

Lookout™ *Direct*

Getting Started Guide



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Lookout™ Direct Getting Started Guide



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Contents

Chapter 1

Introduction

Overview	1-1
Document Conventions	1-1
Related Documentation	1-2
Installation	1-2
Development and Runtime Applications	1-2
Package Contents	1-2
About the Hardware Key	1-3
System Requirements	1-3
Development Systems	1-3
Runtime System	1-3
Installing LookoutDirect	1-3
Setting System Options	1-5
Computer Name Setting	1-5
Citadel Database Settings	1-5
Virtual Keyboard Settings	1-6
Log Alarms Setting	1-6
Security Level Settings	1-6
Panel Navigation Arrows	1-6
Startup Process File Setting	1-7

Chapter 2

How LookoutDirect Works

Architecture	2-2
What is an Object?	2-2
LookoutDirect Object Classes and Functionality	2-4
Parameters	2-4
Object Databases and Data Members	2-5
Logical Data Members	2-7
Numeric Data Members	2-7
Text Data Members	2-13
(implicit) Data Members	2-13
Data Polymorphism	2-14
Data Quality Attributes	2-15
Connections	2-16
Client and Server Processes	2-18
Supervisory Control	2-18
Event-Driven Processing	2-19

Contents

- Advantages of Active Notification.....2-20
- LookoutDirect Environment Services2-21
 - Serial Port Communication Environment Service2-21
 - Database Environment Service2-22
 - Graphics Environment Service.....2-22
 - Alarm Environment Service.....2-22
 - Multimedia Environment Service2-22
 - Security Environment Service.....2-23
 - Historical Logging Environment Service.....2-23
 - ODBC Environment Service.....2-23
 - DDE Environment Service.....2-23
 - Networking Environment Service.....2-24
 - Redundancy Environment Service2-24
- LookoutDirect Windows Services2-24

Chapter 3 Getting Started with LookoutDirect

- Basic Features Tour3-2
 - Starting a New Process.....3-2
 - Adding an Object3-4
 - Creating and Working with Expressions.....3-6
 - Saving Your Work3-8
 - Connecting Objects3-8
 - Creating Useful Interactions Between Objects3-11
 - Dressing Up the Control Panel.....3-15
 - Adding Alarms3-21
- Connected Tour3-23
 - Toggling a Discrete PLC Output.....3-23
 - Writing and Reading a Numeric Value3-27
 - Reading a Discrete Signal3-29
 - Displaying the Number of Scans.....3-30
- Advanced Features Tour.....3-31
 - Creating Panel Navigation Buttons3-31
 - Importing Custom Graphics3-33
 - Creating Alarm Management Buttons.....3-33
 - Process Data Logging.....3-36

Chapter 4

LookoutDirect Basics: Windows, Tools, Files, and Path Names

Starting LookoutDirect	4-1
Logging on to LookoutDirect	4-1
Opening a Process File.....	4-2
The LookoutDirect Screen	4-3
Title Bar	4-4
Menu Bar	4-4
Status Bar.....	4-4
LookoutDirect Workspace.....	4-5
Object Explorer	4-5
Control Panels	4-8
Alarm Window	4-9
Operator Input and Navigation	4-10
Virtual Keypad	4-10
Virtual Keyboard	4-10
Connection Browser	4-11
Connection Browser Options	4-14
LookoutDirect Application Files	4-15
Process File.....	4-15
Source Code File	4-16
State File.....	4-17
Security File.....	4-17
Configuration Shortcuts	4-18
Mouse Shortcuts	4-18
Remembering Object Names.....	4-19
Path Names in LookoutDirect.....	4-20

Chapter 5 Using LookoutDirect

Overview of the Process Development Cycle.....	5-23
Building Client and Server Processes	5-24
LookoutDirect Navigation	5-25
Creating A LookoutDirect Process	5-26
Creating Objects.....	5-28
Choosing Objects.....	5-28
Create an Object	5-28
Object Names.....	5-32
Connecting Objects	5-34
Connecting Data Members to Parameters	5-35
Identifying Object Data Members	5-36
Connecting Data Members to Data Members	5-36
URL Connections	5-40
Remote Position Source Connections	5-41
Symbolic Link Connections	5-41
HyperTrend Item Connections	5-42
Displaying Data Members on Control Panels.....	5-42

Glossary

Index




Introduction

Overview

This guide contains LookoutDirect installation instructions and an introduction to LookoutDirect's features and functionality. It includes general information to help acquaint you with important elements of LookoutDirect and tutorial exercises that introduce you to the basics of building a Lookout process.

Document Conventions

The following document conventions are used in this manual.

»	Indicate the path for nested menu and command selections. Example: Start » Programs » xxx
	Indicates a tip that provides helpful information related to the current procedure or topic.
	Indicates a important supplementary information pertinent to the current procedure or topic.
	Denotes a caution statement. Failure to follow the guidance provide in the caution statement could result in a loss of data or an interruption to a critical process being controlled or monitored by LookoutDirect.
bold face text	Denotes the name of dialog boxes, property sheet items, application features, and menu commands that you select as part of a procedure.
<i>italic</i>	Denotes references to dialog boxes, property sheet items, application features, and menu commands that are not part of the current procedure, or key concepts.
monospace	Denotes characters that you enter from the keyboard, code/syntax examples. The monospace font is also used to express proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions.

Related Documentation

The following documents are cross-referenced in this guide.

- *LookoutDirect Developer's Manual*
Provides in-depth coverage of LookoutDirect functionality including LookoutDirect services.
- *LookoutDirect Object Reference Manual*
Contains detailed description of all LookoutDirect system and driver objects. The *Object Reference Manual* can be found in the documentation directory of the LookoutDirect CD-ROM in Portable Document Format (PDF). To view this file, you must have Adobe Acrobat Reader 3.0 or later installed. If you do not have Adobe Acrobat Reader installed, you can install it from the LookoutDirect documentation directory or from the Adobe web site at www.adobe.com.

Installation

Development and Runtime Applications

The LookoutDirect software is available in both a development and runtime version.

- **PC-LKD-DEV** contains both the LookoutDirect development application and one license for the runtime application.
- **PCD-LKD-RTE** contains only a single license for the LookoutDirect runtime application. The runtime version can only be used to run compiled process files that have been developed using the PC-LKD-DEV application.

Package Contents

The application package should contain the following items:

- CD-ROM
- Hardware key
- Getting Started Guide
- Developers's Manual
- Object Reference Manual
- Registration Card

If you are missing any of the items listed above, contact Automation Direct at 1-770-844-4200.

About the Hardware Key

In order to run *LookoutDirect*, you must install the hardware key provided onto the parallel port of the PC running *LookoutDirect* (development or runtime version). The hardware keys provided with the development and runtime version are not interchangeable. Each hardware key is matched to the software licence number of the application it is provided with.

System Requirements

Development Systems

- Pentium 133 MHz or faster
- Windows 95/98/NT
- 32 MB RAM
- 100 MB available hard disk space
- CD-ROM drive
- 640 x 480 color monitor

Runtime System

- Pentium 133 MHz or faster
- Windows 95/98/NT
- 32 MB RAM
- 100 MB available hard disk space
- CD-ROM (optional if you have a network)
- 640 x 480 color monitor or flat-panel display for HMI

Installing *LookoutDirect*

To install the application:

1. Insert the Product Showcase CD into your CD-ROM drive.
If autorun is enabled on your system, the DirectSOFT32 window will appear and you can skip to step 4.
2. From the **Start** menu, select **Run**.
3. Type `x:\setup.bat` substituting "X" with the letter designation of your CD-ROM drive, and click **OK**.

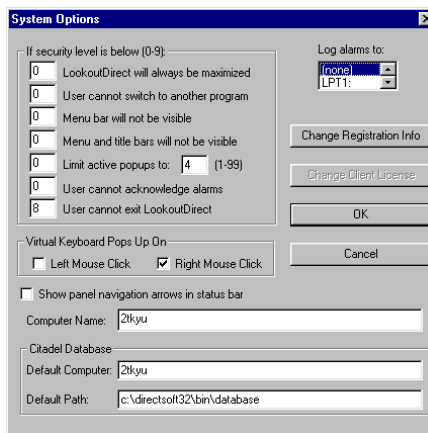
4. From the DirectSoft32 window, select **Install Software**.
5. In the password dialog, enter the 16-digit product key that corresponds to your software license. The product key can be found on back of the Product Showcase CD case. The product key is case-sensitive and requires hyphens. The **OK** button becomes available when you enter a valid product key.
6. Click **OK**.
The password dialog box appears.
7. Press CTRL + V to paste the product key, which you entered previously, into the password text box. The **OK** button becomes available when you enter a valid product key.
8. Click **Continue**.
The LookoutDirect setup window and **Welcome** dialog box appears.
9. Follow the LookoutDirect setup instruction that appear on the screen.
When the LookoutDirect setup is complete, the NI Logos Installation Wizard appears. NI Logos is used to install third-party application components that are licensed to AutomationDirect.
10. Follow the NI Logos Installation Wizard instructions.
When the NI Logos installation is complete, the LookoutDirect installation screen returns
11. Select to view the readme file or launch LookoutDirect.

Setting System Options

Once *LookoutDirect* is installed, make adjustments to the system settings. Access to the system settings is based on the security level assigned to each process by the Administrator. Contact your system administrator for assistance if you cannot access or make changes to a system setting.

1. Select **Options » System**.

The **System Options** dialog box appears. Some default settings may be different for your computer.



2. Select option you want, and then click **OK**.



Note Only users logged on with security levels or 9 or greater can change system options.

Computer Name Setting

The computer name 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 *LookoutDirect*, you need to check your network settings to make sure your computer is properly named for network operations.

Citadel Database Settings

The **Citadel Database** fields set the default destination for Citadel data logged by *LookoutDirect*. All processes running under a single instance of *LookoutDirect* will use this data path to log data to Citadel, unless you override this setting when you create the process.

You set the **Default path** and the **Default computer** separately. Use the complete path name for the **Default path** setting, and the fully qualified computer name for the **Default computer** setting.

Virtual Keyboard Settings

LookoutDirect features a virtual keyboard that you can access when in run mode by clicking on a control that accepts a text or numeric input. You can set whether a right-click or a left-click pops up this keyboard in the **Virtual Keyboard Pops Up On** field in the **System Options** dialog box.

Log Alarms Setting

If you have a printer directly connected to your computer, you can direct that all alarms can be printed when they occur. Set the **Log alarms to** box in the **System Options** dialog box to the communications port to which your printer is connected. See Chapter 9, *Alarms*, in the *LookoutDirect Developer's Manual* for information on the alarm and event logging features of *LookoutDirect*. You can also capture a network printer port on Windows 98/95 machines. Consult your operating system documentation for information on this procedure.

Security Level Settings

You can set local limits on how *LookoutDirect* runs when users with different security levels are logged on. Use the **If security level is below:** selection boxes in the **System Options** dialog box to set these limits. See Chapter 6, *Security*, in the *LookoutDirect Developer's Manual* for full details on the security features of *LookoutDirect*.

Panel Navigation Arrows

Select the **Show panel navigation arrows in status bar** check box if you want to use panel navigation arrows. These arrows, located 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.

Startup Process File Setting

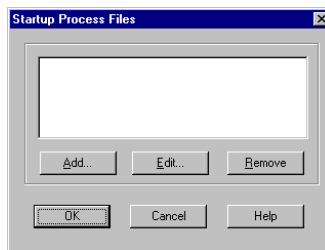
If your computer runs *LookoutDirect* 24 hours a day, you may want to ensure that the system can automatically reboot and begin executing your processes in the event power to the system is lost and later restored.



Note In order for the startup file settings to work, *LookoutDirect* must be setup in Windows as a startup application. Refer to your Windows documentation for information on enabling startup applications.

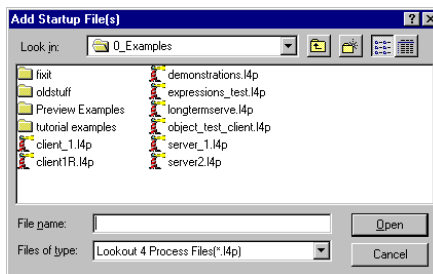
1. Select **Options » Startup**.

The **Startup Process Files** dialog appears.



2. Click **Add**.

The **Add Startup Files** dialog box appears.



3. Navigate to, and then select the process file(s) you want to run when power is restored to the system running *LookoutDirect*.

You can add as many process files as you want. The files will open in the order in which they are entered in the **Startup Process Files** dialog box.

To edit a path name to a file, highlight the file name and click on the **Edit** button.

How Lookout*Direct* Works

This chapter explains the basics of how Lookout*Direct* works, including descriptions of objects, data members, connections, processes, and services.

Lookout*Direct* is a powerful yet easy-to-use Human-Machine Interface (HMI) and Supervisory Control and Data Acquisition (SCADA) software package for industrial automation. Lookout*Direct* runs under Windows and communicates with field I/O from Programmable Logic Controllers (PLCs), Remote Terminal Units (RTUs), and other devices. Typical Lookout*Direct* projects include continuous process monitoring and supervisory control, discrete manufacturing, batch applications, and remote telemetry systems.

Object-oriented and event-driven, Lookout*Direct* is a configurable package that requires no programming or scripting. Instead, you use Lookout*Direct* to create graphical representations on a computer screen of real-world devices such as switches, dial gauges, chart recorders, pushbuttons, knobs, sliders, meters, and then link your images to the actual field instruments using PLCs, RTUs, data acquisition boards, or other I/O devices.

Lookout*Direct* has many diverse capabilities such as Statistical Process Control (SPC), recipe management, Structured Query Language (SQL), built-in security, flexible data logging, running multiple processes on one computer, sophisticated animation, complex alarming, radio and dial-up telemetry support, audit trails of events and setpoint adjustments, multimedia support, touch screen compatibility, networking (including multiple client and server processes running on one or many computers), Dynamic Data Exchange (DDE & NetDDE), and more.

With Lookout*Direct* you can develop an application completely online, without shutting down. You do not have to recompile or download a database every time you make a modification, nor do you have to switch back and forth between programs. You do not even have to run separate development and configuration programs. Instead, you can add, delete and modify control panels, logic, graphics, PLCs, RTUs, I/O, and other field devices without ever interrupting your process.

Because Lookout*Direct* is object-oriented and event-driven, you can use Lookout*Direct* with other programs in the Microsoft Windows multitasking environment. For example, while Lookout*Direct* monitors and controls your

process, you can use a spreadsheet to analyze production figures of hourly average flow rates, then start a word processor to generate a memorandum, paste the spreadsheet into the memo and send it to a laser printer.

The remainder of this chapter describes Lookout*Direct* architecture—the components and how they work together. This will help you understand fully how to use Lookout*Direct* for all your continuous process, discreet, or batch applications.

Architecture

Once you understand the basic Lookout*Direct* components and the fundamentals regarding object-oriented and event-driven structure, using the program becomes much easier.

Lookout*Direct* consists mostly of objects and their data members, connections, and services. Developing a Lookout*Direct* application is a matter of creating, configuring, and connecting objects. Objects are software representations of everything from potentiometers and switches to PLCs and RTUs connected physically to the computers you have running Lookout*Direct*. You then make connections between the software objects. Lookout*Direct*, and the Lookout*Direct* 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*Direct* database, Citadel.

Add to this the idea of client and server processes and you are well on your way to understanding the basic structure of all Lookout*Direct* applications.

What is an Object?

A Lookout*Direct* object is a self-contained software unit designed to do something specific in your HMI/SCADA application. What each object does is generally referred to as its functionality. Each object has a set of data members you can log to a predefined database, and a set of parameters. The following diagram depicts the functionality, data members, and parameters of an object.

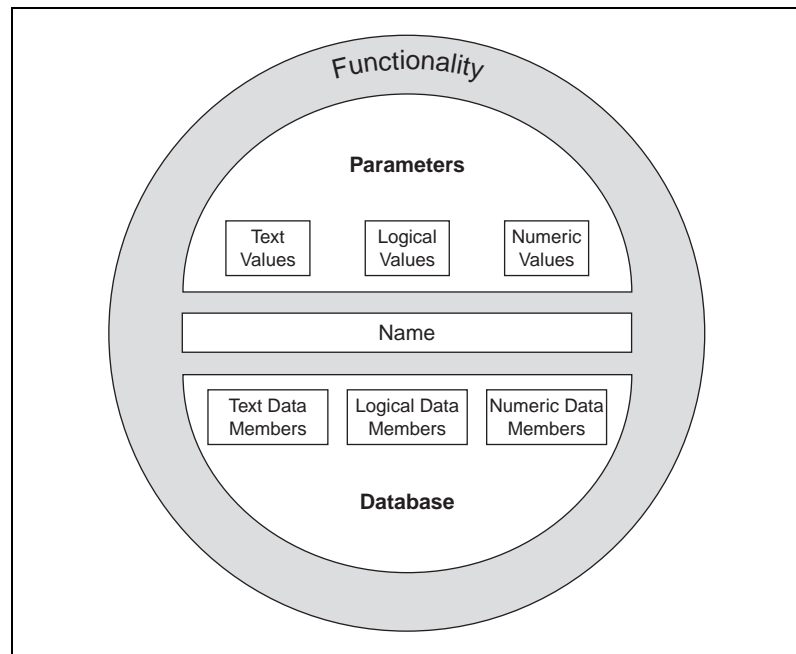


Figure 2-1. Objects Encapsulate Data Members, Parameters, and Functionality

Think of an object as a software model of something physical. For example, a potentiometer is something physical. You can adjust it up and down. In *LookoutDirect*, a Pot object represents the physical potentiometer. You can adjust it too.

Parameters define the limits of object functionality. For example, parameters set the minimum and maximum values of the Pot, the size of the smallest interval of adjustment, and other elements of the Pot's functionality.

The 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. The *database* can store data member information depending on what you want recorded, at what level of detail.

LookoutDirect Object Classes and Functionality

A LookoutDirect object is a specific instance of a LookoutDirect object class. You can think of an object class as the generalized form for an object. When you create an object, you are taking the general form described by an object class, defining it with specific parameters, giving it a name, and putting it to work as a software object. You can make as many objects as you need from each LookoutDirect object class, each specifically configured to perform the task you need that particular object to perform.

For example, LookoutDirect has both Pot and Switch object classes, from which you might create 20 pots and 30 switches. In this case, you would be creating a total of 50 objects using only two object classes.

Different object classes are designed to perform different functions, or tasks. For example, the Pot (potentiometer) object class operates differently from the Switch object class. This is the *functionality* built into every object class.

Global object classes are a special kind of object class. Each contains global system data such as the number of currently active alarms. You cannot create, modify or delete a global object, but you can use its data members just as you would use any other object data members.

When you create or open a LookoutDirect process file, LookoutDirect automatically creates three global objects: \$Alarm, \$Keyboard, and \$System.

Functionality is the way an object class works, operates, or performs a task. Functionality is a general concept that applies in the same way to all objects in a given object class. Parameters, however, can be unique, and define the specific functionality of an individual object.

The object class definitions, found in the *LookoutDirect Object Reference Manual*, outline the functionality of each object class.

Parameters

An object's parameters define its characteristics. LookoutDirect uses object parameters to complete the definition of the object functionality. For example, **Data rate**, **Parity**, and **Stop bits** are a few of the parameters that define how a Modbus object works. Other examples include the **Control security level** of a Switch object; **Minimum**, **Maximum**, and **Resolution** of a Pot object; and **Data** of an Average object.

Every object class supports a set of parameters that you must fill in or select when creating a new object. Many parameters are *expressions*, which means you can change parameters programatically. Others require constant values. Some require you to pick specific settings.

Parameters that accept expressions appear as yellow data entry fields. These parameters can receive signals (that is, they are writable). See Chapter 1, *Expressions*, of the *LookoutDirect Developer's Manual* for more detailed information on expressions.

All the parameters for any given class are visible in the object definition dialog box. For information on how to create this object, see the *Creating & Managing Communication Links* section of Chapter 4.

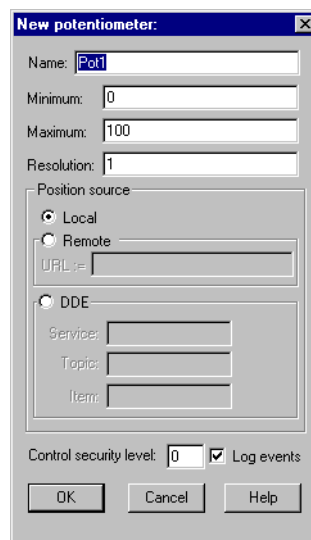


Figure 2-2. Pot Definition Dialog Box

Object Databases and Data Members

Each object has its own built-in database. The individual parts of this self-contained database are called *data members*. Some object classes have a very limited database, while others have extensive databases. The database of an object representing a PLC might have hundreds of data members; but a Switch object database has only six data members. You do not have to build a database—the data members are automatically available when you create the object.

In the case of a switch, the implicit value of the object is a part of the self-contained database. Data members can either generate (*write*) signals, receive (*read*) signals, or both.

Every data member contains a single value that can be one of three types: numeric, logical, or text. LookoutDirect is not strongly typed, however, so you can connect one type data member to another, and LookoutDirect will not generate an error message. See the *Data Polymorphism* section of this chapter for more information on how LookoutDirect interprets data of different types.

The built-in data members for each object are referred to as *native* members, and can be thought of as the default or automatic data members. You can add to and modify the database to suit your specific needs, attaching one or more aliases to a given data member, each with a different set of associated alarm, logging, or scaling properties.

Every object class has an explanation of its database in its class documentation, which you can access by clicking on the Help button in the dialog box used to create or modify an object. The following is an example of the switch object class database explanation.

Table 2-1. Switch Data Members

Data Members	Type	Read	Write	Description
(implicit)	logical	yes	no	Switch Position
enable	logical	no	yes	If TRUE (the default), enables DDE. If FALSE, disables DDE. The default value is ON. This input is ignored for non-DDE Switch objects.
reset	logical	no	yes	While this value equals TRUE, the control will be set to the value in <code>resetvalue</code> .
resetvalue	numeric	no	yes	Sets the value a control will take when the reset data member transitions from FALSE to TRUE.
value	numeric	yes	yes	The current value of the control. If you have remoted this control, then <code>value</code> is the current value of the position source.
visible	logical	no	yes	When FALSE, the switch object cannot be seen on the display panel. When TRUE, the switch can be seen and controlled.

Logical Data Members

Logical data members contain a value that represents a binary or on/off state. A light switch is a logical device—it is either on or off.

Logical data members are typically used to control equipment that can be turned on and off, to indicate that a piece of equipment is running, or indicate whether a limit switch is open or closed.

The Switch object generates a logical signal that is on when the switch is up and off when the switch is down. In the same way, the Pushbutton object generates a logical value that is on while the pushbutton is depressed. The Pulse object generates a logical signal that turns on and off at prescribed intervals, creating a logical pulse.

The logical signals that some objects generate can be displayed graphically on a control panel. See Chapter 2, *Graphics*, of the *LookoutDirect Developer's Manual*, for more information on graphical displays.

LookoutDirect recognizes the following logical constants as expressions:

- Logical constants that represent an on state: `yes`, `true`, `on`
- Logical constants that represent an off state: `no`, `false`, `off`

LookoutDirect is not case sensitive, so case variations such as `On`, `ON`, or `oN` will all be interpreted as `ON`.

See the [Data Polymorphism](#) section of this chapter for information on how LookoutDirect 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 tank level, pressure, flow rate, voltage, and temperature. Numeric data members also represent time, either as a time period (span) or as an absolute time (that is, a particular time of day/week/month/year).

The Pot (potentiometer) object generates a numeric signal compatible with the numeric signals that monitor and control the analog input and output points on a PLC. Numeric signals range from -1.7×10^{275} to 1.7×10^{275} .

See the [Data Polymorphism](#) section of this chapter for information on how LookoutDirect 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 as follows:

- 0
- –123.779999
- 1.5E7 (15,000,000)
- –3.7E-3 (–0.0037)
- –.0036
- 23356636.234579

Time or *Time signals* are stored by LookoutDirect as numeric values that represent days and fractions of a day. For example, you enter one hour as 1:00:00. LookoutDirect interprets the number to the right of the rightmost colon (:) as seconds, the number to the right of the second colon from the right as minutes, the next number as hours, and the number to the left of the third colon from the right as days. If there are no colons in the entry, the time period is assumed to be given in days.

When your operating system switches in or out of daylight savings time, LookoutDirect corrects for the change relative to universal time so that there is no data discontinuity or loss in the Citadel database.

Table 2-2. Examples of LookoutDirect Time Constants

Time Period Constant	LookoutDirect Interpretation
0:23	23 seconds, or 0.0002662 days
75:00	75 minutes, 0 seconds, or 0.05208 days
12:00:05:01	12 days, 0 hours, 5 minutes, 1 second, or 12.003484 days
199::	199 hours, 0 minutes, 0 seconds, or 8.2917 days
0:10.023	10.023 seconds, or 0.0001160 days
12.75	12.75 days
17:64:22.5	invalid number: because hours are specified, minutes must be ≤59

You may enter one hour as 1:00:00, but LookoutDirect stores the number as 0.04167 (or 1/24 of a day). Days are represented by the integer portion of the number. The number zero represents Jan. 1, 1900. You may also find it helpful to know that one second = 0.000011574 and one minute = 0.000694444.



Tip If you display a numeric signal on a control panel, LookoutDirect provides a long list of numeric formats to choose from. You can set the format when you first create the display, or by right-clicking on the display and selecting **Display Properties**. The different possible formats are listed in the following tables.

Table 2-3. General Numeric Format Examples

Numeric Format	Value	Display
(General)	123.78	Displayed as 123.78
(General)	123.789	Displayed as 123.789
Note: General format displays the value in the most compact form possible.		

Table 2-4. Leading Zeroes Numeric Format Examples

Numeric Format	Value	Display
000000000	123.789	Displayed as 000000124
00000000	123.789	Displayed as 00000124
0000000	123.789	Displayed as 0000124
000000	123.789	Displayed as 000124
00000	123.789	Displayed as 00124
0000	123.789	Displayed as 0124
000	123.789	Displayed as 124
00	123.789	Displayed as 124
0	123.789	Displayed as 124

Table 2-5. Fractional Numbers with Trailing Zeroes Format Examples

Numeric Format	Value	Display
0.0	123.789	Displayed as 123.8
0.00	123.789	Displayed as 123.79
0.000	123.789	Displayed as 123.789
0.0000	123.789	Displayed as 123.7890
0.00000	123.789	Displayed as 123.78900
0.000000	123.789	Displayed as 123.789000
0.0000000	123.789	Displayed as 123.7890000
0.00000000	123.789	Displayed as 123.78900000

Table 2-6. Exponential/Scientific Notation Format Examples

Numeric Format	Value	Display
0E0	123.789	Displayed as 1E+2
0.0E+0	123.789	Displayed as 1.2E+2
0.00E+0	123.789	Displayed as 1.24E+2
0.000E+0	123.789	Displayed as 1.238E+2
0.0000E+0	123.789	Displayed as 1.2379E+2
0.00000E+0	123.789	Displayed as 1.23789E+2
0.000000E+0	123.789	Displayed as 1.237890E+2
0.0000000E+0	123.789	Displayed as 1.2378900E+2
0.00000000E+0	123.789	Displayed as 1.23789000E+2

Table 2-7. Hexadecimal Format Examples

Numeric Format	Value	Display
0x0	123.789	Displayed as 0x7
0x00	123.789	Displayed as 0x7
0x000	123.789	Displayed as 0x07
0x0000	123.789	Displayed as 0x007
0x00000	123.789	Displayed as 0x0007
0x000000	123.789	Displayed as 0x00007
0x0000000	123.789	Displayed as 0x000007
0x00000000	123.789	Displayed as 0x0000007

You can also use numeric signals to represent absolute times and periods of time. Because dates and times are represented by numeric values, you can add, subtract, and include dates and times in expressions, just as you would any other numeric signals.

A time *period* represents a span of time or a duration. Time periods are indicated in hours, minutes, seconds, and fractions of seconds. Numeric formats that represent time periods are characterized by capital letters (that is, H rather than h).

Table 2-8. Time Period Display Examples

Time Format	Value	Display
H	0.4789	Displayed as 11 (hours)
H.H	0.4789	Displayed as 11.5 (hours)
H.HH	0.4789	Displayed as 11.49 (hours)
M	0.4789	Displayed as 690 (minutes)
M.M	0.4789	Displayed as 689.6 (minutes)
M.MM	0.4789	Displayed as 689.62 (minutes)
S	0.4789	Displayed as 41377 (seconds)
S.S	0.4789	Displayed as 41377.0 (seconds)
S.SS	0.4789	Displayed as 41376.96 (seconds)

Table 2-8. Time Period Display Examples (Continued)

Time Format	Value	Display
HH:MM	0.4789	Displayed as 11:29 (11 hours, 29 minutes)
HH:MM:SS	0.4789	Displayed as 11:29:36 (11 hours, 29 min, 36 seconds)
HH:MM:SS.S	0.4789	Displayed as 11:29:36.9
HH:MM:SS.SS	0.4789	Displayed as 11:29:36.96
HH:MM:SS.SSS	0.4789	Displayed as 11:29:36.960
MM:SS	0.4789	Displayed as 689:36 (689 minutes, 36 seconds)
MM:SS.S	0.4789	Displayed as 689:36.9
MM:SS.SS	0.4789	Displayed as 689:36.96
MM:SS.SSS	0.4789	Displayed as 689:36.960

Absolute dates and times indicate a specific moment in time. LookoutDirect stores all absolute dates and times as numeric signals. It uses the 1900 date system in which the number 1 corresponds to midnight, January 1, 1900. The number 2 corresponds to midnight, January 2, 1900 and so on. For example, the number 34491.5 represents noon, June 6, 1994.

