

Introduction to Lookout™

Lookout is a Human-Machine Interface (HMI) and Supervisory Control and Data Acquisition (SCADA) software package for industrial automation. Lookout runs under Windows and communicates with field I/O through control hardware. Typical Lookout applications include continuous process monitoring and supervisory control, discrete manufacturing, batch applications, and remote telemetry systems.

This manual introduces the basics of the Lookout environment and the architecture of Lookout applications. Refer to the *Lookout Tutorial*, available by navigating to the `lookout\Documentation` directory and opening the `Lookout_Tutorial.pdf` file, for more information about using Lookout.

Contents

Lookout Features and Capabilities.....	2
Lookout Environment	4
Menu Bar	5
Status Bar.....	5
Lookout Workspace.....	5
Object Explorer.....	6
Control Panels.....	6
Alarms Window	6
Connection Browser.....	7
Connection Browser Options.....	8
Operator Input and Navigation	9
Virtual Keypad.....	9
Virtual Keyboard	9
Lookout Architecture	10
Client and Server Processes	10
Client and Server Versions of Lookout and Driver Objects.....	11
Event-Driven Processing	11
Lookout Objects.....	11
ActiveX Objects.....	12
Parameters.....	12
Data Members.....	13
Connections	15
Setting System Options.....	16

Lookout Features and Capabilities

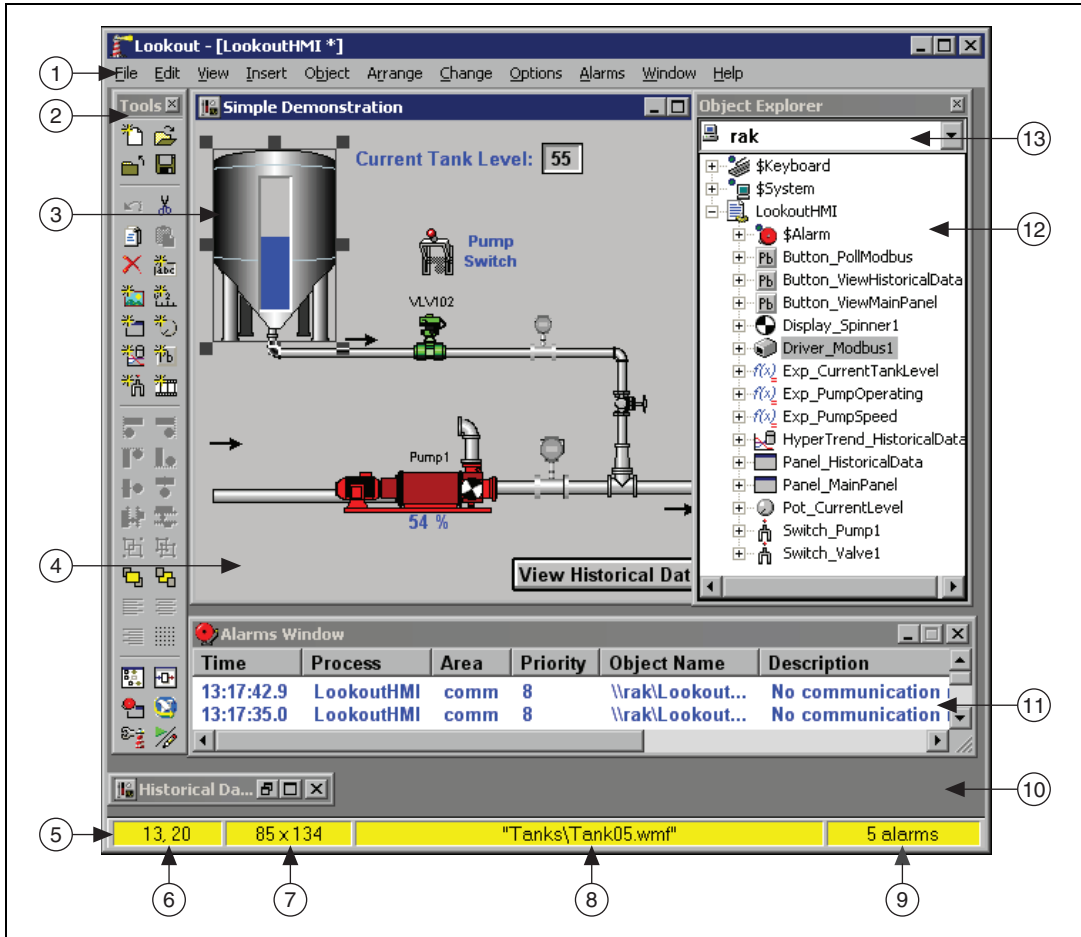
Lookout offers the following features and capabilities. Refer to the *Lookout Help*, available by selecting **Start»All Programs»National Instruments»Lookout x.x»Lookout Help**, for more information about these features and capabilities.

