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LabVIEW™

LabVIEW Datalogging and Supervisory Control Module Run-Time Manual

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Conventions

This manual uses the following conventions:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a tip, which alerts you to advisory information.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.
`monospace italic`	Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

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1 Introduction

The LabVIEW Datalogging and Supervisory Control (DSC) Module Run-Time System provides an environment to run applications developed with the LabVIEW DSC module.

Use the LabVIEW DSC module applications to change setpoints or send control instructions to individual devices while monitoring the entire system. The LabVIEW DSC module provides the following features and capabilities:

- Configuration utilities
- Real-time database
- Historical data collection and trending
- Alarm and event reporting and logging
- Security
- Connection to PLC and industrial device networks
- OPC server and client
- Connection to a wide selection of device servers

You cannot edit the VIs used to create the Human Machine Interface (HMI) of an application with the LabVIEW DSC Module Run-Time System. The system consists of a set of VIs for the HMI and supporting LabVIEW functionality, the definition of all data points in the system (tags), and the configuration of the servers that provide data to LabVIEW and the application.

This manual does not describe the specific nature of the application you might be running in the LabVIEW DSC Module Run-Time System. Instead, it describes the features of the LabVIEW DSC module, its architecture, execution system, and configuration tools. The developer of your application might provide additional documentation for the application. Consult the application developer for specific questions about your application.

Related Documentation

Select **Help»Datalogging and Supervisory Control** to access the *LabVIEW Datalogging and Supervisory Control Module Run-Time System Help*.

The application developer might include online help specific to your application. Refer to your application documentation or check with the application developer for more information about the availability of application-specific online help.

Utilities

Tag Utilities Toolbar

Use the **Tag Utilities** floating toolbar to open other LabVIEW DSC module utilities without selecting them through the menus. Select **Tools» Datalogging & Supervisory Control»Show Toolbar** to display the **Tag Utilities** toolbar.

Tag Configuration Editor

Use the Tag Configuration Editor to create, edit, or delete all of the tags in the LabVIEW DSC module system and to configure Tag Engine parameters. Select **Tools»Datalogging & Supervisory Control» Configure Tags** to open the Tag Configuration Editor.

Caution Editing or deleting tags might cause the application to function incorrectly. Before you make any changes to the configuration (`.scf`) file, contact the application developer.

The Tag Configuration Editor records all tag information and Tag Engine parameters and stores this information in a configuration (`.scf`) file. The Tag Engine reads this file to determine all of the configuration parameters for execution.

Tag Monitor

Use the Tag Monitor to monitor the value, timestamp, alarm state, and connection status for selected tags in the system and to write the value to an output or input/output tag. Select **Tools»Datalogging & Supervisory Control»Monitor Tags** to open the Tag Monitor.

Note Your application might not allow access to the **Tools** menu. If you require access to this menu, contact the application developer.

Tag Engine

The Tag Engine runs as a separate application, independent of the HMI application. Both the device servers and the HMI application communicate with the Tag Engine. Select **Tools»Datalogging & Supervisory Control» Launch Engine** to start the Tag Engine.

The Tag Engine performs the following tasks for the LabVIEW DSC module:

- Starts and stops device servers
- Scales and initializes data
- Processes alarms
- Logs alarms and events to the Citadel historical database
- Logs historical data

Servers and the HMI application send data to the Tag Engine. The Tag Engine logs data to the Citadel historical database and maintains the real-time database.

Citadel Historical Database

Citadel is a National Instruments database used by the LabVIEW DSC module, Lookout, and other National Instruments products. It efficiently stores data acquired and processed by applications.

Refer to Chapter 5, *Historical Data Logging and Extraction*, for more information about the Citadel database.

Classic Historical Trend Viewer and Historical Data Viewer

Use the classic Historical Trend Viewer (HTV) to view the data stored in any Citadel database. The Historical Data Viewer is another way to view and manage Citadel data. It exists outside of the LabVIEW environment, in the Measurement & Automation Explorer (MAX) environment, and requires no programming. Select **Tools»Datalogging & Supervisory Control»View Historical Data** to open the HTV or Historical Data Viewer.

Refer to the *Viewing Historical Data* section of Chapter 5, *Historical Data Logging and Extraction*, for more information about these options.

Real-Time Database

The real-time database (RTDB) is a snapshot of the current state of all tags defined in the active `.scf` file. The RTDB stores the tag values, status, date, time, and alarm information. When you read and write tags and acknowledge alarms, the Tag Engine updates the RTDB.

User Account Manager

Use the User Account Manager to set up and edit individual accounts for users and groups of users who use either the LabVIEW DSC module or the applications you create with it. Use the User Account Manager to create an account for a user, assign a password, control how long the password is valid, set the security level for that user, and determine which security group or groups that user belongs to.

Select **Tools»Datalogging & Supervisory Control»Security»Edit User Accounts** to open the User Account Manager.

Refer to the *Creating and Editing User and Group Accounts* section of Chapter 6, *Security*, for more information about the User Account Manager.

Server Browser

In the LabVIEW DSC module, a *device server* is an application that communicates with and manages I/O devices such as PLCs, remote I/O devices, remote Tag Engines, and data acquisition (DAQ) plug-in devices. These servers read selected input items and write to them on demand. Refer to Chapter 2, *Servers*, for more information about device servers.

Use the Server Browser to see the device servers in a computer and in other computers on the network. You can view server information and display the front panel of VI servers (if the server is running), launch server configuration software for compatible servers, change OPC settings, and unregister a server. Select **Tools»Datalogging & Supervisory Control» Advanced»Server Browser** to open the Server Browser.

Customizing Your Work Environment

Complete the following steps to customize your work environment and to set startup options. Refer to the LabVIEW documentation for more information about customizing the LabVIEW work environment.

1. Select **Tools»Datalogging & Supervisory Control»Options** to display the **Options** dialog box.
2. Select among the options on the **Environment**, **Startup**, and **Advanced** tabs.

   To view descriptions of these options, press <Ctrl-H> and move the cursor over any field.
3. Click the **OK** button.

2

Servers

In the LabVIEW Datalogging and Supervisory Control (DSC) module, a *device server* is an application that communicates with and manages I/O devices such as PLCs, remote I/O devices, remote Tag Engines, and DAQ plug-in devices. These servers read selected input items and write to them on demand.

The LabVIEW DSC module applications you run with the LabVIEW DSC Module Run-Time System might require one or more servers. Check with the application developer for information about any server software you might need to install and configure for your application to run.

The LabVIEW DSC module can connect to any OPC-compliant server and to many third-party device servers. You also can connect to National Instruments servers, including National Instruments DAQ and FieldPoint servers.

A server *item* is a channel, I/O point, or variable in a hardware device. You connect to these items with tags. Device servers monitor the values acquired by the hardware and the Tag Engine updates the tags when the server sends new data to the Tag Engine. Servers also update each output when the HMI application writes that tag value, and they handle and report communications and device errors. A good device server covers all device- and hardware-specific details, thereby establishing a device-independent I/O layer for the LabVIEW DSC module. Many device servers include a configuration utility as well as the run-time application that communicates with the Tag Engine.

When a LabVIEW DSC module application runs, it determines from the configuration (`.scf`) file which servers are needed and which items are needed from those servers. The LabVIEW DSC module launches each server it needs and monitors the specific items of interest through the Tag Engine.

The LabVIEW DSC module also can function as an OPC server and as a data source for the Logos networking protocol.

A server is not the same as a device driver or an instrument driver. In general, an instrument driver is a software component that is designed to control a programmable instrument such as a multimeter. A device driver is typically a low-level software component that a computer needs to work with a plug-in interface. Such a driver also can function as a server if it meets certain standards, such as the OPC specification.

Server Types

The LabVIEW DSC module supports several types of servers including the following:

- **OPC servers**—Compliant with version 2.0 of the OPC Data Access specification, as defined by the OPC Foundation.
- **DDE servers**—Any server that supports the Dynamic Data Exchange (DDE) server interface. Refer to the *Using DDE Servers with the LabVIEW DSC Module* section for more information about DDE servers.
- **IA device servers**—A type of server developed by National Instruments. IA device servers have two implementations—VI-based and DLL-based.
  - **VI-based servers**—Use VIs to provide data to the Tag Engine.
  - **DLL-based servers**—Also known as IAK device servers or Industrial Automation Servers (IAS).

You also can use servers provided by a third-party hardware manufacturer.

IAK Servers

For those who have used BridgeVIEW and the IAK servers in the past, the LabVIEW DSC module still supports the use of IAK servers. However, National Instruments (NI) recommends upgrading to OPC servers.

To be compatible with future Windows versions, NI recommends that you use OPC servers, specifically the OPC servers for NI-DAQ (including SCXI), National Instruments FieldPoint, and National Instruments FOUNDATION Fieldbus. Refer to the *LabVIEW Datalogging and Supervisory Control Notes to BridgeVIEW Users* PDF document installed with the LabVIEW DSC module (`labview6\manuals\bv_note.pdf`), for more information about server compatibility and server strategies for the future.