Numeric formats that represent absolute times are characterized by lower case letters (for example, hh:mm instead of HH:MM).

Table 2-9. Absolute Date and Time Display Examples

Time Format	Value	Display
hh:mm	34668.7889	Displayed as 18:56 (6:56 p.m.)
hh:mm:ss	34668.7889	Displayed as 18:56:02
mm/dd hh:mm	34668.7889	Displayed as 11/30 18:56
mm/dd hh:mm:ss	34668.7889	Displayed as 11/30 18:56:02
mm/dd/yy	34668.7889	Displayed as 11/30/94
mm/dd/yy hh:mm	34668.7889	Displayed as 11/30/94 18:56
mm/dd/yy hh:mm:ss	34668.7889	Displayed as 11/30/94 18:56:02
dd/mm hh:mm	34668.7889	Displayed as 30/11 18:56
dd/mm hh:mm:ss	34668.7889	Displayed as 30/11 18:56:02

Table 2-9. Absolute Date and Time Display Examples (Continued)

Time Format	Value	Display
dd/mm/yy	34668.7889	Displayed as 30/11/94
dd/mm/yy hh:mm	34668.7889	Displayed as 30/11/94 18:56
dd/mm/yy hh:mm:ss	34668.7889	Displayed as 30/11/94 18:56:02

Text Data Members

Text data members contain text character strings. These character strings consist of all displayable characters. You can use text signals to display alarm descriptions on the alarm panel, to display labels on a control panel, and in parameters or expressions. You can enter text signals as constants, or you can construct them with the many text functions available in expressions. Be sure to enclose text constants within 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”

See the [Data Polymorphism](#) section in this chapter for information on how LookoutDirect interprets logical or numeric data when it is passed to a text data member.

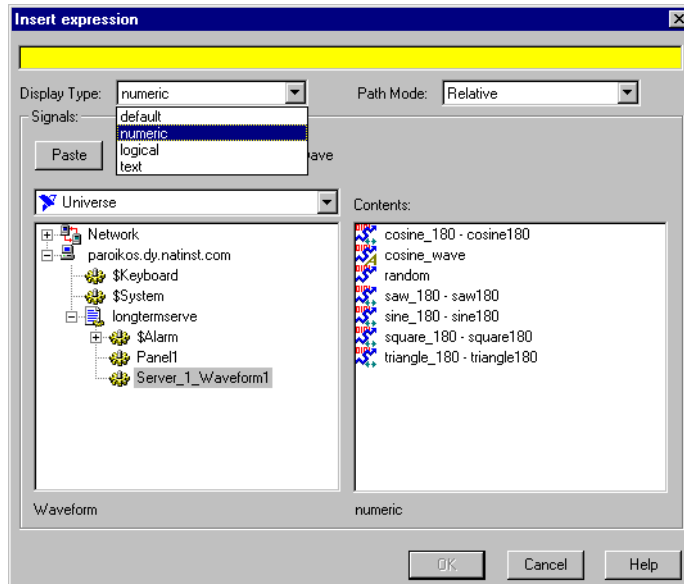
(implicit) Data Members

Many object classes have an (implicit) data member. This implicit value is either logical, numeric, or textual, depending on the object class, and follows the same rules that apply to all other data members. The implicit member represents what LookoutDirect considers to be the most commonly used data member of that object class. In many cases, it is the only data member of a class. It saves you time and reduces the amount of typing required to designate a data member.

For example, LookoutDirect could make you specify the numeric signal generated by a Pot object by typing `Pot1.numeric` where `Pot1` is the name and `numeric` is the current value of the Pot. Instead, you enter `Pot1` and LookoutDirect knows you are referring to the implicit value of the Pot. If you examine the Pot definition in the LookoutDirect online help, you will see that the (implicit) data member is the current value of the Pot.

Data Polymorphism

Polymorphic data is data that is not strongly typed. In *LookoutDirect*, data of one type is interpreted appropriately when connected to an input of another type. You can also select the data type when inserting expressions, using the selection box below the expression field, as shown in the following picture.



Logical values are displayed as 0 and 1 when interpreted as numeric values and as ON or OFF when interpreted as text values.

A numeric value of 0 displays as OFF when viewed as a logical value. Any value other than 0 is displayed as ON. A numeric value displayed as text shows the digits of the number.

Text strings displayed as numeric values appear as digits if the string consists only of digits in a valid *LookoutDirect* display format, such as a decimal number or a scientific expression. Numeric interpretation of text in a time format, such as 10:05:30 is interpreted as number (the fraction of one day represented by the time quantity) in scientific notation.

Any text string that does not consist of digits in a valid *LookoutDirect* format is interpreted as a 0, with the exception of ON or TRUE, which display as 1. OFF or FALSE are interpreted as 0, by default. The terms On, Off, True, and False are not case sensitive.

Text strings displayed as logical values are interpreted as a 0 or as OFF, except when the text string consists of a 1, On, or True, all of which are interpreted as ON. Again, a text string consisting of 0, Off, or False is interpreted as OFF, by default. Again, the terms On, Off, True, and False are not case sensitive.

Once you have placed an expression on your panel, you cannot change the data type in that expression. You have to delete that expression and place a new one if you want to change data types.

Expressions used as parameters in LookoutDirect objects do not permit you to select the data type because the object interprets input according to the data type required by that object. You can, however, use output of a data type different from that required by an object, as long as the output can be interpreted meaningfully by the object.

Polymorphic data types affect the DataTable object. In versions of LookoutDirect earlier than LookoutDirect 4.0, the DataTable used data members such as `Al.logical` to set the type of data in a particular cell. Some LookoutDirect developers used the DataTable to create, in effect, polymorphic data.

The LookoutDirect 3.xx DataTable data members are preserved in LookoutDirect 4 for the sake of compatibility. But it is not necessary to use the data-typed data members to simulate polymorphic data. To achieve this compatibility, however, LookoutDirect DataTable data is still strongly typed. You must input numeric data to DataTable numeric data members, logical data to DataTable logical data members, and so on.

Data Quality Attributes

LookoutDirect 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, LookoutDirect creates an alarm to report the condition.

Because the alarm may only be visible on the local computer, and not on a computer accessing that data from another location, LookoutDirect places a red **X** over the affected control or expression when there is a data quality problem.

Check the Alarms panel of the process reporting the data quality problem for details on the problem. You can also use the data quality functions to monitor data quality and report problems. See the *Data Quality Functions* section of Chapter 1, *Expressions*, of the *LookoutDirect Developer's Manual*.

You can also set your computer to monitor alarms from processes running on other computers. See Chapter 9, *Alarms*, in the *LookoutDirect Developer's Manual* for information on how.

Connections

All the *LookoutDirect* objects you create either take the place of physical objects such as switches or potentiometers, or serve as your interface to some physical object connected to your computer, such as a PLC, and RTU, or another computer on the network that is connected to such objects.

You can connect all these objects in *LookoutDirect*, allowing signals to pass between them—much the same way you would wire a time delay relay to a motor starter relay, for instance. You can do this by connecting database members to each other, or by connecting database members to parameters.

In the broadest sense, one way to understand *LookoutDirect* is in terms of these connections. The following figure shows a data member to parameter connection, and a data member to data member connection.

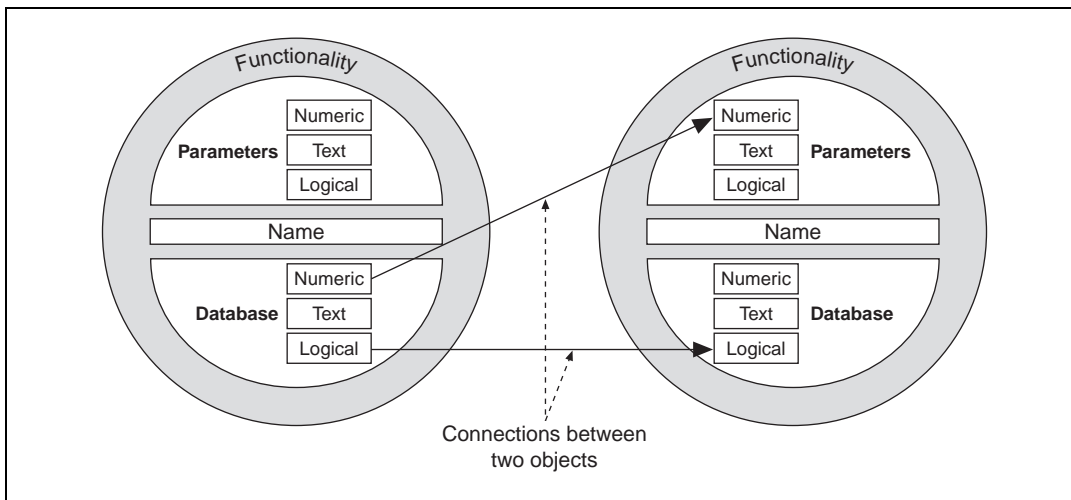


Figure 2-3. Example Connections Between Two Objects

For example, you might make the numeric data member of a Pot object the source for the **High Limit** parameter of an Alarm object. When you adjust the Pot, the Alarm **High Limit** changes.

In this way *LookoutDirect* handles 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 *LookoutDirect* database, Citadel.

Alarming, report generation, trending, data analysis, and a fast and flexible database are all built in; all you do is configure objects and data points, then create the connections, using the *LookoutDirect* dialog boxes.

LookoutDirect connections vary. Some control hardware directly by determining settings, some control or report on processes interactively, some analyze and present data. To all this capability, *LookoutDirect* adds a powerful yet simple way of making *LookoutDirect* connections across a network.

Connections and objects taken together are called a *process*. Because *LookoutDirect* runs multiple processes, and because networking has been made so simple, you can create as many or as few processes as you need, small or large, to increase the efficiency of your control systems.

Fortunately, you need not worry about creating drivers or databases or displays in *LookoutDirect*—all these things are either *LookoutDirect* objects, or contained in *LookoutDirect* objects. All you have to do is place objects where you want them, and make the necessary connections to and from them.

You do not have to worry about elaborate timing systems and polling loops, either. Because *LookoutDirect* is event driven, your connections report on and react to changes and other events as they happen, not in some arbitrary order built into your programs.

You can make the following kinds of connections in *LookoutDirect*:

- **Direct**—Made with the **Edit Connections** dialog box, these connections are fixed and work in one direction only. This sort of connection should only be made from a server process to hardware installed on the server's computer, or between objects contained within the same process.
- **URL remote**—A URL remote connection is a flexible type of fully reciprocal connection between a *LookoutDirect* control and a *LookoutDirect* object read/write data member. Changing the control changes the data member, as you would expect, but if the value of that data member changes from some other cause, the control value changes as well. This sort of connection is what you use to connect a client process to a server process, or to link two client processes through a server. (See the next section for an explanation of client and server processes.)
- **Complex**—You can make complex connections using variables and logic tests to respond dynamically to changing needs and circumstances. You can make direct complex connections, and with the *LookoutDirect* Symbolic Link object, make remote complex connections as well.

Client and Server Processes

Lookout*Direct* processes are programs you create to perform some specific function. Lookout*Direct* 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*Direct* 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*Direct* HMI.

- Computers running Lookout*Direct* servers should be properly connected to external industrial automation hardware such as FieldPoint from National Instruments. Computers running clients only should not be connected to external hardware. In other words, servers connect directly to hardware; clients connect remotely, through the server.
- Servers control and monitor; clients watch, report, and make adjustments to server settings. Servers can do all things clients do; clients act through servers.
- Client applications can move from computer to computer, and so must have no direct dependencies in order to run. In other words, nothing in a client application should refer directly to or depend on the computer running it. You should always use a remote source connection from a client control to a server rather than making a direct connection, so that the control reports settings as well as changing them.

As you might expect, you can have more than one client process attempting to alter a value in a single server process. When this happens, Lookout*Direct* accepts input as it arrives, so the first client input to arrive is executed before the next.

Supervisory Control

As you create and connect objects, you form a web, or system, containing many objects, all linked to perform a supervisory control strategy.

It is how you design your supervisory system, behind the control panel, that makes your process run. Your system routes signals from field components to bar graphs and visual indicators on control panels. It activates and deactivates alarms. You can design it to make complex decisions based on the values of field control signals and setpoints adjusted through pots and switches on control panels. You can include complex spreadsheet-style formulas as a part of your supervisory design.

Event-Driven Processing

An important concept to understand is that LookoutDirect is entirely *event-driven*, not *loop-driven*. To understand the significance of this design requires a digression, to explain how standard loop-driven programs work.

Loop-driven applications execute code sequentially from top to bottom, and loop back to the top to execute the same code over and over, as shown in Figure 2-4.

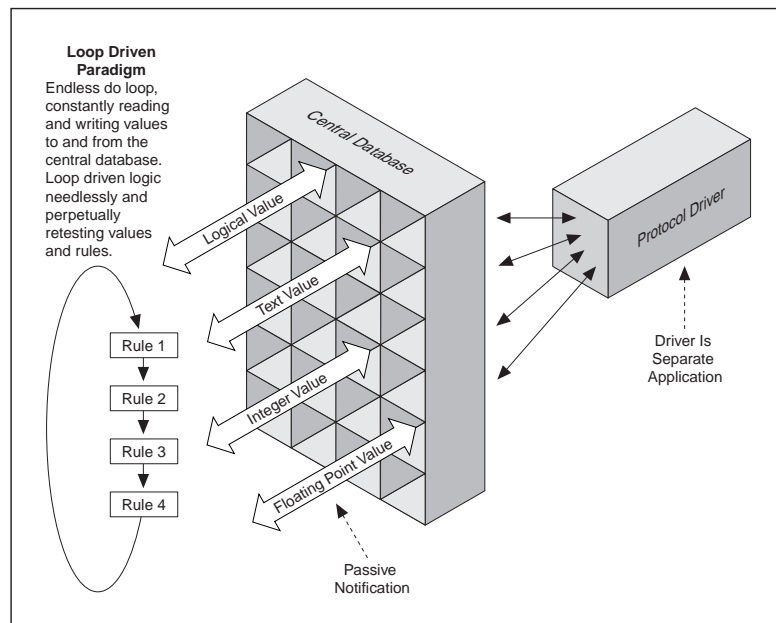


Figure 2-4. Example of Conventional, Loop-Driven Software Program

In this programming model, a given section of code or rule may execute millions of times before the result changes. This wastes computer processor time and slows down responses to frequent events.

The more rules you add to loop-based systems, the slower the response time. Also, as you add more names to the central database, speed and overall performance degrades. This is because many central databases use a *passive notification* system in which the rules of the loop-driven logic must scan an ever larger database for their appropriate values. The larger the database, the longer it takes the rule to find the data it needs to resolve its function.

In sharp contrast to this programming model, *LookoutDirect* is entirely *event-driven*. Each object remains quiescent, doing nothing until an event occurs, as shown in Figure 2-5.

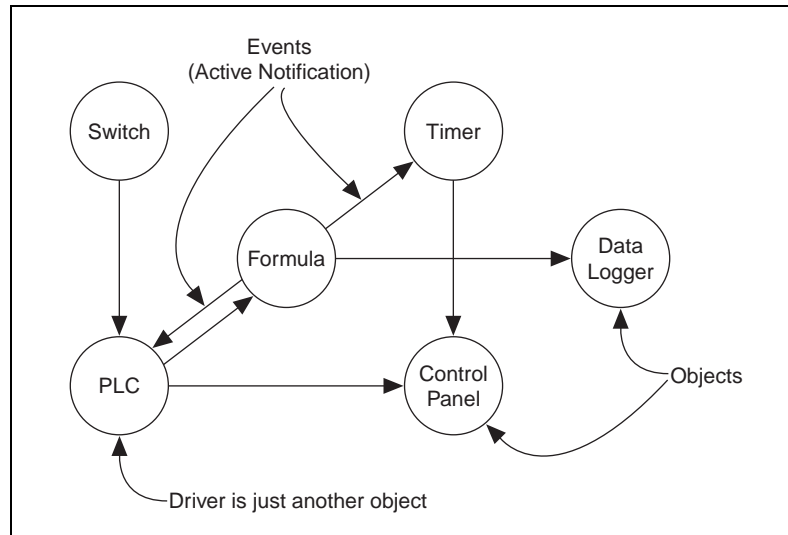


Figure 2-5. LookoutDirect Object-Oriented and Event-Driven Architecture

An *event* is a change in a data value. When an incoming signal changes, the object activates, processing the value according to its functionality. Objects only send out signals when the result of their processing changes. This is how an event propagates throughout your system, creating a chain-reaction that affects only the objects in the chain. This is called *active notification*.

Individual objects activate only when notified of an event. This event-driven paradigm closely simulates the responsiveness of physical switches, pushbuttons, and relays, and is the reason *LookoutDirect* is so fast.

Advantages of Active Notification

Consider the advantages of active notification over passive notification. Active notification is inherently event-driven while passive notification requires a constant do-loop to check for a change in a data value.

A good example would be two people trying to exchange information. One person could ask the other for information, and that person would respond. This would require one person to ask the other repeatedly if anything has changed. This is what loop-driven rules do when they constantly query the central database.

Alternatively, one person could just inform the other when something happens. This is what happens when you connect two objects in *LookoutDirect*.

Adding objects in *LookoutDirect* adds significantly less demand for processor time than adding new rules or enlarging the central database of a traditional loop-driven system.

Because *LookoutDirect* is entirely event-driven, the order in which you create the objects and connect them does not affect how your supervisory strategy works.

LookoutDirect Environment Services

While the cornerstone of object technology is the object itself, objects need an environment in which to function. Objects require the use of system resources like the serial port, hard disk, multimedia functions, and more. For example, multiple PLC objects may need to use the same communication port on your computer. In such a situation, *LookoutDirect* must provide an *environment service*—that is, a mechanism the objects can use to gain access to the communication port in an orderly and timely fashion.

An environment service, then, is a tool that *LookoutDirect* makes available to objects, or a function *LookoutDirect* performs outside of its object-oriented structure. Each environment service provides a special function. The following sections describe *LookoutDirect* environment services.

Serial Port Communication Environment Service

You can configure certain protocol object classes to represent and communicate with PLCs and RTUs through the serial ports of your computer. This environment service arbitrates serial port usage between objects representing PLCs and RTUs. For example, a single two-way radio connected to a serial port on the computer can communicate with several different brands of RTUs out in the field, each one using a different protocol. See Chapter 4, *Serial Communications*, in the *LookoutDirect Developer's Manual* for more information on configuring communications.

Database Environment Service

With the database environment service you can define or modify native data member parameters.

For example, the Modbus object class includes a native data member called 40001. You can give this native data member an alias such as PumpSpeed, and define associated unit scaling, alarming, deadband, and other parameters.

With LookoutDirect you can also directly import database information from external packages like Siemens APT. See Chapter 7, *Logging Data and Events*, and Chapter 8, *Structured Query Language*, of the *LookoutDirect Developer's Manual* for more information on database services provided by LookoutDirect.

Graphics Environment Service

LookoutDirect has an extensive library of standard graphics. These include various switches, potentiometers, pushbuttons, bar graphs, valves, tanks, pumps, and so on. You can also create your own custom graphic and add it to your LookoutDirect library. See Chapter 2, *Graphics*, of the *LookoutDirect Developer's Manual* for more information on graphics.

Alarm Environment Service

The alarm subsystem is a powerful and flexible mechanism for generating, displaying, logging, and printing alarms. This subsystem has several distinct parts including the alarm window, object parameters like **Alarm Group** and **Alarm Priority**, alarm filters, display parameters, and print settings.

LookoutDirect permanently archives alarms to disk. You can easily print this alarm history. See Chapter 9, *Alarms*, of the *LookoutDirect Developer's Manual* for additional information.

Multimedia Environment Service

LookoutDirect also provides a multimedia environment service you can use to play sound wave files. See the online help description of the Playwave object for more information on using this feature.

Security Environment Service

LookoutDirect has a highly sophisticated and comprehensive security system for both local and network security. You can configure control security, viewing security, and action verification. You can selectively determine which operators have control of what objects, which operators can view what control panels, and which objects prompt operators for verification of commands. See Chapter 6, *Security*, of the *LookoutDirect Developer's Manual* for more information on security.

Historical Logging Environment Service

With the logging environment service you can store real-time system information to disk in comma-delimited ASCII files, or in a special LookoutDirect database called Citadel.

The LookoutDirect Event Logger keeps track of who did what, and when they did it. LookoutDirect logs operator commands, from closing a process file to flipping a switch or adjusting a Pot. Along with each event, LookoutDirect 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. See Chapter 7, *Logging Data and Events*, of the *LookoutDirect Developer's Manual* for additional information on logging environment services.

ODBC Environment Service

Because of the LookoutDirect Open Database Connectivity (ODBC) environment service, you can use other applications, such as Microsoft Access, to query the LookoutDirect historical database. See Chapter 8, *Structured Query Language*, of the *LookoutDirect Developer's Manual* for additional information on ODBC environment services.

DDE Environment Service

LookoutDirect can send its live process values to other applications, and it can receive real-time values from other applications. The LookoutDirect system acts as both a DDE client and a DDE server. See Chapter 5, *Dynamic Data Exchange*, of the *LookoutDirect Developer's Manual* for further information on DDE.

Networking Environment Service

LookoutDirect provides a full client-server networking environment service through the use of TCP/IP. With this environment service, you can monitor and control your processes from multiple workstations on a network. See Chapter 4, *Networking*, of the *LookoutDirect Developer's Manual* for information on networking LookoutDirect computers.

Redundancy Environment Service

Use the LookoutDirect redundancy environment service to configure two computers for redundancy, providing automatic transfer of monitoring and control should one of the computers fail. See Chapter 10, *Redundancy*, of the *LookoutDirect Developer's Manual* for information on configuring computer redundancy.

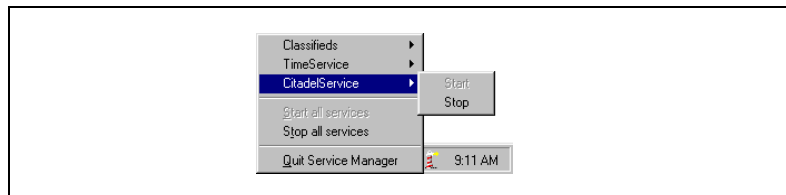
LookoutDirect Windows Services

LookoutDirect requires three background services that run in Windows outside of the LookoutDirect application itself to be running on your computer while it is running: Citadel Server, Classified Ads, and Time Synchronization. In your Windows NT task manager, these services appear as *Classifieds*, *TimeService*, and *CitadelService*. Under Windows NT, these services run automatically as NT services. If you need to interact with these services, use the NT Services utility, found in **Start»Settings»Control Panel»Services**.

In Windows 98/95, LookoutDirect installs a *services manager* during installation, denoted by a small lighthouse icon at one end of your Windows task bar, as shown in the following illustration.



When you right-click on this icon you will see the following menu.



You can start or stop any of the LookoutDirect Windows services using this tool.

Getting Started with Lookout*Direct*

This chapter contains the following three guided tours. Each tour is designed to provide you with practical hands-on exposure to Lookout*Direct*.

Basic Features Tour—Introduces the basics of the Lookout*Direct* process development cycle. You will use Lookout*Direct*'s most common features to create a process that will run locally on your PC without requiring a connection between the PC running Lookout*Direct* and your PLC.

Connected Tour — Provides an immediate demonstration of bi-directional communications between Lookout*Direct* and your PLC using both numeric and logical signals. To complete this tour, the PC on which you are running Lookout*Direct* must be properly connected to a DirectLogic controller. Refer to *Appendix B* for information on establishing a communications link.

Advanced Features Tour—Demonstrates how to create functionality within Lookout*Direct* that you can use to enhance and manage the processes that you create.

To gain full benefit from the tours, we recommend that you complete each tour in the order given. Before starting the tours, ensure that the hardware key supplied with Lookout*Direct* is installed on the parallel port of your PC. Without the hardware key, the functionality of Lookout*Direct* will be limited to one hour of use and ten input/output points. Refer to Chapter 1, [About the Hardware Key](#), for additional information on using the hardware key.

After completing the three tours, you may feel you are ready to begin creating your own process. If you would like more in-depth information on Lookout*Direct*, read Chapter 4, [LookoutDirect Basics: Windows, Tools, Files, and Path Names](#) and Chapter 5, [Using LookoutDirect](#).

Basic Features Tour

In this tour, you will create a process that contains some simple functionality associated with a water treatment plant. The completed process file created by this tour can be found in

C:\DirectSoft32\Projects\Examples\LookoutDirect\WaterWorks.l4p.

You may find it helpful to have the example process open while you complete this tour.

Starting a New Process

You will begin the process-development cycle by starting *LookoutDirect*, naming your process, and creating your first control panel.



Note The first time you start a development version of *LookoutDirect*, the Administrator user account has no password. Any time the Administrator account has no password, *LookoutDirect* opens with Administrator logged in and active, without requiring any log in. This is a convenience for you when creating your *LookoutDirect* processes, but you must be sure to assign a password to the Administrator account before allowing others who should not have Administrator privileges to use your copy of *LookoutDirect*. Refer to [Creating an Account](#) later in this section for more information.

1. Click **Start » Programs**. Point to **DirectSOFT32 » LookoutDirect Tools**, and then click **LookoutDirect**.

The *LookoutDirect* main screen appears. When you start a new process, *LookoutDirect* opens in the edit mode.

2. Select **File » New**.

The **Create Process** dialog box appears.

3. In the **Process Name** box, type `WaterWorks`. This is the name of the example process.

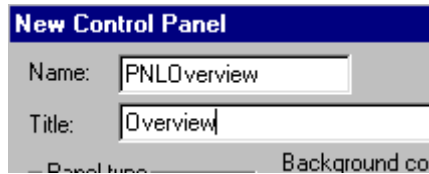
Create Process	
Process Name:	WaterWorks
State Information:	

4. Click **OK**.

The **New Control Panel** dialog appears. Notice that the alarm panel appears at the bottom of the main screen.

- In the **Name** box, type `PNLOverview`.

This is the name of the control panel object. In the **Title** box, type `Overview`. This is the title that will appear at the top of the control panel. The control panel you created serves as a pallet on which you will build and organize the process.



Leave the remaining dialog box properties as they are. You will have the opportunity to change the way the control looks later in this tour.



Tip Begin the name of each object that you create with the two or three letter abbreviation for the type of object. For example, the abbreviation *PNL* is used above to designate the *panel* object. By consistently using this object naming convention, you will be able to quickly locate objects in the process directory tree that you will use throughout the three tours.

- Click **OK**.

The new *Overview* control panel appears. Maximize the control panel. Note that the title of the control panel moves to the window title bar.

- Select **Alarms » Display Options** and set the window style to *Bottom* and the window height to 5 lines.

This establishes the location and capacity of the alarm window.



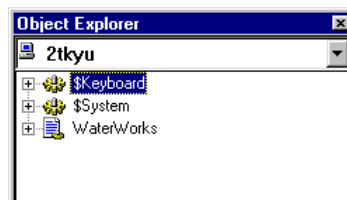
Note If the PC on which you are creating a process does not share the same monitor resolution as the PC(s) on which the process will be run, set the monitor resolution of the development PC to match the resolution of the *lowest* resolution monitor on which you expect the process to be displayed.

Adding an Object

Adding objects is the essence of building a process using LookoutDirect. In this part, you will begin by adding a potentiometer object to the new control panel. The potentiometer will be used to control the water level in a simulated tank.

1. Select **Object » Object Explorer**.

The **Object Explorer** dialog box appears. Notice that the *WaterWorks* process name appears in the tree structure. Drag the Object Explorer to the right side of the control panel to keep it out of the way of the control panel.



Note Object Explorer provides a single, convenient location from which you can access and modify the object that you add to your LookoutDirect processes. Refer to Chapter 4, *Getting Started with LookoutDirect, Object Explorer* for information on using Object Explorer.

2. Right-click on **WaterWorks**, and select **New Object**.
3. Double-click on the **Control** folder, and then navigate down the list of objects and highlight the *Pot* object.

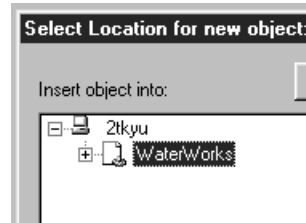
Information on any object that you highlight (before selecting), in this case the *Pot* object, appears on the right side of the dialog box.



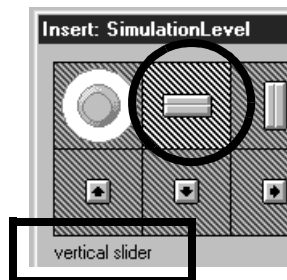
Note Deselecting the **Categorize** check box, located at the top of the *Select Object Class* dialog box, changes the object directory from a folder format to a continuous list format. When displayed in a list format, objects can be found by typing the first letter of the object's name. As you become familiar with the names of an increasing number of objects, you will find it useful to locate them in this manner.

4. Click **OK**.

The **Select Location for new object** dialog box appears. The dialog box displays the structure of your network in a directory tree format. In this example the name of your computer and the *WaterWorks* process should be visible in the directory tree.