- **Hardware connectivity**—Lookout provides custom drivers to control PLCs and RTUs from a wide variety of manufacturers. Lookout is a fully-compliant OPC (OLE for Process Control) client and server, allowing full connectivity through the industry standard for open multivendor connectivity. Lookout is compatible with the OPC Data Access 1.0a and 2.03 specifications. Lookout offers seamless integration with National Instruments hardware, such as FieldPoint and Data Acquisition (DAQ) products.
- **Serial port communication**—You can communicate with certain control hardware through the serial ports of your computer. Lookout arbitrates serial port usage.
- **Graphics**—Lookout has an extensive library of standard graphics, as well as the Image Navigator and its library of graphics, that you can use as you build your user interface. You can also create your own custom graphics for use in Lookout.
- **Alarms**—In Lookout you can generate, display, log, filter, group, and print alarms.
- **Multimedia**—Lookout allows you to play sound wave files. Also, you can create color animations on your Lookout panels using the Animator, Multistate, and Pipe objects.
- **Security**—Lookout provides a security system for both local and network security. You can configure network security, control security, viewing security, and action verification. You can specify the level of access and control for each operator or networked machine.
- **Data and event logging**—You can store real-time system information to disk in comma-delimited ASCII files, or you can log historical data to the Citadel database. Lookout logs operator commands, such as closing a process file or flipping a switch. Along with each event, Lookout logs the account name (operator), date and time of the event, name of the object adjusted, and the before and after settings of the object.
- **ODBC support**—Because of the Lookout Open Database Connectivity (ODBC) support, you can use other applications, such as Microsoft Access, to query the Citadel historical data.

- **DDE support**—Lookout can send its live process values to other applications, and it can receive real-time values from other applications. Lookout acts as both a DDE client and a DDE server.
- **Networking**—Lookout provides high-speed client-server networking through the use of TCP/IP. You can monitor and control your processes from multiple workstations on a network.
- **OPC**—Lookout is a fully-compliant OPC client and server.
- **Redundancy**—You can configure two computers for redundancy, providing automatic transfer of monitoring and control if one of the computers fails.
- **Web capabilities**—With the Report object and Web Client, you can monitor and even control processes through Microsoft's Internet Explorer. Using the Lookout WebBrowser ActiveX control, you can access the Web from inside a Lookout process.

Lookout Environment

Figure 1 shows a Lookout screen in edit mode.



1 Menu Bar	6 Object Location	11 Alarms Window
2 Floating Toolbox	7 Object Size	12 Lookout Object Explorer
3 Selected Display Element	8 Object Name	13 Root Selection Box
4 Process Control Panel	9 Active Alarms	
5 Status Bar	10 Lookout Workspace	

Figure 1. Lookout Environment

Lookout has both edit and run modes. You can toggle between them by pressing <Ctrl-Space> on your keyboard or by selecting or deselecting **Edit Mode** in the **Edit** menu. Some menus and utilities are available in only one mode or the other. The status bar is yellow when Lookout is in edit mode.

Depending on the security access level of the user logged in to Lookout, certain menus and tools may be unavailable. Refer to the *Lookout Help*, available by selecting **Start»All Programs»Lookout x.x»Lookout Help**, for more information about *Lookout Menu Commands*.

