



School of Electrical and Information Engineering



The Remote Laboratory System

Electrical and Information Engineering Project 2006

User Manual

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1. NetLab Booking

1.1 Registering an Account

In order to access the NetLab remote laboratory system, you will need to register for a NetLab account. Accounts can be created freely by anyone simply by visiting the NetLab website at <http://netlab.unisa.edu.au>. Click the *Create an Account* link in the navigation bar on the left hand side of the page. You will be presented with the form shown in Figure 1.1.

You are not logged in. [\[log in\]](#)

NetLab Registration

To create an account, enter your details below, including a display name will be used when you are in the NetLab client's chat room.

User Name:

Password:

Confirm Password:

Full Name:

Display Name:

Email Address:

Figure 1.1: The NetLab Registration Page

Enter the required details in to the form. Your user name and password may contain only English letters, digits and underscores with no spaces or other white space characters. The may be up to 32 characters in length. Note that your password is never displayed. It is also encrypted in the NetLab database so that no one will ever be able to discover your password. You are required to enter your password twice to ensure that you have entered it correctly.

You full name should include both your first name and last name (middle names are not necessary). The display name is the name that will be used when you are in the NetLab chat room. Typically users simply choose their first name as their display name, though you may choose to use any alias you wish. Your full name and display name may contain any of the full range of Unicode characters, including East Asian and Arabic characters. Each may be up to 128 characters in length.

Note that your full name and your email address will never be shown to anyone other than NetLab administrators. However, your display name will be shown during chat sessions, and will be visible to others on the NetLab booking page if you have booked sessions as unavailable booking slots indicate the user name of the user who has booked the slot.

1.2 Account Management

You can use the NetLab website to view and edit your personal details at any time by clicking the *My NetLab Account* link in the navigation bar on the left hand side. You will be required to log in if you have not already. You will be presented with a page that shows your current account details, as shown in Figure 1.2.

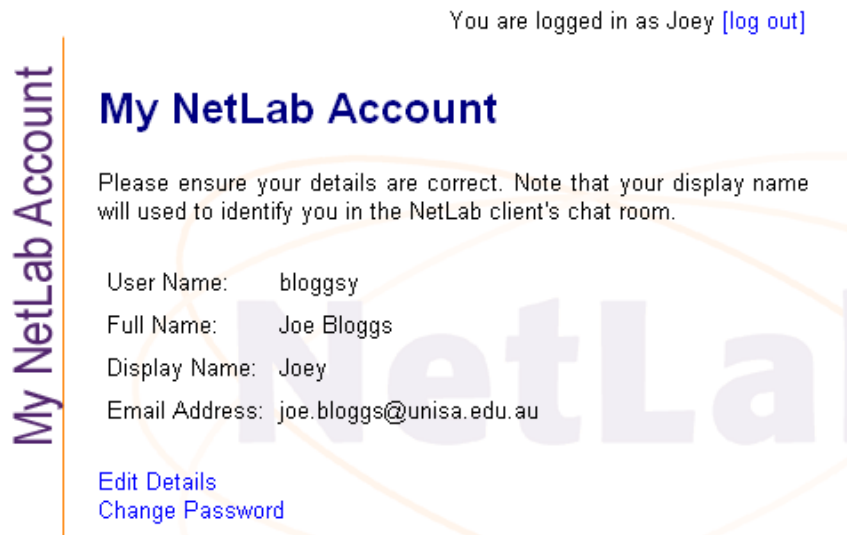


Figure 1.2: The NetLab Account Details Page

You may use the *Edit Details* link on this page to edit your full name, display name or email address, as shown in Figure 1.3. You may use the *Change Password* link to change your account password. You may not change your account user name.

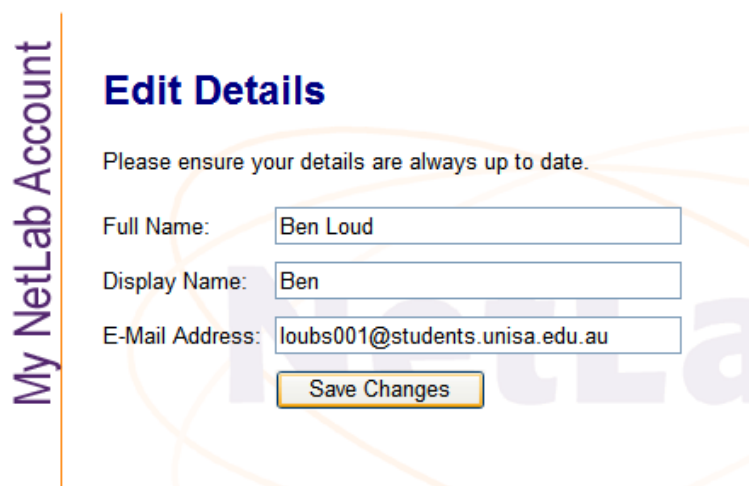


Figure 1.3: Editing NetLab Account Details

1.3 Booking Sessions

To book a session, click on the NetLab Booking link on the navigation bar on the left hand side of the page. You will need to log in if you haven't already. You will be presented with the page shown in Figure 1.4.

NetLab Session Booking

You are logged in as Ben [log out]

Please select the time you wish to book for: **Saturday, November 4, 2006**

The current server time is Saturday, November 4, 2006 11:49 PM

Users outside of South Australia, check timezone differences [here](#).