5. Select **WaterWorks**, and then click **OK**.
The properties dialog box for the new potentiometer object appears.
6. Complete the dialog box properties.
 - **Tag:** POTSimLevel
This is the name of the new potentiometer object. Note that we began the name of the new object with the three-letter abbreviation for *Potentiometer*.
 - **Minimum** and **Maximum:** 0 and 50 respectively.
For this object, the minimum and maximum values you enter represent the incremental range of the potentiometer.
 - **Resolution:** .1
7. Leave the remaining properties of the dialog box as they are and click **OK**.
8. Select the new object from the Object Explorer tree, and then drag it onto the panel.
A dialog box appears that contains the graphic that can be used to represent the new potentiometer object.
9. Select the vertical slider, and then click **OK**.



The new potentiometer object appears on the control panel.

Try out the new potentiometer by pressing `Ctrl + Space` to toggle out of the edit mode, and then click and drag the slider up and down. Return to the edit mode when you are finished.

Creating and Working with Expressions

Because the *POTSimLevel* potentiometer object has an associated numeric range, you can visually represent that range using an expression. For this example, you will create a *graphical* expression in the form of a bar graph and a *numeric* expression in the form of a digital display.

1. Click **Insert » Expression**.

The **Insert Expression** dialog box appears. The *Insert Expression* dialog box provides a convenient method to locate objects and their data members and *Paste* them into a single completed expression.

2. Expand the network directory tree under the name of your PC until the list of objects under the **WaterWorks** process is revealed, and then select *PotSimLevel*.



Tip By making the *WaterWorks* process the root of the directory tree, you can avoid having to repeatedly expand the tree each time you want to select an object. To make the *WaterWorks* process the root of the tree, right-click *WaterWorks* and select **Make Root**.

3. Leave the remaining dialog box properties as they are and click **Paste**. *POTSimLevel* appears in the yellow expression field.

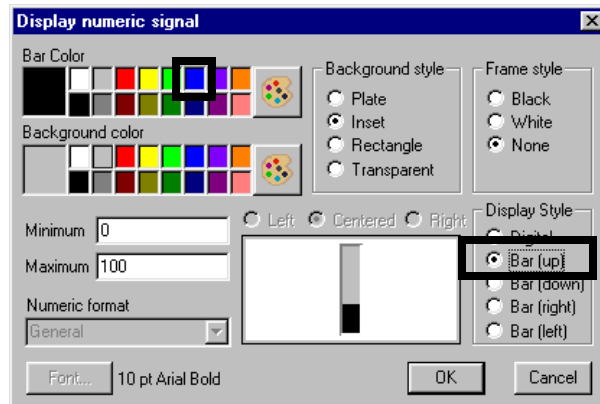
4. Click **OK**.

The **Display numeric signal** dialog box appears. This particular dialog box appears because the *Display type* property, selected by default on the **Insert Expression** dialog box, was set to *numeric*. *LookoutDirect* allows you to select the display properties of a numeric signals.

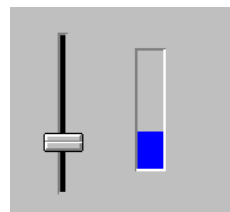
5. Complete the **Display numeric signal** dialog box.

- **Display Style:** Bar (up)
- **Bar Color:** deep blue
- **Minimum** and **Maximum:** 0 and 50 respectively.

Note that these values match the range you selected previously for the *POTSimLevel* object.

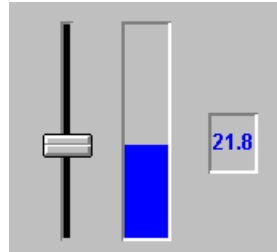


6. Leave the remaining dialog box properties as they are and click **OK**.
The bar graph appears on the control panel.



Creating the Digital Display

1. Select the bar graph, hold down the **Shift** key, and then drag the bar graph in any direction and release it.
A duplicate copy of the bar graph is created. Duplicating objects in this manner is a convenient way to create new objects.
2. Right-click on the duplicate bar graph, and then select **Display Properties**.
3. In the **Display Style** group box, click **Digital**, and then click **OK**.
The display format of the duplicate expression changes from a bar graph to a digital readout. The readout will initially display as "####". Increase the width of the readout display box, by dragging a handle, to correctly display the numeric value.
4. Move the new digital display to the right of the bar graph.



Toggle out of the edit mode, and then move the potentiometer slider up and down to see both graphical expressions function.

Saving Your Work

As with any application, it's a good idea to save your work often.

1. Select **File » Save**.

The **Select process to save** dialog appear with the *WaterWorks* process—the only one open—highlighted.

2. Click **OK**, and then **Save** to save the process under the name *WaterWorks.l4p*.

Connecting Objects

Earlier in this tour, you created the *POTSimLevel* object and graphically displayed its value at a fixed point in time using a bar graph. In this part of the tour, you will create a hypertrend object that will monitor the state of the *POTSimLevel* object and display, in real-time, its value in the form of a trace line on a simulated chart recorder.

To begin, you will create a hypertrend object, and then assign the signal from the *POTSimLevel* object to the hypertrend. To enable the hypertrend to display the activity of the *POTSimLevel* object, you will activate real-time logging of the *POTSimLevel* signal to a historical database.

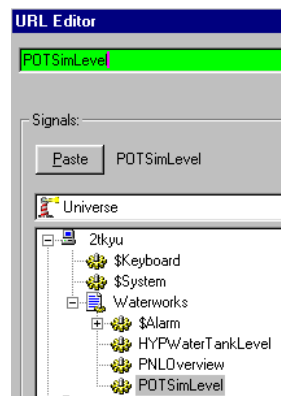
Create the Hypertrend Object

1. In the Object Explorer, right-click on **WaterWorks**, and then select **New Object**.
2. Locate and select the **HyperTrend** object from the directory tree, and then click **OK**.

3. Select the **WaterWorks** process and click **OK**.
The **Create HyperTrend** dialog box appears.
4. In the **Name** text box, type HTTanks.
5. Click **Add Group**.
The **Add Group** dialog box appears. The add group function allows you to logically organize and display multiple signals at one time. In this example however, you will only be adding one signal to the group.
6. In the **Name** text box, type WaterTankTrend, select deep blue as the **Grid Color**, and then click **OK**.

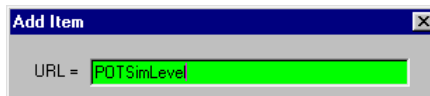
Add a Signal to the Hypertrend

1. Click **Add Item**.
The **Add Item** dialog box appears. The properties of this dialog box define the source of the signal you are adding to the *TankLevel* group.
2. Right-click in the green **URL=** field.
The **URL Editor** dialog box appears. The **URL Editor** dialog box is used to quickly locate the source of a remote signal.
3. Expand the directory tree, select the *POTSimLevel* object, and click **Paste**.
The URL for the *POTSimLevel* object is pasted into the green URL field.



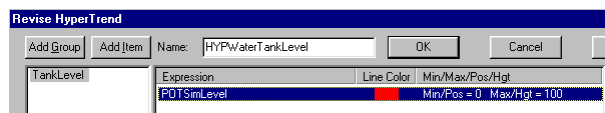
4. Click **OK**.

The source, or URL, of the *POTSimLevel* signal appears in the **URL field** of the **Add Item** dialog box.



5. Select red as the color for **Line color**, and then click **OK**.

The new item is added to the *WaterTankTrend* group in the **Create HyperTrend** dialog box.



6. Click **OK**, and then select the new object from the Object Explorer tree and drag it onto the panel.

A dialog box appears that contains the graphics that can be used to represent the new object.

7. Select the desired graphic and click **OK**.

The new virtual chart recorder appears on the control panel.

8. Drag the new recorder off to the left, and then resize it by dragging one of the corner grips.

The objects you have added to the control panel so far may seem out of proportion or poorly arranged. You will clean up the control panel later in this tour.

Enable the Historical Database

If you toggle out of the edit mode (**Ctrl + Shift**) and adjust the level of the *POTSimLevel* object, you will notice that a trace line does not appear on the hypertrend chart. In order for the trace line to appear, you must first activate real-time data logging of the *POTSimLevel* object to a historical database.

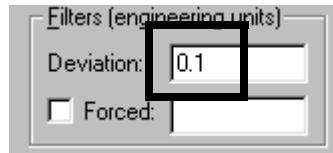
1. Toggle back to the edit mode, and then right click on the *PotSimLevel* object in Object Explorer.

The **Edit Object Database** dialog box appears.

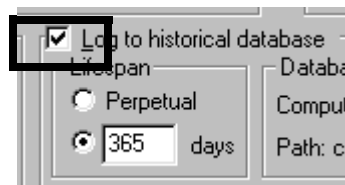
2. Double-click the *POTSimLevel* object.

The database dialog box appears. The title of the dialog box reflects the name of the object you are editing.

- In the **Filters** group box, type .1 for the deviation.



- Click **Log to historical database**.



- Click **Save**, and then **Quit**.

To test the new hypertrend object, toggle out of the edit mode and move the the potentiometer slider up and down. As you move the slider, a red trace line representing the signal from the *POTSimLevel* object appear as a trace line on the recorder.

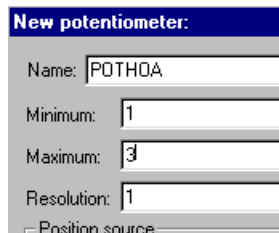
Creating Useful Interactions Between Objects

To add a degree of automation to the process, you will now create a second potentiometer object, this time in the form of a hand-off-auto (*HOA*) switch; a *neutralzone* object that will monitor a pre-determined deadband of the *POTSimLevel* object; and an logical expression that will take the form of a red or green pump graphic and which will have as its variables, data members from both the *HOA* and *neutralzone* objects. Together, these objects will create functionality that will automatically start the pump (as simulated by our logical expression) only when the *HOA* switch is in the automatic position and the *POTSimLevel* (our simulated water tank level) is between 40 and 46.

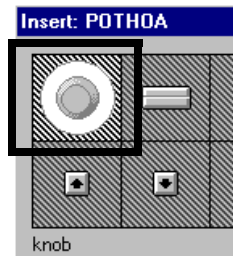
Create the Hand-Off-Auto Switch

- Use Object Explorer to add a new *Pot* object to the *WaterWorks* process.
After you select the *WaterWorks* process as the location for the new object, the **New Potentiometer** dialog box appears.
- Complete the **New Potentiometer** dialog box.
 - Name:** POTHOA

- **Minimum:** 1
This is the low end of the potentiometer's range.
- **Maximum:** 3
This is the high end of the potentiometer's range.
- **Resolution:** 1
We use one as the potentiometer's resolution since we want the potentiometer's range to be segmented into three parts: hand, off, and auto.
- Leave the remaining dialog box properties as they are.



3. Click **OK**.
4. Select the new object from the Object Explorer tree, and then drag it onto the panel.
The **Insert:** (POTHOA) dialog box appears.
5. Select the *knob* graphic, and then click **OK**.



6. Drag the knob to an open area on the control panel.

Toggle out of the edit mode and try out the new three-position switch. For now, we will leave the positions of the switch unmarked. Later in the tour we will add descriptive nameplates to aid in identifying each switch position.

Create the Neutralzone Object

1. Use Object Explorer to add a new *Neutralzone* object to the *WaterWorks* process.

After you select the *WaterWorks* process as the location for the new object, the **Create Neutralzone** dialog box appears.

2. Complete the **Create Neutralzone** dialog box.

- **Name:** NZPumpAuto

This is the name of the new object.

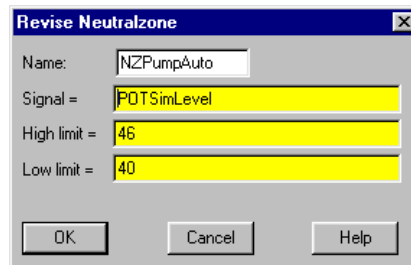
- **Signal:** POTSimLevel

This designates that it is the value of the *POTSimLevel* object which is being assigned a neutral zone (deadband).



Tip If our example process was complex, and you were unsure of the location or exact name of the *POTSimLevel* object, you could right-click in the yellow expression text box to display the *Expression Editor*. Using the *Expression Editor*, you could locate the *POTSimLevel* object (the signal) and then use the *Paste* function.

- **High limit:** 46
- **Low limit:** 40



3. Click **OK**.

Create the Logical Expression

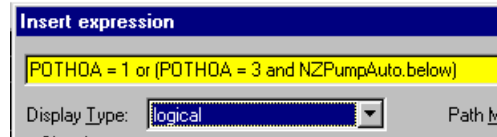
1. Select **Insert » Expression**.

The **Expression Editor** dialog box appears.

- In the yellow expression text box, type

POTHOA = 1 or (POTHOA = 3 and NZPumpAuto.below).

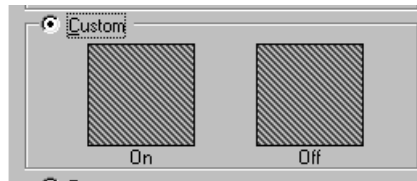
This expression sets up the condition where the pump will only run if the HOA switch is in the position 1 or if the HOA switch is in position three (Auto) and the tank level is within the deadband (the *Neutralzone*).



- Click **OK**.

The **Display logical signal** dialog appears because the default display type for an expression is a logical signal. From this dialog box you can select how you want the logical outcome of the expression to be displayed.

- Click **Custom**, and then click the **On** graphic box.



The **Select Graphic** dialog appears.

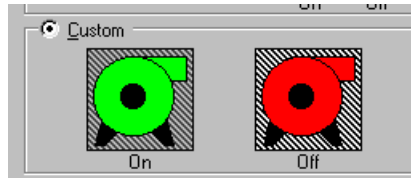
- Navigate to the **Pumps** folder, and then double-click the green **Pmp_3gn.wmf** pump graphic.



The pump graphic appears in the **Display logical signal** dialog box as the *On* graphic.

- Click on the **Off** graphic group box, and then double-click the red **Pmp_3rd.wmf** pump graphic.

Both the **On** and **Off** graphic group boxes should now be selected.



7. Click **OK**.

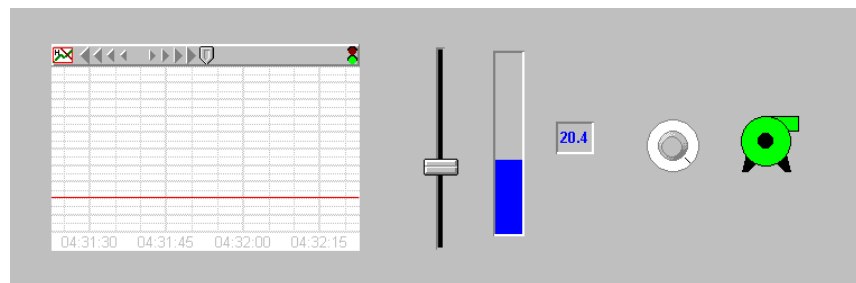
The green pump graphic appears on the control panel.

8. Drag the pump to the right side of the control panel.

To test the new functionality, toggle out of the edit mode and drag the indicator mark on the *POTHOA* switch from the left-hand position (position 1 or *Hand*) around to the twelve-o'clock position (position 2 or *Off*) to see the pump graphic change from green to red. Now drag the indicator mark around to the far right-hand position (position 3 or *Auto*), and then slide the *POTSimLevel* potentiometer up and down. The pump graphic should turn green when the *POTSimLevel* is between 40 and 46.

Dressing Up the Control Panel

Now that you have created the functionality for the *WaterWorks* process, your control panel should look similar to the following illustration.

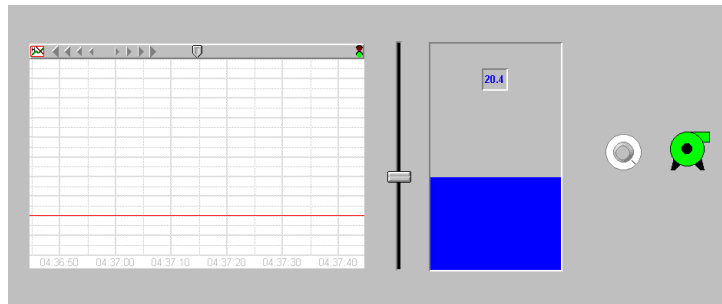


To make the control panel intuitive and easy to use, you will now resize and arrange objects and add various graphics, text name plates, and scales.

Resizing and Arranging Objects on the Control Panel

1. Ensure that you are in the edit mode, and then select the *HyperTrend* chart and resize it so that it takes up about one-half of the control panel.

2. Drag the chart to the left side of the control panel.
3. Select, resize, and arrange each of the remaining objects until your control panel looks similar to the illustration that follows.



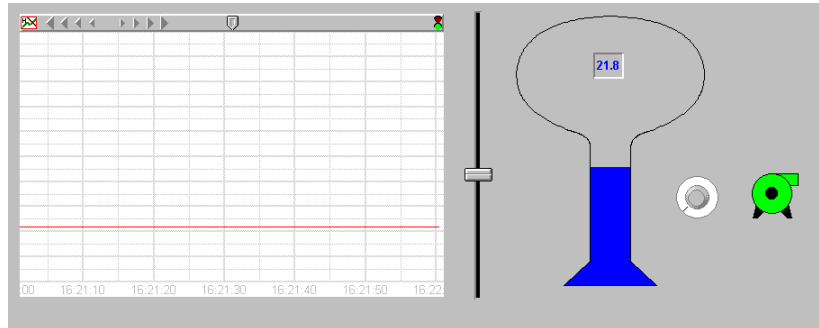
Adding Graphics

1. Select **Insert » Graphic**, open the **Tanks** folder, and double-click on the **Tank1_A.wmf** graphic.

The tank graphic appears on the control panel. The tank graphic will serve as a stencil over the bar graph giving the appearance of the water level in the tank raising and lowering.

2. Resize both the bar graph and tank until the blue portion of the bar graph fills the tank at its widest point. You may need to toggle out of the edit mode and adjust the *POTSimLevel* potentiometer to check the fit of the tank over the bar graph.
3. Move the digital display of the *POTSimLevel* to the middle of the tank.

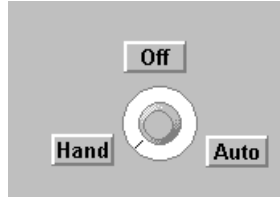
When you are finished, your control panel should look similar to the following illustration.



Adding Labels

In this procedure you will create text plates to label the three positions of the HOA switch.

1. Select **Insert » Text/Plate/Inset**.
The **Insert Text/Plate/Inset** dialog box appears. Use this dialog box to design text labels and add background panels to the control panel. Available design options include the ability to change the style of the background plate; font type, color, and size; and text justification.
2. In the **Text** box, type *Hand*, and then select black for the text color.
As you type, the text appears in the preview window in the default font (10 pt. Arial, bold).
You can experiment with other fonts, background colors, and frame styles or you can accept the default settings.
3. Click **OK**.
4. Drag the new text plate to the left side of the HOA switch.
5. Using the *Shift* + drag method, make two duplicate copies of the *Hand* text plate, and then move one of the text plates to the top of the HOA switch and the other to the right side of the HOA switch.
6. Change the text of the middle text plate to *Off* and the text of the right-hand plate to *Auto*, by right-clicking each text plate, selecting **Display Properties**, and then editing the contents of the **Text** box.

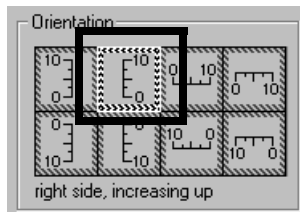


7. To make it easier to reposition the HOA switch and text plates, drag a box around all four objects, and then select **Arrange » Group**.

Adding Scales

Enhance the usability of hypertrend chart and *POTSimLevel* potentiometer object by adding scale bars.

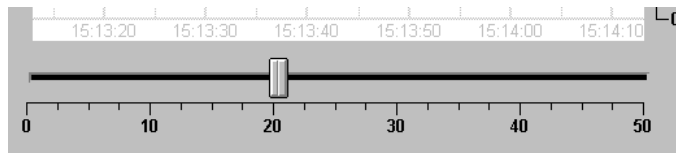
1. Select **Insert » Scale**.
The **Insert Scale** dialog box appears.
2. Complete the dialog box.
 - **Orientation** group box: *Right side, increasing up* scale style.



- **Minimum:** 0
 - **Maximum:** 50
 - **Major Unit:** 10
 - **Minor Unit:** 2.5
3. Leave the other properties as they are and click **OK**.
 4. Drag the new scale to the right side of the hypertrend chart and resize it to align with the top and bottom of the chart.

To make more room on the right side of the chart, you will now change the display properties of the *POTSimLevel* potentiometer from a vertical slider to a horizontal slider and add a scale to it.

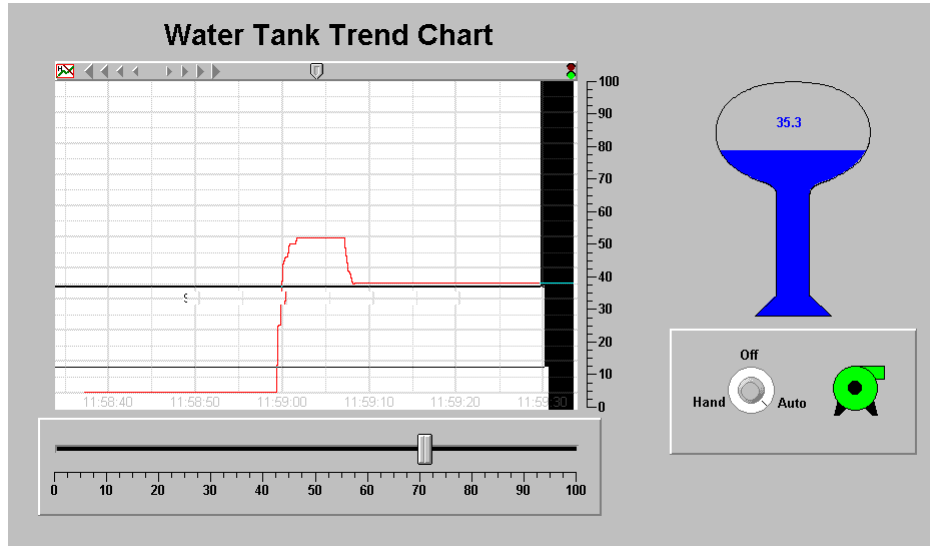
5. Right-click the *POTSimLevel* potentiometer and select **Display Properties**.
6. Select the *Horizontal slider*, and then click **OK**.
7. Move the horizontal slider to beneath the chart and resize to the width of the chart.
8. Duplicate the scale used on the right side of the chart, change the scale's display properties to a *Bottom, increasing right* scale, move it beneath the horizontal slider, and then resize the scale to fit the slider.



For practice, finish dressing up the control panel by:

- adding text plates, without any text, behind the HOA switch and horizontal slider,
- labeling the chart,
- resizing and arranging the tank above the HOA switch group,
- removing the plates from behind the HOA switch position labels,
- moving the digital display of the *POTSimLevel* inside the top of the tank graphic, and
- creating and placing a large text plate, without text, behind all of the objects on the control panel using the commands provided in the **Arrange** menu.

When finished, your control panel should look similar to the following illustration.



Adding Alarms

To complete the basic features tour, you will now add alarm functionality to the *WaterWorks* process. You will create both a simple alarm and a database generated alarm. A simple alarm is an alarm object that activates only when an alarm-specific parameter is met. A database generated alarm differ from a simple alarm in that it can use the value or condition of one or more data members of an existing object for its activation parameters.

Creating a Simple Alarm

1. Use Object Explorer to add a new *Alarm* object to the *WaterWorks* process.

The **Create Alarm** dialog box appears.

2. Complete the dialog box.

- **Name:** AlarmManMode
- **Alarm Area:** Main
- **Message:** "Pump in Manual Mode"

This is the message that will appear in the alarm panel. Note that the message text must be enclosed in quotation marks.

- **Condition:** POTHOA=1

This simple expression specifies that the alarm should activate when the *POTHOA* switch is in the hand position.

3. Leave the other properties as they are and click **Ok**.

Toggle out of the edit mode and set the *POTHOA* switch to **Hand**. The alarm you just created should activate. To silence the alarm, right-click in the alarm panel and select **Acknowledge All**. You can enter a comment for the alarm or just click **Ok**.

Creating a Database Generated Alarm

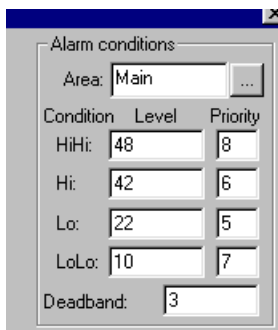
1. In Object Explorer, under *WaterWorks* process, right-click the *POTSimLevel* object, and then select **Edit Database**.

The database dialog for the *POTSimLevel* object appears.

2. Complete the properties of the **Alarm conditions** group box.

- **Area:** Main
- **HiHi:** 48 , priority 8
- **Hi:** 42 , priority 6
- **Lo:** 22 , priority 5
- **LoLo:** 10 , priority 7
- **Deadband:** 3

These properties specify that an alarm should activate when the numeric value of the *POTSimLevel* object is 48, 42, 22, or 10.



3. Click **Update**, and then **Quit**.

Toggle out of the edit mode and move the potentiometer up and down. As the numeric value of the *POTSimLevel* object changes, each alarm activates in-turn.

Connected Tour

If you have already set up your PLC and established communications between the PLC and the PC running LookoutDirect, this tour will demonstrate LookoutDirect's ability to read and write numeric and logical data to and from your PLC. If you have not already setup your PLC or established communications between the PLC and the PC that is running LookoutDirect, refer to *Appendix B*.

The examples in this tour demonstrate the following types of connectivity between LookoutDirect and your PLC.

- using a virtual switch to toggle a discrete PLC output,
- writing a numeric value to a PLC register, and then reading the value back and displaying it in the form of a virtual trend line,
- reading a discrete signal back from the PLC and use a graphic expression to display its status in the form of a light, and
- Using a digital counter to display the number of scans since the last power-up or program-to-run transition.

The example process file used for this tour can be found in *C:\DirectSoft32\Projects\Examples\LookoutDirect\ConnectedTour.l4p*.

Refer to the *Basic Features Tour* for information on how to create and manage objects using LookoutDirect.

Toggleing a Discrete PLC Output

In this example, you will create a driver object, and then link the object to a discrete output on your PLC using a new or an existing connection. To test the connection between the driver object and your PLC, you will create a switch object to toggle the discrete output. To indicate the state of the output on the control panel, you will create a logical expression in the form of an indicator light.

Creating the Driver Object

1. Create a new process. Use *ConnectedTour* as the tag name and *PNLConnectedTour* as the title of the control panel.
2. Select **Object » Object Explorer**.
Move Object Explorer to the right side of the display.
3. Use Object Explorer to add a new *DirectLogic* driver object to the *ConnectedTour* process.

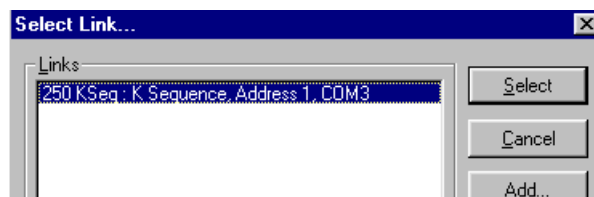
The **Create DirectLogic** dialog appears.

4. Rename the driver object to *DRConnectedTour*, and then click the ellipses button to the right of the **Comm Link** text box.



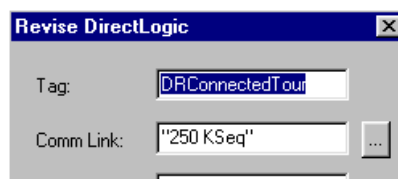
Tip When you create your own driver objects, use the *DR* prefix to identify the object as a driver and the name of your PLC's CPU as the tag's suffix.

The **Select Link** dialog box appears.



5. Do *one* of the following.
 - If the **Links** list box contains active communications links found by the links wizard during the installation process, highlight the link you want to use.
 - If no active link is available, or, if you do not want to use one of the active links, click **Add**, and then follow the directions provided in the **Links Wizard**. Click **Finish** to close the wizard.
6. On the **Select Links** dialog box, click **Select**.

The name of the new link appears in the **Comm Link** text box.



7. Click **OK**, and then go to [Creating the Switch Object](#).

Creating the Switch Object

1. Use Object Explorer to add a new *Switch* object to the *ConnectedTour* process.

The **New Switch** dialog box appears.

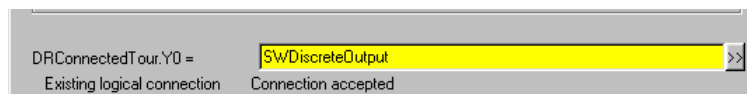
2. Rename the switch *SWDiscreteOutput*, and then click **OK**.
The **Display Switch** dialog box appears.
3. Select one of the standard switch options, and then click **OK**.
The switch appears on the *ConnectedTour* control panel.
4. Go to [Linking the Switch Object to a PLC Output](#)

Linking the Switch Object to a PLC Output

1. In Object Explorer, right-click on the *DRConnectedTour* object, and then select **Edit Connection**.
The connections dialog box for the driver object appears.
2. In the **Writable members** scroll list, double-click the *Y0* member. If the *Y0* member is in use, select any other available and writable data member.



3. In the **Signals** group box, navigate through the directory tree to the *ConnectedTour* process, and then double-click *SWDiscreteOutput*.
Look in the middle of the connections dialog box. Notice that the connection between the driver object and the switch is defined as `DRConnectedTour.Y0 = SWDiscreteOutput`.



4. Click **Accept**, and then **Quit**.

Creating the Indicator Light

1. Select **Insert » Expression**, select *SWDiscreteOutput* from the directory tree, double-click *value* in the **Contents** pane, and then click **OK**.
The logical signal display dialog box appears.
2. Click **Custom**, and then click in the **On** group box.
3. Open the **Indicators** folder, and then double-click on the green light named *LightOG.wmf*.
4. Click in the **Off** group box, and then double-click on the red light named *LightOR.wmf*.
5. Click **OK**.