Menu Bar

The menu bar displays the currently available menu commands, which change depending on whether Lookout is in run mode, edit mode, or is open without any processes running. These commands may or may not be available to the operator, depending on his or her security level.

Status Bar

When Lookout is in run mode, the status bar is gray. The time and date display on the left end of the bar. The account name of the currently logged-on operator comes next. The company name, as entered during activation, appears in the middle. The alarm status is on the right end of the status bar. The control panel navigation arrows, which scroll through various control panels, may or may not be visible, depending on your system options settings. Refer to the *Setting System Options* section of this manual for information about configuring system option settings.



Figure 2. Lookout Status Bar in Run Mode

In edit mode, the status bar is yellow. The X and Y coordinates of the currently selected item (if any) appear on the left end of the bar. The width and height of the currently selected item come next. The name, file name, or expression of the selected item appears in the middle, and the alarm status appears on the right end of the status bar.

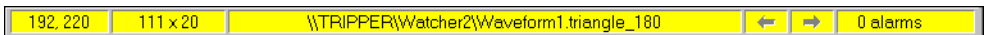


Figure 3. Lookout Status Bar in Edit Mode

To toggle in and out of edit mode, select **Edit»Edit Mode**, or press <Ctrl-Space>.

Lookout Workspace

The workspace is the area in which you view and operate control panels. The visible workspace on your screen is only a window into the Lookout virtual workspace. If control panels or their associated icons are partially or completely outside the visible workspace, Lookout automatically displays horizontal and vertical scroll bars.

Object Explorer

The Lookout Object Explorer is a useful tool for exploring and editing your Lookout processes. Access the Lookout editing functions from this window by right-clicking the objects displayed there. You can perform the following tasks by using the Object Explorer.

- Creating processes, objects, and folders within processes.
- Organizing objects by moving them from one location to another within a process.
- Dragging displayable objects and display expressions to different panels.

By default, the Object Explorer always displays when Lookout is in edit mode. If the Object Explorer does not display, select **Object»Object Explorer**. When you leave edit mode, the Lookout Object Explorer window closes.

Control Panels

Control panels provide the display area for any switches, knobs, bar graphs, digital displays, trend graphs, and other components that you want to use to monitor and control your operations.

You can move the panels around the screen by grabbing the title bar of a panel with the mouse cursor and dragging it to a new location. There is no limit on the number of control panels you can create or the number of objects displayed on any one panel.

When in edit mode, you can access many of the Lookout editing functions by right-clicking an object or expression in the panel, or on the panel itself.

There are three types of control panels: normal, pop-up, and pop-up with no icon. A normal control panel can be maximized, normal size, or minimized within the Lookout workspace. Control panels can also “pop up” when an event occurs, such as when a pushbutton is pressed or when an alarm is activated. When a pop-up control panel displays, this control panel remains on top of all other panels until you minimize it.

Alarms Window

Below the Lookout Object Explorer and the Reader Control Panel in Figure 1 is the Alarms Window. You can choose how the Alarms Window displays by selecting **Alarms»Display Options**. In Figure 1, the Alarms Window is set to display at the bottom of the workspace.

Connection Browser

Use the Connection Browser to register network computers, navigate quickly between objects, follow connections, monitor values, identify unused objects, and organize the objects in a process.

To access the Connection Browser, select **Object»Connection Browser**. To browse the connections in your Lookout processes, Lookout must be in edit mode. After opening the browser, double-click items in the Connection Browser to expand the view and see the existing connections.

When you select an individual object to show connections, your browser screen looks something like the following figure.