You can purchase separately the National Instruments Servers CD, which includes the Lookout Protocol Drivers OPC server. You can use the Lookout Protocol Drivers OPC server to connect to a wide variety of devices through the OPC interface protocols. These devices include Allen-Bradley, Siemens, Modbus, and more. The Lookout Protocol Drivers OPC server also includes a large number of reliable, time-tested, and field-proven Lookout drivers. You can use these Lookout drivers to replace IAK servers, if necessary. The National Instruments Servers CD also includes a patch allowing IAK servers to run in Windows 2000. This patch is provided for backwards compatibility only, without the guarantee that IAK servers can continue to work in future Windows versions.

Installing and Configuring Servers

After you select the device servers to use with your hardware, install and configure them according to the server documentation or your application documentation.

For many servers, you must use the device server configuration utility to configure how the server monitors items, including how often it polls the devices and other server-specific and device-specific parameters.

Registering and Unregistering Servers

You might need to register your device servers manually for the LabVIEW DSC module to access them.

Registering OPC Servers

If a server complies with the OPC specification, it should register itself according to that specification. If an OPC server does not appear in the **Servers** listbox in the Tag Configuration Wizard, refer to the server documentation for information about registering the server.

Note If you change the server registration while the Tag Configuration Editor is open, the change does not appear in the **Servers** listbox. To update the **Servers** listbox while the Tag Configuration Editor is open, select **Servers»Refresh**.

Registering DDE Servers

You do not need to register DDE servers.

Registering VI-Based Servers

VI-based servers include a VI you use to register the server. Before you can use a VI-based server, you must run this registration VI.

The LabVIEW DSC module installs VI-based servers, which are the servers used in the LabVIEW DSC module examples. These servers include the tanks server, the SIM server, and the cookie server and are in `labview\examples\lvdsc\servers`.

These servers should already be registered. If they do not appear in the **Servers** listbox in the Tag Configuration Wizard, complete the following steps to manually register the server.

1. Open the server registration VI in `labview\examples\lvdsc\servers`. For example, open the Register Tanks Server VI to register the tanks server.
2. Run the VI.
3. Close the VI.
4. Repeat steps 1 through 3 for each server you need to register.

If you are writing VI-based device servers, refer to these server registration VIs for examples of registering your servers.

Unregistering a Device Server

You can unregister an OPC server only by uninstalling the server software.

You can usually unregister VI-based or IAK servers in the Server Browser. Do this only if no tags are configured to use that server and you no longer want to access any items defined by the server. After you unregister a server, you can no longer connect to it from the LabVIEW DSC module and any tag configured to use that server no longer has a valid configuration. After you unregister a device server, you must run the server configuration utility and register it to use it with the LabVIEW DSC module again.

Complete the following steps to unregister a VI-based or IAK device server.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).
2. Select the server you want to unregister.
3. Click the **Unregister Server** button.
4. Click the **Close** button.

Refer to the server documentation for information about unregistering third-party servers.

Launching Server Configuration Utilities

When you register a VI-based or IAK device server in your system, the LabVIEW DSC module also registers the location of its configuration utility, if possible.

Note On Windows 2000/NT/XP, you might need to log in as an administrator to access server configuration utilities.

Complete the following steps to use the Server Browser to open these same configuration utilities, when available.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).
2. Select the server you want to configure in the **Servers** listbox.
3. Click the **Run Server Configuration** button. If no configuration utility is associated with that server, the **Run Server Configuration** button is dimmed.

You also can open registered server configuration utilities from the Tag Configuration Editor by selecting **Servers»*Server Name* Configuration**, where ***Server Name*** is the name of the server.

Viewing Server Information

Use the Server Browser to view information about the device servers in your system and on the network. You also can use the Server Browser to view certain properties of OPC and VI-based servers.

You also can use the Engine Manager to view information about servers in use.

Viewing Information about All Servers

Complete the following steps to use the Server Browser to view information about all servers.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).

2. Select a server in the **Servers** listbox. The symbol to the left of the server name indicates the following information:
   - A black diamond indicates that the server is loaded and running.
   - A white diamond indicates that the server is loaded but not running.
   - No symbol indicates that the server is not being used in the current tag configuration.
3. Click the **View Server Information** button. A **Server Information** dialog box appears.

   This dialog box varies based on the type of server you selected and displays general information about the server, devices, and server items. If the Server Browser does not find any devices or items, a checkmark appears in the **No devices found** or **No items found** checkbox, respectively.

   OPC servers have an optional Server Browse Address Space Interface. If a server supports this interface, the LabVIEW DSC module can query it to find which items are available from the server and display them in this dialog box.
4. Select a parameter in the **Sort By** pull-down menu to sort this table by item name, data type, or direction.

Viewing Information about Running Servers

Complete the following steps to use the Engine Manager to view information about running servers.

1. Open the Engine Manager (with the Tag Engine running, **Tools» Datalogging & Supervisory Control»Launch Engine»Show**).

2. Click the **View Servers in Use** button in the toolbar, shown at left. The **Servers In Use** window appears, listing the servers currently running and supplying data to the Tag Engine.
3. Select a server in the **Server** column. If the server is VI-based, click the **Show** or **Hide** button to show or hide the front panel of the server.
4. Click the **Details** button. A **Server Information** dialog box appears.

   This dialog box varies based on the type of server you selected and displays general information about the server, devices, and server items. If the Server Browser does not find any devices or items, a checkmark appears in the **No devices found** or **No items found** checkbox, respectively.

OPC servers have an optional Server Browse Address Space Interface. If a server supports this interface, the LabVIEW DSC module can query it to find which items are available from the server and display them in this dialog box.

You can select a parameter in the **Sort By** pull-down menu to sort the information by item name, data type, or direction.

Testing a Server

Complete the following steps to use the Server Browser to make sure your servers are properly installed and configured.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).
2. Check the **Servers** listbox to see if your server is listed. If it is not, skip to step 4.
3. Double-click the server to display the **Server Information** dialog box. If the items on that server appear in the dialog box, you successfully installed and configured the server. If the server items do not appear, continue to step 4.
4. Use the configuration utility for that server to check the installation and configuration.

After you configure the tags and save them, complete the following steps to make sure the server is providing data properly.

1. Start the Tag Engine.
2. Open the Tag Monitor.
3. Use the Tag Monitor to connect to tags.
4. Make sure the data values and timestamps change.
5. If you cannot get live data with the Tag Monitor, use the configuration utility for that server to check the installation and configuration.

Accessing OPC Servers Using the LabVIEW DSC Module as an OPC Client

The LabVIEW DSC module can function as an OPC client and communicate with any server implementing the OPC Foundation OPC server interface, which is a Microsoft COM-based standard. The LabVIEW DSC module finds all OPC servers installed on your computer and reads any available information about the server capabilities and items directly from the server.

Configuring the LabVIEW DSC Module OPC Client

You might need to configure the LabVIEW DSC module OPC client for the following reasons:

- If the server does not support asynchronous communication, you can force the client to use synchronous communication.
- If the server has many OPC items, you can increase the maximum number of items that display while you browse the server.
- If you perform many writes to the server and receive an output queue overflow, you can increase the length of the OPC write queue, which contains requested but not completed asynchronous writes to the OPC server.

Complete the following steps to configure the LabVIEW DSC module OPC client.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).
2. Click the **OPC Client Settings** button.
3. Complete the following steps to use synchronous communications with an OPC server.
    a. Click the **View All** button to display the **View All OPC Servers** dialog box.
    b. Select the server(s).
    c. Click the **Add** button. You also can type the server name in the textbox next to the **Add** button and click the **Add** button.
4. Change the **OPC Items in Browse** value to change the maximum number of OPC items that display while you browse an OPC server.
5. Change the **OPC Write Queue** to change the maximum length of the OPC write queue.

Accessing Remote OPC Servers through the LabVIEW DSC Module

You can use the LabVIEW DSC module to access OPC servers running on other computers on the network. Use this method to access remote OPC servers so you can access different instances of the same server, such as National Instruments DAQ OPC, running both on your local computer and on the remote computer.

Complete the following steps to use the LabVIEW DSC module to access remote OPC servers.

1. Open the Server Browser (**Tools»Datalogging & Supervisory Control»Advanced»Server Browser**).
2. Click the **Network OPC Servers** button to display the **Browse OPC Servers on Network** dialog box.

   (You could also open the Tag Configuration Editor and select **Servers» Browse Network OPC Servers** to display the **Browse OPC Servers on Network** dialog box.)
3. In the **Network** listbox, navigate to the OPC server you want to access.
4. Select the server and click the **Add Server** button.

   The server appears in the **Registered Remote OPC Servers** listbox. Select a server and click the **Remove Server(s)** button to remove a server from this listbox.

   If you receive an error while connecting to the server, run the `dcomcnfg.exe` Windows utility on the remote computer to configure OPC security options to allow your computer access to launch and connect to the remote computer. For more troubleshooting information, refer to the NI Developer Zone resources at `ni.com/zone`.