The light representing the logical expression appears.

Toggle out of the edit mode and test the connection between the *LookoutDirect* switch object and the PLC. When the switch is turned on, both the output LED on the PLC and virtual indicator on the control panel should light. If the connection did not work and an alarm error occurred, check the PC-to-PLC connection. If the connection did not work and *no* alarm error occurred, there is a problem with the connection setup. Review this procedure and confirm that the connection was set-up correctly.

Writing and Reading a Numeric Value

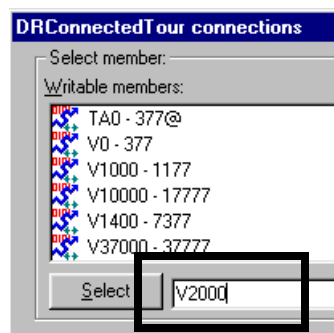
In this example, you will use a potentiometer object, in the form of a digital input, to write a numeric value to the PLC. To confirm that data is being written to the PLC, you will create a hypertrend object to read back and display the numeric values sent to the PLC.

Creating the Potentiometer Object

1. Create a new *digital* potentiometer object. Use the following values to complete the **New Potentiometer** dialog box.
 - **Name:** PotNumRWTest
 - **Min:** 0
 - **Max:** 9999
 - **Resolution:** 1
2. Click **OK**.

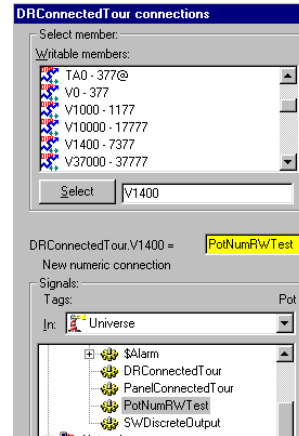
Connecting the Potentiometer Object to the PLC

1. In Object Explorer, right-click on the *DRConnectedTour* object, and then select **Edit Connection**.
2. In the **Writable Members** scroll list, double-click *V1400-7377*.
V1400 appears in the selection text box.
3. Replace the *V1400* selection with *V2000*.



Note The *V2000* register is used since it is common to all DirectLogic PLCs.

4. In the **Signals** group box, double-click the *PotNumRWTest* object.



5. Click **Accept**, and then **Quit**.
The new digital potentiometer appears on the control panel.

Creating the Hypertrend Object

1. Create a new hypertrend object named *HyperRWTest*.
2. Add a group to the hypertrend. Use the following values to complete the **Add Group** dialog box.
 - **Name:** RWTest
 - **Major increments:** 10
 - **Minor increments:** 1
3. Add an item to the *RWTest* group. Use the following values to complete the **Add Item** dialog box.
 - **Numeric Minimum:** 0
 - **Numeric Maximum:** 9999
4. Right-click in the **URL=** field.
5. In the **URL Editor** dialog box, highlight *DRConnectedTour*, and then double-click *V1400-7377* in the **Contents** pane.
6. In the **URL** text box, replace *V1400* with *V2000*, and then click **OK**.
7. Click **OK** in both the **Add Item** and **Create HyperTrend** dialog boxes.
The new hypertrend object appears on the control panel.

8. Enable data logging for the new hypertrend object. Select **Object » Edit Database** and select the *DRConnectedTour* object.
9. In the **Native members** scroll list, double-click *VI400-737*, replace *VI400* with *V2000*, and then update the database dialog box.
 - **Deviation:** 0 . 1
 - **Log to historical database:** selected
10. Click **Update**, and then **Quit**.

Test the connection between the digital potentiometer and PLC by toggling out of the edit mode, clicking on the potentiometer object, and entering a new value. The hypertrend object displays the change to the value entered.

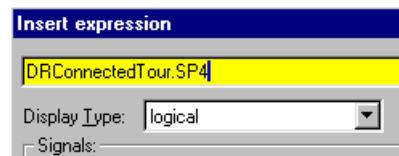
Reading a Discrete Signal

In the previous example, you were able to toggle a discrete PLC output using a switch object. In this example, you will read a discrete signal from the PLC and display its status using an indicator object.

1. Select **Insert » Expression**.
2. In the **Insert Expression** dialog box, double-click the *DRConnectedTour* object.
3. Edit the yellow expression field so that the expression reads: *DRConnectedTour.SP4*, and then click **OK**.



Note The *.SP4* refers to a special relay feature in the DirectLogic controller that provides a one second pulse signal.



4. In the **Standard** group box, select any indicator, and then click **OK**.
The logical expression, in the form of the indicator you selected, appears on the control panel and begins to flash at a one second interval.

To confirm that the expression is displaying the signal from the *SP4* relay, toggle out of the edit mode, switch off the PLC, and observe that the indicator stops flashing.

Displaying the Number of Scans

In this connected tour example, you will create a numeric expression that will actively display the instantaneous total for the number of scans performed by your DirectLogic controller.

1. Select **Insert » Expression**.
2. In the **Insert Expression** dialog box, double-click the *DRConnectedTour* object.
3. Edit the yellow expression field so that the expression reads:
DRConnectedTour.V7765:B, where ":B" is the data modifier that specifies conversion of the data to BCD (16 bit) format. Refer to Appendix B, *Data Modifiers*, for information on using data modifiers.
4. In the **Display Type** drop-down list, select **Numeric**, and then click **OK**.
5. In the **Display numeric signal** dialog box, accept the default settings and click **OK**.

The numeric readout appears on the control panel and immediately begins displaying the total number of scans.

Advanced Features Tour

Much of LookoutDirect's functionality—control panels, alarm functions, security services, etc.—are themselves part of an object class and can, therefore, be customized and to create useful process management functionality. This tour will introduce you to some of LookoutDirect's advanced features that you can use to enhance and manage a process.

In this tour you will:

- create buttons that will allow you to quickly navigate between control panels,
- import a custom graphic into a process control panel,
- create a shortcut push-button to acknowledge and silence alarms
- establish security permissions to limit access to all or part of your process, and
- create a data log to record process activities to a spreadsheet file

This tour assumes you are understand the process development concepts introduced in [Basic Features Tour](#).

Creating Panel Navigation Buttons

In situations where LookoutDirect is displayed on a touch-panel display, where no PC mouse is available, it may be necessary to provide a means of navigating between process control panels. In this example you will create a set of simple push-button that will allow you to navigate between the connected tour control panel (*PNLConnectedTour*) and a new panel you will create in this example. The second portion of this example explains how to create a “Home panel” for your process.

The functionality created in this example can be found in the *ConnectedTour.14p* process file in the examples folder.

1. Create a new panel object named *PNLNavTest* in the *ConnectedTour* process. Give the panel the title *Navigation Test*.
2. Select the *Connected Tour* control panel.
3. Create a new push-button object named *PBNavTest*. In the **Button Text** box, type *Navigation Test*.
4. In Object Explorer, right-click on the *PNLNavTest* object, and then select **Edit Connection**.

The edit connection dialog box appears.

5. In the **Writable members** scroll list, double-click *activate*, and then double-click *PBNavTest* in the **Signals** group directory tree.

The logical connection you just created between the *Navigation Test* panel and the *Navigation Test* push-button appears in the center of the dialog box.



```
PanelNavTest.activate = PBNavTest
```



Note Take a moment to review the **Writable member** scroll list to learn about other actions you can generate when editing a connection.

6. Click **Accept**, and then **Quit**.

Test the new inter-control panel push-button by toggling out of the edit mode and clicking the new button.

Continue by creating a second push-button to return to the *Connected Tour* panel.

7. With the *Navigation Test* panel still selected, create a new push-button object named *PBNavTestReturn*. Type `Return` for the button's text.
8. In Object Explorer, right-click on the *PNLConnectedTour* object, and then select **Edit Connection**
9. In the **Writable members** scroll list, double-click *activate*, and then double-click *PBNavTestReturn* in the **Signals** group directory tree.

The logical connection you just created between the *Navigation Test* control panel and the new *Return* push-button appears in the center of the dialog box.



```
PanelConnectedTour.activate = PBNavTestReturn
```

Toggle out of the edit mode and test the new *Return* push-button.

Creating a Home Panel

To ensure users do not get lost when switching between panels, you might define one panel as your master control panel, or home panel or computer main menu. You could connect the activate data member of your home panel to `$Keyboard.Shift.F1`, or perhaps to a pushbutton object. If connected to the

function key, any time the user presses <SHIFT-F1> (no matter what panel he or she is looking at), the home panel is called, returning the operator to a familiar control panel.

You might also want the home panel to maximize upon startup. If you have already created a pushbutton to call the home panel, you can connect it to the maximize data member.

The exclamation point (!) instructs LookoutDirect to use the opposite of the pushbutton value. At startup, the pushbutton is not depressed so its value is FALSE. But because you are using the opposite of the pushbutton value, Panel1.maximize is TRUE at startup. Any time a user depresses CallHomePb after this connection is made, nothing happens until the pushbutton is released—at which time the panel is called.

Importing Custom Graphics

While LookoutDirect's graphics library is quite extensive, you may occasionally want to customize a process control panel using your own graphics. You can import graphics saved in either the windows metafile (.wmf) or bitmap (.bmp) file format. To insert your own graphic, first save the graphics in *C:\DirectSOFT32\Bin\Graphics*, and then insert it using the **Insert » Graphic** command.

Creating Alarm Management Buttons

To more efficiently acknowledge process alarms, you can create push-button objects that can acknowledge or silence an alarm with a single mouse click. Normally, acknowledging and silencing alarms requires a multi-step procedure that must be executed from the **Alarms** menu.

The functionality created in this example can be found in the *ConnectedTour.14p* process file in the examples folder.

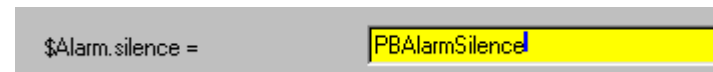
1. Create two new push-button objects, one named *PBAlarmAck* with *Alarm Ack* as its button text and the other named *PBAlarmSilence* with *Silence* as its button text.
2. In Object Explorer, right-click on the *\$Alarm* object, and then select **Edit Connection**.
\$Alarm Connections dialog box appears.
3. In the **Writable Members** list box, double-click *Ack*, and then, in the **Signals** directory tree, double-click *PBAlarmAck*.

The logical connection that provides alarm auto-acknowledgement functionality appears in the center of the dialog box.



4. Click **Accept**.
5. In the **Writable Members** list box, double-click *Silence*, and then, in the **Signals** directory tree, double-click *PBAlarmSilence*.

The logical connection that provides the alarm silencing functionality appears in the center of the dialog box.



6. Click **Quit**.

Establishing Object Security Permissions

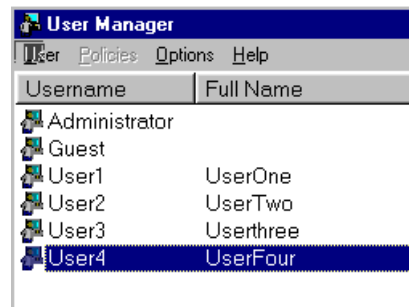
To prevent unauthorized or accidental changes to your process, you can restrict access to specific process-level objects using security permissions. Typically, security permissions are assigned to control-type objects such as pots, switches, etc., but they can also be assigned to the process as a whole or to a control panel within the process. When a user, who is logged into the process under a valid account containing their security level, attempts access an object with a security permission, the user's security level is compared to that of the object's, and then access to the object is either granted or denied.

Creating an Account

Complete the following procedure to create accounts for four fictitious users.

1. Select **Options » User Manager**.
The **User Manager** dialog box appears.
2. Select **User » New User**.
The **New User** dialog box appears.
3. Create the first of the four users by completing the **New User** dialog box.
 - **Username:** User1

- **Full Name:** UserOne
 - **Password:** 1111
 - **Confirm Password:** 1111
 - **Security Level =** 1
4. Click **OK**.
User1 appears on the **User Manager** window.
 5. Repeat step 2 through 4 to create accounts for users named *User2*, *User3*, and *User4*. Use 2222 as *User2*'s password and assign a security level of 2. Continue this sequence for the other three users.

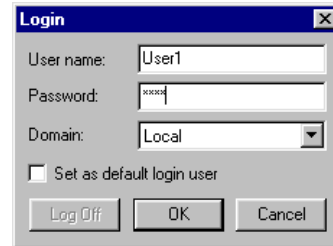


Setting an Object's Security Level

1. Open the *BasicSecurity.L4p* process file located in the examples folder.
This process contains a control panel with four simple switch objects.
2. Right-click switch #1 and select **Object Properties**.
3. In the **Control security level** dialog box, type 1.
4. Edit the object properties for each of the remaining three switches, setting their security level to 2, 3, and 4 respectively.

To test the security levels you established for the four switches, you will now log into *LookoutDirect* under each of the user accounts you created.

5. Select **File » Log On**.
The **Login** dialog appears.
6. Log in as *User1* (password=1111), and then click **OK**.



7. Toggle out of the edit mode and activate switch #1. Now attempt to activate any of the other switches.

When you point at switch #2, 3, or 4, notice that the cursor changes to a prohibition symbol. The prohibition symbol indicates that the current account does not have permission to use these controls.

8. Log in as *User2* and then *User3* and finally *User4*, each time you log in as a new user, attempt to activate the remaining switches to see which you have access to.

Process Data Logging

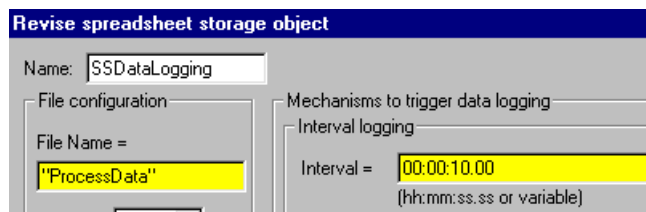
An extremely valuable feature of *LookoutDirect* is its ability to log process events to file. Using the *Spreadsheet* logging object you can dynamically save the state or value of any data member to a comma separated value spreadsheet file.

In this example, you will create a logging spreadsheet object to record, at 10 second intervals, the value of two objects that you created during the connected tour. To automate the data logging process, you will create a push-button and an indicator object to start the logging process.

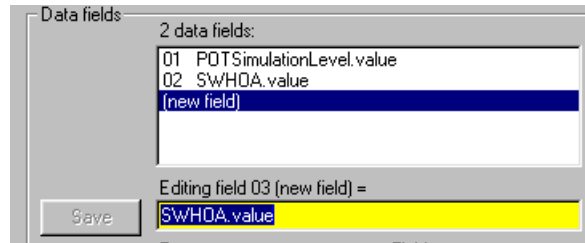
The functionality created in this example can be found in the *WaterWorks.l4p* process file in the examples folder.

Creating the Spreadsheet Object

1. Open the *WaterWorks* process file in the examples folder, and then maximize the *Overview* control panel.
2. Add a new *Spreadsheet* object to the *WaterWorks* process.
The **Create spreadsheet storage object** dialog appears.
3. Complete the dialog box properties.
 - **Name:** *SSDataLogging*
 - **File Configuration / File Name:** "ProcessData"
The complete file name will appear in windows as *ProcessData.csv*.
 - **Interval Logging / Interval:** 00:00:10.00
This specifies that data will be written to the spreadsheet file every 10 seconds.



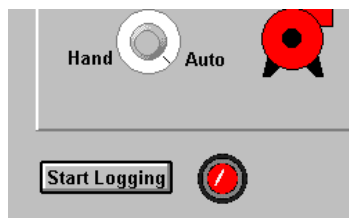
4. In the **Data fields** group, select (**new field**), and then right-click in the yellow expression text box.
The expression editor appears.
5. In the **Signals** group directory tree, select the *POTSimLevel* object, double-click the **value** data member in the **Contents** list box, and then click **OK**.
6. Click **Save**.
The value of the simulation level potentiometer is added to the list of data fields that will be included on the *ProcessData* spreadsheet.
7. Repeat step 4 through 6, except this time, add the *value* data member of the *POTHOA* object to the **Data fields** list box.



8. Click **OK**.

Creating the Push-button to Start the Data Logging

1. Create a new push-button object named *PBStartLogging* in the *WaterWorks* process. Use *Start Logging* as the button text.
2. Create a new *Flipflop* control object named *FFStartLogging* in the *WaterWorks* process. When the **Create Flipflop** dialog appears, right-click in the **Input=** expression text.
The expression editor appears.
3. Double-click the *PBStartLogging* object, and then click **OK**.
4. Click **OK** to close the **Create Flipflop** dialog box.
The expression editor appears again.
5. Click **OK**.
6. Select a green (On) and red (Off) custom indicator light, and then click **OK**.
7. Group the *PBStartLogging* push-button and flipflop indicator light in the lower right corner of the control panel.



8. Select **Object » Object Explorer**, right-click on the *SSDataLogging* object, and select **Properties**.

The **Revise spreadsheet storage object** dialog appears.

9. Right-click in the **Logging** expression field, double-click *FFStartLogging*, and then click **OK**.

Testing the Data Logging Functionality

1. Toggle out of the edit mode, and then click **Start Logging**.
2. Move the HOA switch to **Auto** (or **Hand** if it's already in **Auto**), and then move the simulation level slider back and forth across its full range of motion.
3. Repeat step 2 approximately every 10 seconds, for one minute.
4. Click **Start Logging** again to stop logging.
5. Use Microsoft *Excel* or another spreadsheet program to open the *ProcessData.csv* file located in:
C:\DirectSOFT32\Projects\[Year]\[Month]. Notice that the file contains a time column plus the columns for the two data members you selected when you created the *SSDataLogging* object.

	A	B	C
1	Time	POTSimulationLevel.value	SWHOA.value
2	#####	50	1
3	#####	0	3
4	#####	0	3
5	#####	50	1
6	#####	0	3
7	#####	50	1
8	#####	32.8	1
9			



Note The Excel spreadsheet file must be closed before logging is started or the data cannot be written to it.

Lookout*Direct* Basics: Windows, Tools, Files, and Path Names

This chapter explains how to start and get around within Lookout*Direct*. It describes the Lookout*Direct* screen and introduces some important mouse and keyboard shortcuts.

Starting Lookout*Direct*

Logging on to Lookout*Direct*



Note If you are using Lookout*Direct* outside of the United States, you may be required to use a hardware key. Be sure to plug the key into the parallel port on your computer before activating Lookout*Direct*. If you do not, the program will not run.

Launch Lookout*Direct* by selecting **Start»Programs»National Instruments Lookout*Direct*»Lookout*Direct***.

When you first install Lookout*Direct*, the built-in Administrator account has no password. When the Administrator account has no password, Lookout*Direct* opens without requiring any log-in. The Administrator is logged in automatically.



Note Server and Client run-time versions of Lookout*Direct* open with the (nobody) user account logged in, no matter what the password setting for the Administrator account.

Once you provide an Administrator password, Lookout*Direct* requests a log-in before opening with the following dialog box.



Enter the appropriate password in the **Password** field and click on **OK**. LookoutDirect is not case sensitive in this instance.



Note You set passwords with the LookoutDirect User Manager. As long as the administrator password is empty (that is, if you do not insert one of your own), LookoutDirect will always log on with the administrator as the user, and will not require anyone opening LookoutDirect to log on. This can be a great convenience to you as a developer of LookoutDirect processes, but be sure to set and administrator password before allowing others access to your development copy. See Chapter 6, *Security*, of the *LookoutDirect Developer's Manual* for more information about the LookoutDirect User Manger, passwords, and LookoutDirect security in general.

The **Idle time** field determines how long a period of inactivity LookoutDirect will wait before logging off the current user. When set to 0, LookoutDirect leaves the current user logged in until that user logs off, a new user logs on, or LookoutDirect is shut down.

You can alter passwords and create or edit user accounts and groups with the user manager, accessed by selecting **Options»User Manager**. See Chapter 6, *Security*, in the *LookoutDirect Developer's Manual* for more detailed information on the user manager and other security considerations.

Opening a Process File

1. If you have a LookoutDirect process file available, select the **File»Open** menu item from the LookoutDirect menu bar. You can look in the `Examples` folder for sample processes to start with.
2. In the **File name** data field, enter the name of a LookoutDirect process file (they have a `.14p` file extension), or choose a process file from the list and select **OK**.

If you select a valid process file, LookoutDirect opens the file and immediately begins executing the process.

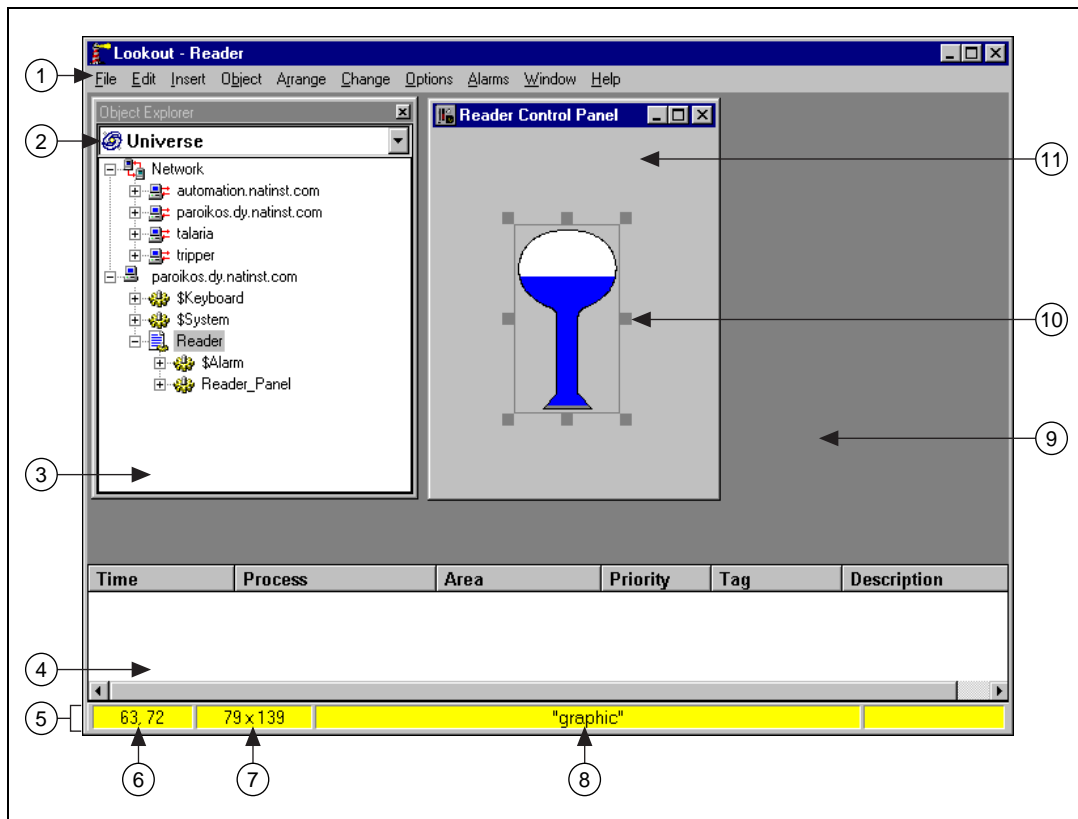
When a process file opens, LookoutDirect makes additional menu selections available and displays control panels and the alarm window.

You can open and run as many process files at one time as you want in LookoutDirect, and close them individually or all together. While there is no theoretical upper limit to how many process files you can run on one computer, in practical terms you may begin to see degraded performance with a very large number of processes, depending on your computer's hardware resources and other variables. Running multiple instances of LookoutDirect on one computer, or distributing LookoutDirect processes on networked computers can increase performance.

The LookoutDirect Screen

LookoutDirect first appears on your screen maximized, taking up the entire screen.

LookoutDirect 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. The following illustration shows a LookoutDirect screen in edit mode.



1	Menu Bar	4	Alarm Window (appearance depends on Alarms»Display Options setting)	5	Status Bar	9	LookoutDirect Workspace
2	Root Selection Box			6	Object Location	10	Selected Display Element
3	LookoutDirect Object Explorer			7	Object Size	11	Process Control Panel
				8	Object Name		

Figure 4-1. The LookoutDirect Screen

Title Bar

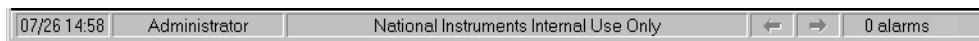
The title bar at the top of the *LookoutDirect* window displays the program name and the name of the currently active process. If a control panel is maximized, the control panel name appears in the title bar.

Menu Bar

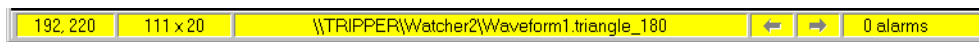
The menu bar displays the currently available menu commands, which change depending on whether *LookoutDirect* is in run mode, edit mode, or is open without any processes running. These commands may or may not be available to the operator, depending on his or her security level.

Status Bar

The status bar is at the bottom of the *LookoutDirect* window, as shown in Figure 4-1. It changes when toggled into and out of edit mode. When not in edit mode, the status bar is gray and the time and date are displayed on the left end of the bar. The account name of the currently logged on operator comes next. The company name as entered during registration appears in the middle, and the alarm status is on the right end of the status bar. The control panel navigation arrows may or may not be visible, depending on your system options settings.



When in edit mode the status bar turns 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, filename, or expression of the selected item appears in the middle, and the alarm status appears on the right end of the status bar.



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

LookoutDirect Workspace

The LookoutDirect workspace is the area between the menu bar and the status bar. The workspace is the area in which you view and operate control panels. The alarm window also appears within the workspace. You organize and arrange control panels in this workspace area.

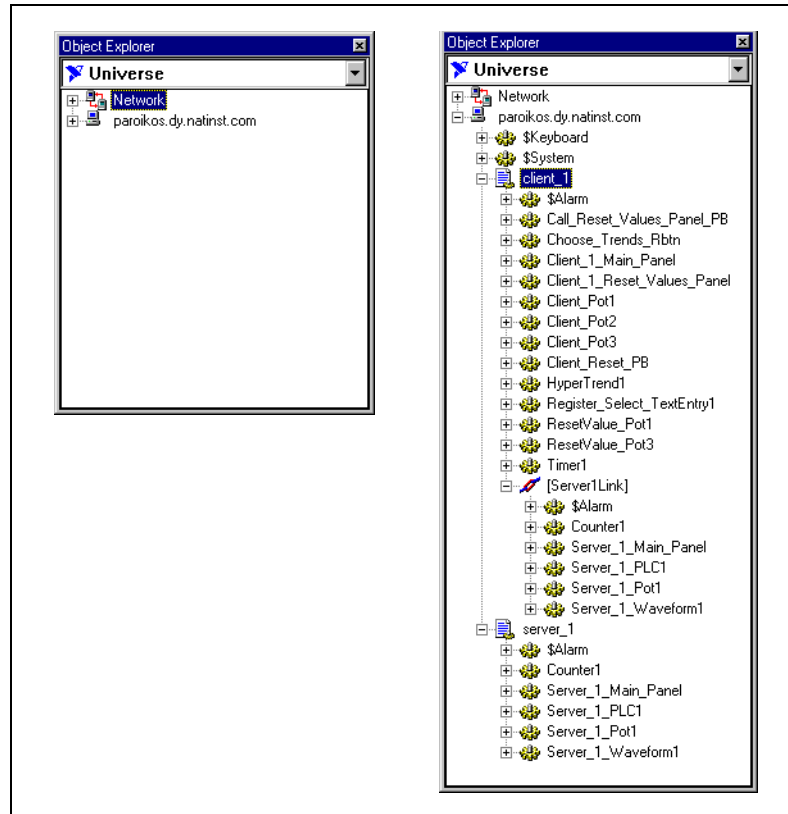
In Figure 4-1 the LookoutDirect workspace contains the LookoutDirect Object Explorer (visible only when you are in edit mode) and the Reader process control panel.

The visible workspace on your screen is only a window into the LookoutDirect virtual workspace. If control panels or their associated icons are partially or completely outside the visible workspace, LookoutDirect automatically displays horizontal and vertical scroll bars along the right side and bottom of the visible workspace. If scroll bars are visible, you can scroll around in the virtual workspace to see all of your control panels.

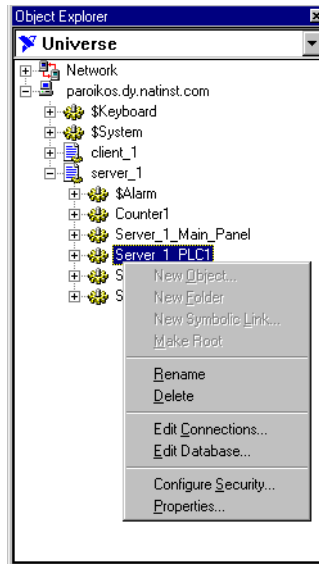
Object Explorer

The LookoutDirect Object Explorer is a useful tool for creating and editing your LookoutDirect processes. You can access the LookoutDirect editing functions from this window by right-clicking on objects displayed there (options change depending on what item you click on). You can also create processes, objects, folders within processes, and then organize objects by moving them from one location to another within a process, create objects, drag displayable objects and display expressions to different panels, and more.

To use the LookoutDirect object browser, make sure LookoutDirect has a process running and is in edit mode, then select **Object»Object Explorer**. The initial window along with a somewhat expanded Object Explorer are shown in the following illustration.



Right-clicking inside the explorer displays some variation of the following menu.



