5

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 Lookout*Direct*.

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 Lookout*Direct* 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) Lookout*Direct* files to retitle 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 Lookout*Direct*. 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 Lookout*Direct* 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*, Lookout*Direct* server processes are run on computers with physical connections to your hardware. Lookout*Direct* clients run on computers that can communicate with the computers running Lookout*Direct* servers.

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

Lookout*Direct* Navigation

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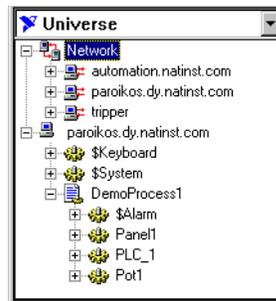
Each computer registered as running Lookout*Direct* appears in this dialog box. Clicking on the computer to open the full display reveals the processes currently running on that computer. Clicking on a particular process reveals all the objects in that process that you can access.

The pull-down combo box at the top of such displays indicates the root location. To display all the computers registered as running Lookout*Direct* 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 Lookout*Direct* computers, any specific computer in the network, or any process as the root by right-clicking on that node and selecting **Make Root**.

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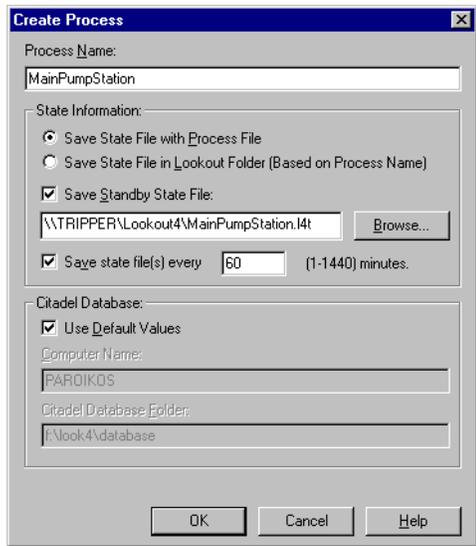
See Chapter 4, *Networking*, in the *LookoutDirect Developer's Manual* for more information on registering computers and navigating through Lookout*Direct* processes on your network.

Creating A Lookout*Direct* 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 Lookout*Direct* process name in the **Process Name** field. This name must follow the same conventions as a Lookout*Direct* object name. See the *Object Names* section for detailed information on Lookout*Direct* 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 Lookout***Direct* **Folder** to save the state file in the Lookout*Direct* folder of the copy of Lookout*Direct* your 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 Lookout*Direct* 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, Lookout*Direct* uses the default location set in the **System Options** dialog box of any instance of Lookout*Direct* running the process.

   - If you enter a computer name and a path on that computer to a specific folder, Lookout*Direct* 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 Lookout*Direct*, ask yourself which object does what you need done.

Lookout*Direct* has many object classes with obvious uses, such as push buttons, switches, and trend displays. Other Lookout*Direct* 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 Lookout*Direct*.

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 Lookout*Direct* functionality. You can find a list of these descriptions in Appendix A, *LookoutDirect Object Descriptions.*

After you become familiar with the Lookout*Direct* 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 Lookout*Direct* object.

1. Open or create a new process if one is not already open in Lookout*Direct*. 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 Lookout*Direct*:
   - Select **Object»Object Explorer** from the menu to activate the Lookout*Direct* 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 Lookout*Direct* 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
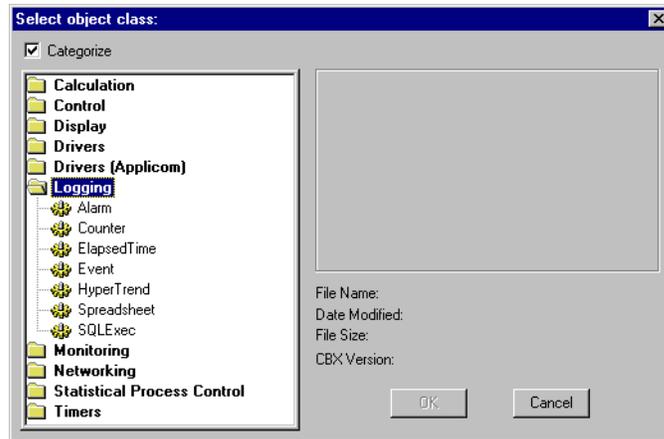   illustration.