Accessing Remote OPC Servers with dcomcnfg.exe

If necessary, you can use the `dcomcnfg.exe` Windows utility to configure an OPC server to run on a remote computer rather than your local computer. However, if you use `dcomcnfg.exe` to select a remote server, you can run only one version of that server, either locally or on one remote computer. You cannot use the same server on more than one computer. Refer to the *Accessing Remote OPC Servers through the LabVIEW DSC Module* section for more information about accessing different instances of the same server.

Complete the following steps to configure an OPC server to run remotely.

1. Make sure `dcomcnfg.exe` is installed on your computer.
2. Run `dcomcnfg.exe`.
3. Click the **Applications** tab.
4. Select the OPC server in the list.
5. Click the **Properties** button to display the **Properties** dialog box.
6. Click the **Location** tab.
7. Remove the checkmark from the **Run application on this machine** checkbox and place a checkmark in the **Run application on the following computer** checkbox.
8. Type the name of the remote computer or click the **Browse** button to navigate to it.
9. Click the **OK** button.
10. Click the **Default Properties** tab and set the following options.
    a. Place a checkmark in the **Enable Distributed COM on this computer** checkbox.
    b. Set the **Default Authentication Level** to **Connect**.
    c. Set the **Default Impersonation Level** to **Identify**.
11. Click the **Default Security** tab.
12. Click the **Edit Default** button. Make sure that the computer on which you want to launch the OPC server is allowed to access your computer. This is necessary for the remote computer to call the LabVIEW DSC module on your computer when supplying OPC values.

Connecting to Data Published by LabVIEW Real-Time

You can configure a host computer's DataSocket server for use with LabVIEW RT. In this case, LabVIEW RT publishes its real-time data to the DataSocket server on the host machine. You can then use the LabVIEW DSC module to create tags that connect to the data in the DataSocket server running on the host computer.

Using Other Remote Servers

With the Logos networking protocol, you can access data from any LabVIEW DSC module application, Lookout application, or FieldPoint Ethernet module running on computers in your network.

To access LabVIEW and Lookout applications as servers, you must register the computers on which they are running. Refer to the *Registering Networked Computers* section of Chapter 7, *Networking and Running Applications*, for more information about registering computers.

Using DDE Servers with the LabVIEW DSC Module

The LabVIEW DSC module can communicate with any server using DDE as its interface. A DDE server is a simple server in which you type a device and item string to select a specific data point to which to connect.

Third-party DDE servers do not register themselves with the LabVIEW DSC module. Therefore, the LabVIEW DSC module cannot start the DDE server automatically when it runs the HMI application. To use a DDE server, start or run the DDE server before you start the Tag Engine. The LabVIEW DSC module returns system error messages if it cannot connect to the DDE server when it starts the Tag Engine. Thereafter, it attempts to reconnect to the DDE server periodically.

3

Using Tags to Manage I/O in LabVIEW

In the LabVIEW Datalogging and Supervisory Control (DSC) module, you use a *tag* to create and maintain a connection to a real-world I/O point. You also can use a *memory tag* for data held by your application that you need to use or track. A *network tag* is a tag remotely connected to any type of tag on another Tag Engine.

The tasks you perform through tags depend on how you configure the tag attributes. Tag attributes include how the data a tag reports are scaled; whether, where, and how a tag is logged to a historical database; and alarm levels and priorities for the tag data.

In addition, you can organize tags into logical groups for convenience and efficiency, configure the tag data type, set initialization values, set separate deadbands for logging or updating data, attach units of measurement to data, attach an alarm message to a tag whose values enter the alarm ranges you set, and set alarm deadbands separate from the logging and update deadbands.

You perform tag management in the Tag Configuration Editor, which you access by selecting **Tools»Datalogging & Supervisory Control» Configure Tags**. Before you create or configure tags, you must install and configure your servers. Refer to Chapter 2, *Servers*, for more information about installing and configuring servers.

The application developer configures the tags for your application. However, you might have to adjust or maintain the tags, as described in this chapter.

Configuration Files

After you create tags and configure their attributes, you save that information in a configuration (`.scf`) file. Any LabVIEW DSC module utility that needs tag information uses the `.scf` file. These utilities include the Tag Engine, Tag Monitor, and HMI Wizard, which generally access the `.scf` file to find a list of active tags and other configuration information.

The `.scf` file does not contain any information about the VIs in the HMI. In fact, it does not need to be specific to any single application. Multiple applications can run concurrently if they use the same `.scf` file.

Changing the Active SCF File

With the exception of the first time you run the LabVIEW DSC module, the active (default) `.scf` file is the last `.scf` file you saved with the Tag Configuration Editor. The Tag Configuration Editor opens the active `.scf` file by default and the Tag Engine accesses the active `.scf` file by default.

Complete the following steps to change the active `.scf` file.

1. Select **Tools»Datalogging & Supervisory Control»Options**.
2. Click the **Environment** tab.
3. Change the **Default SCF** value.

   This change could take effect immediately, depending on the options you select in the **Options** dialog box.

Creating Tags

You can create tags in the following ways:

- Generate tags automatically in the Tag Configuration Wizard.
- Create tags manually in the Tag Configuration Editor.

Note You must create DDE server connections manually in the Tag Configuration Editor, instead of in the Tag Configuration Wizard.

Note You might not be able to create new tags because you cannot modify your application. However, you might find it necessary to modify the attributes of a tag using the same tools you use to create a tag.

Generating Tags Automatically

Use the Tag Configuration Wizard to generate tags from the server information if you want the Tag Engine to monitor a large number of I/O points in your system. When you run the server configuration utilities for the servers on your system, you can define devices and items for the I/O points that the servers monitor and control. You can then generate tags from these server items in the Tag Configuration Wizard.

The wizard uses the tag name, data type, I/O group, I/O connection, and scaling attributes for each server item to create the tags. For IAK and VI-based servers, the wizard reads server information from the Common Configuration Database (CCDB). For OPC servers that support the Server Browse Address Space Interface, the wizard reads server information by browsing the server address space. The wizard uses the default tag attributes to configure the remaining attributes. You can change the default tag attributes in the Tag Configuration Wizard by clicking the **Set Tag Defaults** button. Refer to the *Defining Default Values for Tag Configuration Fields* section for more information.

Note You must create DDE server connections manually in the Tag Configuration Editor, instead of in the Tag Configuration Wizard. Refer to the *Creating Tags Manually* section for more information about creating tags in the Tag Configuration Editor.

Complete the following steps to use the Tag Configuration Wizard to generate tags.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Click the **Configuration Wizard** button in the toolbar, shown at left.
3. Expand each server branch in the **Servers** tree view to display the devices and items for one or more servers. If the **Servers** tree view lists item ranges instead of individual item names, skip to step 7.
4. Select the items for which you want to create tags.

   Select a branch in the **Servers** tree view to generate tags for all the items in that branch. Select a server branch to generate tags for all items on that server.
5. (Optional) You can create a tag for a DataSocket item:
   a. Click the **DataSocket** button.
   b. Double-click on **DataSocket Server** to see the items on your local machine, or browse to a networked machine under **Network Neighborhood** and view its DataSocket items.

c. Select the item for which you want to create a tag. Currently, you can create only one tag at a time. The tag created from this item will use the entire URL as its tag name (the "/" will be replaced with "_"), with the data type and access rights shown.

d. Click **OK**.

6. Click the **Add Item(s)** button. The Tag Configuration Wizard moves the selected items to the **Selected Items** listbox.

7. (Optional) Some OPC servers do not list individual item names in their hierarchical tree, but instead provide ranges for item names. This is common when the server contains a large set of items. These item ranges help you create specific item names. The format for the item ranges depends on the OPC server. If your server uses item ranges, complete the following steps to generate tags from an item range.

   a. Select an item range.

   b. Click the **Add as Range** button to display the **Add Items in a Range** dialog box.

   c. Type the starting item name and set the number of items that you want to create.

      The Tag Configuration Wizard creates the item names, incrementing the trailing numbers in the starting item name. If you did not add a trailing number to the starting item name, the Tag Configuration Wizard appends a zero to the first name and increments trailing numbers in each subsequent name.

8. (Optional) The Tag Configuration Wizard uses the tag configuration defaults to set most of the tag parameter values. To change these defaults, click the **Set Tag Defaults** button.

9. (Optional) The Tag Configuration Wizard automatically creates I/O groups for each server and uses the tag configuration defaults to set the I/O group rate and deadband settings. The Tag Configuration Wizard also sets the I/O group name to the server name. Complete the following steps to change the I/O group settings for each server.

   a. Select a server.

   b. Click the **Properties** button to display the **Properties of Tags Generated for Device/Server** dialog box.

   c. Click the **I/O Group** tab.

   d. Select among the I/O group settings.