Bookings are limited to 3 hours per week, per user.

Legend

- Available slot
- Unavailable slot
- Booked slot

November 2006						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Hour	User 1	User 2	User 3
0	●	●	●
1	●	●	●
2	●	●	●
3	●	●	●
4	●	●	●

Hour	User 1	User 2	User 3
12	●	●	●
13	●	●	●
14	●	●	●
15	●	●	●
16	●	●	●

Figure 1.4: The NetLab Booking Page

Use the calendar to select the date you wish to book a session for. There are three slots for each hour of the day. A green slot indicates that the slot is available. You may click it too book that slot. The slot turns blue to indicate that you have booked it. You may book up to three hours a week. Note that you may book multiple slots in the same hour and it will only count as one out of the three hours you may book for that week. This means if you want to ensure that no others book slots for your session, you can simply book all three slots.

All slots that you have booked are shown in blue. You may click a blue slot to cancel that booking. However, you can not cancel slots for times that have already passed. Slots that have been booked by other users are shown in red. You cannot click these slots.

When you have booked a session time, you may launch the NetLab client during that time and join a NetLab session. See the following section for details.

2. Getting Started with NetLab

2.1 Prerequisites

As NetLab is a Java based application, it will run on any operating system provided it has an installation of the Java SE runtime environment, version 6.0 or later. Various vendors provide Java SE 6 implementations. Sun Microsystems' implementations for Microsoft Windows, Linux and Solaris operating systems are recommended. These are available for free download at <http://java.com>. The download is approximately 15MB. Apple also provides a Java SE 6 implementation for Mac OS X operating systems which is fully compatible with NetLab.

NetLab is a graphically intensive application so a modern computer with a CPU of at least 1GHz is recommended, in addition at least 512MB of RAM. A broadband internet connection, 512kbps or greater, is strongly recommended for the best possible remote laboratory experience. Lastly, you should have a desktop screen resolution of 1024x768 or higher.

2.2 Launching NetLab

You may launch NetLab from the website at <http://netlab.unisa.edu.au>. You will need to have registered for a NetLab account and booked a session in order to successfully log in with the client (see Section 1). Click the *NetLab Access* link on the navigation bar to the left hand side of the page. Be sure to read the information on the access page carefully. When ready, click the NetLab button to launch the application.



Figure 2.1: Launching the NetLab Client

NetLab uses Java Web Start technology. In addition to allowing an application to be launched by clicking a link on a web page, it also performs automatic downloading and installation of the application. In the future, if a new version of the application becomes available, it will automatically be downloaded and your current installation will be upgraded to the new version.

Clicking the link should begin the download process, as shown in Figure 2.2. The download size is under 800kB, which should take less than a minute on a broadband connection. The Web Start installer will also place a shortcut to the NetLab application on your desktop and in your system menu (eg: the Start Menu on Microsoft Windows). You may use these launches to launch NetLab in the future, or you may use the link on the website again. Note that the application only needs to be downloaded once. Subsequent launches of the application should begin immediately.

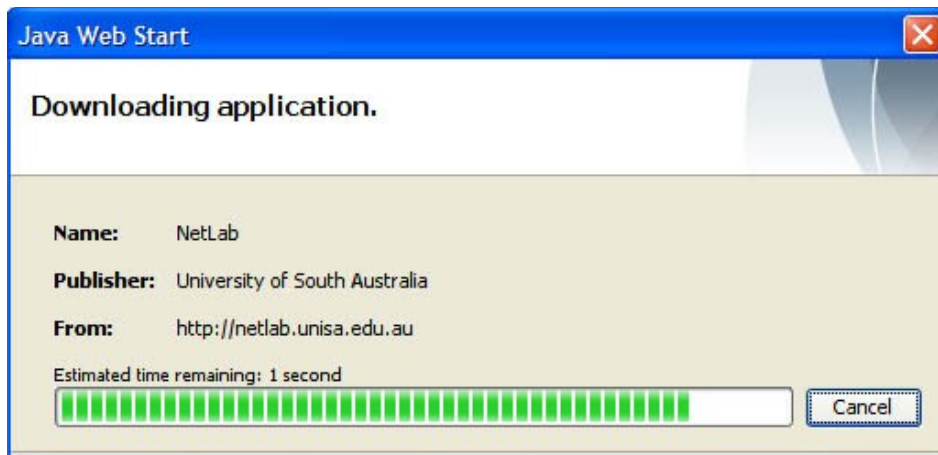


Figure 2.2: Downloading the NetLab Application

When the application has been successfully downloaded, you may be prompted with the warning dialog shown in Figure 2.3. This is a security measure provided by the Java platform for your own protection. Because NetLab requires special permissions, such as accessing the internet and writing to your hard disc, you must explicitly authorise the application to do so. Therefore NetLab is signed with a *digital certificate* that uniquely identifies its publisher (the University of South Australia).

You should tick the box “Always trust content from this publisher” to avoid being presented with this dialog every time you launch NetLab. By doing so, you are giving NetLab and any other application that we release that is also signed with our digital signature, permission to run on your system. If you have any concerns about security risks associated with NetLab, you may contact us at <http://netlab.unisa.edu.au>. Otherwise, click *Run* to continue with launching the application.