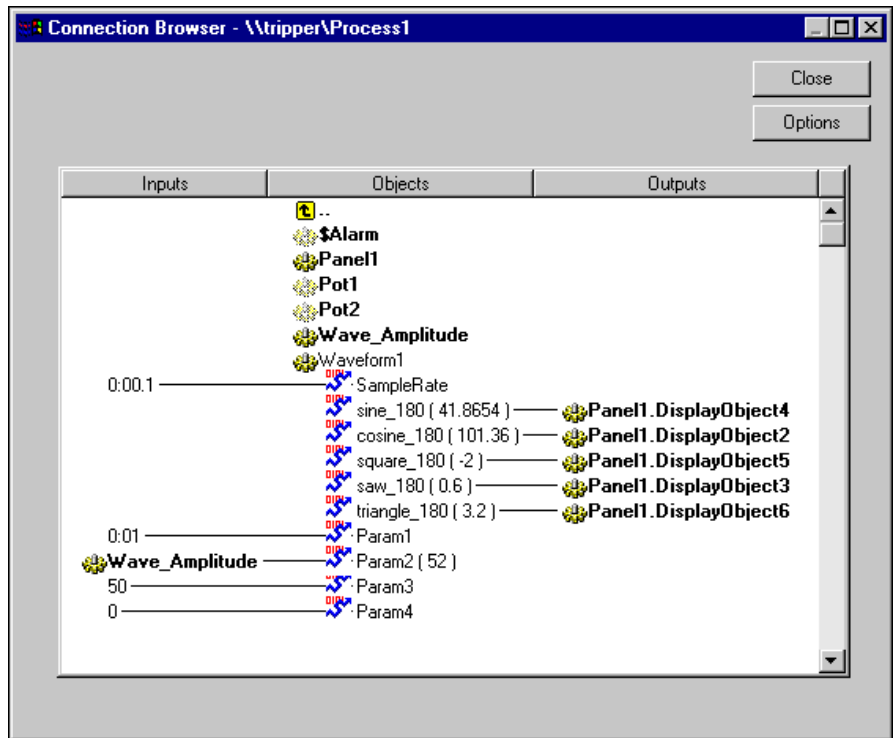


Figure 4. Connection Browser

In this example, the Waveform object named `Waveform1` has been selected. All the various display sites and connections are shown, including the way this Waveform is connected to a Pot (`Wave_Amplitude`) controlling the amplitude. The values of the different waveforms are shown in parentheses to the right of each output.

A value must be connected to or displayed to appear as live data in the Connection Browser. Using data as an item in a HyperTrend, however, is not a Lookout connection, so data displayed in this manner will not appear live on the Connection Browser.

The Pot1 and Pot2 object icons are dimmed, meaning that their outputs are not being used by any other object.

While you can browse from one process to another when both processes are open on one computer, you cannot browse across the network to a process running on another computer. The Connection Browser will show an object from another computer on the network on the screen, but cannot browse that object.

You can use the Connection Browser to move objects from one location into another inside a given process, using the typical Windows drag-and-drop technique. You can also create new objects or folders, and edit existing objects or connections. Right-click in the Connection Browser to get the menu to choose one of these operations. But carefully plan how you want to arrange the objects in each process, and be aware of how path relativity works in Lookout, to avoid connection problems.

Refer to the *Lookout Help* for information about using the Connection Browser to register networked computers in Lookout and how a change in location can affect object connections.

Connection Browser Options

In the Connection Browser, click the **Options** button to activate the **Connection Browser Options** dialog box.

If you want to eliminate object parameters (in order to focus on data member connections), disable the **Show parameters** option.

Disabling the **List Panel displays as connections** removes all display components from the Connection Browser view of a control panel.

Disabling the **Show constant connections** removes all static values connected to an object parameter or data member. Disabling this option can help you focus on variables and connections to changing values originating in other objects.

Selecting **Save settings on exit** to keep your configured options for the Connection Browser the next time you open the browser in a Lookout session.

Selecting **Play sound effects** enables your Windows system alarm sound when you attempt an illegal operation in the Connection Browser.

Operator Input and Navigation

Operators may navigate using a mouse, trackball, touchscreen, or keyboard. When the cursor moves over a controllable object, the cursor turns into a hand, indicating you now have control of the object. Controllable objects include such things as Switches, Pots, and Pushbuttons.

When using a keyboard, the arrow keys move the cursor around the screen. The <Tab> key jumps the cursor from one controllable object to another, and the <Space> bar acts as the left mouse button, so you can click a controllable object without actually using a mouse.