10. (Optional) The Tag Configuration Wizard sets the tag name to the item name for each tag created. For non-OPC servers that have devices, the tag name contains both the device and item name if the server has more than one device. Follow these steps if you want to change the tag name format for a server.
    a. Select a server.
    b. Click the **Properties** button to display the **Properties of Tags Generated for Device/Server** dialog box.
    c. Click the **Tag Names** tab.
    d. Set the tag name format.
11. To remove individual items from the **Selected Items** listbox, select the items and click the **Remove Item(s)** button. To remove all of the items, click the **Remove All** button.
12. When all the items for which you want to create tags are in the **Selected Items** listbox, click the **OK** button.

    The Tag Configuration Editor creates tags for each item and appends the tags to the current tag configuration (`.scf`) file.
13. (Optional) If you want the changes to be a separate `.scf` file, select **File»Save As** and save the file with a different name.

Creating Tags Manually

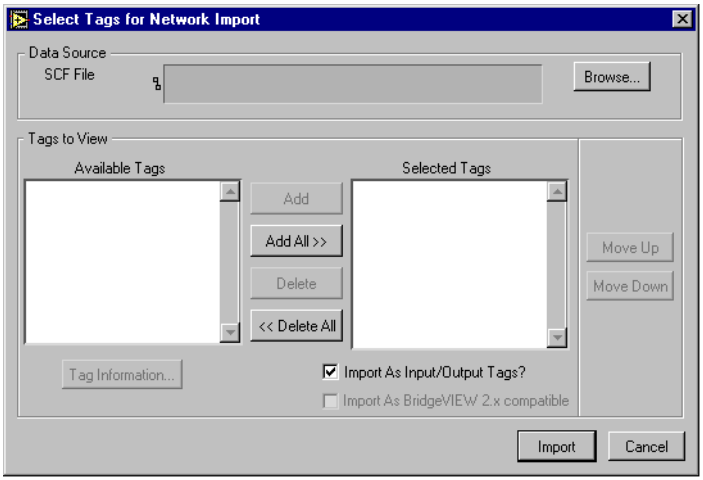
When you generate tags, you can either add them to an existing configuration, or you can create a new configuration file (`.scf`). You can later manually change the configuration of any tag.

1. If you have not already done so, install and configure your server(s) as described in Chapter 2, *Servers*.
2. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
3. Select **Edit»Create** and select the type of tag you want to create. A **Tag Configuration** dialog box appears.
4. Select among the tag configuration options. The tag name must be unique within a given `.scf` file. Refer to the *Configuring Tag Attributes* section for more information about the tabs and fields in this dialog box.
5. Click the **OK** button to create the new tag or click the **Create Next Tag** button to create the new tag and create another tag of the same type.
6. Select **File»Save** to save the changes.

Importing Network Tags

You can import tags into a local `.scf` file from a `.scf` file located on another computer.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **File»Import Network Tags** to display the **Select Tags for Network Import** dialog box.



3. Click the **Browse** button next to the **SCF File** field and navigate to a `.scf` file on any computer on the network.
4. Click the **Add** buttons to add the tags you want to import to the **Selected Tags** listbox.
5. (Optional) To import tags from a remote computer using BridgeVIEW 2.*x* networking, place a checkmark in the **Import As BridgeVIEW 2.x compatible** checkbox. To convert to the Logos networking protocol, do not place a checkmark in this checkbox. National Instruments recommends converting to the Logos networking protocol when possible, but the BridgeVIEW 2.*x* networking option is provided in case you need backward compatibility. Refer to the NI Developer Zone resources at `ni.com/zone` for more information about networking options.
6. Click the **Convert** button to import tags from that file into the local `.scf` file.

Importing Virtual DAQ Channels as Tags

You can create memory tags that use DAQ virtual channel names to incorporate LabVIEW DSC module tags into your existing VI-based DAQ application. Using this method, you can take advantage of the LabVIEW DSC module features such as alarming, logging, and security, without reconfiguring your virtual channels. Follow these steps to import DAQ virtual channels as tags.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **File»Import DAQ Memory Tags**.
3. Click **Add All** or select the DAQ channels you want to import and click **Add**.
4. Click **OK**. You should see memory tags with the same names as your DAQ channels.

Editing Tags

You can edit tags manually or in a spreadsheet.

Editing Tag Configuration Manually

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. Select among the tag configuration options. Refer to the *Configuring Tag Attributes* section for more information about the tabs and fields in this dialog box.
4. Click the **OK** button. A diamond appears next to the tag to indicate it has changed.
5. Select **File»Save** to save the changes.

If you want to update the Tag Engine and any static attributes have been changed, the Tag Engine shuts down and restarts. If you have changed only dynamic attributes in the `.scf` file, the Tag Engine is updated without restarting.

Caution Communication between the Tag Engine and any device server is stopped temporarily when the Tag Engine shuts down and restarts.

Editing Tag Configuration in a Spreadsheet

With the Tag Configuration Editor, you can export tag configuration information to spreadsheet files and import tag configuration information from spreadsheet files. The files are tab-delimited text (`.txt`) files.

If you use spreadsheet files with the Tag Configuration Editor, it is important that you consider the following:

- If you do not select *all* of the fields when exporting data, you lose configuration information when you import it back to the Tag Configuration Editor.
- You can export a subset of information, and then rely on tag default parameters when you import the data back into the Tag Configuration Editor. However, each row in the spreadsheet file must contain the tag name and data type fields, or the import mechanism cannot read it.
- Some configuration parameters, such as those in the **Historical Logging Configuration** and **Event Configuration** dialog boxes, are inherited from the currently open `.scf` file when you import spreadsheet data.
- When importing, you can append the imported tags to the current `.scf` file.
- If you create a spreadsheet file to import as a tag configuration, use the same format as a file created by exporting an existing tag configuration.

Exporting Tag Configuration to a Spreadsheet

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **File»Export** to save the file as a tab-delimited `.txt` file.
3. A dialog box prompts you to select and order the fields you want in the spreadsheet file. If you want to edit the spreadsheet and import the edited data back into the Tag Configuration Editor, click the **All** button to select all available fields. Click the **Default Order** button to restore the order of the fields to the default order.

Importing Tag Configuration from a Spreadsheet

1. Save the spreadsheet as a `.txt` file.
2. In LabVIEW, open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).

3. (Optional) Select **File»New** to open a new `.scf` file for the imported tag configuration.
4. Select **File»Import** and select the `.txt` file to import the data from the spreadsheet.
5. Select **File»Save** to save the changes.

Defining Default Values for Tag Configuration Fields

You can simplify the tag configuration process by defining default values for several fields. These default values are then used when you create tags automatically, such as with the Tag Configuration Wizard or by importing. For example, you might want to set the default to **Log Data** or **Log Events**, or set the log deadband to a particular value by default.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Configure»Default Parameters** to display the **Set Default Parameters** dialog box. You also can click the **Set Tag Defaults** button in the Tag Configuration Wizard to display this dialog box.
3. Set the default values for the parameters listed. Refer to the *Configuring Tag Attributes* section for more information about these parameters.
4. Click the **OK** button.

The default values apply when creating a new tag, importing a tag from a server, or importing a tag from a spreadsheet. In the case of a spreadsheet, a value in the spreadsheet overrides the default value for the field.

Setting Tag Deadbands

A deadband is a filter that eliminates noise from data. Any changes in value from a data point are compared to the previous value, and only if the difference between the new value and the previous value exceeds the deadband does the new value replace the old. Deadbands in LabVIEW DSC module tags are set as a percentage of the value range of a data point.

The Tag Engine uses update deadband and log deadband values to eliminate unnecessary processing on insignificant data value changes. Deadband allows you to define what constitutes a significant change. The Tag Engine ignores an operation if the change in data is not considered significant. You can increase engine throughput by increasing deadband size (though this might compromise data resolution). If you set the update

deadband too high, the RTDB might not be updated. This might result in inadequate historical logging or alarm management. In addition, you can configure a server to apply a deadband to items associated with an I/O group.

Deadbanding Interaction

Three deadband settings are directly under your control when you configure individual tags. The fourth takes advantage of an OPC specification and is consequently subject to how that specification was implemented in a given OPC server.

The three deadband settings that are directly under your control are update deadband, log deadband, and alarm deadband.

The update deadband affects how the Tag Engine updates values in the RTDB. The log and the alarm deadbands both operate on the values contained in the RTDB, that is, values that have passed through the update deadband. If the update deadband is set too wide, under some circumstances, it can interfere with your intended alarm and log settings. A careful analysis of the interaction of your deadbands might be indicated, depending on how critical your requirements are.

The deadband setting that takes advantage of an OPC specification is the OPC server I/O group deadband. This deadband is implemented in the server. This deadband affects values coming from the server before the Tag Engine gets the value, so the effects of a deadband setting here can ripple through the update deadband and the log and alarm deadbands. Also, because items in an I/O group can have different ranges, the percentage you select as a deadband might have different numeric results with different items. Refer to your server documentation before you change OPC server I/O group deadband settings.

Setting Update Deadbands

When you set an update deadband, any new value acquired by the Tag Engine is compared to the existing value held in the RTDB. The new value replaces the existing value in the RTDB only when the difference between the new value and the existing value exceeds the update deadband. You set the update deadband in the tag configuration **Operations** tab.