Figure 2.3: The Digital Signature Security Warning Dialog

When the application launches, you will be presented with the Login dialog shown in Figure 2.4. Enter your NetLab account user name and password. You can tick the Remember Details checkbox to save your user name and password so that you do not need to retype it each time you run the application. These details are stored in an encrypted form on your disc. Click the *Connect* button to establish the connection with the NetLab server.

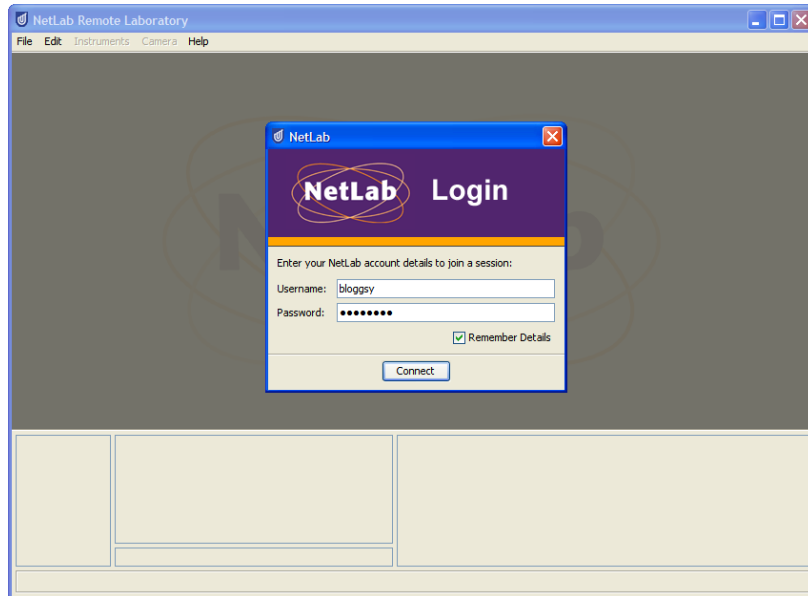


Figure 2.4: The NetLab Login Dialog

If you should close the Login dialog, the main NetLab window stays, but as you are not connected to a NetLab session, all remote laboratory features will be disabled. You can show Login dialog again by selecting “*Connect...*” from the *File* menu at the top of the main window.

While NetLab is attempting to establish a connection, the *Connect* button in the Login dialog changes to say *Disconnect*, as shown in Figure 2.5. This allows you to cancel the connection attempt at any time.

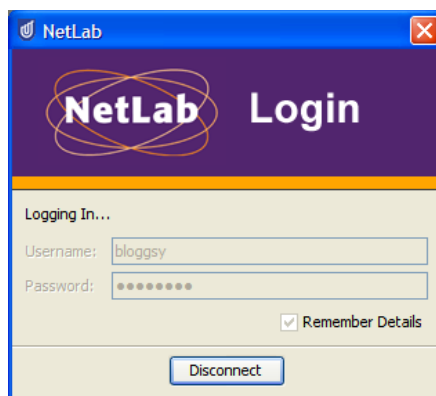


Figure 2.5: The Login Dialog during Connection Establishment

2.3 The NetLab Desktop

Once you have successfully logged in to NetLab, you will be presented with the NetLab desktop environment shown in Figure 2.6.

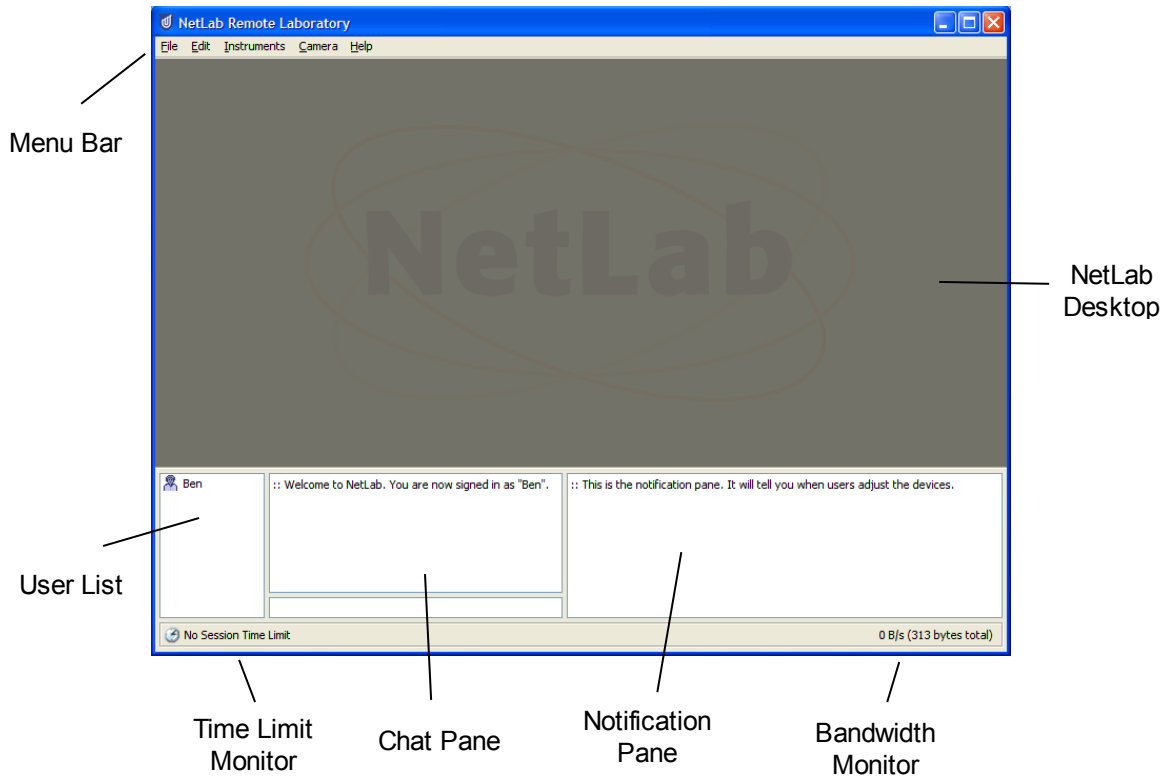


Figure 2.6: The NetLab Desktop Environment

User List:

The user list displays a list of the display names of all users (including yourself) that are currently logged in to the NetLab session.

Time Limit Monitor:

The time limit monitor displays a countdown of the amount of time remaining in your booked NetLab session. When the remaining time is less than one minute, the text turns to red as a warning. When there is less than 30 seconds left, the text will flash. Note that you will be automatically disconnected from the NetLab session when your booked session has elapsed.

Notification Pane:

The notification pane displays messages when other users have made significant changes to any of the devices.

Bandwidth Monitor:

The bandwidth monitor displays the applications current internet bandwidth usage (downstream only) and the total amount of data downloaded so far. This is useful for users connecting from home who may have to consider download quotas.

Chat Pane:

The chat pane allows you to communicate with other users who are currently logged in to the same NetLab session. Simply type a message in the text field at the bottom, and press Enter. Your message will be displayed in the chat pane of all other connected users. Messages sent by other connected users will be displayed in your chat pane. Messages from different users will be displayed in different colours.

Messages may be of any length, and can contain the full range of Unicode characters, including Arabic and Asian characters. Just for fun, certain keystrokes can produce emoticons. The supported emoticons and the keystrokes that produce them are shown in Figure 2.7. They emoticons will be inserted after you press Enter.

😊	:)	😂	haha	😄	:D
😬	:@	😱	:O	😏	:-)
😬	!-(😬	;)	😬	:(

Figure 2.7: Emoticon Keystrokes in NetLab

Menu Bar:

The menus are discussed in detail in the next section. They allow you to connect to, and disconnect from, a NetLab session, show or hide instrument windows, launch the circuit editor, operate the camera, and access information about NetLab.

NetLab Desktop:

The NetLab desktop is area is where instrument windows are displayed. You can right-click on this background area with your mouse to access common NetLab menu items as shown in Figure 2.8 as an alternative to using the main menu bar. The items include selecting instruments, launching Circuit Builder, and operating the camera

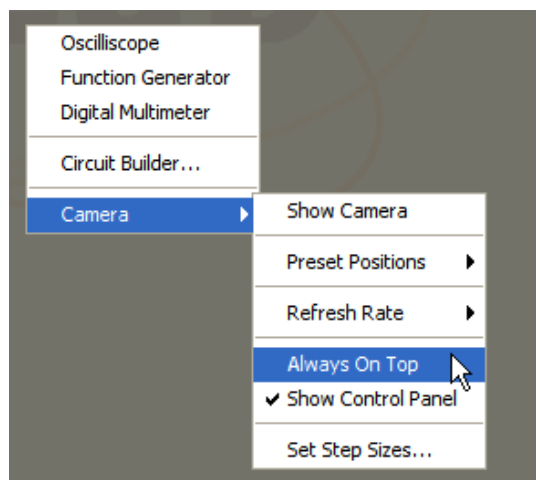


Figure 2.8: The NetLab Desktop Shortcut Menu

2.4 The NetLab Menu Bar

Most of NetLab's functionality is accessed through the main menu bar, which is located at the top of the main window, as shown in Figure 2.9. These menus allow you to connect to, and disconnect from, a NetLab session, show or hide instrument windows, launch the circuit editor, operate the camera, and access information about NetLab.

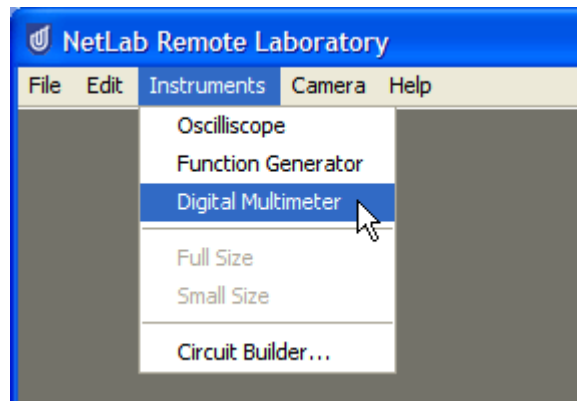


Figure 2.9: The NetLab Desktop Shortcut Menu

File

This menu contains items to connect to a NetLab session, disconnect from the active session or exit the application. This menu is always enabled, but the *Connect...* option is only enabled while you are not connected to a NetLab session and the *Disconnect* option is only enabled when you are connected.

Edit

This menu is a standard text editing menu, with Undo, Redo, Cut, Copy, Paste and Select All. This menu is used for all three text components in the main NetLab interface, including the chat log window, the chat text field and the notification pane. The specific text component that the menu refers to is the last component that was focussed. The menu is only enabled when you are connected to a NetLab session. The individual menu items are enabled or disabled appropriately based on the state of the active text component.