Figure 5-1. Select Object Class Dialog Box

The first time you create a Lookout*Direct* 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
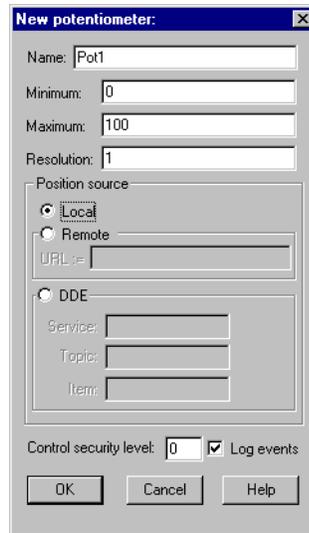example for creating a Pot object.

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 Lookout*Direct* 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 Lookout*Direct* 4.0. If you are accustomed to developing processes in earlier versions of Lookout*Direct*, 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 Lookout*Direct*, 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 Lookout*Direct* earlier than Lookout*Direct* 4.0. In general, the TCP/IP networking built into Lookout*Direct* 4.0 and greater is more efficient and easier than DDE networking. If you are maintaining an old Lookout*Direct* 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 Lookout*Direct* object classes with special functionality).

   Some objects, like Pots, can be displayed on a control panel. When you create such an object, Lookout*Direct* 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 Lookout*Direct* 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.
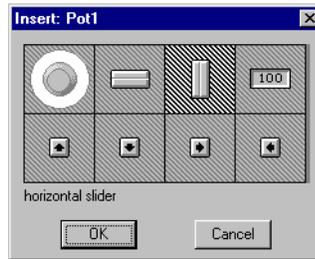

Figure 5-3. Pot Display Dialog Box

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 Lookout*Direct* 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 Lookout*Direct* Object Explorer.

Object Names

A name is how you identify a specific object. You must assign each object a unique name. Lookout*Direct* 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.
*   Lookout*Direct* recognizes uppercase and lowercase characters as the same character, so SW2 and sw2 are the same name.
*   Names cannot be Lookout*Direct* 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 Lookout*Direct*, 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 Lookout*Direct*, 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 Lookout*Direct* control or symbolic link, or as a trace item for a HyperTrend object.

You can make these Lookout*Direct* 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 Lookout*Direct* 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 Lookout*Direct* 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 Lookout*Direct* 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.
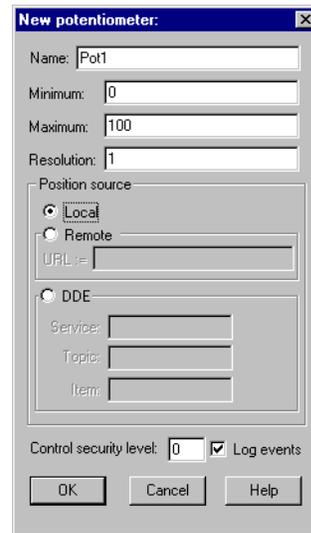
Next you might create an Average object. Connect the potentiometer numeric signal to the **Data** parameter by entering Pot1 as the Average object's **Data** parameter. The Average object calculates the average level of Pot1 over time, as described in the Average object definition in Lookout*Direct* help or the *LookoutDirect Object Reference Manual*.
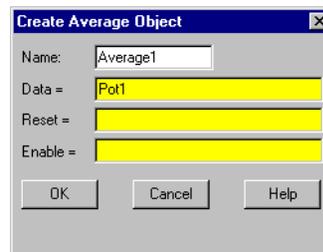
This is the simplest case for making a direct connection in Lookout*Direct*; connecting the input for one object to the output of an object in the same process. In many cases you will have to connect objects in one process to objects in another process on the same computer, or on another computer on