You can also tie keyboard function keys to control panels and other objects, so you can switch between control panels or issue control commands just by pressing a function key. Refer to the *Lookout Help* for more information about *\$Keyboard*.

Virtual Keypad

When Lookout is in run mode, you can click a digital Pot control and bring up a virtual keypad to enter numeric values, either with a mouse or a touchscreen.

Virtual Keyboard

Lookout also has a virtual keyboard you can use with a touchscreen or a mouse.

To enable the virtual keyboard, select **Options»System** and then check **Left Mouse Click** or **Right Mouse Click** in the **Virtual Keyboard Pops Up On** section of the dialog box.

When this feature is enabled, clicking in a data entry field or touching the field on a touchscreen displays the virtual keyboard, as shown in the following figure.



Figure 5. Virtual Keyboard

Lookout Architecture

Lookout consists mostly of objects, connections, and services. Developing a Lookout application is a matter of creating, configuring, and connecting objects. Lookout and the Lookout services handle the connections between your computer and various PLCs or other controllers; between your computer and various sensors; between your computer and other computers; and between your computer and the Lookout database, Citadel.

Client and Server Processes

A Lookout process is a program that you create to perform some specific job. Lookout can run any number of processes at one time. You can open and close a process without disturbing other processes that are running at the time. Your processes can report and analyze data and control machinery, all while interacting with other Lookout processes running on your computer and others scattered across the network.

It is important to make a distinction between client and server processes as you design and develop your Lookout HMI. In general, server processes communicate with your control hardware; client processes connect to server processes and provide the user interface for operation of your system. Refer to the *Lookout Help* for more information about server and client processes.

Client and Server Versions of Lookout and Driver Objects

Lookout is available in two basic types of packages: server versions and client versions.

Use server versions of Lookout to develop Lookout processes and run those processes on computers with physical connections to field hardware. Server versions of Lookout come with various I/O and client connection licenses, either with development capabilities or as run-time only. You must use a development server version of Lookout to create or edit processes.

Client versions of Lookout cannot run processes that contain a Lookout driver object. The client run-time version of Lookout is distributed at no charge.

Event-Driven Processing

Lookout is entirely *event-driven*, not *loop-driven*. Loop-driven applications execute code sequentially from top to bottom, and loop back to the top to execute the same code over and over. Commands may execute millions of times before the result changes, which wastes computer processor time and slows down responses to frequent events. In contrast to this programming model, Lookout is entirely *event-driven*. Each object remains inactive until an event occurs.

When an incoming signal changes in Lookout, the object processes the value according to its functionality. Objects send out signals only when the result of their processing changes. This event-driven paradigm demands much less processor time than a loop-driven design. It closely simulates the responsiveness of physical switches, pushbuttons, and relays, and is the reason Lookout is so fast.

Lookout Objects

Lookout architecture is based on objects and connections between objects. Objects are software representations of such things as switches, timers, or PLCs. Each object encapsulates a specific functionality. Each object has a set of parameters, which basically define and configure the object, and a set of data members, which act as input and output points. Figure 6 shows the functionality, data members, and parameters of an object.