Instruments

This menu is the most important as it allows you to display the available NetLab instruments. This menu is only enabled while you are connected to a NetLab session. The menu contains a list of all available remote instruments. The contents of the list depend on the instruments connected in the current circuit configuration. When you select the name of an instrument you wish to use, it will appear on the NetLab desktop. A check mark appears next to the name of the instrument in the menu if it is already visible on the desktop. You can select the instrument's menu item again to hide it.

The menu includes options to set the active instrument window (if any) to one of two preset sizes. Its small size is its default size. The full size is useful for high resolution displays. Below this is an option to launch the Circuit Builder, which allows you to reconfigure the active circuit. Circuit Builder is discussed in Section 50.

Camera

This menu is allows you to operate the laboratory's live camera. This menu is only enabled while you are connected to a NetLab session. It allows you to show or hide the camera window, move it to a preset position, adjust the refresh rate of the image, force it to always appear on top of instrument windows, show or hide the camera control panel and adjust the step sizes. This menu is discussed in detail in Section 2.4.

Help

This menu is allows you to access information about NetLab. The *NetLab Help* item will launch your systems browser and direct it to the HTML version of this user manual on the NetLab website. The About item shows a dialog box with information about the NetLab application, including the version of the application, the version and vendor of your Java installation, copyright information and a list of credits. This dialog is shown in Figure 2.10.

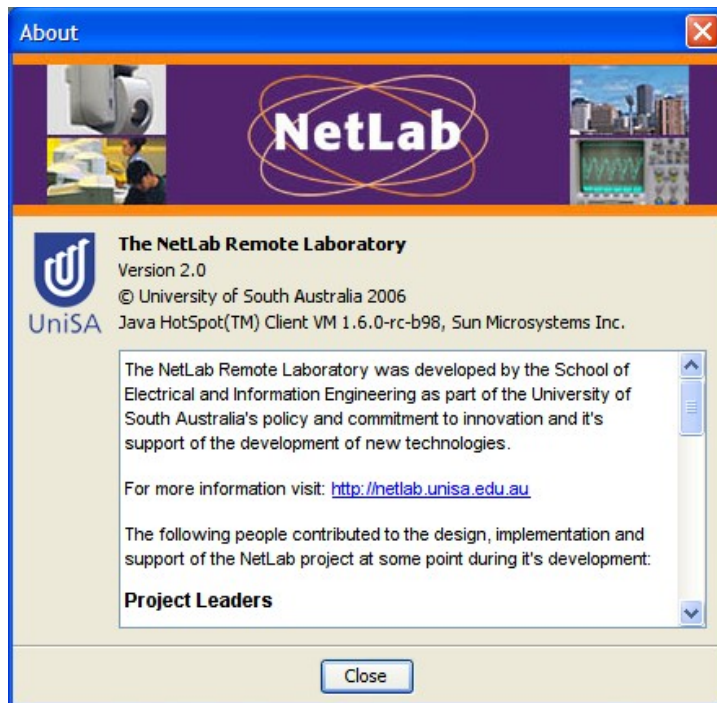


Figure 2.10: The About Dialog

2.5 The Live Laboratory Camera

The NetLab Live Laboratory Camera allows you to observe the real instruments in the laboratory while you operate them remotely. You can display the camera window by selecting *Show Camera* from the *Camera* menu. The camera window appears on the NetLab desktop as shown in Figure 2.11. As with any window on the NetLab desktop, the window can be freely moved and resized.

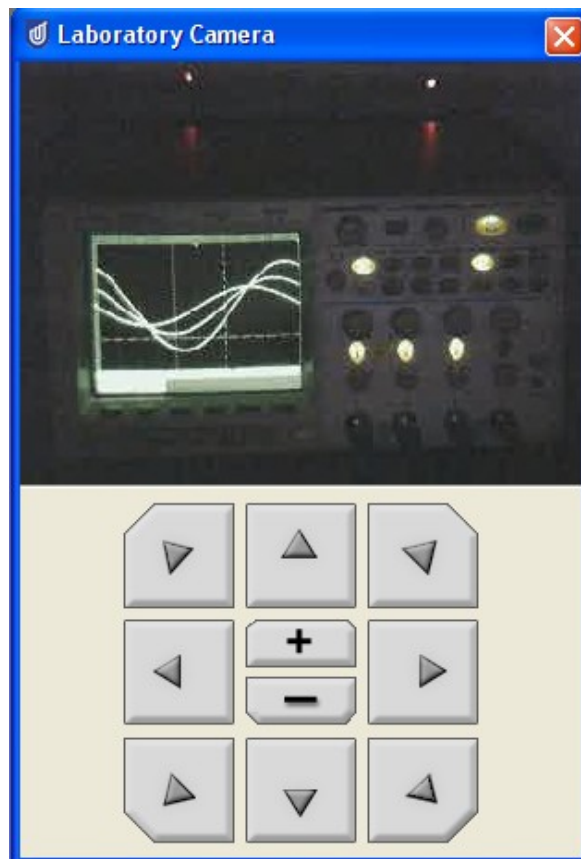


Figure 2.11: The Laboratory Camera Window

When the camera window is displayed, it will begin retrieving images from the laboratory. It will stop retrieving images when you close the camera window. Below the camera image area is the control panel which you can use to move the camera around the room. The arrow buttons are for pan and tilt. The plus and minus buttons are for zooming in and out respectively. You can show or hide the control panel using the *Show Control Panel* item in the *Camera* menu.