Example

For a data point with a range of values of 0 to 100, set the update deadband to 1%. The existing value in the RTDB is 12.3. If the Tag Engine reports a new value of 13, the RTDB does not update because the change in value did not exceed the deadband. If the Tag Engine reports a new value of 11, the RTDB updates because the difference is greater than the deadband.

Setting Log Deadbands

When you set a log deadband, the new value in the RTDB is compared to the old value in the RTDB. The new value is logged if it exceeds the log deadband. You set the log deadband in the tag configuration **Operations** tab.

The default setting for the log deadband is 1%.

Example

For a data point with a range of values of 0 to 100, set the logging deadband to 2%. The last value logged was 12.3. When the RTDB updates to 11, the updated value is not logged because it is smaller than the deadband. The value in the RTDB must be greater than 14.3 or less than 10.3 for the data point to be logged.

Setting Alarm Deadbands

When you set an alarm deadband, the new value in the RTDB is compared to the old value in the RTDB. The alarm is triggered when the value falls outside the range of the deadband and is cleared when it reaches the inside range of the deadband. You set the alarm deadband in the tag configuration **Alarm** tab.

Example

For a data point with a range of values of 0 to 100, set a LO condition alarm at a value of 12 with a deadband of 1.5%. Your alarm condition is not triggered to active until the RTDB value drops to 12 or below. The alarm stays active until the RTDB value rises to 13.5 or greater.

Setting I/O Group Deadbands with OPC Servers

When you set a deadband for I/O groups in OPC servers, the OPC server gets the tag value, then filters the tags in the I/O group by deadband before sending the data to the Tag Engine. The Tag Engine can filter data by deadband again before sending the values to the RTDB.

Complete the following steps to set I/O group deadbands.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag in the I/O group for which you want to set deadbands. The **Tag Configuration** dialog box appears.
3. Click the **Connection** tab.
4. Click the **Edit** button located under the **I/O Group** pull-down menu to display the **IO Group Configuration** dialog box.
5. Change the **Update Rate** and **Deadband** values.
6. Click the **OK** button twice.

The percentage you set applies to the range of each individual OPC item, so the actual raw value of the deadband might change from item to item. This I/O group deadband takes place in the OPC server. Settings made in the OPC server might impact the effect of your deadband setting. Refer to your OPC server documentation for more information about that server.

Deleting Tags

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select the tag(s) you want to delete.

3. Click the **Delete Tag** button on the toolbar. A trash can icon appears next to the tags.
4. Select **File»Save** to delete the marked tags. The Tag Configuration Editor removes the tag and its configuration information from the `.scf` file. You still can retrieve historical and event information about the tag, but the Tag Configuration Editor removes information such as the tag description, units, range, and alarm settings.

You can use the **Delete Tag** button in the button bar of the Tag Configuration Editor to undelete tags if all selected tags have a trash can symbol.

Configuring Tag Attributes

Tag attributes set how the Tag Engine handles a tag. There are five categories of tag attributes: General, Connection, Operations, Scaling, and Alarms.

When you create a tag using the Tag Wizard, the Tag Wizard assigns the default values for each tag attribute. Refer to the *Defining Default Values for Tag Configuration Fields* section for more information about setting tag default values.

When you create a tag manually by selecting **Edit»Create** in the Tag Configuration Editor, you can set each attribute in the **Tag Configuration** dialog box that appears.

Complete the following steps to edit the attributes of an existing tag.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. Click the following tabs and select among the options.
   - **General**—Attributes such as tag name, group, and description.
   - **Connection**—Attributes that describe where the Tag Engine sends or receives values for the tag and how to access that data.

     These tags have access rights of input, output, or input/output. Memory tags are not connected to a real-world I/O point; set their **Tag Access** to **Memory**. Refer to the *Determining When to Use Memory Tags* section for more information about memory tags.
   - **Operations**—Attributes that describe additional functionality that the Tag Engine performs on a tag or its values.
   - **Scaling**—Attributes that describe which scaling function is applied to a tag value.
   - **Alarms**—Attributes that describe abnormal process conditions for a given tag.
4. Click the **OK** button.
5. Select **File»Save** to save the changes.
6. Use the Tag Monitor to test the tag configuration and make sure you are reading and writing data properly with your servers. Refer to the *Monitoring and Writing Tag Values* section for more information about using the Tag Monitor.

Tag Data Type

How you configure a tag varies slightly depending on the data type. Tag data types include analog, discrete, bit array, and string tags.

Analog Tags

An *analog tag* is a continuous value representation of a connection to a real-world I/O point or memory variable. This type of tag can vary continuously over a range of values within a signal range.

Use an analog tag when you want to express a continuous value (for example, 0 to 100).

Discrete Tags

A *discrete tag* (Boolean control or indicator in LabVIEW) is a two-state (ON/OFF) value representation of a connection to a real-world I/O point or memory variable. This type of tag can be either a 1 (TRUE) or a 0 (FALSE).

Use a discrete tag when you want to express a two-state (ON/OFF) value.

Bit Array Tags

A *bit array tag* is a multi-bit value representation of a connection to a real-world I/O point or memory variable. This type of tag can be comprised of up to 32 discrete values.

Use a bit array tag when you have a multi-bit value in which each of the bits represents a flag or single value that is turned on or off. The maximum length of a bit array tag is 32.

LabVIEW stores a bit array as a number (which is what displays in the Tag Monitor), but it is an array of bit values.

String Tags

A *string tag* is an ASCII or binary character representation of a connection to a real-world I/O point or memory variable.

Use a string tag when you have binary information or an ASCII value. When you configure a string tag, you must select whether to treat the data in the tag as text or binary information. You might use a string tag to obtain values from a bar code reader, or if you have data that does not fit into any

other data type. You also can use a string tag for PLC control strings and PLC reporting strings.

Static and Dynamic Attributes

Tag attributes are classified as either static or dynamic attributes. *Static attributes* require you to restart the Tag Engine when you change them in the Tag Configuration Editor. A static attribute change is marked with a solid diamond in the Tag Configuration Editor. Examples of static attributes include general attributes and I/O connection attributes, such as server, device, or item.

Dynamic attributes do not require the Tag Engine to restart. The Tag Configuration Editor can change a dynamic tag attribute in a running Tag Engine. A dynamic attribute change is marked with a hollow diamond in the Tag Configuration Editor. Examples of dynamic attributes include enabling logging operations, alarm attributes, and some scaling attributes.

Defining a Tag Group

Use tag groups to define a subset of tags in the system. You also can use tag groups to examine the alarm states for a subset of tags in the system. Refer to Chapter 4, *Alarms and Events*, for more information about alarm groups.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **General** tab.
4. Select an existing tag group or define a new tag group by selecting **Enter New**.
5. (Optional) To view the tag groups, select **Configure»Tag Groups**. The **Tag Group Display** dialog box appears. Click the **Remove Tag Group** button to delete the tag group.
6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Configuring I/O Groups

I/O groups are used to configure item rate and deadband for items of a server and to select a specific device, if the server uses devices. For servers that support resource configuration, you also can use I/O groups to configure devices and communication resources. For OPC servers, an I/O

group conforms to the concept of an OPC group, which is user-defined and controls timing. Each I/O group you create maps to an OPC group in the OPC server with the same attributes. An I/O group is associated with only one server and, if that server uses devices, with only one device. A server can have multiple I/O groups associated with it.

Any tag other than a memory tag must be part of an I/O group. If you are editing a tag an I/O group probably already exists. If you want the tag to go into a new I/O group or your are creating a tag, you will have to create an I/O group before connecting your tag to a server item.

Complete the following steps to edit the I/O group configuration.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the following buttons, which are located under the **I/O Group** pull-down menu. If the **I/O Group** pull-down menu is dimmed, set **Tag Access** to something other than **Memory**.
   - To create an I/O group, click the **Create** button. Select a device from the list of available devices that appears.

     A list of items connected to that device appears in the **Tag Configuration** dialog box. For a selected device and item, the Tag Configuration Editor imports any available item engineering range and unit information and also makes sure the directions or access rights for an item are compatible with the access rights you have selected for the tag.

     If a device server does not appear in the server name list, you must run the configuration or registration utility for your server before the LabVIEW DSC module can access the server. Refer to the *Installing and Configuring Servers* section of Chapter 2, *Servers*, for more information.
   - To edit an I/O group, select a group in the **I/O Group** pull-down menu and click the **Edit** button.
   - To delete an I/O group, select a group in the **I/O Group** pull-down menu and click the **Delete** button. The I/O group is deleted from the server configuration. Deleting an I/O group does not delete the device and communication resource from the server configuration.

5. Click the **OK** button.
6. Select **File»Save** to save the changes.

Configuring DDE Devices and Items

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the **Create** or **Edit** button under the **I/O Group** pull-down menu. The **IO Group Configuration** dialog box appears.
5. Click the **Add** button under the **Device** pull-down menu. If no **Add** button is available, you are not configuring a DDE device or item.
6. Type the DDE application name and topic in the form *application*|*topic* in the **Device** textbox. For example, type excel|*worksheetname* to connect to a cell in Microsoft Excel.