As you can see, depending on what you selected in the explorer before right-clicking, you can:

- create an object
- create a folder
- create a symbolic link
- change the root computer or process.
- modify an object or process by selecting **Properties**
- rename an object or process by selecting **Properties**
- delete an object or a folder
- edit object connections or an object database
- configure security permissions for a computer, process, object or collection of objects

When you create a displayable object in the Object Explorer, it appears in the explorer window but not on a control panel. To place the displayable part of an object on a control panel, you can drag and drop it. If there is no displayable component to the object, LookoutDirect creates an expression (if possible).

If you drag and drop an object or data member from one process to a control panel in another process, LookoutDirect inserts an expression to display the value represented. You cannot place the displayable part of an object on a control panel in a process other than the one in which the object was created.

When you leave edit mode, the LookoutDirect Object Explorer window closes. Switching into edit mode restores the explorer window in the same location and at the same size it was when you left edit mode.

You can rename folders and relocate objects with the LookoutDirect Object Explorer as well.

LookoutDirect also has a complimentary tool called the Connection Browser, not shown above, that you can use to trace the connections you make between objects. See the [Connection Browser](#) section later in this chapter for more information on the Connection Browser.

Control Panels

Control panels provide the display area for any collection of switches, knobs, bar graphs, digital displays, trend graphs, and other components that you want to use to visually monitor and control your operations. Panels can be full-screen, minimized, or any size in between. 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. Control panels can also “pop up” when an event occurs such as when a pushbutton is pressed or when an alarm is activated. 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 some of the LookoutDirect editing functions by right-clicking on 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 LookoutDirect workspace. A pop-up control panel is either a pop-up state or minimized. When a pop-up control panel is displayed, it remains on top of all other panels until you minimize it.

Control panels do not have a standard appearance. You can customize each control panel for your particular control strategy with switches, potentiometers, and other graphical objects. Some control panels may only display information, while others combine control and display information. The information displayed always represents the most current values available to LookoutDirect through its communications with your I/O devices.

With LookoutDirect you have considerable latitude in how you make control panels look and operate. For example, you can draw your own switches and substitute them in place of the standard switches. You can easily make a pushbutton or switch work backwards from the way one might ordinarily expect. You might insert time delays and conditions behind the panel that may not be obvious just from viewing the panel.

Control panels are windows into your process you use to control equipment by flipping switches, pressing buttons and turning knobs. Unlike real switches and knobs, you can assign security levels to individual controls, as well as entire control panels within LookoutDirect. You can use this feature to lock out operators that do not have high enough security levels for specific devices. See Chapter 6, *Security*, of the *LookoutDirect Developer's Manual* for more information on security.

Unlike physical switches and knobs, you can display the same control object multiple times in a given process by using multiple displays, both on the same control panel and on different control panels. For example, when you turn a knob in one location, all copies of that knob turn at the same time, in each location of that control. The same control object may appear differently in each location. You might display a potentiometer as a horizontal slide on one panel, a pair of increment/decrement buttons on another panel, and a knob on yet another panel.

You can have the same sort of synchronous operation between controls in different processes running on your computer, or between controls running in processes on different computers in your network. LookoutDirect networking makes this possible, using remote position sources and objects such as the Symbolic Link.

Alarm Window

Below the LookoutDirect Object Explorer and the Reader Control Panel in Figure 4-1 is the alarm window. You can choose how the alarm window is displayed by selecting **Alarms»Display Options**. In Figure 4-1 the alarm window is set to display at the bottom of the workspace.

Operator Input and Navigation

There are numerous methods for plant operators to make setpoint adjustments or switch from one control panel to another. These include mouse, trackball, touchscreen, and keyboard activated commands.

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 on 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.

Virtual Keypad

When you are in operating mode, you can click on a digital Pot control and bring up a virtual numeric keypad to enter numeric values, either with a mouse or a touch-sensitive screen.

Virtual Keyboard

LookoutDirect also has a virtual keyboard you can use with a touch-sensitive screen 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** section of the dialog box.

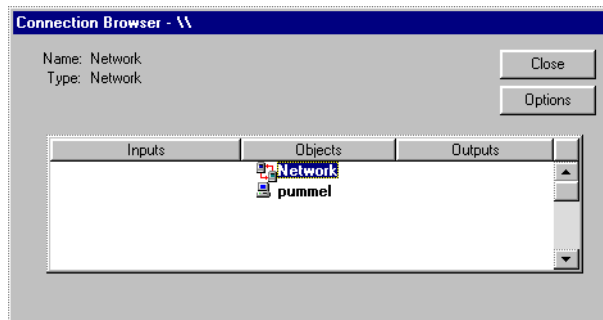
When this feature is enabled, clicking in a data entry field or touching the field on a touch-sensitive screen displays the virtual keyboard, as shown in the following illustration.



Connection Browser

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

To access the Connection Browser, select **Object»Connection Browser**. The following dialog box appears.



See the *Registering Computers* section in Chapter 4, *Networking*, in the *LookoutDirect Developer's Manual* for information on using the Connection Browser to register networked computers in LookoutDirect.

To create and modify objects as well as edit connections and the object database in the Connection Browser, right-click on the object you want to modify.

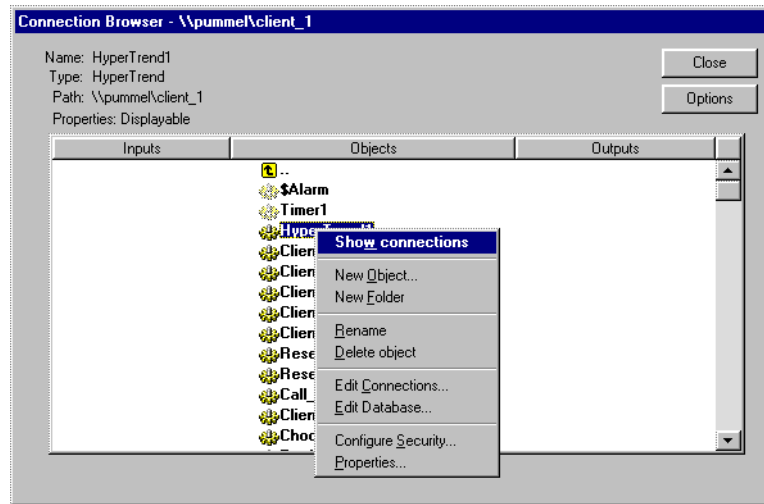
You can also create folders and move objects into and out of folders.

Some planning on how you want to arrange the objects in each process, combined with an awareness of how path relativity in LookoutDirect works, can protect you from most inconveniences in this respect. See Chapter 5, *Using LookoutDirect*, for more information on how a change in location can affect object connections.

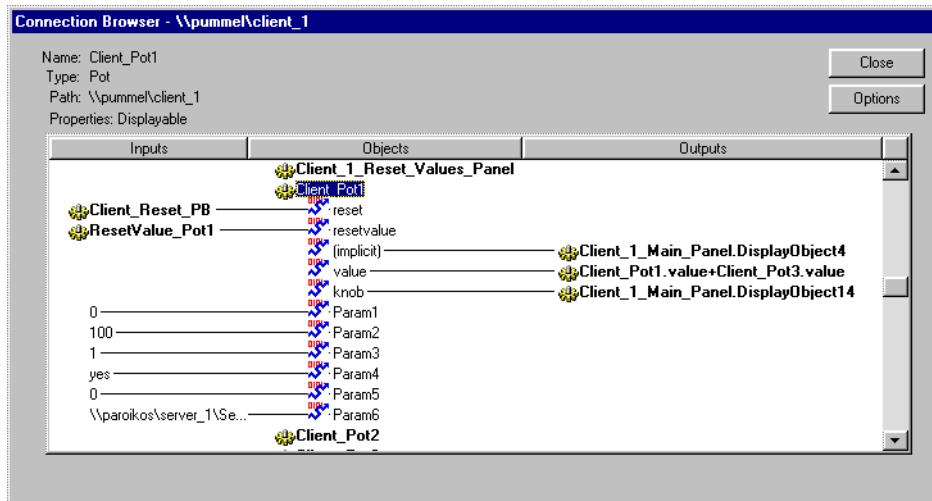
To browse the connections in your LookoutDirect processes, LookoutDirect must be in edit mode. After opening the browser, click on your local computer name, and select the process you want to browse. You will then be presented with a list of objects in that process.

You can use the Connection Browser to create or rename folders inside your process, and you can 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 edit existing objects, connections, or the database through the Connection Browser. Right click in the Connection Browser to get the menu to choose one of these operations.



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



In this example, the Pot object named `Client_Pot1` has been selected. All the various display sites and connections are shown, including the way this Pot is remote connected to a data member in another process.

The `$Alarm` and `Timer1` object icons are faded in appearance. This indicates that this object is an orphan, meaning that its output is not being used by any other object.

By clicking on input or output objects you can trace chains of connections in your processes. By right clicking on an object or parameter, you can edit the object or parameter from the Connection Browser.

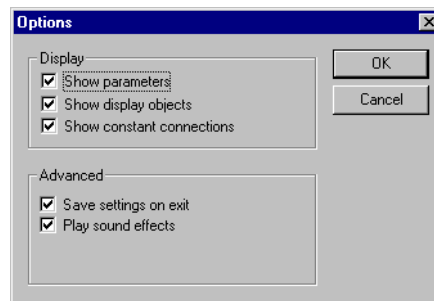
While you can browse from one process to another when both processes are open on one computer, you cannot browse across the network to a process running on another computer. The Connection Browser will show a network object on the screen, but cannot browse that object.

LookoutDirect also has a complimentary tool called the Object Explorer that you can use to trace the connections you make between objects. See the [Object Explorer](#) section earlier in this chapter for more information on the Object Explorer.

Connection Browser Options

You can simplify the Connection Browser view by selecting what elements of an object are displayed. The LookoutDirect default is for all settings to be enabled.

Click on the **Options** button to activate the Connection Browser **Options** dialog box, shown in the following illustration.



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

Disabling the **Show display objects** removes all display components from the Connection Browser view of a control panel.

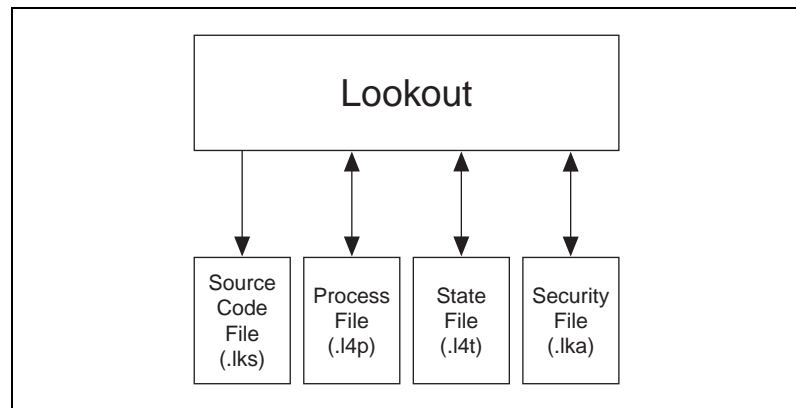
Disabling the **Show constant connections** removes all static values connected to an object parameter or data member. Disabling this option can help you focus on variables and connections to changing values originating in other objects.

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

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

LookoutDirect Application Files

Using LookoutDirect you can quickly develop a complete process file. All development is interactive. You do not have to program or compile. Just create objects and connect them as needed. The development cycle creates four unique files for every application: a process file, a source code file, a state file, and a security file.



If you develop a LookoutDirect process on one computer and want to run it on another computer, you must copy the process (.l4p) and security (.lka) files to the new computer for your process to run properly.

You can also copy the source and state files, if you want, but LookoutDirect can recreate these files in the new location if necessary.

Process File

A *process file* is a compiled file that contains the LookoutDirect process you want to run. It is updated every time you select the **File»Save** command. Process files are binary files with an .l4p (LookoutDirect Process) file name extension. You do not directly edit or modify process files with a text editor. Rather, LookoutDirect compiles the .l4p file on an object-by-object basis as you create each object. With this approach you can stay online while creating, updating, or editing your application. There is no need to shut down your process. LookoutDirect does not cease operation while you add or delete controllers, I/O, graphics, or modify your logic. It is recommended that you save your process often while editing, so that you do not lose changes in the event of a power failure.

Source Code File

LookoutDirect also automatically updates a corresponding *source code file* when you invoke the **File»Save** command, LookoutDirect can compile this file to create an `.l4p` file, so it includes object definitions, names, I/O configuration, communications, control logic, control panel layout and other object parameters.

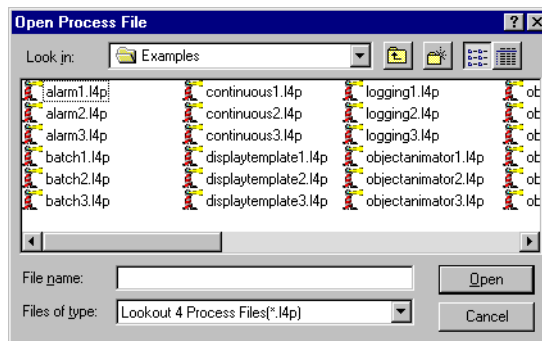
Source code files have an `.lks` (LookoutDirect Source) file name extension. These are standard ASCII text files that you can print or view with any word processor or text editor. You can use this information for debugging and documentation purposes.



Note Because the binary format of LookoutDirect process files both past and future is subject to change for efficiency reasons, you should always keep your `.lks` source files backed up. This is the file you will recompile to open a process created in an older version of LookoutDirect with any new version of LookoutDirect released in the future.

You can recompile LookoutDirect source files through the Open command, or manually, using a DOS window.

To open and compile a source file inside LookoutDirect, select **File»Open**. The following dialog box opens.



Set the **Files of type** to LookoutDirect Source Files (`*.lks`) and select the source file you want to compile.

To compile a LookoutDirect source file manually, consult the instructions in Appendix B, *The CBL Compiler*, in the *LookoutDirect Developer's Manual*.

State File

The *state file* contains the actual values of object data members. These values include setpoints and other important data held within and used by objects. You might think of the state file as permanent memory for LookoutDirect setpoints and real-time trends. LookoutDirect uses the state file to store the position of switches, potentiometers, and trend lines. When LookoutDirect first loads an application, it reads the appropriate state file to determine what state the Pots, switches, trend lines, and so on should be in upon startup.

The state file updates any time you save, close or exit the LookoutDirect application file. It can also update on a periodic basis as defined in the process properties dialog box or the Loader object. You invoke this dialog box by selecting the **File»Modify Process** menu command. State files have an `.14t` (LookoutDirect State) file name extension.

Security File

Every LookoutDirect process has an attached security file, identified by the `.1ka` extension. All the security information for a LookoutDirect process is kept in the `.1ka` file for that process. You must keep the `.1ka` file in the same directory as the `.14p` file for your security settings to work. If you misplace the `.1ka` file, all users will have complete access to all parts of the process. To reconstruct the file, you would have to reset all your security permissions.

See Chapter 6, *Security*, of the *LookoutDirect Developer's Manual* for more detailed information on LookoutDirect security.

Configuration Shortcuts

Mouse Shortcuts

This manual references a number of mouse-implemented shortcuts. Becoming familiar with mouse commands is easy and pays significant dividends during application development.

Function	Mouse Action
select object display, graphic, text, expression, or any item on a display panel	Click: Select the item by pointing the cursor at the item and clicking the left mouse button. (<i>See Note.</i>)
create a new object from an existing object	CTRL-drag: Select the item(s) you want more of. Hold the CTRL key down and drag the selected item(s). This makes a completely new instance of the control: <CTRL>-dragging Pot1 will produce a new object named Pot2.
copy object display, graphic, text, expression, or any item on a display panel	Shift-drag: Select the item(s) to be copied. Hold the <Shift> key down and click the left mouse button while dragging the item(s). This makes a duplicate of the selected object that is linked to the original. Both the original and the duplicate have the same name.
modify display or object parameters of an object, graphic, text, expression, or any item on a display panel	Right-click: Select the item(s) to modify. Position the cursor over the item(s) and click the right mouse button.



Note You can select multiple items on a display panel by clicking in a panel and dragging the box outline around the objects you want to work with. Subsequent commands affect the entire group at once or toggle from one item to the next, prompting you for new instructions. You can stop this process at any time by holding the <Shift> key down and selecting either the **OK** or **Cancel** buttons in the current dialog box.

Remembering Object Names

Many dialog boxes contain *expression fields*. Expression fields are yellow to indicate that you can get help identifying or remembering an object name and associated data members by pressing the right mouse button (right-clicking on the selected expression field).

Assume, for example, that you want to average some value. You start to create an expression for this value, but you cannot remember the name of the object or data member you want to have an average value for. Right-click on the expression field (the field in which you normally type the a data member you want to connect or display).

When you right-click any expression field, *LookoutDirect* presents the **Revise expression** dialog box, as shown in the following diagram.

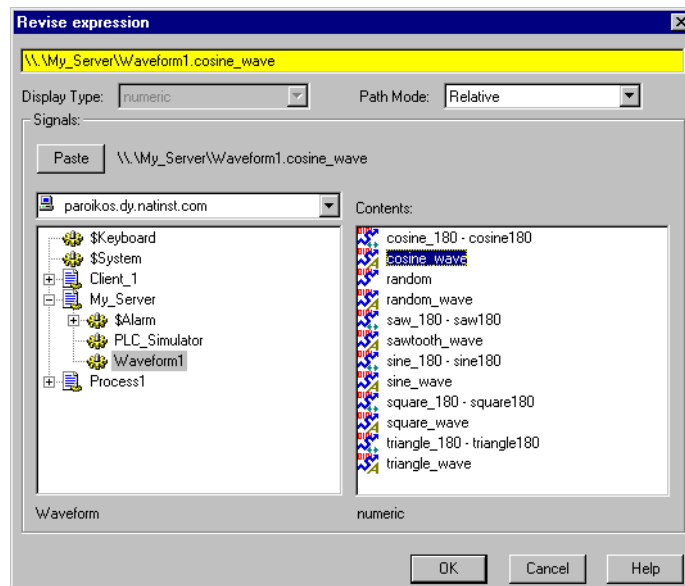
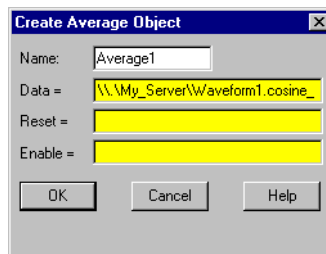


Figure 4-2. Expression Editor Activated by Right-Clicking on a Yellow Data Field

Using the expression editor, you can easily paste object names and their data members directly into the expression field. Navigate through processes and objects until you have selected the object and data member you want. Paste them into the expression editor data field, either by clicking on the **Paste** button or double-clicking on the data member. Click on **OK**, and LookoutDirect writes your expression into the expression data field of the object, such as the **Data** field in the **Create Average Object** dialog box shown in the following illustration.



Path Names in LookoutDirect

In versions of LookoutDirect prior to LookoutDirect 4.0, you could only have one process running in any instance of LookoutDirect, and there were no folders in a process to organize objects. Networking was done through DDE, which used specific paths.

In LookoutDirect 4 and greater, the relationship between objects running in different processes on different computers is far more flexible and potentially complicated. When you insert an expression on a LookoutDirect panel or make a connection to or between data members, you might be displaying a value that comes from the process containing that panel. You might also need to display a value that comes from another process running on the same computer or from a process running on some other computer in your network.

A path can be *absolute*, starting with a computer's fully qualified network name and leading through nested directories and subdirectories to a single object; or *relative*, instructing the computer to search for an object in some directory defined not from the computer down, but relative to the currently active folder.

In order to provide maximum programming flexibility, you can use a number of different levels of relativity, or *path relativity modes*, in setting the path to the data when you create an expression. These modes operate very much like

other relative paths used in DOS operations, spreadsheet cells, and Web page addressing.

You can set a path for each individual object or connection, using a different level of relativity. These path relativity modes include:

- Relative (the LookoutDirect default)
- Process Relative
- Computer Relative
- Absolute

The level of path relativity you choose makes a difference in how your process operates when copied or moved to another computer. For instance, suppose you have a client process running on computer Alfred that refers to objects in a server process also running on computer Alfred. If you run that client process on computer Bert, will it refer to objects on computer Alfred or computer Bert?

Setting the level of path relativity is how you can control which objects your processes refer to. The key point to remember about path relativity modes in LookoutDirect is that the modes are distinguished by the path prefix.

In *Relative* mode, the form of the path is:

object

or

folder\object

without prefix.

Relative mode is the default mode in LookoutDirect 4. All paths are relative to the folder or process that contains the expression you are creating or the object you are connecting to. Use Relative mode when connecting objects that should be grouped together and that should be copied or moved as a group.

Connections between objects in a folder should use Relative mode so that they can be copied and moved elsewhere while maintaining the same relationship with each other.

Process Relative mode is indicated by a single prefixed backslash (\) followed by a folder or object name, as in:

\folder\...folder\object

or

\object

Use Process Relative mode when you want to make a connection between two objects in different folders in the same process.

Computer Relative mode is indicated by a prefix consisting of two backslashes, a period, and a backslash (`\\. \`) followed by a process name, as in

```
\\. \process\folder\...\folder\object
```

Use Computer Relative mode when you want to reference other processes running on the same computer.

For instance, if you had a process called `Station_Control` that called a number of other processes by name on computer Alfred, you could use that same `Station_Control` process on computer Bert, to refer to the identically named processes running on computer Bert.

Absolute mode is indicated by two backslashes (`\\`) followed by a complete network path, as in:

```
\\computer.place.com\process\folder\...\folder\object
```

Absolute mode is, in effect, a URL. Use Absolute mode when you want to refer to a particular process on a particular computer. Any references to a PLC, for instance, should be in Absolute mode so as to always refer to the computer physically connected to that PLC—no matter where the process making the reference is running.



Note Though Relative mode is the *LookoutDirect* default, when you use an object outside the immediate location of your expression, the path becomes more specific. The addition of two periods (`..`) at the beginning of a path, for instance, can be used to specify the parent of the first folder listed.

The reason for manually changing a path mode to a level beyond that strictly necessary under your current circumstances is to ensure that your process will still work properly if you relocate it, completely or partially.

Using Lookout*Direct*

Overview of the Process Development Cycle

The first step in developing a process file is creating a process file. After the file is created, control panels are added. Control panels are windows you use to place other objects, such as switches, Pots, and trends to be displayed. You can make them look like physical control panels, complete with switches, push buttons, bezels, insets, lamps, gauges, and so on. Your imagination is the only limit to how the control panels look and function.

After you create at least one control panel, you can then create and display any number of other objects. Remember that objects can be displayed on a single control panel or on multiple control panels. For example, you can insert the same switch on several panels. If you flip the switch on one panel it immediately flips on all the other panels.

The first objects you might want to create could be those that represent your Plus and Ruts. These type of object classes often use your computer communication ports, so you may have to configure your ports for radio, dial-up modem, or hard-wired connection, as appropriate. See Chapter 3, *Serial Communications*, in the *LookoutDirect Developer's Manual* for information on configuring communications.

When you create an object that represents a PLC, RTU, or other I/O device, its associated functionality and database are part of the object. The functionality built into this type of object class includes a protocol driver, enabling the object to talk with the physical device. The native (default) database includes all registers, bits, I/O signals, parameters and other values that the physical device can transmit to or receive from *LookoutDirect*.

At this point, you may want to add data members to the native databases for your objects. Such new data members, called aliases, can include descriptive names, signal scaling parameters, alarming parameters, and so on. You can create more than one alias for a given native data member, using different scaling or alarm parameters for each.

As you create objects, you can connect them to other objects. The type of objects you create (such as Pot, Switch, Madcaps, Trend, and so on) and the

manner in which you connect them determine how your system interacts with your process.

Many object classes you use take advantage of LookoutDirect services. For example, you can assign a security level to a Pot object, and the Alarm object class uses the Alarm processing subsystem. As you create objects that take advantage of these services, you should configure the services to custom fit your application requirements.



Tip You can save a process file with any name you choose. Your process file name does not have to be identical to your process name. You can copy (or Save As) LookoutDirect files to retitile them and run the process just as you would run the original files. You cannot, however, run two processes with the same process name in a single instance of LookoutDirect. If you have a basic process that you need to make several variations on, you can rename the process in each file by right-clicking on the process name in the LookoutDirect Object Explorer and selecting **Rename**.

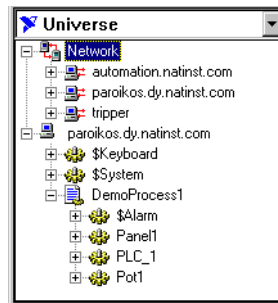
Building Client and Server Processes

As explained in the *Client and Server Processes* section of Chapter 2, *How LookoutDirect Works*, LookoutDirect server processes are run on computers with physical connections to your hardware. LookoutDirect clients run on computers that can communicate with the computers running LookoutDirect servers.

You build these clients and servers by choosing objects and making connections.

LookoutDirect Navigation

Many LookoutDirect dialog boxes that you use to create an object, display an expression, make a connection, and so on contain some variation of the following dialog box. This dialog box is used to locate any object in any LookoutDirect process running on your network.



Each computer registered as running LookoutDirect appears in this dialog box. Clicking on the computer to open the full display reveals the processes currently running on that computer. Clicking on a particular process reveals all the objects in that process that you can access.

The pull-down combo box at the top of such displays indicates the root location. To display all the computers registered as running LookoutDirect as well as displaying your own computer as local, you set **Universe** as your root. You can set your local computer, the network of registered LookoutDirect computers, any specific computer in the network, or any process as the root by right-clicking on that node and selecting **Make Root**.



Note LookoutDirect cannot edit processes over the network, so what you can do with computers and processes running under the Network node is limited. To edit a process, you must work from your computer's local node (or a process running on it).

You can distinguish between LookoutDirect's local and network representation of your computer in the root selection window by looking at the computer icon. The network representation of your computer name has red arrows representing the network I/O connection, as shown on the right in the following illustration. The local representation, on the left, has no I/O arrows.



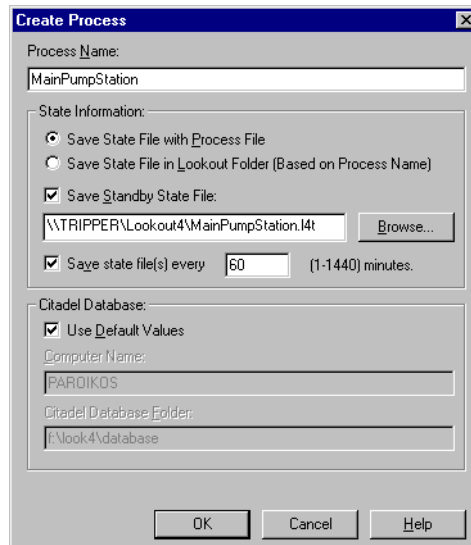
See Chapter 4, *Networking*, in the *LookoutDirect Developer's Manual* for more information on registering computers and navigating through LookoutDirect processes on your network.

Creating A LookoutDirect Process

The following explains the basic procedure for creating a new process file.

1. Select **File » New**.

The **Create Process** dialog box appears.



2. Enter a LookoutDirect process name in the **Process Name** field. This name must follow the same conventions as a LookoutDirect object name. See the *Object Names* section for detailed information on LookoutDirect naming conventions.
3. Make selections in the **State Information** group. Each control is explained below.



Note If you are going to have a backup computer in your network that will come online and run this process in the event that your primary computer crashes, you should include a location on that computer as one place to save the process state file. See Chapter 10, *Redundancy*, of the *LookoutDirect Developer's Manual* for more information about setting up backup computers and processes.

- Select **Save State File with Process File** to save the state file in the location where the process file was opened. This is the default behavior.
 - Select **Save State File in LookoutDirect Folder** to save the state file in the LookoutDirect folder of the copy of LookoutDirect you are currently running. The state file name will be the same as the process name. This is useful if multiple computers are sharing a process file. In this case, each computer maintains its own state file locally.
 - Select the **Save Standby State File** check box to save one or more extra copies of the state file in a location of your choosing. Enter a complete path, including state file name, to each location you want to save a state file. If you are saving the state file to more than one backup or alternative location, separate the paths with the vertical bar (|) symbol.
 - To set the frequency that LookoutDirect saves the state file, check the **Save state file(s) every** check box and fill a value for the number of minutes you want to pass between each save. Remember that saving files uses system resources, so if you have a number of processes, each saving one or more state files fairly often, you may experience some performance problems.
4. Make selection in the **Citadel Database** group. Each control is explained below.
- If you check the **Use default values** check box, LookoutDirect uses the default location set in the **System Options** dialog box of any instance of LookoutDirect running the process.
 - If you enter a computer name and a path on that computer to a specific folder, LookoutDirect logs data to that location on that computer, no matter what computer is running the process.
 - To designate a specific computer and path for your process to log data to, enter the fully qualified network name for the target computer in the **Citadel database computername** field, and the complete path to the target database directory in the **Citadel database folder** field.



Note **State Information** and **Citadel Database** settings you make when creating a process override any settings you may have made in the **System Options** dialog box.

Creating Objects

Choosing Objects

How do you decide what objects to use and what connections to make?

Some decisions are easy—you will certainly use driver objects for the different PLCs, RTUs and other devices you need to monitor and control. Other decisions are driven by what you want to do.

To solve problems with *LookoutDirect*, ask yourself which object does what you need done.

LookoutDirect has many object classes with obvious uses, such as push buttons, switches, and trend displays. Other *LookoutDirect* object classes may not be as immediately obvious as to how they might be used. To familiarize yourself with *LookoutDirect* object classes, you can browse through the online help *LookoutDirect Object Reference* topic, or the PDF *LookoutDirect Object Reference Manual* that was installed along with *LookoutDirect*.