There is also an *Always on Top* option in the *Camera* menu that allows you to specify that the camera window should always appear on top of instrument windows on the NetLab desktop.

The refresh rate of the camera images can be adjusted by selecting an option from the *Refresh Rate* submenu of the *Camera* menu, as shown in Figure 2.12. It supports options to refresh the camera image once a second, once every five seconds and once every ten seconds, as well as a *Continuous* option which retrieve camera images as fast as possible. The continuous option is recommended when using NetLab within the university network where bandwidth and download usage is not a concern.

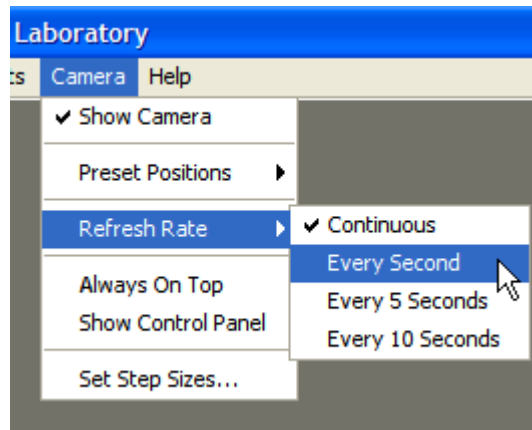


Figure 2.12: Selecting a Camera Refresh Rate

You can move the camera to any of ten preset positions by selecting them in the *Preset Positions* submenu of the *Camera* menu. The preset positions all have descriptive names, as shown in Figure 2.13.

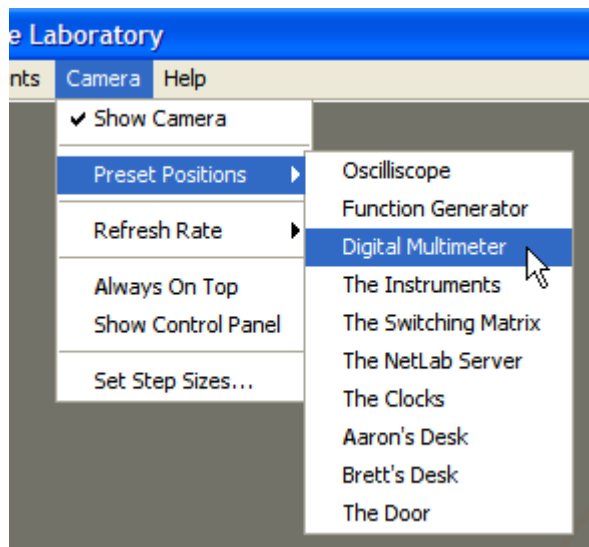


Figure 2.13: Selecting a Preset Camera Position

The pan/tilt and zoom step sizes which control how much the camera moves when you click the buttons on the control panel can be adjusted by selecting the *Step Sizes* option from the *Camera* menu. This displays the dialog shown in Figure 2.14. The zoom step size can be set to value from 1 to 100. The pan and tilt angle can be set to a value from 1 to 320 degrees.

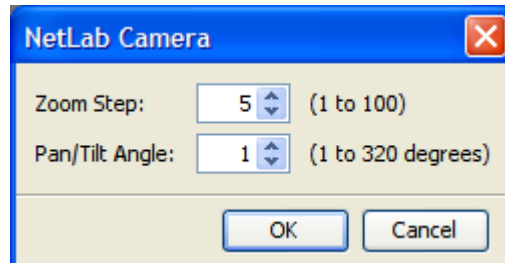


Figure 2.14: Adjusting the Camera Step Sizes

3. Circuit Builder

3.1 Wiring Circuits

Circuit builder can be launched by selecting the *Circuit Builder...* item from *Instruments* menu of the main NetLab main. The Circuit Builder window appears as shown in Figure 3.1. If there is a previously wired circuit configuration, it will be displayed in the canvas when the window appears. Otherwise, the canvas will be blank.