   If you are using network DDE to use a DDE server running on another computer, use the network DDE name for the *application* part of the device name. Refer to your DDE server documentation for more information about application and topic names.
7. Click the **OK** button twice.
8. Click the **Add** button under the **Access Path** pull-down menu.
9. Type the name of the item you want to connect to in the **Item** textbox. For example, type r2c2 to connect to cell B2 in Excel. You cannot browse a DDE server for available items. Refer to your DDE server documentation for more information about item names.
10. Click the **OK** button.
11. Select **File»Save** to save the changes.

Configuring Communication Resources

You can configure communication resources only for IAK servers. Complete the following steps to configure the communication resource.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the **Create** or **Edit** button under the **I/O Group** pull-down menu. The **IO Group Configuration** dialog box appears.

5. Click the following buttons, which are located under the **Communication Resource** pull-down menu when configuring an IAK server.
   - To create a new communication resource, click the **Create** button.
   - To edit a communication resource, select a resource in the **Communication Resource** pull-down menu and click the **Edit** button.
   - To delete a communication resource, select a resource in the **Communication Resource** pull-down menu and click the **Delete** button.
6. Click the **OK** button twice.
7. Select **File»Save** to save the changes.

Configuring Device Names

You can configure device names only for servers that allow users to configure device names, such as DDE servers. DDE servers use the device name to specify the DDE application and topic. Complete the following steps to configure the device name.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the **Create** or **Edit** button under the **I/O Group** pull-down menu. The **IO Group Configuration** dialog box appears.
5. Click the following buttons, which are located under the **Device** pull-down menu for servers that allow you to configure device names.
   - To add a device name, click the **Add** button. In the **Add Device Name** dialog box, enter a new device name for a server and click the **OK** button.
   - To edit a device name, select a device in the **Device** pull-down menu and click the **Edit** button. In the **Edit Device Name** dialog box, edit the existing device name for a server and click the **OK** button.
   - To delete a device name, select a device in the **Device** pull-down menu and click the **Delete** button. The selected device name is removed from the device list.
6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Configuring Device Resources

You can configure device resources only for servers that allow users to configure device resources. Complete the following steps to configure the device resources.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the **Create** or **Edit** button under the **I/O Group** pull-down menu. The **IO Group Configuration** dialog box appears.
5. Click the following buttons, which are located under the **Device** pull-down menu for servers that allow you to configure device resources. The options in the **Device Configuration** dialog box vary depending on the type of server.
   - To create a new device configuration, click the **Create** button. In the **Device Configuration** dialog box, configure the device and click the **OK** button.
   - To edit a device configuration, select a device in the **Device** pull-down menu and click the **Edit** button. In the **Device Configuration** dialog box, edit the existing device configuration and click the **OK** button.
   - To delete a device configuration, select a device in the **Device** pull-down menu and click the **Delete** button. The selected device name is removed from the server configuration.
6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Configuring Item Names

You can configure item names only for servers that allow users to configure item names, such as DDE servers. Complete the following steps to configure item names.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.

4. Click the following buttons, which are located under the **Access Path** pull-down menu. If the server does not support item names, these buttons are disabled.
   - To add an item name, click the **Add** button. In the **Add Item Name** dialog box, enter a new item name for a selected server and click the **OK** button.
   - To edit an item name, select an item in the **Item** pull-down menu and click the **Edit** button. In the **Edit Item Name** dialog box, edit the existing item name for a selected server and click the **OK** button. If the server has access paths, you also can edit an access path.

     For OPC servers, you also can click the **Browse** button to view the hierarchical organization of the server items, navigate to an item, select it, click the **OK** button, and click the **Edit** button.
   - To delete an item name, select an item in the **Item** pull-down menu and click the **Delete** button. The selected item name is removed from the item list. If the server has access paths, the selected access path is removed from the access path list.
5. Click the **OK** button.
6. Select **File»Save** to save the changes.

Configuring Item Resources

You can configure item resources only for servers that allow users to configure item resources, such as many OPC servers. Complete the following steps to configure item resources.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Connection** tab.
4. Click the following buttons, which are located under the **Access Path** pull-down menu. If the server does not support item configuration, or if the selected item is not valid, these buttons are disabled.
   - To create an item resource, click the **Add** button. In the configuration dialog box, configure a new item for a selected server and click the **OK** button.
   - To edit an item resource, select an item in the **Item** pull-down menu and click the **Edit** button. In the server-dependent dialog box, edit the configuration of the selected item and click the **OK** button.

- To delete an item resource, select an item in the **Item** pull-down menu and click the **Delete** button. The selected item is removed from the server configuration.
- To browse available items from OPC servers that support browsing, click the **Browse** button. In the **Browse OPC Server** dialog box, browse the list of available items, select an item and associated access path, and click the **OK** button.
- To use the item name as the tag name, click the **Paste Item Name to Tag Name** button. Clicking this button replaces any name in the **Tag Name** field on the **General** tab.

5. Click the **OK** button.
6. Select **File»Save** to save the changes.

Configuring a Tag to Log Data or Events

By default, when a tag is first created, the LabVIEW DSC module enables logging, so when you start logging, you log all tags except those you have configured not to be logged. To start logging, you either manually activate it in the Engine Manager or you set logging to begin automatically when the Tag Engine starts.

Complete the following steps to configure logging manually.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. Click the **Operations** tab.
4. Check or uncheck the **Log/Print Events** and **Log Data** checkboxes. Events, in this case, include enabled alarms for the tag. Set the logging deadband and the data resolution, if applicable.
5. Click the **OK** button.
6. Select **File»Save** to save the changes.
7. Make sure the Tag Engine is set to log historical data or events. Refer to *Logging Historical Data* in Chapter 5, *Historical Data Logging and Extraction*.

The LabVIEW DSC module logs data from all tags that have been configured for logging.

Setting Startup Tag Values

Set startup values to initialize a tag to a known value when the Tag Engine starts.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Operations** tab.
4. Check the **Set Initial Value** checkbox.
5. Type the initial value in the adjacent textbox.
6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Scaling Tags

Scaling is useful for converting the range of values from measured units into a calculated range. Only analog (numeric), discrete, and bit array tags have scaling attributes. There is no scaling for string tags or memory tags.

Often an application needs the LabVIEW DSC module to manipulate the raw data used in the device server to put it in a form, called engineering units, suitable for the operators.

Scaling Analog Tags

You can define the raw range and engineering range for a tag to perform simple conversions between the two ranges. The raw range, defined by Raw Full Scale and Raw Zero Scale, refers to the values used by the device server. Engineering range, defined by Engineering Full Scale and Engineering Zero Scale, refers to the values used by the Tag Engine and HMI.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click an analog tag to display the **Tag Configuration** dialog box.
3. Click the **Scaling** tab.
4. Select **Linear** in the **Scale Type** pull-down menu to enable a linear conversion between raw and engineering ranges, $(mx + b)$. Select **Square Root** to enable a square root conversion between the raw and engineering ranges, which is $b + m * sqrt(raw - o)$ where b = EngMin, m = (EngMax – EngMin)/sqrt(RawMax-RawMin), and o = RawMin.

5. Click the **OK** button.
6. Select **File»Save** to save the changes.

Square Root and Linear Scaling

Linear scaling is a straight proportional scale of raw values to engineering unit values.

Square root scaling is a proportional way of scaling raw values to engineering units. It is generally used when scaling down by scaling to the square root of the of the raw unit (after compensating for any offsets involved).

Suppose you want to scale a raw value that ranges from 0 to 100 to engineering units ranging from 0 to 10. The tag returns values, as shown in the Table 3-1.

Table 3-1. Square Root and Linear Scaling Example Values

Raw Units	Linear Scale	Square Root Scale
0	0	0
4	.4	2
9	.9	3
16	1.6	4
25	2.5	5
36	3.6	6
49	4.9	7
81	8.1	9
64	6.4	8
10	1	3.16
20	2	4.47
30	3	5.48
40	4	6.32
50	5	7.07
60	6	7.75

Table 3-1. Square Root and Linear Scaling Example Values (Continued)

Raw Units	Linear Scale	Square Root Scale
70	7	8.37
80	8	8.94
90	9	9.49
100	10	10

Table 3-2 shows a raw value that ranges from 0 to 100 scaled to engineering units ranging from 15 to 30. Offsets deliver somewhat more complicated results.

Table 3-2. Scaling with Offset Example Values

Raw Units	Linear Scale	Square Root Scale
0	15	15
4	15.60	18
16	17.40	21
36	20.40	24
64	24.60	27
10	16.50	19.74
20	18	21.71
30	19.50	23.22
40	21	24.49
50	22.50	25.61
60	24	26.62
70	25.50	27.55
80	27	28.42
90	28.5	29.23
100	30	30

Example—Linear Scaling

A device server returns a simple voltage from 0 to 5 V. The voltage is related to a position sensor, and the real-world position is measured in centimeters, with 0 volts mapped to 50 cm and 5 V mapped to 100 cm.