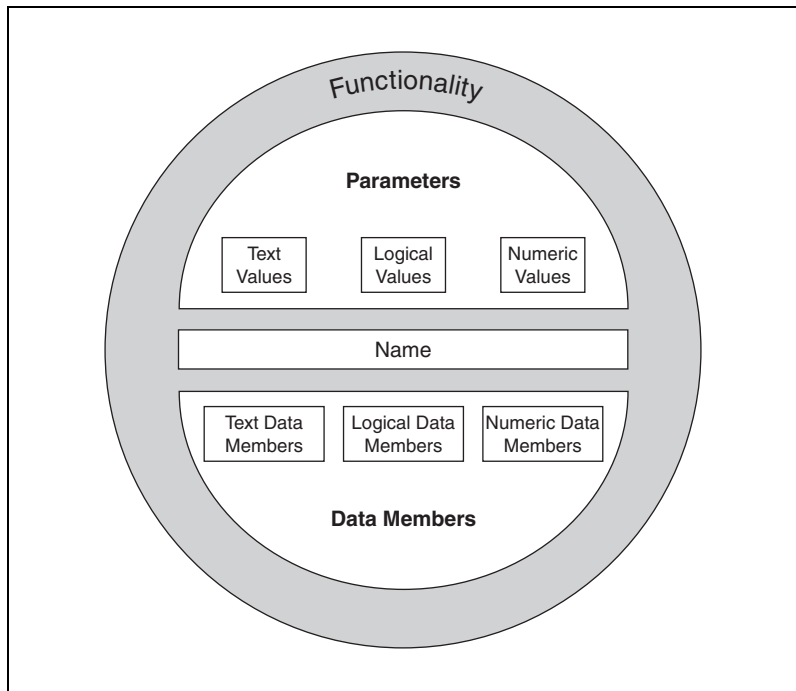


Figure 6. Objects Encapsulate Data Members, Parameters, and Functionality

Lookout object categories include calculation, control, display, drivers, logging, monitoring, multimedia, networking, statistical process control, and timers. Driver objects allow communication with specific control hardware models. Also, Lookout automatically creates three global objects: \$Alarm, \$Keyboard, and \$System. Refer to the *Lookout Help* for more information about these objects.

ActiveX Objects

Another special type of object is the Lookout ActiveX object. You create an ActiveX object to use an ActiveX control in a Lookout process. Refer to the *Lookout Help* for more information about using ActiveX objects in Lookout.

Parameters

Parameters define a Lookout object's characteristics and functionality limits. Parameters appear in the dialog box when you create an object or modify its properties. For example, **Baud rate**, **Parity**, and **Stop bits** are a few of the parameters that might define how a driver object works. Another example would be the **Control security level** of a Switch object. The *Lookout Help* topics for each object contain a list of object parameters.

Some parameters require constant or specific values. Many parameters can contain *expressions*, as indicated by a yellow field, which means that the parameters can change programmatically. Refer to the *Lookout Help* for more detailed information about expressions. For added flexibility, some parameters double as data members.

Data Members

Object *data members* contain information about the current state of the object, such as the value, whether the control is visible or hidden, and so on. Driver object data members represent the I/O values of your control hardware. The *Lookout Help* for each object contains a list of that object's data members.

A driver object representing a PLC might have hundreds of data members, but a Switch object has less than 10 data members. Every data member is a single value that can be one of three types: numeric, logical, or text.

You can configure the data member to suit your specific needs, including properties such as alarms, logging, or scaling. You can even create one or multiple aliases for a data member, each with a different configuration.

Logical Data Members

Logical data members represent a binary or on/off state. Lookout recognizes the following logical constants:

- An on state: `yes`, `true`, `on`
- An off state: `no`, `false`, `off`

Lookout is not case sensitive in this instance.

Refer to the *Lookout Help* for information about how Lookout interprets numeric or text data when it is passed to a logical data member.

Numeric Data Members

A *numeric* data member is a floating point number representing analog values such as a tank level, voltage, or temperature. Numeric data members also represent time, either as a span of time or as a particular time of day, week, month, or year. Numeric signals range from -1.7×10^{275} to 1.7×10^{275} .

Refer to the *Lookout Help* for information about how Lookout interprets logical or text data when it is passed to a numeric data member.

Numeric constants are entered using decimal digits (0–9), the minus sign (–), the exponent symbol (E or e), and the time format separator (:).

Some examples of numeric constants would be 0, -123.779999, 1.5E7, -3.7E-3, -.0036, or 23356636.234579.

For more information about numeric display formats, including time and date values, refer to the *Lookout Help*.

Text Data Members

Text data members contain text character strings consisting of any displayable characters A–Z, a–z, or 0–9. You can use text signals to display alarm descriptions on the alarm panel, to display labels on a control panel, and in expressions. You can enter text as constants, or you can construct them with the many text functions that are available for use in expressions. Be sure to enclose text constants in double quotes (" ") when using them within expressions.