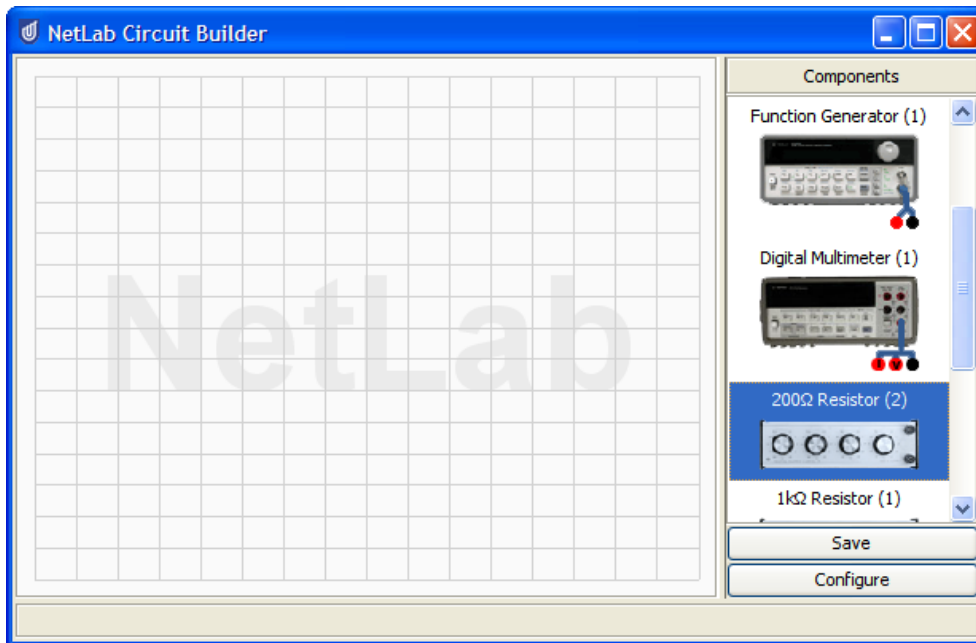


Figure 3.1: Adjusting the Camera Step Sizes

The list of all available components is on the right hand side of the window. Simply select the components you want, and drag and drop them on to the canvas. Each component icon contains terminals which you can connect to terminals on other components. When you move the mouse over a terminal, the cursor changes to crosshair and a description of the terminal appears in the status bar of the Circuit Builder window, as shown in Figure 3.2.

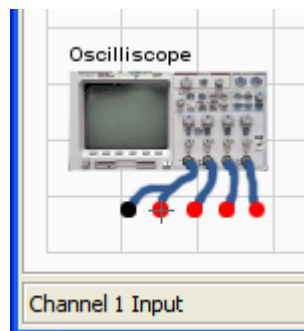


Figure 3.2: Component Terminals

You can right-click on components to display a popup menu that will allow you to delete them, or you can simply select the components and press the delete key on your keyboard. You can also select multiple components by left-clicking on the canvas and dragging to form a selection rectangle around the components you wish to select, or by holding down the control key on your keyboard when you left-click on components. A complete circuit is shown in Figure 3.3.

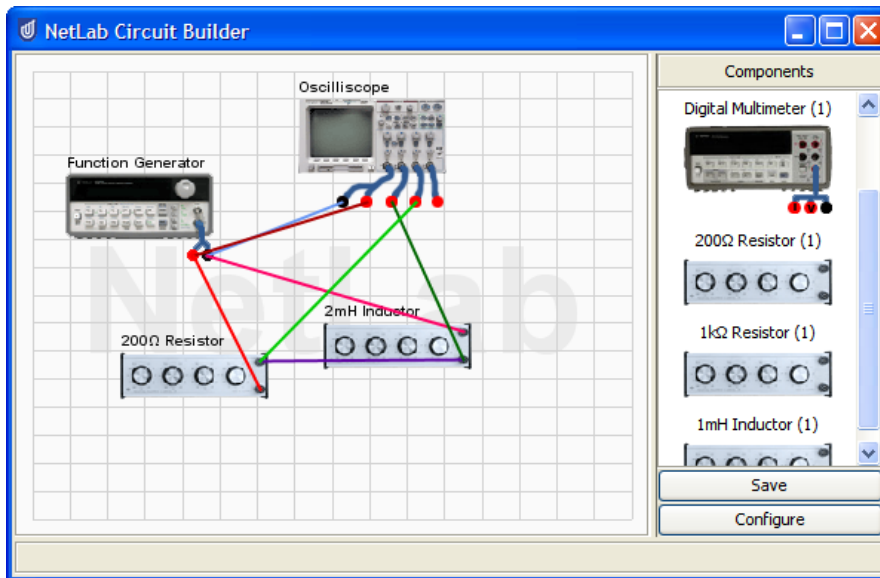


Figure 3.3: Wiring a Circuit

Right clicking on the canvas also shows a popup menu with items that allow you to save the current circuit configuration to a file, or load a circuit configuration from an existing file.

When the circuit is complete, you can click the *Configure* button to initialise the new circuit. Doing so will cause all instrument windows to be closed, in both your client and all other connected clients, and a message will be displayed to all users informing them that the circuit has changed. The *Instruments* menu will then have been updated to include a list of all instruments in the new configuration. Available instruments that are not included in the circuit configuration will not appear in the *Instruments* menu. For example, in the configuration of Figure 3.3, the digital multimeter will not appear in the *Instruments* menu.

3.2 Variable Components

NetLab supports variable resistors, capacitors and inductors. Variable components are displayed in the list of instruments, dropped on the canvas and wired up in the same manner as all of the other components. The value of a variable component must be set before clicking the *Configure* button. To edit the value of a variable component, simply double click it, or right-click and select *Edit Value*. A dialog similar to the one shown in Figure 3.4 will appear.



Figure 3.4: The Variable Component Editor

When there are multiple variable components available, you can change the component type and select one of the available ranges. The range value shows the maximum possible value, with the smallest possible increment in parenthesis. You can then rotate the knobs by clicking and dragging them with your mouse to select a value.

4. The Function Generator

4.1 Introduction

A function generator is used to generate input signals to circuits. The function generator in NetLab is based on the Agilent 33102A model. It supports frequencies from 0.1mHz up to 15MHz and amplitudes up to 10Vpp. It supports sine waves, square waves, ramp waves and triangular waves, and adjustable frequency, amplitude, duty cycle (for square waves) and DC offset.

The NetLab function generator does not yet support some of the more advanced features of the Agilent 33102A. For example, it does not support signal modulation, frequency shift keying, burst or sweep modes, or arbitrary waveforms. It also does not implement any menus.