Configure the tag for raw range from zero (Raw Zero Scale) to five (Raw Full Scale). Select **Linear**, and set the engineering range from 50 (Eng Zero Scale) to 100 (Eng Full Scale).

Example—Square Root Scaling

A flow meter measures the flow rate of a liquid using a differential pressure reading. The device server provides 4–20 mA readings. The actual flow is measured in gallons per minutes (GPM). 4 mA corresponds to 0 GPM; 20 mA corresponds to 100 GPM.

Configure the tag for raw range from 4 (Raw Zero Scale) to 20 (Raw Full Scale). Select **Square Root Scaling** and set the engineering range from 0 (Eng Zero Scale) to 100 (Eng Full Scale).

Assigning Units to an Analog Tag

Use the **Engineering Unit** field to assign units to a tag. If the desired unit is not in the list, select **Enter New** and enter the desired unit. In the previous example, you select units of GPM.

Scaling Discrete Tags

The only scaling available for discrete (Boolean) tags is invert scaling.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a discrete tag to display the **Tag Configuration** dialog box.
3. Click the **Scaling** tab.
4. Place a checkmark in the **Invert Data** checkbox for the Tag Engine to invert the discrete value when it communicates with the device server.
5. Click the **OK** button.
6. Select **File»Save** to save the changes.

Scaling Bit Array Tags

Bit array tags can have invert and/or select mask scaling.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a bit array tag to display the **Tag Configuration** dialog box.
3. Click the **Scaling** tab.
4. Place a checkmark in the **Scale Data** checkbox.
5. Set which bits you do not need in the **Scaling Select Mask** textbox.

   Mask scaling applies only to bit arrays. LabVIEW stores a bit array as a number, translating it back into a 32-bit array when needed. The array holds a collection of 32 values, each value limited to 1 or 0. Mask scaling lets you decide which of these array members to pay attention to. Any bit filtered out by the mask shows up as a zero; bits not filtered out show up as zero or one, reflecting the actual value. A mask of

   `xxxxxxxxxxxxxxxxoooooooooooooooo`

   where `x` marks a position to be filtered out and `o` marks a place to report, would read the bit array

   `10110011100011001100111000110010`

   as the following:

   `00000000000000001100111000110010`
6. Set which bits are inverted between the device server and the Tag Engine in the **Scaling Invert Mask** textbox. You can invert only the bits selected in the **Scaling Select Mask** textbox.

Note The invert mask does not invert bits that are masked out.

7. Click the **OK** button.
8. Select **File»Save** to save the changes.

Table 3-3 shows examples of tags configured for bit array scaling.

Table 3-3. Bit Array Scaling Examples

Tag Name	Length	Raw Value	Scaling Invert Mask	Scaling Select Mask	Scaled Value
Tag 1	8	0x0F	0x00	0xFF	0x0F
Tag 2	8	0x0F	0x33	0xFF	0x3C

Table 3-3. Bit Array Scaling Examples (Continued)

Tag Name	Length	Raw Value	Scaling Invert Mask	Scaling Select Mask	Scaled Value
Tag 3	8	0x0F	0x33	0x0F	0x0C
Tag 4	8	0x0F	0x00	0x33	0x03
Tag 5	8	0x0F	0x33	0x33	0x30
Tag 6	16	0x0FF0	0x000F	0x00FF	0x00FF

Setting Alarms

Alarms are useful for notifying users of abnormal conditions for a given tag. These attributes include whether to enable alarms, under what circumstances a tag is in alarm, the priority level of an alarm, and how alarms are acknowledged. Each alarm limit has a priority, ranging between 1 and 15. In the LabVIEW DSC module, 15 is the highest priority and 1 is the lowest.

Alarms include two main types:

- Alarms based on status
- Alarms based on tag values

Configuration for alarms based on tag values is specific to data type. Therefore, many alarm attributes apply to only a subset of the tag data types. Refer to Chapter 4, *Alarms and Events*, for more information about accessing and displaying alarms and events.

Complete the following steps to set alarms.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click a tag to display the **Tag Configuration** dialog box.
3. Click the **Alarms** tab.
4. Place a checkmark in the **Enable Alarms** checkbox.

   Alarms are generated depending on the value or state of a tag. The alarms based on value vary with the tag data type. For any tag, if the status is bad, a bad status alarm is generated. By default, **Bad Status Alarm** is enabled and has the highest priority (15).
5. Set the alarm attributes. The available attributes vary depending on the type of tag you are configuring.

6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Setting Alarms for Analog Tags

Analog tags have four alarm levels: HI_HI, HI, LO, and LO_LO. By providing separate alarm levels, you can provide more information about the nature of the alarm condition. Alarms are calculated after scaling is performed. Alarm levels are expressed in engineering units.

Setting Alarm Deadband on Analog Tags

Alarm Deadband defines how much a tag value must change from the alarm limit before it is considered normal. For example, if a tag that represents a temperature value hovers near an alarm limit of 40 degrees Celsius, the tag might go in and out of alarm many times in a relatively short period of time. Table 3-4 shows examples of events with Alarm Deadband set to 0.0%.

Table 3-4. Events with Alarm Deadband = 0.0%

Time	Value	Event	Alarm Type
9:15:05	40.1	Yes	HI
9:15:10	39.9	Yes	Normal
9:15:15	40.1	Yes	HI
9:15:20	38.5	Yes	Normal

This type of situation clogs event files with redundant information and can cause operators some frustration in having to acknowledge alarms constantly when the tag has not changed significantly. You can use the Alarm Deadband to alleviate this problem.

For the tag to go into alarm, it must go above the exact Alarm Value (in the previous example, 40). However, to be considered normal again, it must leave the Alarm Value by an amount greater than the Alarm Deadband. For example, if the range is 0 to 100 degrees Celsius, an Alarm Deadband of 1.0% (one degree Celsius) eliminates unnecessary events. Table 3-5 shows examples of events with Alarm Deadband set to 1.0%.

Table 3-5. Events with Alarm Deadband = 1.0%

Time	Value	Event	Alarm Type
9:15:05	40.1	Yes	HI
9:15:10	39.9	No	HI
9:15:15	40.1	No	HI
9:15:20	38.5	Yes	Normal

Setting Alarms for Discrete Tags

Discrete tags have two alarm states—either the tag is in alarm or it is not. You can determine whether a discrete tag is in alarm when it is ON (high) or OFF (low).

Setting Alarms for Bit Array Tags

You can enable one of two types of alarms for bit array tags. **Alarm on Any** indicates the overall tag is in alarm if any of its bits are in alarm state. **Alarm on All** means the tag is in alarm only if all of the bits are in the alarm state. You can use the Invert Mask to determine the bits that should use alarm on low (OFF) rather than the default alarm on high (ON). You can use the Select Mask (logical AND) to determine the bits that should be considered for the alarm. If you have bits in the Select Mask that are zero (OFF), these bits are not used in calculation of the tag alarm state.

Setting Alarms for String Tags

String tags have no alarm states based on tag value. They only support Bad Status alarms.

Keeping an Alarm Unacknowledged after the Alarm Returns to Normal

On the **Alarms** tab in the **Tag Configuration** dialog box, select the **Alarm Acknowledgement Mode** field and select either **Auto Ack on Normal** or **User Must Ack**:

- **Auto Ack on Normal**—With this option enabled, when a tag returns to normal state, the alarm is automatically acknowledged. A message is logged to the event file if event logging is turned on for the tag. By default, **Auto Ack On Normal** is enabled.

- **User Must Ack**—With this option enabled, an alarm remains unacknowledged until the operator acknowledges the alarm.

Determining When to Use Memory Tags

Use memory tags when you want to perform alarm calculations or log historical data and event information on data that are either a software-generated values or combinations of values from different I/O tag readings. You do not need to use a memory tag for program variables unless you want to use the historical and event logging or alarm management capabilities of the Tag Engine.

Creating a Memory Tag

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Edit»Create** and select the type of tag you want to create.
3. Click the **Connection** tab.
4. Set **Tag Access** to **Memory**.
5. Select any other settings you want for the memory tag.
6. Click the **OK** button.
7. Select **File»Save** to save the changes.

Note You might not be able to create new tags because you cannot modify your application. However, you might find it necessary to modify the properties of a tag.

Customizing the Tag Configuration Editor View

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Edit»Column Setup** to display the **Select Tag Fields to View** dialog box. You can display the same columns of information, describing every tag attribute, as in the spreadsheet import/export options in the Tag Configuration Editor.
3. Select tag fields in the **Available Tag Fields** listbox and click the **Add** button to move the fields to the **Fields to View** listbox. Click the **All** button to move all fields to the **Fields to View** listbox.

4. Select tag fields in the **Fields to View** listbox and click the **Move Up** or **Move Down** buttons to customize the order of appearance of columns. You also can drag and drop fields to rearrange them.
5. Click the **OK** button.