Some examples of text constants would be the following:

- "Water Temperature:"
- " " (empty text string)
- "Low level in 'Polymer 2' tank"
- "gpm"
- "Fire in the: " "Pink room" " " (an expression containing a quote)

Refer to the *Lookout Help* for information about how Lookout interprets logical or numeric data that is passed to a text data member.

(implicit) Data Members

Many objects have an (implicit) data member. An (implicit) data member is read-only. It is either logical, numeric, or textual, depending on the type of object, and it follows the same rules that apply to all other data members. The (implicit) member represents what Lookout considers to be the most commonly used data member of that object type. In some cases, it is the only data member for an object. Existing (implicit) data members are defined in the object data member topics in the *Lookout Help*.

If you specify an object without specifying a data member, you are implying the (implicit) data member. For example, instead of typing `Pot1.value` where `Pot1` is the name and `value` is the current read-only value of the Pot, you could enter `Pot1` and Lookout treats that as the implicit read-only value of the Pot.

Because (implicit) data members are read-only, you cannot write to them or make a remote connection to them. For example, to specify the position of a Switch as a read/write value, you would use the Switch's `value` data member.

Data Quality

Lookout uses data quality attributes to keep track of any problems with your data. If there is a communications failure with a device, if the network connection to the source of the data is bad, if the data source is undefined, if the value is stale, or if some other problem arises, Lookout creates an alarm to report the condition. Lookout places a red X over the affected control or expression when there is a data quality problem. Lookout also provides functions to check for quality and report about quality problems.

Connections

You can connect objects in Lookout, allowing signals to pass between them—much the same way you would connect a light switch to a light bulb. You can do this by connecting data members to each other, or by connecting data members to parameters.

Figure 7 shows a data member to parameter connection and a data member to data member connection.

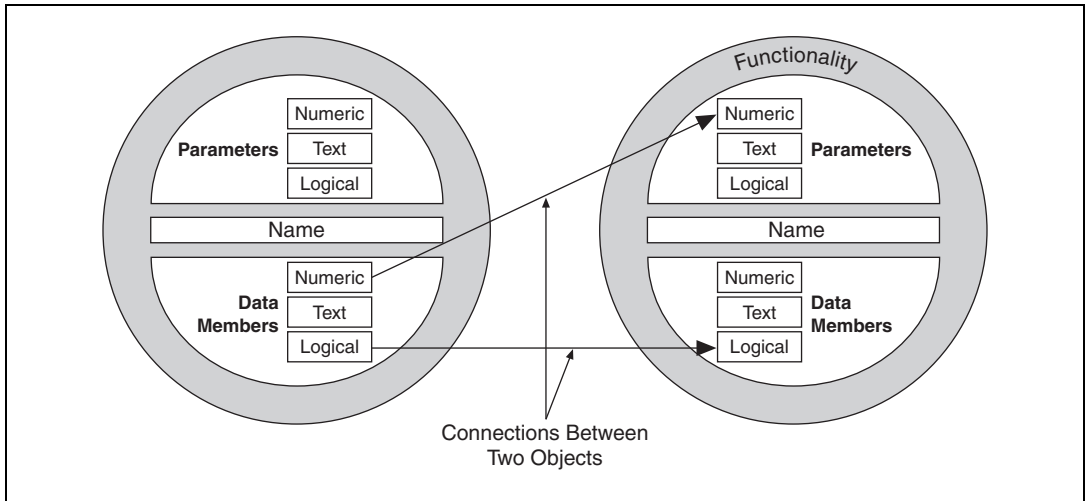


Figure 7. Example Connections between Two Objects

For example, you might make the numeric data member of a Pot object the source for the **Hi Level** parameter of an Alarm object. When you adjust the Pot, the Alarm **Hi Level** would change.

Your connections report on and react to events as they happen, not in some arbitrary order as in a loop-driven paradigm. Refer to the *Lookout Help* for more information about making connections in Lookout.

Setting System Options

You can configure certain system options in Lookout that determine the way your version of Lookout operates. Select **Options»System** from the menu bar. The System Options dialog box appears as shown in the following figure. Some default settings may be different for your computer.



Note Only users logged on with security levels of 9 or greater can access the System Options dialog box.