To display the function generator, simply select it from the *Instruments* menu of the main NetLab window. Note that it must be connected in the current circuit configuration or else it will not appear. Turn it on by clicking the power button on the left-hand side of the front panel. The NetLab 33120A function generator is shown in Figure 4.1.

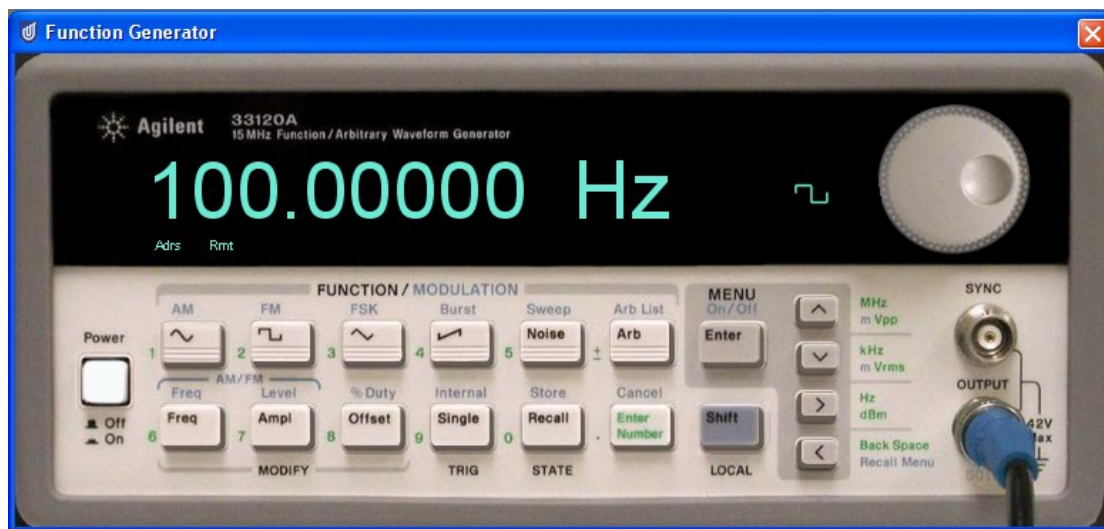


Figure 4.1: The NetLab 33120A Function Generator

4.2 Options

You can select the wave shape by clicking one of the shape buttons on the top line. Recall that noise and arbitrary waveforms are not supported. As you select different wave shapes, you will notice the wave shape indicator on the display panel change accordingly.

You can view and edit the waveform frequency, amplitude and offset by clicking on the corresponding button on the bottom left of the front panel. You can view and edit the duty cycle by first clicking the Shift button and then the Offset button.

4.2 Editing Values

One way to edit values is by adjusting digits. When an editable value is displayed, one digit or the units will be flashing. You change the selected digit using the left and right arrow buttons on the right-hand side of the front panel. When you have selected a digit, you can increment or decrement its value using the up and down arrow buttons respectively. Alternatively, you can rotate the knob by clicking and dragging it with your mouse, or by moving the mouse over it and rotating your mouse wheel.

The second way to set a value is by clicking the *Enter Number* button. Notice that buttons have digits next to them in green, as well as a decimal point and a +/- button. You can use these to enter the value. You select the units by selecting one of the top three arrow buttons. For frequencies, choose the up, down or right arrow button for MHz, kHz and Hz respectively. For amplitudes, choose the up, down or right arrow button for V_{pp}, V_{rms} or dBm respectively. DC Offset and duty cycle values do not require units so you can simply click the *Enter* button. The left arrow button functions as a back space during Enter Number mode. To cancel this mode, press Shift and then the Enter Number button.

5. The Digital Multimeter

5.1 Introduction

A digital multimeter is to measure DC and AC voltage, resistance, frequency, period as well as continuity and diode testing. The NetLab digital multimeter is based on an Agilent 34401A 6½ Digit Multimeter. It supports all of the previously mentioned measurements, as well as auto and manual triggering, adjustable ranges and adjustable displayed precision. It does not support any of the math functions. The measurement precision is also fixed at 6½ digits (the maximum).

To display a digital multimeter, simply select it from the *Instruments* menu of the main NetLab window. Note that it must be connected in the current circuit configuration or else it will not appear. Turn it on by clicking the power button on the left-hand side of the front panel. The NetLab 34401A digital multimeter is shown in Figure 5.1.



Figure 5.1: The NetLab 34401A Digital Multimeter

5.2 Taking Measurements

To make a measurement, select the appropriate function from the buttons on the top row of the front panel. To select one of the functions that are written above the button, you will need to press the Shift button first.

Whether or not readings are taken automatically depends on whether the current triggering mode is automatic or manual. If the multimeter display panel has the “Trig” indicator lit, then it is in manual trigger mode. You must click the *Single* button on the bottom row to manually take a single reading. If this indicator is not lit, then readings will appear periodically automatically. To switch to auto triggering while in manual triggering mode, press the *Shift* button, and then the *Single* button. To go back to manual triggering mode, simply press the *Single* button at any time.

Auto ranging is enabled by default. However, you can manually adjust the range using the up and down arrow buttons. The “Man” indicator lights on the display panel when manual ranging is enabled. To re-enable auto ranging, simply click the *Auto/Man* button.