allow you to begin your testing sooner.

There are four areas that require attention prior to installation:

- Transit corridor for the system

- AC power for the system

- Facility air and water

- Facility network access

System Transit Corridor

To facilitate shipment, the LRS-9550 system rack is placed on its side, boxed in foam and cardboard, and attached to a pallet. All shelves, CMMs, and fixtures are removed and packaged separately. Some boxed components, including fixtures and the system computer, will be loaded inside of the empty rack during transport.

When the rack arrives, remove all boxes from its interior and carefully stand the rack upright onto its casters. The empty rack weighs approximately 400 lbs; therefore a minimum of five people will be required to stand the rack upright. Once the rack is upright, it can be rolled into its final location and loaded with shelves and CMMs. A corridor of at least 74" high by 48" wide will be needed to maneuver the rack.

AC Input Power

The 9550-1200 system rack requires 208VAC 50/60 Hz, 3Ø, and 70A. The 9550-1202 system rack requires 400VAC, 50/60 Hz, 3Ø, 4 pole, 5 wire, and 40A. The system comes with a 5 conductor cable that must be hard-wired to facility power.

The system control computer requires battery operation capabilities to ensure database integrity and to allow the computer to shut down in a controlled fashion in the case of a power failure. This operating mode will be supplied by ILX Lightwave unless other arrangements have been made.

Air and Water Requirements

The LRS-9550 system requires connection to a facility water supply and drain. The inlet and outlet ports on the system are ¾" female NPT fittings. The system requires > 6 GPM flow rate at a temperature no greater than 25°C.

Hard facility water can (over time) cause scale to deposit on the cold plates, affecting thermal performance. It is preferred to use water with total hardness <100 ppm. If you have hard facility water, please contact ILX for recommendations.

The LRS-9550 utilizes compressed air to operate pneumatics and to provide a front facet wash to the DUTs. The system requires a filtered, clean air supply regulated at no less than 60 psi. Connection is made at the rear of the rack with a ¼" male coupler.

Network Access

While the LRS-9550 system does not require network access to function correctly, it is recommended that access be granted to allow backup of the test database. Network access should be in the form of a separate user account with a non expiring password. To maintain network security, user rights can be strictly limited by the network administrator.

Access to the internet is also recommended. Access will allow the user to permit ILX to remotely operate the system for troubleshooting.

The following questionnaire should be filled out and returned to ILX Lightwave prior to final test and shipment of the system to allow you to receive the system preconfigured and ready for use.

ILX Lightwave

Network Questionnaire

1. Will the LRS-9550 be connected to your facility network?

    ❑ YES - Please answer the remaining questions.

    ❑ NO - STOP HERE.

2. Does this network use DHCP?

    ❑ YES

    ❑ NO

3. If this network uses DHCP, what is the network portion of the IP addressing scheme? This question is important because the 9550 system must be configured with a different IP addressing scheme for the internal instrumentation network.
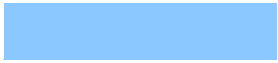
    IP Addressing Scheme: _____

    For example, if a computer is configured with the IP address of 192.168.0.24 and the subnet mask is 255.255.255.0, the network portion of the addressing scheme is 192.168.0.0.

4. If your facility network does not use DHCP, please provide the following information for the system computer:

    Static IP Address:_____._____._____._____

    Subnet Mask:_____._____._____._____

    Primary DNS Server:_____._____._____._____

    Secondary DNS Server:_____._____._____._____

    Default Gateway:_____._____._____._____

5. Will this computer be a member of a domain or workgroup?

    ❑ DOMAIN

    ❑ WORKGROUP

    Domain or Workgroup Name:_____

    Establishing a computer name will allow the network administrator to configure the network to allow this computer to join the domain prior to computer installation.

6. Primary DNS Suffix:_____

7. The computer will require a user account to authenticate to your network in order to access and back up the test database. The computer is configured to automatically boot and resume testing after a power outage. It is recommended that the user account have limited network permissions and that the password be non expiring.
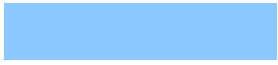
    Username for computer:_____

    Password:_____

CUSTOM COMPONENTS

SPECIFICATIONS