The **Select Object Class** dialog box that appears when you create a new object has short descriptions of each object class. Browsing through these descriptions is another good way to acquaint yourself with *LookoutDirect* functionality. You can find a list of these descriptions in Appendix A, [LookoutDirect Object Descriptions](#).

After you become familiar with the *LookoutDirect* object classes, you have a better idea of which object to create—or which object classes to investigate—to solve the problem you are facing at the moment.

Create an Object

Complete the following steps to create a *LookoutDirect* object.

1. Open or create a new process if one is not already open in *LookoutDirect*. Make sure you are in edit mode. (Select **Edit»Edit Mode** or press <Ctrl-Shift> if necessary.)
2. There are two ways to create new objects in *LookoutDirect*:
 - Select **Object»Object Explorer** from the menu to activate the *LookoutDirect* Object Explorer. Right-click on the process you want to create an object in and select **New Object**. For this example, select the **Pot** class of objects, found in the **Control** category.

- Select the **Object»Create** command from the LookoutDirect menu bar. For this example, select the **Pot** class of objects, found in the **Control** category.
3. The **Select object class** dialog box appears, as shown in the following illustration.

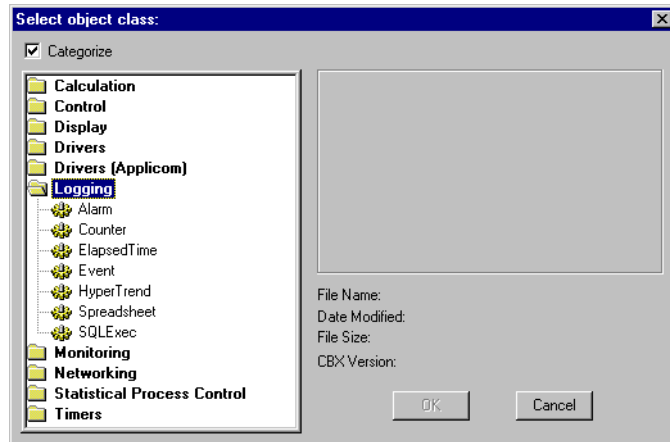


Figure 5-1. Select Object Class Dialog Box

The first time you create a LookoutDirect object, the **Select object class** dialog box appears with the **Categorize** option checked. Some object classes are contained in more than one category, depending on their versatility.

If a category is open, you can jump to the object class you want by type in the first few letters. To have access to all object classes with this technique, disable the **Categorize** option by clicking the **Categorize** check box.

When you select an object class, a dialog box you use to define the parameters for a specific object appears, as shown in the following example for creating a Pot object.

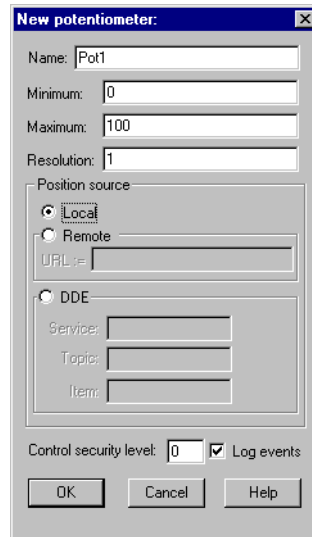


Figure 5-2. Object Definition Dialog Box

4. Assign a unique name to the object. Valid names are described in the next section, *Object Names*.
5. Define the object parameters. Each object class has unique parameters, described in the LookoutDirect help file or the *LookoutDirect Object Reference Manual*.

Ordinary parameters that can only be set in the object definition dialog box are indicated by white fields.

Some parameters, however, are *expressions*, denoted by a yellow field. Expressions let you set a parameter value programmatically by connecting the parameter to a data member of another object. You can also manipulate data using the expression functions, which are roughly the equivalent of spreadsheet formulas. See the *Connecting Objects* section of this chapter for a basic explanation of using expressions, and Chapter 2, *Expressions*, of the *LookoutDirect Developer's Manual* for detailed information on expressions and expression functions. The tutorial exercise in Chapter 3, *Getting Started with LookoutDirect*, also demonstrates using expressions.

6. Leave **Position source** set to **Local**.

The **Position source** determines what value your control takes when your process first opens, and also affects the way the control operates.

Selecting **Local** configures your control to take its value from the state file when the process opens. The value of the control will not change unless you adjust it manually or programmatically using a direct connection to the control's `value` data member.

Selecting **Remote** configures your control to take its initial value from a read/write data member of some other LookoutDirect object. To accomplish this you enter a URL to the data member, wherever its host process may be running. This connection is reciprocal; adjusting the control changes the value of the data member, and any change in the data member from some other cause adjusts the value of the control. See the [Remote Position Source Connections](#) section of this chapter for more information on remoting controls.



Note The remote position source has changed in LookoutDirect 4.0. If you are accustomed to developing processes in earlier versions of LookoutDirect, make sure to read the [Remote Position Source Connections](#) section of this chapter in order to understand the changes and make the best use of this feature.

You can select **DDE** as your position source if you want to use DDE networking or if you need to connect your control to an application other than LookoutDirect, such as Microsoft Excel. See Chapter 5, *Dynamic Data Exchange*, of the *LookoutDirect Developer's Manual* for detailed information on using this feature.

DDE networking was used in versions of LookoutDirect earlier than LookoutDirect 4.0. In general, the TCP/IP networking built into LookoutDirect 4.0 and greater is more efficient and easier than DDE networking. If you are maintaining an old LookoutDirect process, or have some special need to use DDE networking, you can find detailed information on this function in Appendix A, *Networking with DDE*, of the *LookoutDirect Developer's Manual*.

7. Select **OK** to create the new object.

Many object classes do not have components (other than a data member value) that you can display on a control panel, such as a protocol driver for a typical PLC, or an object class such as Neutralzone or Pulse (both LookoutDirect object classes with special functionality).

Some objects, like Pots, can be displayed on a control panel. When you create such an object, LookoutDirect presents you with a dialog box you use to define how the object is displayed on the currently active panel (if there is one).

8. If you created your object using the LookoutDirect Object Explorer, it will appear in the Object Explorer window but not on any control panel. To display the pot, you will have to drag and drop it to the control panel

you want it to appear on. If you created your object using the menu, the display properties dialog box appears as soon as you click on **OK** to finish defining the object.

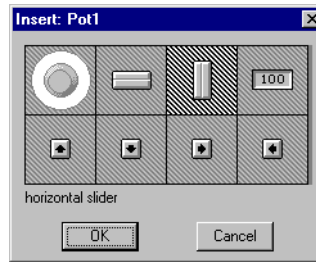


Figure 5-3. Pot Display Dialog Box

9. In the display dialog box, choose how you want the object to be represented and select **OK**.
10. Position the object on the control panel and adjust the size.



Note You can copy objects to paste onto another *LookoutDirect* panel in the same process, but if the panels are of different sizes, the pasted objects may not appear in the proper location on the new panel. In general it is easier just to drag the object to the new panel from the *LookoutDirect* Object Explorer.

Object Names

A name is how you identify a specific object. You must assign each object a unique name. *LookoutDirect* does not allow you to create or modify an object if the name is not unique or if it does not follow the proper naming convention.

Rules for choosing names are as follows:

- Names may include the characters A – Z, a – z, 0 – 9, and the underscore character (_).
- Names must begin with a letter.
- Names may be up to thirty two (32) characters long.
- Spaces and tabs are not allowed.
- *LookoutDirect* recognizes uppercase and lowercase characters as the same character, so SW2 and sw2 are the same name.
- Names cannot be *LookoutDirect* keywords (object class names and function names). For example, you cannot use terms such as Switch,

DelayOn, STDEV, Modbus, nif, and Trend. You can, however, use Switch1, Switch2, and so on.

Some example of *valid* names are as follows:

- Pump3_HOA
- HighServicePump3_Run
- ClearWellLvl_at_Hiway289_and_I35
- ShaftTempF
- Pushbutton1
- runtime
- Sw1
- Sw2

Some examples of *invalid* names are as follows:

- 3Pump_HOA, which begins with a number
- _HighServicePump3_Run, which begins with an underscore
- ClearWellLvl at Hiway289 and I35, which contains spaces
- #ShaftTempF, which begins with #
- Pushbutton, which is a reserved word
- ThisnameIsWellOverThirtyTwoCharacters, which is too long
- and, which is a reserved word

Connecting Objects

In LookoutDirect, you connect objects to pass control signals between objects. Once connected, objects pass signals between their various data members and parameters.

There are a number of different kinds of connections in LookoutDirect, and different ways to make those connections. The method you use depends on what you are trying to accomplish.

You can connect one data member to another. You can connect a data member to an object parameter, or an object parameter to a data member. Finally, you can make a URL connection as a remote position source for a LookoutDirect control or symbolic link, or as a trace item for a HyperTrend object.

You can make these LookoutDirect connections in the following ways:

- **Direct**—Made with the **Edit Connections** dialog box, these connections are fixed and work in one direction only. This sort of connection should only be made from a server process to hardware installed on the server's computer, or between objects contained within the same process.
- **URL remote**—A URL remote connection is a flexible type of fully reciprocal connection between a LookoutDirect control and a LookoutDirect object read/write data member. Changing the control changes the data member, as you would expect, but if the value of that data member changes from some other cause, the control value changes as well. This sort of connection is what you use to connect a client process to a server process, or to link two client processes through a server.
- **Complex**—You can make complex connections using variables and logic tests to respond dynamically to changing needs and circumstances. Complex connections can apply mathematical operations to data, processing it for use by another object. You can make direct complex connections, and with the LookoutDirect Symbolic Link object, make remote complex connections as well.



Tip Remember, when you choose an object in the **Edit Connections** dialog box, always select the object you want to connect *to*.

Connecting Data Members to Parameters

The following example uses the (implicit) data member of a Pot object as the **Data** source of an Average object to illustrate the simplest type of LookoutDirect connection. You can tell that **Data** is a parameter because it appears in the Average object dialog box.

Suppose you create a Pot object as shown in the following illustration.

Next you might create an Average object. Connect the potentiometer numeric signal to the **Data** parameter by entering Pot1 as the Average object's **Data** parameter. The Average object calculates the average level of Pot1 over time, as described in the Average object definition in LookoutDirect help or the *LookoutDirect Object Reference Manual*.

This is the simplest case for making a direct connection in LookoutDirect; connecting the input for one object to the output of an object in the same process. In many cases you will have to connect objects in one process to objects in another process on the same computer, or on another computer on

the network. For these connections you may find it more convenient to use the expression editor, which you access by right-clicking in the yellow expression field. The tutorial examples in Chapter 3, *Getting Started with LookoutDirect*, guide you through making connections in detail.

Identifying Object Data Members

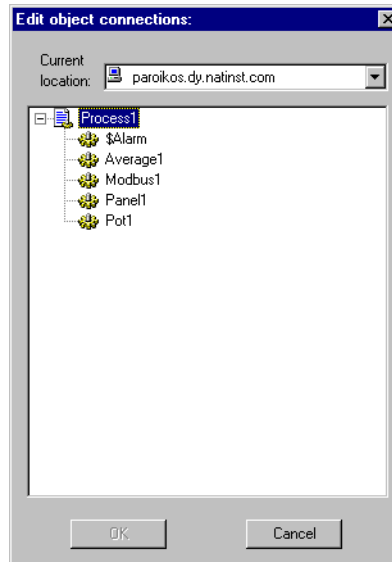
Because many objects generate multiple signals you can use as inputs to other objects, the object name is not always sufficient to identify the desired signal. You must identify both the object name and the appropriate data member. For example, a Modbus object generates thousands of signals, some logical and some numeric. To specify exactly which signal you want from a particular Modbus object, enter the object name followed by a period (.) and the data member you want.

If you have a Modbus object with a name `PLC1`, and you want to display the value residing in holding register 40001 and the status of coil 100, reference those particular data members by typing `PLC1.40001` in one expression and `PLC1.100` in another expression.

Connecting Data Members to Data Members

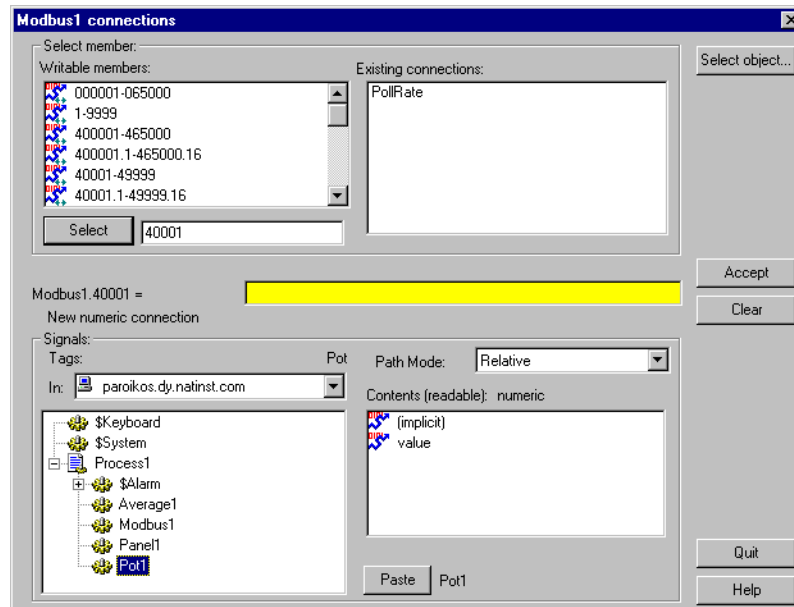
The following information expands on the previous example, in which you created a potentiometer named `POT1`. In this example, you create a Modbus object and connect the numeric signal generated by the pot to a 16-bit holding register at address 40001 on the PLC.

1. Create a Modbus object. You do not have to have a real PLC connected to your system. Just accept the default parameter settings in the Modbus dialog box and click **OK**.
2. If your Object Explorer is open, right-click on the Modbus object you just created and select **Edit Connections** from the pop-up menu. Otherwise select **Object»Edit Connections** from the LookoutDirect menu bar. You use this the **Edit Connections** dialog box any time you are connecting to the database of another object.
3. If you use the **Object»Edit Connections** menu command, the **Edit Object Connections** list box appears. Choose the object that contains the data member you are *connecting to*.



The **Current location** combo box at the top of this dialog box should show your computer as root. See the [LookoutDirect Navigation](#) section for more information on how to set the root in a LookoutDirect dialog box.

Because you are connecting the Pot1 signal to data member 40001 in the Modbus object, select the Modbus1 object and click on **OK**. The **Edit Connections** dialog box appears.



The top part of this dialog box contains information on the object you are connecting to. You select a writable data member from those listed in the **Writable members** list, and the selected member appears to the left of the yellow expression field in the center of the dialog box.

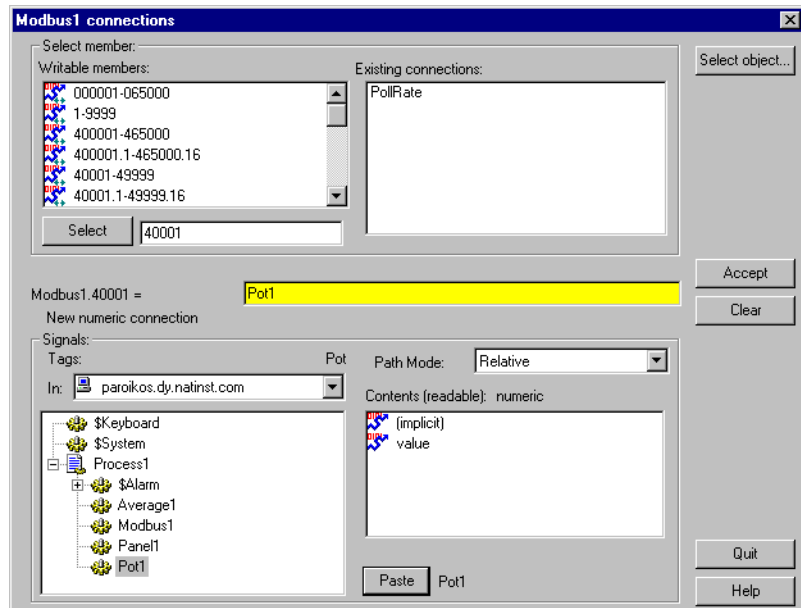
The lower part of the dialog box lets you navigate to the data member you want to connect to the data member you select in the upper portion of the box. You can also enter a data member directly in the yellow expression field.

4. Enter the data member you want to connect *to* in the list box to the right of the **Select** button. You can type the data member you want directly, or you can choose it by scrolling through the list of writable members and clicking on the data member (or range of data members) you want. You can edit the number that appears in the selection box.

Click on the **Select** button to identify the data member to be written to. Notice the dialog box now reflects the specific member; **Modbus1.40001 =**. Also notice the equal (=) sign. This prompts you to connect an expression to **Modbus1.40001**. In this case, use the expression `Pot1`.

5. Inside the **Signals** section of the dialog box, set the your local computer as the root in the **In** field. Navigate to `Pot1` and select it by clicking on

it. Click on the (implicit) data member in the **Contents (readable)** list and then click on the **Paste** button.



Notice that the data type of the data members you have selected are displayed to help you make sure you are connecting like type to like type. Notice too that you can easily edit existing connections by clicking on the list in the **Existing connections** field.



Note Just above the Contents (readable) list in the Signals section, you will notice a list box named Path Mode. This is an important setting for developing networked processes in LookoutDirect. See the [Path Names in LookoutDirect](#) section for more detailed information on how to use this feature. Using different path settings is demonstrated in the exercises contained in Chapter 3, [Getting Started with LookoutDirect](#).

6. Click on the **Accept** button. This confirms the connection. You should see a message confirming the action. You will also see data member 40001 added to the **Existing connections** list box.

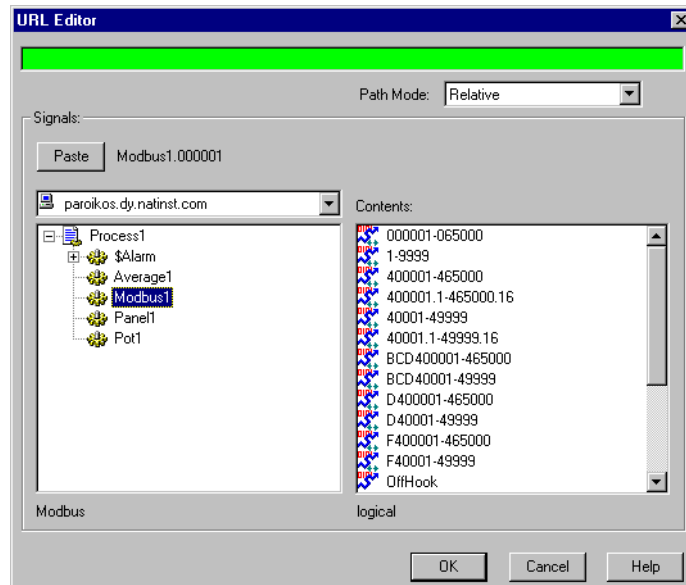
You have now connected a data member of one object to a data member of another object. Any change in the (implicit) value of Pot1 is, by definition, an event, sending a signal to all the other objects Pot1 is connected to. Because it is now connected to Modbus1.40001, adjusting Pot1 changes the value of data member 40001 in object Modbus1.

URL Connections

A URL (Universal Resource Locator) connection is distinct from a connection made through an expression because it cannot contain any condition checking or mathematical operations. It is also designed to permit reciprocal flow of data through the connection. A control connected to a PLC register using a URL connection changes the register value when it is adjusted. But if the register value changes from some other cause, the control will also change to match the current register value.

You can only make a URL connection to data members that are writable, or both readable and writable. You cannot make a URL connection to a read-only data member. Remote position source connections, Symbolic Links, and the HyperTrend object require URL connections, as indicated by a green field.

You can edit a URL by right-clicking in the green field, which opens the LookoutDirect **URL Editor** dialog box, shown in the following illustration.



You can use the tree view in the left window to locate the object you want, and select the data member in the right window. Click on the **Paste** button to insert the complete string into the URL field.

You control the path relativity of your URL with the **Path Mode** selection box. See the Chapter 4, *Path Names in LookoutDirect* section for more information on using the Path Mode selection.

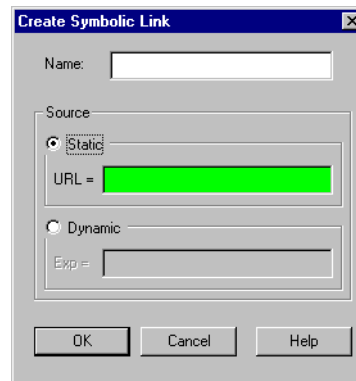
Remote Position Source Connections

Remote position source connections are the preferred method for connecting a control in a client process to a server process in *LookoutDirect*.

Because you ordinarily want to be able to have your client processes work from any computer on your network without having to edit them, it is best to make connections from client processes to server processes, and not from servers to clients. Because server processes usually need to be run from the same computer all the time, you can use absolute paths to make sure your client processes will connect to your server processes no matter where the clients are run.

Symbolic Link Connections

LookoutDirect Symbolic Link objects have several important uses in *LookoutDirect*. *The following figure shows the Create Symbolic Link dialog box.*



You can make a URL connection in the **Static** source field to an entire process with a Symbolic Link and then access any object in that process through the link. This is a crucial part of *LookoutDirect* redundancy, which is described in Chapter 10, *Redundancy*, of the *LookoutDirect Developer's Manual*.

You can enter a complex expression in the symbolic link **Dynamic** source field, and then make a URL connection to the symbolic link itself, circumventing the restriction on complex expressions in remote position source connections for controls.

HyperTrend Item Connections

Because the HyperTrend trends data from the Citadel database, every item you display on a HyperTrend object is accessed through a URL connection.

If you need to trend a complex expression, you can create a named expression by creating an (expression) object. You can enter the complex expression you want to trend, log it to the historical database, and then display it as a HyperTrend item.

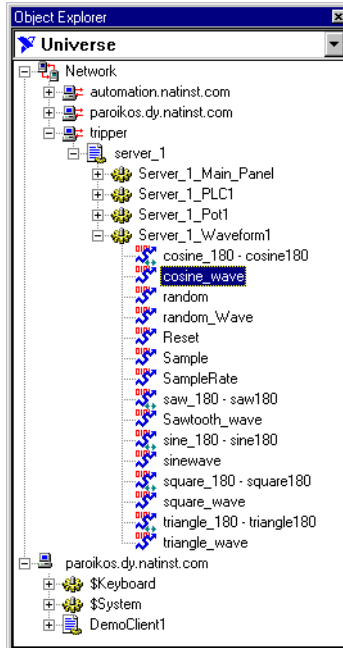


Note If you convert a LookoutDirect process created in a version earlier than LookoutDirect 4.0, LookoutDirect will automatically create and log a named expression for your HyperTrend object to display when it recompiles the .lks source file.

Displaying Data Members on Control Panels

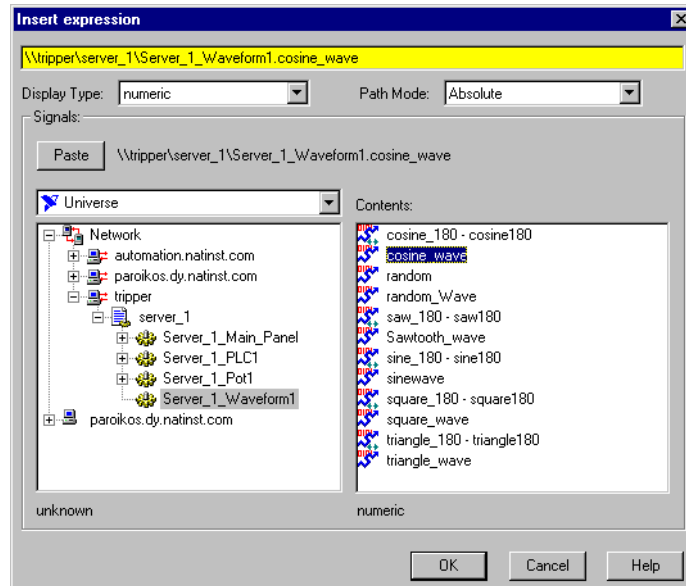
Follow these steps to display a data member on a control panel:

1. Make sure LookoutDirect is in edit mode and open the Object Explorer by selecting **Object»Object Explorer**.
2. Navigate to the object or data member you want to display on your panel. In the following illustration, a data member from a waveform object running on a server process located on another computer on the network has been selected.



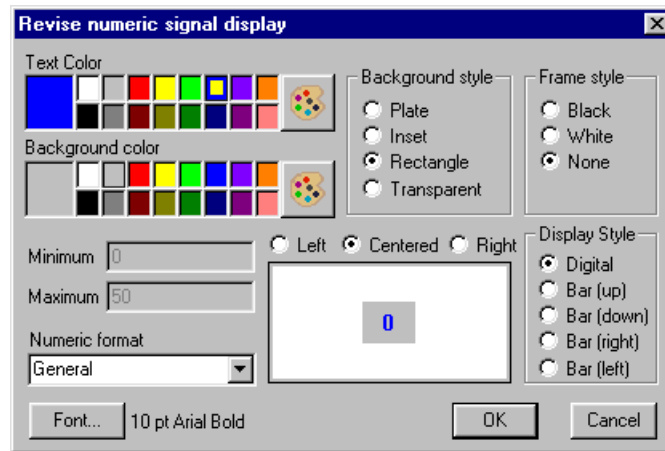
3. Drag and drop the data member onto the panel you want the data to display in. *LookoutDirect* inserts an expression to display the data. You may have to adjust the size of the display for the data to appear properly.
4. Right-click on the display to change its display characteristics, modify the expression, change the data format, or alter any other properties of the display.

You can also insert an expression to display data by choosing **Insert»Expression** from the *LookoutDirect* menu bar. The **Insert Expression** dialog box appears as shown in the following illustration.



5. Navigate to the data member you want to display, just as you did with the Object Explorer.
6. Set the **Path Mode**. In the preceding illustration it is set to absolute because the data is being displayed on a client process panel in one computer (paroikos) and originating from a server process on a different computer (tripper).
7. Select the data member you want to display in the **Contents** list.
8. Click on **Paste** and then **OK**.

LookoutDirect responds by presenting the **Display numeric signal** or **Display logical signal** dialog box. The type of dialog box depends on the type of data member being inserted (numeric or logical). In this case the signal is numeric, a cosine wave generated by the *LookoutDirect* Waveform object.



Select the display parameters you want, and click on **OK**.

You can also drag an object from the Object Explorer to a panel. When you do, the **Insert Expression** dialog box appears, and you can proceed as you did when you invoked this dialog box from the menu.

A

Lookout*Direct* Object Descriptions

This appendix provides descriptions of the Lookout*Direct* system objects and Lookout*Direct* driver objects.

You build Lookout*Direct* processes by creating Lookout*Direct* objects and by making select connections. Lookout*Direct* has two kinds of objects: Lookout*Direct* system objects, which you use for control, monitoring, data analysis, and data presentation, and Lookout*Direct* driver objects, which you use to connect to hardware, such as PLCs (Programmable Logic Controllers), RTUs (Remote Terminal Units), computer boards, and other hardware.

Lookout*Direct* System Objects

The following table lists the Lookout*Direct* system objects, along with their categories and a description of what each one does.

Table A-1. Lookout*Direct* System Objects

Object Class	Category	Description
Accumulator	Calculation, Control	Accumulate a running total by adding a sampled value to the previous total each time a sample trigger fires. A reset trigger is also available.
Alarm	Logging	Define specific alarm conditions that can trigger alarms via complex conditions, or as a result of numeric inputs going out of range or based on rate of change. Attach audible (.wav) files to these alarms that play back whenever the alarm conditions is triggered.
Animator	Display	Dynamically animate graphics files through any combination of horizontal and vertical motion, resizing, visibility, and color changes. Play consecutive filmstrip images from a bitmap to simulate complex motions on the screen.

Table A-1. Lookout*Direct* System Objects (Continued)

Object Class	Category	Description
Average	Calculation, Control	Calculate the average of a variable input over time. Optionally control when averaging is active via the Enable input, and reset the average to the current input via the Reset input. The results of up to 35 previous averages are available, and the current average is updated approximately once per second.
Counter	Control, Logging	Count and record the number of times a logical signal turns on. Optionally reset the count with the Reset input. Maximum count is approximately 2^{52} .
DataTable	Control, Networking	Multiplex multiple data sets into a single control panel by allowing the operator to alter the table cursor setting. Import and export entire tables of data between other applications via DDE and NetDDE. A DataTable consists of a matrix of cells arranged into rows and columns.
DdeLink	Networking	Import a single live value into Lookout <i>Direct</i> from another application via DDE or NetDDE.
DdeTable	Networking	Import a table of values into Lookout <i>Direct</i> from another application via DDE or NetDDE. DdeTable is a subset of the DataTable object class which allows the bidirectional flow of DDE and NetDDE data.
DelayOff	Control, Timers	Introduce a variable time delay between the time the input signal turns off and this timer turns off.
DelayOn	Control, Timers	Introduce a variable time delay between the time the input signal turns on and this timer turns on.
Derivative	Calculation, Control	Calculate the rate of change of a numeric signal, specifying the time unit.
DialGauge	Display	Display a numeric signal as a sweeping dial. Specify the starting position and angle of sweep.
ElapsedTime	Control, Logging, Timers	Calculate and record the cumulative elapsed time that a particular signal has been on. Optionally use the Reset input to reset the elapsed time at any time.
Event	Logging, Monitoring	Permanently record the occurrence a particular event to the event log.
Flipflop	Control	Change the state of this object from on to off, or from off to on each time the input signal goes high.