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.
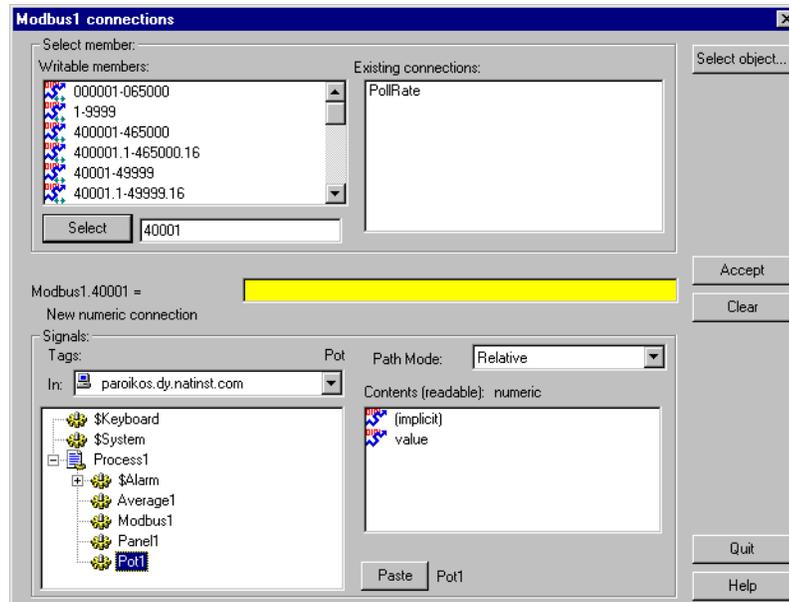
Connecting Data Members to Data Members

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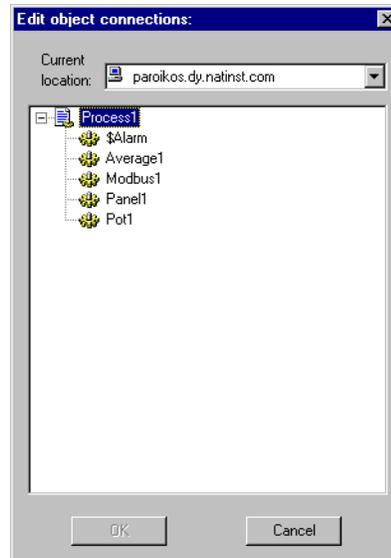
The **Current location** combo box at the top of this dialog box should show your computer as root. See the *LookoutDirect Navigation* section for more information on how to set the root in a LookoutDirect dialog box.

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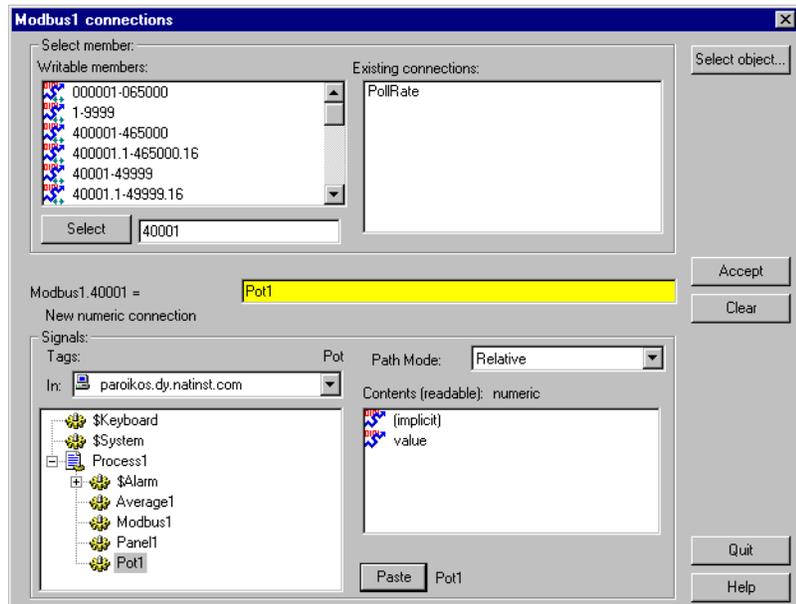
Notice that the data type of the data members you have selected are displayed to help you make sure you are connecting like type to like type. Notice too that you can easily edit existing connections by clicking on the list in the **Existing connections** field.

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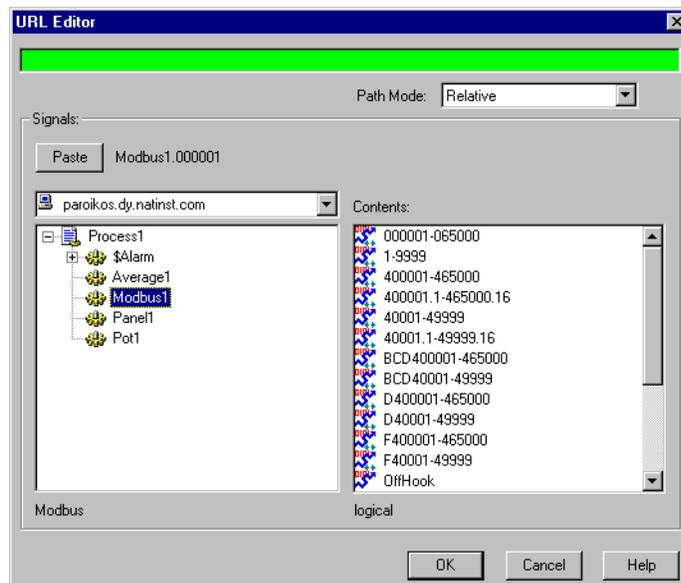
You can use the tree view in the left window to locate the object you want, and select the data member in the right window. Click on the **Paste** button to insert the complete string into the URL field.