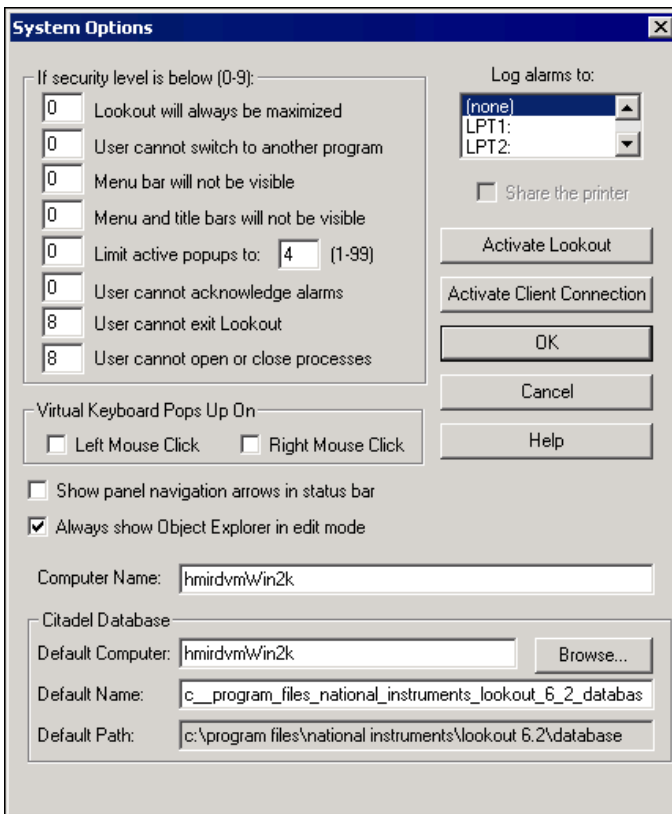


Figure 8. Lookout Environment

- **If security level is below (0-9)**—You can set local limits on how Lookout runs when users with different security levels are logged on. Use these selection boxes to set these limits. Refer to the *Lookout Help* for full details on the security features of Lookout.

- **Log alarms to**—If you have a printer directly connected to your computer, you can direct that all alarms be printed when they occur. Set this field to the communications port to which your printer is connected. Refer to the *Lookout Help* for information about the alarm and event logging features of Lookout.
- **Virtual Keyboard Pops Up On**—Lookout features a virtual keyboard that you can access by clicking a control that accepts a text or numeric input. You can set whether a right-click or a left-click pops up this keyboard.
- **Show panel navigation arrows in status bar**—Select this checkbox if you want to use panel navigation arrows. These arrows, which appear in the right side of the status bar, activate control panels in the order in which you last accessed them. This feature is most convenient when you have a large number of control panels in a process and need to cycle through a subset of them several times in a short period of time.
- **Always show Object Explorer in edit mode**—Select this checkbox if you want to always show Object Explorer when you switch Lookout from run mode to edit mode.
- **Computer Name**—This field shows the network name of the computer you are working on. If this field is blank, and you intend to use the networking capability of Lookout, you need to check your network settings to make sure your computer is properly named for network operations.
- **Citadel Database**—These fields set the default destination for historical data logged by Lookout. All processes running under a single instance of Lookout will use this database to log data to Citadel, unless you override this setting when you create the process.

You set the **Default Name** and the **Default Computer** separately. Use the database name for the **Default Name** setting and the fully qualified computer name for the **Default Computer** setting. Click **Browse** to select an existing database or to create a new database. **Default Path** is the computer-relative path to the database shown in **Default Name**. **Default Path** is filled in automatically and is read-only.

- **Activate Lookout and Activate Client Connection**—Click these buttons to enter new activation or serial number information.

National Instruments, NI, ni.com, and LabVIEW are trademarks of National Instruments Corporation. Refer to the *Terms of Use* section on ni.com/legal for more information about National Instruments trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering National Instruments products/technology, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your media, or the *National Instruments Patent Notice* at ni.com/patents. In regards to components that use Citadel 5, the following copyright applies. Copyright © 1994 Hewlett-Packard Company.