Table A-1. LookoutDirect System Objects (Continued)

Object Class	Category	Description
Gauge	Display	Display a numeric value as a digital value or as a bar graph, and change the color of the bar or digits based on any set of conditions.
HyperTrend	Display, Logging	Display and peruse historical data as a moving chart, and zoom in on data of interest or search the Citadel historical database for maxima, minima, and other points of interest. Scroll back in time, or leap to any specific date and time instantly.
Integral	Calculation, Control	Totalize a numeric input signal that represents a rate with respect to time, specifying the time unit. Totalizing the flow based on a measured flow rate is a typical use of the Integral.
Interval	Control, Timers	Introduce a variable time delay between the time the input signal turns on and this timer turns off. The timer turns on immediately when the input turns on, and remains on for the timer duration or until the input signal goes low.
L3OPCClient	Obsolete	Obsolete LookoutDirect OPC client. Use OPC client version 4.0 instead. This class is included for compatibility.
L3Pot	Obsolete	A LookoutDirect 3.8-style potentiometer to track and/or alter the value of a numeric variable. A Pot can be displayed on a panel as a slider, rotating knob, or digital display/input. This class is included for backward compatibility with LookoutDirect 3.xx.
L3Pushbutton	Obsolete	A LookoutDirect 3.8-style push button to navigate between control panels within LookoutDirect, or to initiate any other action, such as executing an external application, or latching a pump on or off. This class is included for backward compatibility with LookoutDirect 3.xx.
L3Switch	Obsolete	A LookoutDirect 3.8-style toggle switch to track and/or alter the value of a logical variable. A Switch can be displayed on a panel in a variety of ways. This class is included for backward compatibility with LookoutDirect 3.xx.

Table A-1. LookoutDirect System Objects (Continued)

Object Class	Category	Description
L3TextEntry	Obsolete	A LookoutDirect 3.8-style text-entry object to track and modify a text value via a control panel, using either the computer keyboard or a keyboard display on the screen. This class is included for backward compatibility with LookoutDirect 3.xx.
LatchGate	Control	Latch the output of this object on or off based on whichever of two input signals last went high.
Loader	Control	Load or unload a process file when input goes high.
Maximum	Calculation, Control	Calculate the maximum of a variable input over time. Optionally control when maximum monitoring is active via the Enable input, and reset the maximum to the current value via the Reset input. The results of up to 35 previous maxima are available.
Meter	Display	Display a numeric value as a vertical bar graph or speedometer. Complete displays provide bar/needle, label, scale, and background.
Minimum	Calculation, Control	Calculate the minimum of a variable input over time. Optionally control when minimum monitoring is active via the Enable input, and reset the minimum to the current value via the Reset input. The results of up to 35 previous minima are available.
Monitor	Networking	Monitor a single network I/O point and output true if the data quality is bad.
Multistate	Display	Display a unique graphic for each of up to six different conditions.
Neutralzone	Control	Control the on/off status of a signal based on an incoming numeric signal, and based on two potentially variable upper and lower control limits. Use a Neutralzone to control whether a pump is running based on the varying level in a water storage tank, for example.
OneShot	Control, Timers	Introduce a variable time delay between the time the input signal turns on and this timer turns off. The timer turns on immediately when the input turns on, and remains on for the timer duration, and then turns off irrespective of the input signal.

Table A-1. LookoutDirect System Objects (Continued)

Object Class	Category	Description
Pager	Monitoring	Call a numeric or alphanumeric pager and automatically deliver messages based on specified conditions or alarms in your process.
Pipe	Display	Display rectangles on the screen, and control their colors based on a set of up to six different conditions.
PlayWave	Display	Play a standard Windows audio (.wav) clip based upon the satisfaction of a specified condition.
Pot	Control, Display	Create a potentiometer to track and/or alter the value of a numeric variable. A Pot can be displayed on a panel as a slider, rotating knob, or digital display/input.
Pulse	Control, Timers	Create a periodic pulse train of a specified and variable period and duration. The pulse train can be turned on and off based on the state of the On/Off signal.
Pushbutton	Control, Display	Create a push button to navigate between control panels within Lookout, or to initiate any other action, such as executing an external application, or latching a pump on or off.
RadioButtons	Control, Display	Create a set of buttons only one of which can be active at a time. The radio buttons can be displayed in a variety of ways.
Recipe	Control, Display	Create a set of recipes in a spreadsheet application such as Microsoft Excel and import them into a Recipe to allow the user to select a particular recipe. Recipe supports any number of ingredients—each column in the spreadsheet represents a specific ingredient.
Run	Control	Invoke a Windows application or DOS batch command with a variable set of command line parameters, whenever the Run When input signal turns on.
Sample	Calculation, Control	Take a sample of a numeric variable whenever the Reset input goes high. Optionally control when sampling is active via the Enable input, and reset first sample to the current value via the Reset input. The results of up to 35 previous samples are available.

Table A-1. LookoutDirect System Objects (Continued)

Object Class	Category	Description
SampleText	Calculation, Control	Take a sample of a text variable whenever the Reset input goes high. Optionally control when sampling is active via the Enable input, and reset first sample to the current value via the Reset input. The results of up to 35 previous samples are available.
Scale	Display	Create a dynamic scale where the range and minimum/maximum can change dynamically based upon variable inputs.
Sequencer	Control	Create a sequencer object that generates a sequence of states with associated outputs. The sequencer will remain in the current state until that state's time limit is reached or until a Goto or Jump input causes it to transition to another state.
Spinner	Display	Display a small rotating disk that rotates at a speed that varies according to a numeric input value. A Spinner can spin in both directions and can also be controlled by a simple logical input.
Spreadsheet	Logging	Permanently log data to disk in industry-standard comma-separated-value (.csv) spreadsheet files. Specify which variable to sample in each column and set up a logical trigger that will log the set of data each time the trigger goes high or log data at specified time intervals.
Switch	Control, Display	Create a toggle switch to track and/or alter the value of a logical variable. A Switch can be displayed on a panel in a variety of ways.
TextEntry	Control, Display	Allow the operator to track and modify a text value via a control panel, using either the computer keyboard or a keyboard display on the screen.
TimeOfDay	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each day. This time can be enabled and disabled via the On/Off input signal.
TimeOfHour	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each hour. This time can be enabled and disabled via the On/Off input signal.

Table A-1. LookoutDirect System Objects (Continued)

Object Class	Category	Description
TimeOfMinute	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each minute. This time can be enabled and disabled via the On/Off input signal.
TimeOfMonth	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each month. This time can be enabled and disabled via the On/Off input signal.
TimeOfWeek	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each week. This time can be enabled and disabled via the On/Off input signal.
TimeOfYear	Control, Timers	Schedule a periodic pulse of a specified duration that will occur at some offset into each year. This time can be enabled and disabled via the On/Off input signal.
Waveform	Calculation	Create sine, square, saw tooth, triangle, and random waveforms with specified values for the period, amplitude, offset, phase, and sampling rate.

Lookout*Direct* Driver Objects

The following table lists the Lookout*Direct* driver objects, along with their categories and a description of what each one does.

Table A-2. Lookout*Direct* Driver Objects

Object Class	Category	Description
AB_PLC5	Drivers	Communicate with Allen-Bradley PLC5 line of programmable controllers via serial port, Data Highway Plus (KT, KTx, PCMK, S-S 5136SD), and TCP/IP Ethernet.
AB_SLC500	Drivers	Communicate with Allen-Bradley SLC5xx line of programmable controllers via serial port, Data Highway Plus (KT, KTx, PCMK, S-S 5136SD), and DH485 (AB1747-KE, AB1770-KF3, KTx, PCMK).
ASCII	Drivers	Communicate with any device that transmits and accepts formatted strings of ASCII data. Extract numeric, logical and text values from messages and incorporate them into a Lookout <i>Direct</i> process. For example, one can use the ASCII object class to read the output from a barcode scanner.
DeltaTau	Drivers	Communicate with the Delta Tau Data Systems PMAC Motion Controller cards via dual-ported memory.
DirectLogic	Driver	Communicate with all AutomationDirect (formerly PLCDirect) PLCs through the DirectSoft32 communications server. Supports RS232 and Ethernet. Allows sharing of communications connection between DirectSoft32 - Programming, DSDData, and Lookout <i>Direct</i> .
GE_Series90	Drivers	Communicate with GE Series 90-30 and 90-70 programmable logic controllers via RS-232 using the SNPX serial protocol, or via Ethernet using the GE TCP/IP communication module.
Modbus	Drivers	Communicate with any device that supports the Modbus serial protocols, has a Modbus+ port, or has a Quantum Ethernet module. Modbus+ requires the Modicon Modbus Plus network card and support software to be installed in the computer. The serial protocol communicates via both the ASCII and RTU protocols.

Table A-2. LookoutDirect Driver Objects (Continued)

Object Class	Category	Description
ModbusMOSCAD	Drivers	Communicate with Motorola MOSCAD PLCs and RTUs via the Modbus serial protocols. Supports the Motorola data naming convention.
ModbusSlave	Drivers	Allow other devices or computers to read and write variables in your process by polling a serial port on your computer with the Modbus RTU protocol.
National Instruments Field Point	Drivers	Communicate with National Instrument's FieldPoint modular distributed I/O system via RS-232 or RS-485 serial communications or Ethernet.
NIDAQDevice	Drivers	Communicate with National Instruments data acquisition cards and SCXI hardware connected in parallel mode. Use the NISCXI object class to communicate with SCXI hardware connected in multiplex mode. This object class requires NI-DAQ 5.0 software or better to be installed.
NISCXI	Drivers	Communicate with National Instruments data acquisition devices connected in multiplex mode to SCXI hardware. This object class requires NI-DAQ 5.0 software or better to be installed.
Omron	Drivers	Communicate with Omron PLCs using the Host Link serial protocol.
OPCClient	Drivers	Communicate with OPC (OLE for Process Control) servers. Use the shortcut objects OPCFieldPoint and OPCNIDAQ to make OPC connections to National Instruments FieldPoint modules and data acquisition boards.
Tiway	Drivers	Communicate with the Siemens TI5x5 line of PLCs and other equipment via the serial port using the TBP or NITP protocol, via the TIWAY card or Unilink Host Adapter, or via the CTI or Siemens TCP/IP Ethernet NIM card. Import APT tag files once a Tiway object is created via the Options»Import APT database menu command.

Appendix A

B

Creating & Managing Communication Links

Certain object classes represent and such as PLCs, RTUs, and controllers. Lookout**Direct** uses the term *driver* to refer to these types of object classes. The functionality built into driver objects enables them to communicate with the physical devices that they represent. Lookout**Direct** communicates with the outside world primarily through driver objects.

The drivers are not separate applications. They work as any other object in the Lookout**Direct** event-driven environment, except that they communicate with external devices.

With traditional systems, a particular driver is assigned to a specific serial port. In these configurations, multiple drives cannot share a single serial port. Lookout**Direct** does not associate baud rate, data bits, parity, or stop bits with a particular serial port. In this configuration, drivers that implement different protocols and baud rates can use the same port and the same modem or radio frequency (RF).

This capability allows you to mix and match PLCs, RTUs, and other devices over a single RF without communications conflicts or special hardware. This is possible because of Lookout**Direct's** *communication service*. Objects use the communications service to gain access to serial ports in an orderly and timely fashion.

Note Some LookoutDirect driver objects communicate with physical devices through dedicated hardware. These driver objects do not use serial ports but instead rely on their own proprietary network cards for interfacing to the outside world. A few examples include Modbus Plus (SA85 card), Data Highway (KT card), and DeltaTau (PMAC card). You do not need to configure serial ports for these object classes. Refer to the appropriate object class documentation in Online Help or the Reference manual to verify if a particular object class uses a serial port.ion in Online Help.

Understanding the Communications Service

The Lookout*Direct* serial communication service allocates serial port usage between driver objects. At the frequency of the object Poll Rate, a driver object notifies the communications service that it needs to use a specific serial port to poll a device. If the requested serial port is not in use, Lookout*Direct* allocates the serial port to the driver object. When the driver object takes control of the serial port, it defines port communications parameters such as baud rate and protocol and polls its device. When polling is complete, the driver object releases the port so the communications service can allocated it to other driver objects.

You can uniquely configure each serial port for hardwired, radio, or dial-up communications through the Serial Port Settings dialog box.

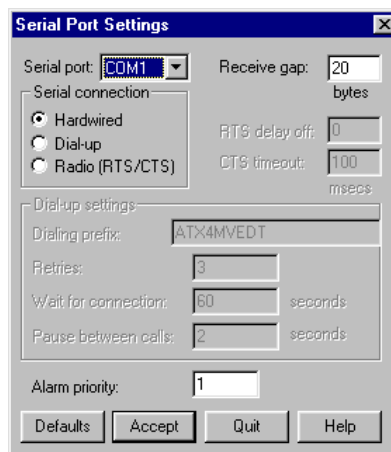


Note You must define serial port communication settings on both the Development/Runtime and Runtime only Lookout*Direct* products.

Defining Serial Port Connections

This section provides the necessary steps to configure serial port settings for hardwired, radio, and dial-up communications.

1. From the Lookout*Direct* menu bar, select **Options Serial Ports...**
The **Serial Port Settings** dialog box appears.



2. In the **Serial Port** data field, select the communication port you are defining. In this example we are using *COM 1*.
3. Define the serial port parameters for the appropriate communication port.
4. Click on **Accept** to save the parameter changes for the serial port.
5. Click on **Quit** to exit the dialog box.

Selecting the Serial Port

The **Serial Port** data field is a drop-down list box. Use it to select the communication port you are defining. Windows supports up to nine serial ports; however, most computers support only two serial ports without additional hardware.

Setting the Receive Gap

The **Receive gap** setting is available for all serial connection types. This number specifies the number of empty bytes (or amount of time) a driver receives from a controller before the driver recognizes the end of a message frame and asks for another message. Normally you should leave this at the default setting of 20. However, if you are experiencing garbled communication alarms, you might try increasing this number to allow more dead time before *LookoutDirect* decides it has received a complete message. For example, with a slow baud rate of 1200, you might have to increase the **Receive gap** setting to approximately 30.

Hardwired Settings

Hardwired serial connections require no hardware handshaking for line control. Use this setting for all serial communication types except dial-up telephone and remote radio transceivers. You should also use this setting when directly connecting to the Master Repeater on a radio system or through a leased-line modem. Because a Master Repeater is a full duplex device that does not require keying and unkeying of the frequency, it acts much like a physically hardwired network. Other hardwired connection types include RS-232, RS-422, RS-485, and leased telephone lines.

RTS/CTS Handshaking Settings

RTS/CTS is a local hardware handshaking mechanism between the local computer and the local communication device. Use the Radio (RTS/CTS) serial connection when connecting the serial port to a device that requires RTS/CTS hardware handshaking, such as a radio transceiver that must be keyed up during data transmission and unkeyed during data reception. Other half-duplex communication media such as RS-485 may require RTS/CTS hardware handshaking.

When you select RTS/CTS hardware handshaking, *LookoutDirect* controls the RTS, or request-to-send pin, and monitors the CTS, or clear-to-send pin, during data transmission (pins 4 and 5 on a 25-pin RS-232 connector). Therefore, you must have at least the RTS pin (pin 4) wired straight through on your RS-232 cable. The CTS pin (pin 5) is optional.

LookoutDirect initiates a serial transmission on an RTS/CTS port by first asserting RTS to key the radio. It then begins monitoring the state of the CTS pin. When the radio transmitter is fully keyed and ready to transmit, the radio asserts CTS and immediately begins data transmission. If the radio does not assert CTS within the CTS timeout setting (default is 100 msecs), *LookoutDirect* assumes the radio is ready to transmit and transmits anyway. The CTS timeout setting is the maximum amount of time that *LookoutDirect* waits after asserting RTS for CTS before transmitting. Most radios typically take between 10 and 80 milliseconds to key up. Consult your radio specifications and DIP switch settings to determine the key-up delay on your radio.

If your radio can assert CTS when it is ready to transmit, add about 50 milliseconds to the radio key-up delay specification and use this total value for the CTS timeout. If your radio does not assert CTS, you should begin by adding about 20 milliseconds to your radio key-up time. Then increase this value in 10 millisecond increments until the remote radio begins to correctly receive the first bytes of the message.

Some radios may assert CTS before they are actually ready to transmit. In this case, disconnect the CTS line (pin 5 on a 25-pin RS232 connector) and set the CTS timeout to a value high enough to let the radio fully key before transmission.

After it transmits the last byte of data, *LookoutDirect* continues to assert RTS, keeping the radio keyed until the RTS delay off time period expires. You should set this value to the default of zero milliseconds so that *LookoutDirect* un-keys the radio as soon as possible to prepare to receive the response.

When un-keyed, most radios generate an audible squelch tail that the remote device might decode as unexpected garbage bytes. Some remote devices reject the entire message instead of just decoding the valid data and ignoring the extra garbage bytes. In this case, keep the radio keyed for several milliseconds using the RTS delay off setting. This time period delays the squelch tail long enough for the remote device to recognize the last data frame as valid before receiving garbage bytes caused by the squelch tail.

If you set the RTS delay off setting too high, the remote device begins transmitting its response before the local radio is un-keyed, causing a communication alarm in Lookout**Direct**.

Dial-Up Modem Settings

Use the Dial-up serial connection when you use a modem in conjunction with a switched telephone line (not leased line). You can customize the dial-up settings for your particular modem and phone line.

The default Dialing prefix settings are based on the Hayes Corporation AT command set, which is an industry standard for data modems. The following table explains the Lookout**Direct** default settings. For additional commands, refer to your modem operation manual.

Table B-1 Default Dial-Up Modem Settings

AT	Attention code that must precede all commands
D	Dial phone number with these modifiers: P for pulse; T for tone
En	Local echo mode: E for no echo
Mn	Speaker on or off: M for speaker always off
Vn	Verbal or numeric result codes: V for numeric result codes
Xn	Result code and dialing options: X4 waits for dial tone before dialing and recognizes busy signal.

When you use an external dial-up modem with Lookout**Direct**, the DTR line in your cable between the modem and the computer must be wired straight through. This line is pin 20 on a 25-pin RS-232 connector and pin 4 on a 9-pin connector. Lookout**Direct** uses the DTR line to command the modem to disconnect (hang up) and return to the command mode.

Some factory modems are not configured to respond to the DTR line. After Lookout*Direct* first successfully dials out to a remote modem and finishes the polling cycle, it drops the DTR line but the modem remains connected. If the modem does not respond after several seconds of attempting to raise and drop the DTR line, Lookout*Direct* generates an alarm stating that the modem is not responding. If you receive this alarm message, your modem is not configured to monitor the DTR line.

The Hayes Corporation standard command for configuring the modem to hang up and enter command mode upon loss of DTR is &D2. You can use a terminal program to make this setting permanent on most modems by entering the modem command AT&D2&W to store the setting permanently in nonvolatile modem memory. Or you can just add &D2 into the Dialing prefix. The default Dialing prefix is ATX4MVEDT, so you might change it to AT&D2X4MVEDT.

Retries specifies the number of times Lookout*Direct* dials the specified phone number and attempts to connect to the modem at the other end of the line. If it fails to connect after the specified Retries, it generates an alarm and moves on to the next phone number in the polling queue (if a queue has formed).

Wait for connection specifies the length of time Lookout*Direct* waits to receive a connect signal back from the modem it is calling. The time period begins when Lookout*Direct* first sends the local modem the dialing prefix command. The time should be long enough for the local modem to receive a dial tone, dial the phone number, allow the remote modem to pick up the line, and send back a connect message. If the specified time is too short, your system could be operating correctly but never make a connection.

Pause between calls is the length of wait time after hanging up before it sends the local modem the next dialing prefix signal. If the specified time is too brief, your system may not hang up the existing call but instead attempt to call the next number.



Note Specific modems, radios, and local phone lines may operate faster or slower than the default settings. You may need to use a trial-and-error approach to find the best settings for your system.

DirectLogic Data Members

Protocol driver objects contain a great deal of data. V-memory registers, inputs, outputs, internal control relays are all included within this object. Therefore, as soon as you create a DirectLogic object you have immediate access to the entire data member set of the object. As with all LookoutDirect drivers, you can access I/O points and other data through data members. The following tables contain data members currently supported by the DirectLogic object class.

Data Modifiers

In order to have the DSDData Server perform data conversions as it moves data in and out of the PLC, the data modifier presented in the following can be added to the end of a data item.

Table B-2

Modifier	Description	Recognized by (DirectLogic PLC)
No modifier	Decimal value (16 bits)	All
:D	Decimal value (32 bits)	All
:B	Convert to BCD (16 bits)	All
:DB	Convert to BCD (32 bits)	All
:nn	Read a specific bit in a Word (not available for writing bits)	All
:R	Convert to Real (32 bits)	DL250, DL350, and DL450
:W	Word (16 bits)	DL330, DL330P, DL340, and DL305
:WB	Word (16 bits), converts to BCD	DL330, DL330P, DL340, and DL305



Note The range of data members shown in the following tables may be beyond the capacity of the specific DirectLogic PLC or compatible CPU that you are using OR may not include some of the data members shown. Consult the appropriate PLC family user manual for the specific memory types and ranges available for your PLC CPU.

05/105/205/350/405 DirectLogic PLC Family Data Members

Table B-3. 05/105/205/350/405 DirectLogic PLC Data Members

Data Member	Type	Read	Write	Description
Activated	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies an active5 communication connection between the process file and the PLC.
C0 – C3777	Logical	Yes	Yes	Control Relays – addressed in octal and mapped to V40600 – V40777.
CT0 – CT377	Logical	Yes	Yes	Counter status (done) bits – addressed in octal and mapped to V41140 – V41157
CTA0:B – CTA377:B	Numeric	Yes	Yes	Counter current value words BCD – addressed in octal and mapped to V01000 – V01377
CTA0:DB – CTA376:DB	Numeric	Yes	Yes	Counter current value double words (two adjacent addresses; 32-Bit) BCD – addressed in octal and mapped to V01000 – V01377
Failed	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies the process file is no longer communicating with the PLC.
GX0 – GX3777	Logical	Yes	Yes	Remote I/O Inputs – addressed in octal and mapped to V40000 – V40177
GY0– GY3777	Logical	Yes	Yes	Remote I/O Outputs – addressed in octal and mapped to V40200 – V40277
Paused	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies that the communication connection has paused but is still active and will go FALSE when its paused condition is satisfied. Usually caused by modifying the Link while it is in use.
S0 – S1777	Logical	Yes	Yes	Stage status (active) bits – addressed in octal and mapped to V41000 – V41077
SP0 – SP777	Logical	Yes	No	Special Relays (system status bits) – addressed in octal and mapped to V41200 – V41237

Table B-3. 05/105/205/350/405 DirectLogic PLC Data Members

T0 – T0377	Logical	Yes	Yes	Timer status (done) bits – addressed in octal and mapped to V41100 – V41117
TA0:B – TA377:B	Numeric	Yes	Yes	Timer current value words BCD – addressed in octal and mapped to V00000 – V00377
TA0:DB – TA376:DB	Numeric	Yes	Yes	Timer current value double words (two adjacent addresses; 32-Bit) BCD – addressed in octal and mapped to V00000 – V00377
V0 – V41237	Numeric	Yes	Yes	Single (16-Bit) V-memory registers decimal
V0:D – V41237	Numeric	Yes	Yes	Double (two adjacent registers; 32-Bit) V-memory registers decimal
V0:B – V41237:B	Numeric	Yes	Yes	Single (16-Bit) V-memory registers BCD 0- 9999
V0:DB – V41236:DB	Numeric	Yes	Yes	Double (two adjacent registers; 32-Bit) V-memory registers BCD 0- 99999999
V0:R - V41236:R	Numeric	Yes	Yes	Double word V-memory registers signed real (IEEE 32-Bit Floating Point)
V0:S - V41237:S	Numeric	Yes	Yes	Single (16-Bit) V-memory registers signed decimal ranging from -32768 to 32767
VC0 – VC3760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Control Relays C0 – C3777
VC0:B – VC3760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Control Relays C0 – C3777
VCT0 – VCT360	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Counter Status (done) bits CT0 – CT377
VCT0:B – VCT360:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Counter Status (done) bits CT0 – CT377

Table B-3. 05/105/205/350/405 DirectLogic PLC Data Members

VGX0 – VGX3760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Remote I/O Inputs GX0 – GX3777
VGX0:B – VGX3760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Remote I/O Inputs GX0 – GX3777
VGY0 – VGY3760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Remote I/O Outputs GY0 – GY3777
VGY0:B – VGY3760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Remote I/O Outputs GY0 – GY3777
VS0 – VS1760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Stage status (active) bits S0 – S1777
VS0:B – VS1760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Stage status (active) bits S0 – S1777
VSP0 – VSP760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Special Relays (system status bits) SP0 – SP777
VSP0:B – VSP760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Special Relays (system status bits) SP0 – SP777
VT0 – VT360	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Timer Status (done) bits T0 – T377
VCT0:B – VCT360:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Timer Status (done) bits T0 – T377
VX0 – VX1760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Inputs X0 – X1777

Table B-3. 05/105/205/350/405 DirectLogic PLC Data Members

VX0:B – VX1760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Inputs X0 – X1777
VY0 – VY1760	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers decimal Aliases for mapped Outputs Y0 – Y1777
VY0:B – VY1760:B	Numeric	Yes	Yes	Single (16-Bit) V-memory word registers BCD Aliases for mapped Outputs Y0 – Y1777
X0 – X1777	Logical	Yes	Yes	Inputs – addressed in octal and mapped to V40400 – V40477
Y0 – Y1777	Logical	Yes	Yes	Outputs – addressed in octal and mapped to V40500 – V40577

305/305S Direct Logic PLC Family Data Members

Table B-4. 305/305S DirectLogic Data Members

Data Member	Type	Read	Write	Description
Activated	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies an active communication connection between the process file and the PLC.
C160 – C373 C1000 – C1067	Logical	Yes	No	Control Relays – addressed in octal
C374 – C377 C770 – C777 C1070 – C1077	Logical	Yes	No	Special Relays – addressed in octal
Failed	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies the process file is no longer communicating with the PLC.
IO0 – IO157 IO700 – IO767	Logical	Yes	No	Inputs and Outputs – addressed in octal
Paused	Logical	Yes	No	Object-generated signal when TRUE, this flag signifies that the communication connection has paused but is still active and will go FALSE when its paused condition is satisfied. Usually caused by modifying the Link while it is in use.
R0 – R777	Numeric	Yes	Yes	Single (8-Bit) byte registers decimal
R0:W – R776:W	Numeric	Yes	Yes	Single (16-Bit) word registers decimal
R0:WB – R776:WB	Numeric	Yes	Yes	Single (16-Bit) word registers BCD
RC160 – RC370 RC760RC1000 – RC1070	Numeric	Yes	Yes	Single (8-Bit) byte Control Relay and Special Relay registers decimal Aliases.

Table B-4. 305/305S DirectLogic Data Members

Data Member	Type	Read	Write	Description
RC160:W – RC360:W RC760:W RC1000:W – RC1060:W	Numeric	Yes	Yes	Single (16-Bit) word Control Relay and Special Relay registers decimal Aliases.
RC160:WB – RC360:WB RC760:WB RC1000:WB – RC1060:WB	Numeric	Yes	Yes	Single (16-Bit) word Control Relay and Special Relay registers BCD Aliases.
RIO0 – RIO150 RIO700 – RIO760	Numeric	Yes	Yes	Single (8-Bit) byte registers decimal Aliases for mapped Inputs and Outputs IO0 – IO157 and IO700 – IO767
RIO0:W – RIO140:W RIO700:W – RIO750:W	Numeric	Yes	Yes	Single (16-Bit) word registers decimal Aliases for mapped Inputs and Outputs IO0 – IO157 and IO700 – IO767
RIO0:WB – RIO140:WB RIO700:WB – RIO750:WB	Numeric	Yes	Yes	Single (16-Bit) word registers BCD Aliases for mapped Inputs and Outputs IO0 – IO157 and IO700 – IO767
RS400 – RS570	Numeric	Yes	Yes	Single (8-Bit) byte Shift Registers decimal
RS400:W – RS560:W	Numeric	Yes	Yes	Single (16-Bit) word Shift Registers decimal
RS400:WB – RS560:WB	Numeric	Yes	Yes	Single (16-Bit) word Shift Registers BCD
SR400 – SR577	Logical	Yes	No	Shift Register Status Bits – addressed in octal
T600 – T677	Logical	Yes	No	Timer/Counter status (done) bits – addressed in octal
TCA600:WB – TCA677W:WB	Numeric	Yes	Yes	Timer/Counter current value words BCD – addressed in octal and mapped to R600 – R677

Establishing DirectLogic PLC Links

Lookout*Direct* will use “Links” to easily build and store the communication settings for the DirectLogic PLC connection(s). This will also remove the guess work from communication settings. There are three different types of Links you can create.

- a standard serial link that uses COM1 through COM4 directly to the PLC port
- a serial link that will connect through a pair of modems to the PLC port
- a link that will connect through a network card to an Hx-ECOM module

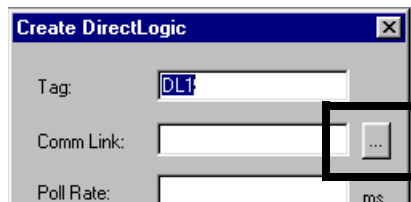
The majority of communications links can be quickly established using the LinkWizard. The LinkWizard automatically searches for established communications links.