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 Lookout*Direct*.

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

Lookout*Direct* Symbolic Link objects have several important uses in
Lookout*Direct*. *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 Lookout*Direct* 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 Lookout*Direct* process created in a version earlier than Lookout*Direct* 4.0, Lookout*Direct* 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 Lookout*Direct* 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.
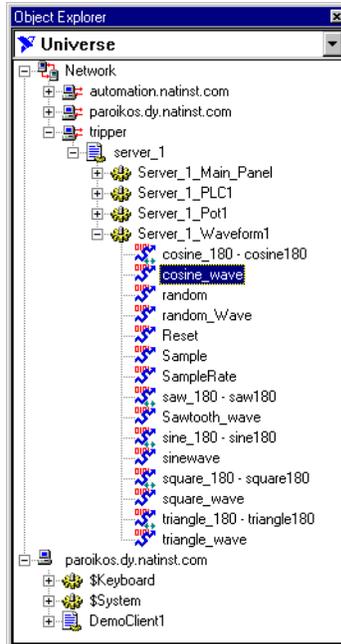
3. Drag and drop the data member onto the panel you want the data to display in. Lookout*Direct* inserts an expression to display the data. You may have to adjust the size of the display for the data to appear properly.

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 Lookout*Direct* menu bar. The **Insert
Expression** dialog box appears as shown in the following illustration.
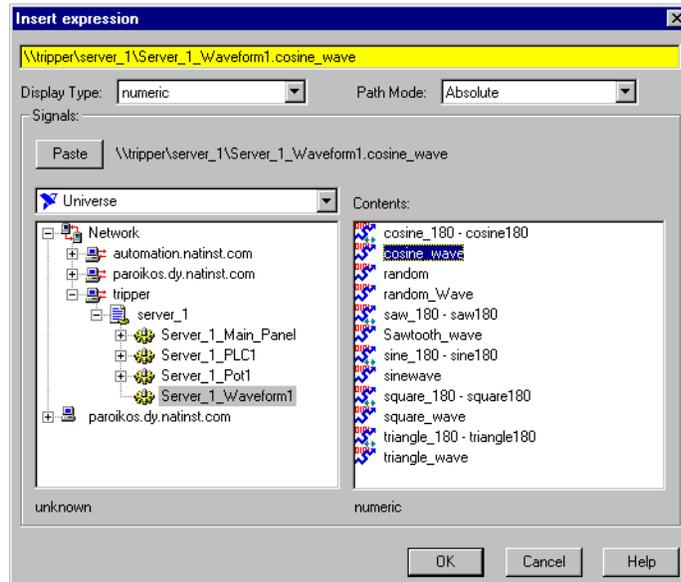
5.   Navigate to the data member you want to display, just as you did with the
     Object Explorer.

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**.

     Lookout*Direct* 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 Lookout*Direct*
     Waveform object.
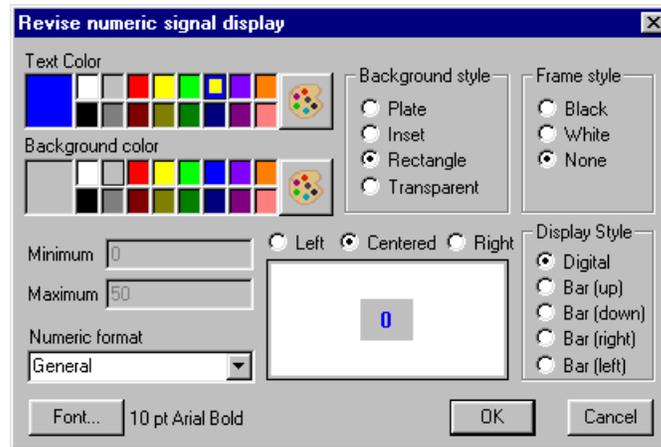
Select the display parameters you want, and click on **OK**.

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.