Note If you have a network of PLCs, you must build a communications link for each different PLC. For example, it is possible that all PLCs on a network have the same communications settings (protocol, baud rate, etc.). However, each one would have a unique station address, therefore you must build a separate link for each one.

Establishing a Communications Link Using the LinkWizard

1. Select **Object »Create Drivers**, choose **DirectLogic** as the object class, and then click OK.
The **Create DirectLogic** dialog box appears with no **Comm Link** selected.
2. Click the link button (...).



The **Select Link** dialog appears. Existing communications links that are links found by the *Link Wizard* are displayed in the **Links** gallery.



Note If no links appear in the **Links** gallery, refer to [Using the Link Wizard to Add a Serial Communications Link](#) below.

3. Double-click the desired link.

The links name appears on the **Create DirectLogic** dialog box in the **Comm Link** text box.

4. Click **OK** to establish the link.

Using the Link Wizard to Add a Serial Communications Link

The wizard will guide you through the creation of a communications link between *LookoutDirect* and your PLC.

1. In the **Select Link** dialog, click **Add**.

The **Link Wizard** opens.

2. Select the correct communications port, and then click **Next**.
3. Select the PLC family. Click *Not Sure* if you do not know what family your PLC belongs to. Click **Next** after making your family selection.

If you are using a AutomationDirect compatible PLC, the *Link Wizard* will attempt to detect the family automatically.

4. Select the correct protocol. The correct protocol will already be highlighted if a PLC family was selected in the previous step. Click **Next** after making your protocol selection.

LookoutDirect attempts to establish communications with the PLC using the node address and protocol you selected. The first attempt at communicating with the PLC will be made using 9600 baud and odd parity. If the first attempt is unsuccessful, a second attempt will be made using an autobauding sequence. If both attempts at establishing communication with the PLC are unsuccessful, use the **Link Editor** to manually adjust the port configuration until communications are established.



Note The choice of protocol is determined by two factors.

- Whether or not the PLC supports the protocol on the port where you are connecting. Refer to your PLC user manual for a list of protocols available for ports on *PLCDirect* and compatible CPUs.
- If you need to perform write operations to individual Discrete I/O points or control relays. In this case you must select the K-sequence protocol. *DirectNET* protocol cannot write to individual bit locations.

5. Enter a unique name for the link that is no more than 16 characters in length and a description of that is no more than 32 characters in length, and then click **Finish**.

The name of the new link appears in the **Link** gallery of the **Select Link** dialog box.

6. Click **Select**.

The abbreviated name for the communications link you selected appears in the **Comm Link** text box in the **Create DirectLogic** dialog box.



Note The **Poll Rate** and **Poll=** text boxes are used to for Modem/RF communications links or to compensate for noisy networks. Under normal circumstances, it is unnecessary to complete these text boxes. Refer to the online help for further information.

Using the Link Wizard to Add an Ethernet Link

The following provides the procedure for configuring a communications link between a standard network interface card and an Ethernet communications module.



Note Refer to Windows online help for information on configuring your network and installing network protocols.

1. In the **Select Link** dialog, click **Add**.
The **Link Wizard** opens.
2. Select *Ethernet*, and then click **Next**.
3. Select the correct transport and protocol, and then click **Next**.

Lookout*Direct* scans the network for ethernet modules.



Note The following restriction apply to the transport layer:

- If the Operating System is Windows NT 4.0, the only Transport option available to you is Winsock. Windows 95/98 allow you to choose either IPX interrupt or Winsock.
 - If you select UDP/IP as the Transport Protocol, you must change the IP address of the module from its default value of 255.255.255.255 before you can connect to it.
4. Select the device and addressing mode. If you selected the UDP/IP protocol in the last step, enter correct the IP address of the network card. Refer to *Making Changes to the Device and Addressing Mode* below for further information.
 5. Click **Next**.

Lookout*Direct* attempts to communicate with the ethernet module.

6. Enter a unique name for the link that is no more than 16 characters in length and a description of that is no more than 32 characters in length, and then click **Finish**.

The name of the new link appears in the **Link** gallery of the **Select Link** dialog box.

7. Click **Select**.

The abbreviated name for the communications link you selected appears in the **Comm Link** text box in the **Create DirectLogic** dialog box.

Making Changes to the Device and Addressing Mode

Module List Group

Each ethernet module is assigned a unique 12 digit address at the factory, called the Ethernet address. A sticker located either on the back of the PC board in the module or on the side of the module itself, will have the Ethernet address printed on it. The Module List will display any ethernet modules it finds on the network, sorted by their Ethernet address. If you select any device in the Module List, the current configuration for that device is displayed in the fields in the Address Mode section.

- The **Query** button executes a rescan of the network for Ethernet modules using the same Transport and Transport Protocol specified in the previous dialog.
- The **Setup...** button displays a dialog box that allows you to assign a Name, Description and IP address to the selected module.
- The **Link Editor** button displays a dialog box that will let you manually configure the Link parameters for a specific Ethernet module.

Address Mode Group

Each ethernet module must have some way of uniquely identifying itself on a network. The Ethernet address, which is assigned at the factory, is most always unique, but it is not always the most convenient identifier to remember.

Fortunately there are three user-configurable identifiers available: the Module ID, the Name, and the IP Address (the Ethernet address is not user configurable). The Address Mode selection determines which of these identifiers Lookout*Direct* will use to locate the ethernet modules on your network. The important thing to remember is that whichever identifier you choose for the Address Mode, it must be unique on the network.

If you want to change the module's configuration, click the **Setup** button and make any adjustments needed for your network.

Setup Button

Selecting a module in the Devices section will display the current configuration for that module in the Configuration section. Before you change any of the values, look at each of the options in more detail.

- The Module ID is a unique numerical identifier given to each module on the network. This number can be either the module's dipswitch setting, or a user configured address (if the dipswitches are set to address 0). Refer to the Ethernet module's user manual, part number H24-ECOM-M, for detailed information on assigning an address.
- The Name field can contain a 32 character alphanumeric string. The value assigned at the factory is "Name". If you intend to use the Name field as the identification method, you must change the default value from "Name" in order to make it unique on the network.
- The Description field can contain a 32 character alphanumeric string.
- The IP Address field must contain a valid IP address that is unique on your network. You must be careful not to duplicate IP addresses on a network (you will not be able to complete the link configuration if the IP address is not unique). Your Network Administrator should be able to tell you what addresses are available to use. If you intend to use IP Address, you must change the value from its default value.



Note You must be careful not to duplicate information in these user-configurable fields in any module on the network. You will not be able to complete the Link creation process if you choose an identifier that has been duplicated on another module.

If you enter new values for a field, click the **Update Module** button to write these new values to the EEPROM in the Ethernet module. The **Query Network** button will initiate a rescan of the network using the Transport and Transport Protocol previously specified.

Appendix B

Glossary

Prefix	Meanings	Value
μ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^3
M-	mega-	10^6

A

absolute date absolute time	<p>Numeric system <i>LookoutDirect</i> uses for keeping track of dates and times, in which midnight (0 hours), January 1, 1900 is represented by 1, midnight of January 2, 1900 is represented by 2, and so on. The absolute date/time number 36234.47222250 represents 11:20 AM, March 15, 1999.</p> <p>The numeric value for 1 second in <i>LookoutDirect</i> is .000011574, the numeric value for 1 minute is .000694444, and the numeric value for 1 hour is .041666667.</p>
ACK	Acknowledge (an alarm or event).
active notification	A feature of event-driven software systems in which the application is alerted of value changes when they occur instead of through continuous, loop-driven queries.
address space	An OPC term for the area you browse to find what items are available on an OPC server. Part of the standard OPC interface, this space may arrange items hierarchically.
alarm	Software notification of a condition in a process. This alarm may call attention of a value that has exceeded or fallen below certain levels, set in the object database or in an Alarm object.
alias	Name given to a data member using the Edit Database dialog box. This name can be descriptive or mnemonic, and may be associated with other data member configurations such as scaling, logging, and alarming. A data member can have more than one alias, each with different associated configurations.

B

- baud rate Measurement of data transmission speed, formally defined as the number of electronic state changes per second. Because most modems transmit four bits of data per change of state, is sometimes misused or misunderstood—a 300 baud modem is moving 1200 bits per second. See [BPS](#).
- .bmp files Graphic files in bitmap format. If you are using a .bmp file in LookoutDirect, you cannot resize it on screen. See [Windows metafile](#).
- BPS Bits per second—measure of the rate of transfer of data.

C

- CBL compiler LookoutDirect uses the CBL (Control Block Language) compiler to compile a LookoutDirect source file (.lks) into a binary file (.l4p).
- .cbx file A LookoutDirect file containing a LookoutDirect object class. A .cbx (Control Block Extension) file may have one or more object classes in it.
- checksum A method of verifying that the number of bits received is the same as the number of bits transmitted. Used by TCP/IP and serial protocols.
- Citadel The LookoutDirect historical database that stores your data for access later.
- classes See [object classes](#).
- client A LookoutDirect process that monitors a LookoutDirect server process. LookoutDirect clients should be computer independent so that they can be run from any computer on your network. LookoutDirect server processes run on computers actually connected to your control hardware.
- comm port Term sometimes used for a serial port.
- connection Input to a LookoutDirect object's writable data members. For more information, refer to Chapter 4, [Using LookoutDirect](#).
- control objects LookoutDirect objects you use to control a process, change a data value, adjust a register, and so on.
- controllable objects LookoutDirect objects you can control with a LookoutDirect control object.

.csv files	Comma Separated Value file, a format widely accepted by spreadsheet and other data handling programs.
CTS	Clear to Send. Part of a handshaking protocol for certain devices that connect the serial port of a computer. See the <i>RTS/CTS Handshaking Settings</i> section of Chapter 3, <i>Serial Port Communications</i> , in the <i>LookoutDirect Developer's Manual</i> for detailed information.
cursor (data table)	The <i>LookoutDirect</i> data table can activate one row of data at a time using the data table cursor. See the data table reference in the <i>LookoutDirect</i> online help or the <i>LookoutDirect Object Reference Manual</i> .

D

DAQ	Short for Data Acquisition.
data member	Data source or sink associated with a <i>LookoutDirect</i> object. A readable data member, or source, may be used in expressions or as inputs to other objects. A writable data member, or sink, may have at most one connection into it, created using the Object»Edit Connections dialog box. A data member may be both readable and writable. See also native data member and alias .
data type	Kind of value (numeric, logical, or text) that a parameter or data member can hold.
database	Collection of data stored for later retrieval, display, or analysis.
datagram	Message sent between objects in <i>LookoutDirect</i> . A datagram contains a route and a value.
DCOM/COM	Distributed Component Object Model, a Microsoft standard in which client program objects request services from server program objects. The Component Object Model (COM) is a set of interfaces, clients, and servers used to communicate within the same computer (running Windows 98/95 or Windows NT).
DDE	Dynamic Data Exchange, currently used in <i>LookoutDirect</i> to exchange data with other programs (such as Microsoft Excel) running on your network.

Glossary

deadband	A value that must be exceeded for an alarm to sound or a change in state to be recorded. For instance, if you have a low-level alarm set at 5 with a deadband of 2, the alarm will not trigger until the value being monitored drops to 5. The alarm will then stay active until the value being monitored moves above 7. A deadband keeps small oscillations of value from triggering an alarm and then canceling it too rapidly.
deviation	Set a deviation to filter out small changes in value when logging data. Before being logged to a database, a value must change by at least the deviation amount of the last logged value.
dialing prefix	Part of the Hayes AT command set for use with modems. See the Dial-Up Modem Settings section of Chapter 3, <i>Serial Port Communications</i> , in the <i>LookoutDirect Developer's Manual</i> for detailed information.
displayable objects	A <i>LookoutDirect</i> object class that has a displayable component, such as a Pot, a Switch, or a Pushbutton.
DLL	A Dynamic Link Library, which is a collection of small, special purpose programs which can be called by a larger program running on the computer. Sometimes called Dynamically Linked Library.
driver objects	<i>Lookout Direct</i> objects used to communicate with PLCs, RTUs, and other I/O devices.

E

edit mode	<i>LookoutDirect</i> mode in which you can alter and create objects within a process. Switch in and out of edit mode by pressing <Ctrl-space> or by selecting Edit»Edit Mode .
engineering unit	In <i>LookoutDirect</i> , used to refer to scaled or converted data. Thermocouple data, for instance, arrives in volts as the raw unit, and must be converted to degrees, an engineering unit.
environment services	Tasks <i>LookoutDirect</i> performs as a part of making your SCADA/HMI work easier. <i>LookoutDirect</i> environment services include serial communications, database and logging, security, networking, alarming, and so on.
Ethernet	A widely used, standardized local area networking technology, specified in the IEEE 802.3 standard.

event	Anything that happens can be an event. In <i>LookoutDirect</i> , events include such things as adjusting a control value, entering or exiting edit mode, opening or closing a control panel, and logging in or logging out of the system.
expression functions	Mathematical, logical, and other functions used by <i>LookoutDirect</i> expressions.
expressions	<i>LookoutDirect</i> expressions are often paths to a data member. They can also function like variables that, using a spreadsheet cell type formula, become capable of performing flexible, real-time math operations, condition testing, and other complex operations functions. See Chapter 1, <i>Expressions</i> , in the <i>LookoutDirect Developer's Manual</i> for more information on expressions.
F	
failover	A failover is the takeover of a process by a standby computer when the primary computer fails for any reason.
FieldBus	An all digital communication network used to connect process instrumentation and control systems.
FieldPoint	A National Instruments hardware product line for industrial automation, control, monitoring, and reporting.
frame	Sequence of bytes sent from a computer to a device or vice versa. The syntax of the frame depends on the protocol being used. A read frame contains enough information to specify a set of variables whose values the device should return. A write frame specifies a variable in the device and a new value to write into that variable. Some protocols support the writing of multiple variables in a single frame. A response frame is returned from the device to the computer, indicating whether the frame just sent to it was received successfully. If the frame just received was a read frame, the response frame contains a set of requested values.
functionality	The way an object works, operates, or performs a task. Functionality is a general concept that applies in the same way to all objects in a given object class. Parameters define the specific functionality of an individual object.
functions	<i>See</i> expression functions .

G

gray proximity A term used in Lookout*Direct* color animation. This sets what percentage of gray will be replaced by a given color as conditions change in a monitored value or set of values.

H

Hi and HiHi Alarm settings. Both warn that a value has gone above some setpoint. Generally a Hi alarm is used to alert an operator of a need for intervention. A hihi alarm is usually used to alert an operator that the value has been exceeded by an even greater margin than a hi alarm indicates, and is usually used to indicate an urgent need for action.

historical logging The process of storing data in a database for use at another time, or from another location.

HOA Hand-Off-Auto control, used to set whether a value must be changed manually, is completely turned off, or functions automatically. You can use a Pot object and a complex expression to create this sort of control in Lookout*Direct*, or you can use a RadioButton object, depending on the particular requirements of the task you need to accomplish.

I

I/O point Every read-only, write-only, or read-write connection Lookout*Direct* makes to external hardware is counted as an I/O point. Lookout*Direct* is licensed for use with a set number of I/O points. If you exceed the number you are licensed to use with your copy of Lookout*Direct*, a warning message appears on your computer screen warning you to shut down one of your processes within a specified time before Lookout*Direct* cuts back on I/O usage.

(implicit) data member A Lookout*Direct* data member containing the fundamental data for certain object classes. When you make a connection to an (implicit) data member, you only use the name of the object, not the name of the object followed by the data member name.

L

.14p files	File extension for Lookout <i>Direct</i> process files. These are the compiled files Lookout <i>Direct</i> runs when it runs a process.
.14t files	File extension for a Lookout <i>Direct</i> state file, which stores the values for Lookout <i>Direct</i> controls and other objects with state information.
.1ka files	File extension for Lookout <i>Direct</i> security files.
.1kp files	File extension for Lookout <i>Direct</i> process files in versions of Lookout <i>Direct</i> earlier than Lookout <i>Direct</i> 4.
.1ks files	File extension for a Lookout <i>Direct</i> source file, which Lookout <i>Direct</i> compiles to make a Lookout <i>Direct</i> process file that Lookout <i>Direct</i> can run. This is the file you should make sure you keep backed up in case you need to recreate a corrupted process file, or in case some future version of Lookout <i>Direct</i> cannot run a process file compiled in an earlier version of Lookout <i>Direct</i> .
logging	The process of storing data in a computer database file. See Chapter 7, <i>Logging Data and Events</i> , in the <i>LookoutDirect Developer's Manual</i> for more information on logging data in Lookout <i>Direct</i> .
logical data member	A Lookout <i>Direct</i> data member of the logical data type.
.1st files	Extension for the Lookout <i>Direct</i> state file in versions of Lookout <i>Direct</i> earlier than Lookout <i>Direct</i> 4.

M

multiplex	A method of working with more than one data stream using only one communications channel. There are a number of different methods of multiplexing, depending on the hardware and software being used. A number of Lookout <i>Direct</i> driver objects support multiplexing hardware.
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N

- native data member Data members built into a *LookoutDirect* object class, as opposed to data members you create by using aliases.
- NetDDE A way of networking using DDE (dynamic data exchange), retained in *LookoutDirect* 4 and later for compatibility with earlier versions of *LookoutDirect*.
- numeric data member A *LookoutDirect* data member of the numeric data type.

O

- object A specific instance created from an object class.
- object classes Software modules you use to create individual objects to perform tasks in *LookoutDirect*.
- object connections Software links between objects used to transmit data and commands from one object to another.
- ODBC Open DataBase Connectivity, a standard application programming interface (API) for accessing a database. You can use ODBC statements to access files in a number of different databases, including Access, dBase, DB2, and Excel.
- ODBC is compatible with the Structured Query Language (SQL) Call-Level Interface. ODBC handles SQL requests by converting them into requests an ODBC database can use.
- OPC OLE for Process Control, an industry standard interface providing interoperability between disparate field devices, automation/control systems, and business systems. Based on ActiveX, OLE, Component Object Model (COM), and Distributed COM (DCOM) technologies.

P

parameter	Input to an object, similar to a writable data member, whose value is specified in the object parameter list in a Lookout <i>Direct</i> source (.1ks) file. Typically, parameter values are set in the object Object»Create or Object»Modify dialog box.
ping	A small utility program in Windows and DOS that checks to see if a computer can be reached across a network. Also used to indicate the running of that program.
pixel	Picture Element, the smallest bit of a picture. Has one color or shade of grey. The number of pixels per inch determine the resolution of an image.
PLC	Programmable Logic Controller.
poll	A software event in which a computer checks some value in a device or register. In Lookout <i>Direct</i> , a logical command that forces a device poll to check data member values.
poll rate	How often a device is polled.
pop-up panel	One variety of Lookout <i>Direct</i> control panel that can only be displayed at the size set by the process developer, and which cannot be maximized. When open, a popup panel remains on top of other panels until minimized.
process	In Lookout <i>Direct</i> , process refers to a Lookout <i>Direct</i> “program,” used for industrial automation, control, monitoring, or reporting.
process file	The Lookout <i>Direct</i> binary file Lookout <i>Direct</i> executes when running a process. Carries the .14p extension.

R

raw unit	Data as it arrives in your process, such as voltage or amperage. Thermocouple data, for instance, arrives in volts as the raw unit, and must be converted to degrees, an engineering unit.
receive gap	A serial communications setting that determines the number of empty bytes (or amount of time) a driver receives before recognizing the end of a message frame and requesting another message. See the <i>Setting Receive Gap</i> section of Chapter 3, <i>Serial Communications</i> , in the Lookout <i>Direct Developer's Manual</i> for more information about the receive gap.

Glossary

redundancy	A system for making sure that a computer can come online and run a LookoutDirect process if the computer currently running that process fails for some reason.
remote	In the context of LookoutDirect, remote is a position source location for a control. See the <i>Remote Position Source Connections</i> section of Chapter 4, <i>Using LookoutDirect</i> , for detailed information on the LookoutDirect remote position source.
resolution	The smallest signal increment that can be detected by a measurement system. Also, the number of pixels per inch on a computer monitor screen or dots per inch in printer output.
RTS	Request to Send, part of a handshaking protocol for certain devices that connect the serial port of a computer. See the <i>RTS/CTS Handshaking Settings</i> section of Chapter 3, <i>Serial Communications</i> , in the <i>LookoutDirect Developer's Manual</i> for detailed information.
RTU	Remote Terminal Unit, a device similar to a PLC for use at a remote location, communicating with a host system through radio or telephonic connections.
run mode	LookoutDirect mode in which processes run but no editing changes can be made. Switch in and out of run mode by pressing <Ctrl-space> or selecting Edit»Edit Mode .
S	
SCXI	Signal Conditioning eXtensions for Instrumentation, a National Instruments product line for conditioning low-level signals.
security accounts	Also called user and group accounts, LookoutDirect uses security accounts to define what users or group of users have different operation privileges in LookoutDirect. See Chapter 6, <i>Security</i> , in the <i>LookoutDirect Developer's Manual</i> for detailed information on LookoutDirect security.
server	A process that provides data (services) to client processes. In LookoutDirect, server processes are intended to be run on one computer only, with direct connections to field hardware. Client processes interact with field hardware through server processes.
source file	LookoutDirect file that can be compiled to produce a binary LookoutDirect process file that runs a process. Uses a .1ks file extension.

SQL	Structured Query Language, used to get information from and update information in a database.
standby	A computer standing by to take over running a process if the primary computer fails or falls offline.
startup file	A Lookout <i>Direct</i> process file (.14p) you designate in the System Options dialog box that Lookout <i>Direct</i> will open and run any time Lookout <i>Direct</i> is opened.
state file	The Lookout <i>Direct</i> file that stores the value of all Lookout <i>Direct</i> control parameters and object data members in use in a process. Uses the file extension .14t.
system objects	Lookout <i>Direct</i> objects used to control other objects or process and analyze data.

T

TCP TCP/IP	Transmission Control Protocol, a method (protocol) for sending data between computers. Used with IP, the Internet Protocol. TCP/IP sends data as packets, with IP handling the delivery of data and TCP keeping track of the individual packets.
text data member	Lookout <i>Direct</i> data member used for text data.
trace	A term for data from a single source over some period of time, stored in an ODBC-compliant database.
traces table	ODBC databases present data in the form of traces tables. A traces table contains a field or column of data for each data member being logged, along with a field you can use to query the database.
trend	Historical data showing the change in a value over time. Often used in connection with graphing the data for display.

W

.wav files	File extension given to sound files. You can play a .wav file in Lookout <i>Direct</i> to add sounds or speech to alarms or events.
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Glossary

Windows metafile A standard graphics file type for use in the Microsoft Windows operating environment. If you use a metafile graphic in *LookoutDirect*, you can enlarge or reduce it on the screen, use them as masks without specifying transparent pixels, and use the *LookoutDirect* Animator to animate the colors of the graphic.

.wmf file File extension given to Windows Metafile graphic files.

X

.xls file File extension given to Microsoft Excel files.

Index

A

absolute dates and times (table), 2-12

active notification, 2-20 to 2-21

alarms

adding to process, 3-21

database generated, 3-22

log settings for, 1-6

overview, 2-22

architecture of LookoutDirect, 2-2

C

Citadel database, setting for, 1-5

configuration shortcuts, 4-18 to 4-20

connecting objects, 5-34 to 5-39

data members to data members,
5-36 to 5-39

data members to parameters, 5-35

example (figure), 2-16

identifying object data members, 5-36

overview, 2-16 to 2-18

selecting target object (note), 5-34

supervisory control, 2-18

connecting, objects, 3-8

control panels, 4-8 to 4-9

normal, 4-8

overview, 4-8 to 4-9

conventions, document, 1-1

conventions, manual, 1-1 to ??

copying and pasting objects (note), 5-32

creating objects, 5-28 to 5-33

D

data members

connecting

identifying data members, 5-36

to data members, 5-36 to 5-39

to parameters, 5-35

definition of, 2-5

(implicit) data members, 2-13

logical data members, 2-7

numeric data members, 2-7

text data members, 2-13

displaying on control panels, 5-42

Switch object class (table), 2-6

types of, 2-5

database

historical, enabling, 3-10

database service, 2-22

datalogging, process, 3-36

dates/times

absolute (table), 2-12

DDE (dynamic data exchange)

DDE service in LookoutDirect, 2-23

development environment

process file, 4-15

source code file, 4-16

state file, 4-17

development process, overview of, 5-23

document, conventions used in, 1-1

documentation

related documentation, 1-2

E

environmental services, 2-21

alarm service, 2-22

database service, 2-22

DDE service, 2-23

graphics service, 2-22

historical logging service, 2-23

multimedia service, 2-22

network services, 2-24

ODBC service, 2-23

redundancy service, 2-24

security service, 2-23

serial port communication service, 2-21

event-driven processing, 2-19 to 2-21

- advantages of active notification, 2-20 to 2-21
- architecture (figure), 2-20
- loop-driven applications compared with, 2-19 to 2-20

exponential/scientific notation (table), 2-10

Expression editor dialog box, 4-19 to 4-20

expression fields

- definition, 4-19
- remembering tagnames, 4-19

F

fractional numbers with trailing zeroes (table), 2-10

G

global object classes

- definition, 2-4

graphics

- LookoutDirect graphics service, 2-22

graphics, importing custom, 3-33

H

Hardware key, about, 1-3

hexadecimal formats (table), 2-11

historical logging service, 2-23

I

importing graphics, 3-33

K

keyboard, virtual settings, 1-6

keyboard, virtual. *See* virtual keyboard

keypad, virtual, 4-10

L

leading zeroes (table), 2-9

LookoutDirect

- architecture of, 2-2
- automatic process loading, 1-7
- configuration shortcuts, 4-18 to 4-20
- features, advanced tour of, 3-31
- installation of, 1-2
- installing, 1-3
- navigation in, 5-25
- overview, 2-1 to 2-2
- starting, 1-7, 4-1 to 4-3

LookoutDirect screen

- control panels, 4-8 to 4-9
- illustration of, 4-3 to 4-4
- menu bar, 4-4
- operator input, 4-10 to 4-11
- status bar, 4-4
- title bar, 4-4
- workspace, 4-5

loop-driven applications, compared with event-driven processing, 2-19 to 2-20

M

menu bars

- overview, 4-4

mouse shortcuts, 4-18

multimedia service, 2-22

N

name, computer setting of, 1-5

normal control panels, 4-8

numeric constants, 2-8

numeric data members, 2-7

- absolute dates and times (table), 2-12

- constants for, 2-8

- exponential/scientific notation (table), 2-10

- fractional numbers with trailing zeroes (table), 2-10

- general numeric format (table), 2-9

- hexadecimal formats (table), 2-11

- leading zeroes (table), 2-9

- time or time signals, 2-8 to 2-9

- time period (table), 2-11 to 2-12

numeric signal, format (table), 2-9

O

object classes

- definition, 2-4

- global, 2-4

- overview, 2-4

object databases

- database service, 2-22

object parameters

- connecting to data members, 5-35

- definition, 2-4
- overview of, 2-4
- objects
 - adding to process, 3-4
 - connecting, 3-8
 - data members to data members, 5-36 to 5-39
 - data members to parameters, 5-35
 - example (figure), 2-16
 - identifying object data members, 5-36
 - overview, 2-16 to 2-18
 - selecting target object (note), 5-34
 - supervisory control, 2-18
 - copying and pasting (note), 5-32
 - creating, 5-28 to 5-33
 - steps for, 5-28 to 5-32
 - tagnames for, 5-32
 - databases and data members, 2-5
 - definition, 2-2 to 2-3
 - functionality, 2-4
 - remembering names of, 4-19
 - selecting, 5-28, 5-28
 - tagnames. *See* tagnames
- ODBC
 - LookoutDirect ODBC service, 2-23
- operator input, 4-10 to 4-11
- options, system settings, 1-5
- P**
- Panel object class
 - See also* control panels
- passive notification system, 2-19
- popup control panels, about, 4-8
- power failure, automatic process loading after, 1-7
- process data logging, 3-36
- process development, overview of, 5-23
- process files
 - definition, 4-15
 - loading automatically, 1-7
 - opening, 4-2 to 4-3
 - purpose and use, 4-15
- process, creation of, 5-26
- process, starting new, 3-2
- R**
- redundancy
 - LookoutDirect redundancy service, 2-24
- related documentation, 1-2
- requirements, system, 1-3
- S**
- scientific notation (table), 2-10
- security
 - level, settings for, 1-6
 - LookoutDirect security service, 2-23
- Select Object Class list box (figure), 5-29
- selecting objects, 5-28
- serial communications
 - LookoutDirect serial port communication service, 2-21
- settings, system options, 1-5
- source code file, definition of, 4-16
- starting LookoutDirect, 4-1 to 4-3
- state file
 - purpose and use, 4-17
- status bar, 4-4
- Switch object class
 - data members (table), 2-6
 - overview, 2-5 to 2-6
- \$\$System global object
 - created automatically, 2-4
- System requirements, 1-3
- T**
- tagnames
 - characters allowed in tagnames, 5-32
 - definition, 5-32
 - remembering, 4-19
 - valid names for (example), 5-33
- time
 - absolute dates and times (table), 2-12
 - stored as numeric values, 2-8
 - time period constants (examples), 2-8
 - time periods (table), 2-11 to 2-12

Index

title bars

 overview, 4-4

trailing zeroes (table), 2-10

V

virtual keyboard

 enabling, 4-10

virtual keypad, 4-10

W

workspace, 4-5

Z

zeroes

 fractional numbers with trailing zeroes
 (table), 2-10

 leading zeroes (table), 2-9