Accessing Tags Over a Network

A LabVIEW DSC module *server* is a computer that allows tags configured in the current `.scf` file to be accessed by other computers connected to it. A *client* is a computer that gets its data through tags from one or more LabVIEW DSC module servers. A LabVIEW DSC module server also can act as a client and get its data from other LabVIEW DSC module server computers.

A `.scf` file for a LabVIEW DSC module client can contain network tags from multiple LabVIEW DSC module servers, as well as other servers. Refer to the *Importing Network Tags* section earlier in this chapter for more information about importing network tags.

Access to data via DataSocket or across the network is subject to security access rights. Refer to the *Setting Data Access* section in Chapter 6, *Security*, for more information.

Accessing Tags Over the Network using BridgeVIEW

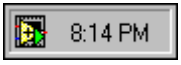
If you are using BridgeVIEW in your system, you have to perform some additional steps to make sure tags created in the LabVIEW DSC module can be accessed by BridgeVIEW applications. This is also true for BridgeVIEW applications you might be running using the LabVIEW DSC module. If you import a set of tags from a `.scf` using BridgeVIEW 2.*x* networking, you can only import from one `.scf` file per computer. Also, you must make sure that the BridgeVIEW Engine running as a data server is using the correct `.scf` file for your client application to work properly.

1. On the server computer, open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Open the `.scf` file that contains the tags you want to access over the network.
3. Select **Configure»Network»BridgeVIEW 2.x Networking»Allow Network Access**. Select **Configure»Network»BridgeVIEW 2.x Networking»Clients have write access** if you want network clients to be able to write to the tags in the `.scf` file.
4. Select **File»Save** to save the changes.

5. On the client computer, open the Tag Configuration Editor.
6. Select **Configure»Network»BridgeVIEW 2.x Networking»Import Network Configuration** to display the **Select Tags for Network Import** dialog box. Only tags exposed through BridgeVIEW 2.*x* networking appear.
7. Click the **Add** buttons to add the tags you want to import to the **Selected Tags** listbox.
8. Click the **Import** button.
9. Select **File»Save** to save the changes.

Viewing Tag Engine Status

Launch the Tag Engine and open the Engine Manager. If the Tag Engine is already launched and running, the Engine Manager might be minimized and appear only as an icon in the system tray of your Windows taskbar. Double-click the Tag Engine icon to open the Engine Manager display.



Otherwise, you can launch the Engine Manager when the Tag Engine is running by selecting **Tools»Datalogging & Supervisory Control» Launch Engine»Show**.

You can leave the Engine Manager display minimized unless you want to use it to start or stop the Tag Engine, start or stop historical logging, event logging and printing, view system events, or view server information.

The Tag Engine works with tags configured in the `.scf` configuration file and created in the Tag Configuration Editor. The Engine Manager shows the current state of the Tag Engine.

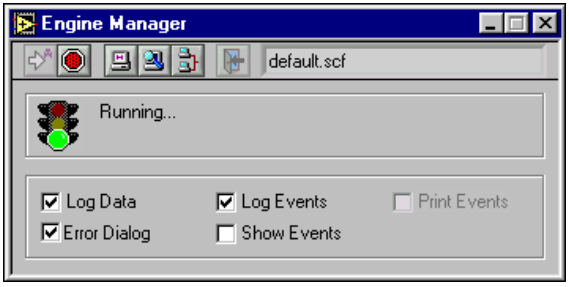


Table 3-6 describes the fields in the **Engine Manager** window.

Table 3-6. Engine Manager Field Descriptions

Field	Description
Engine Status (next to the traffic signal)	Displays the current status of the Tag Engine—whether launching, running, or stopped.
Log Data	Turns on or off logging of historical data to file. To turn on logging of historical data to file automatically, select **Configure»Historical** from the Tag Configuration Editor, then select **Start logging on system start-up**. If you do not have a valid historical log path configured, logging of historical data to file is disabled.
Log Events	Turns on or off logging of alarms and events to file. To turn on logging of alarms and events to file automatically, select **Configure»Events** from the Tag Configuration Editor, then select **Start event logging on system start-up** on the **Event Logging** tab. If you do not have a valid event log path configured, logging of alarms and events to file is disabled.
Print Events	Turns on or off printing of alarms and events to a line printer. To turn on printing of alarms and events automatically, select **Configure»Events** from the Tag Configuration Editor, then select **Start printing on system start-up** on the **Printing** tab. If you do not have a printer configured, printing of alarms and events is disabled.
Error Dialog	Enables or disables showing the **Error** dialog box. If this checkbox contains a checkmark, a **System Error Display** dialog box appears for you to acknowledge the event when a system error occurs.
Show Events	Shows or hides the System Event Display. The System Event Display shows the following when **Show Events** contains a checkmark: • LabVIEW system events • When the Tag Engine started and stopped • Which servers have been launched • Any system errors that have occurred
Toolbar	
Start the Tag Engine	Starts the Tag Engine.
Stop the Tag Engine	Stops the Tag Engine and shuts down any running servers.

Table 3-6. Engine Manager Field Descriptions (Continued)

Field	Description
Start Tag Monitor	Opens the Tag Monitor.
View Servers in Use	Displays the servers in use by the Tag Engine.
View Client Connections	Shows all the computers currently accessing data from the LabVIEW application.
Exit the Tag Engine	Closes and exits the Tag Engine application.

Configuring Tag Engine Parameters

The Tag Engine has several default settings for parameters. Complete the following steps to override these defaults.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Configure»Engine**.
3. Select among the Tag Engine options on the various tabs.

Note Although you can configure these parameters, it is highly recommended you maintain the default values. If you use a large number of string tags and the string tags are large or change rapidly, you might need to increase the input queue binary size to be larger than the default 2,000 bytes.

4. Click the **OK** button.

The Tag Engine allocates certain amounts of memory for various queues. You can configure some of the parameters used by the Tag Engine and Tags VIs to allocate memory for the Tag Engine buffers.

Monitoring and Writing Tag Values

You can use the Tag Monitor to monitor the value, timestamp, alarm state, and quality for selected tags in the system, as well as write the value to an output or input/output tag.

1. Open the Tag Monitor (**Tools»Datalogging & Supervisory Control»Monitor Tags**).
2. Navigate to the tags you want to monitor using the tree in the left pane. Select **View»Default** to restore the full tree.

   You can see tags both directly in your local computer, under the **My Computer** node, and across the network, under the computer name under the **Network** node. You also can see data from other software and devices on other networked computers. To find tags or data on another computer, you must first register the computer. Refer to the *Registering Networked Computers* section of Chapter 7, *Networking and Running Applications*, for more information about registering and unregistering computers.
3. To select a tag for monitoring, double-click the tag to move it to the tag display pane on the right. You also can select one or more tags and drag them to the tag display pane or you can select tags, right-click, and select **Add** from the shortcut menu. The **Quality** column shows status information for the tags.
4. To add, remove, write to, or edit the properties of a tag, select the tag and select the corresponding options in the **Items** menu. You also can right-click a tag to access these options.
5. Select **View»Refresh** to refresh the tree view in the left pane and the alarm view in the bottom right pane. The tags in the tag display pane update continuously and do not need to be refreshed.
6. Select **File»Save As** to save different sets of tags to monitor.

4

Alarms and Events

This chapter describes how to report, log, and respond to *alarms* and *events* with LabVIEW Datalogging and Supervisory Control (DSC) module applications.

An event is something that happens within the LabVIEW DSC module system. Events can be divided into two groups: *tag events* that pertain to individual tags, and *system events* that pertain to the overall LabVIEW DSC module system. An example of a tag event is a change of alarm state for a tag. Examples of system events include a user logging on, the Tag Engine starting up, or historical logging being turned on.

In the LabVIEW DSC module, an alarm is a specific kind of event related to the value of a tag. An event could be virtually any instantaneous activity such as clicking a mouse button, but an alarm typically has the following characteristics:

- Denotes an abnormal condition
- Occurs under certain, specific conditions
- Must be acknowledged by the user or configured for automatic acknowledgment

Because alarms are generated by tag values, you set most alarm attributes as a part of configuring tags. Refer to the *Setting Alarms* section of Chapter 3, *Using Tags to Manage I/O in LabVIEW*, for more information. You also enable tag event logging when you configure tags. Refer to the *Configuring a Tag to Log Data or Events* section of Chapter 3, *Using Tags to Manage I/O in LabVIEW*, for more information.

For the purposes of logging and retrieval, events and alarms are combined.

The application developer configures the alarms and events for your application. However, you might have to adjust or maintain the alarms and events, as described in this chapter.

Logging and Printing for Alarms and Events

You can configure automatic logging and printing for alarms and events in the Tag Configuration Editor as follows.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Configure»Events** to display the **Event Configuration** dialog box.
3. Select among the logging and printing options. To open the context help window and view descriptions of these options, press <Ctrl-H> and move the cursor over any field.

Note If you log data to directories created in a secure file system, such as NTFS, you must grant the System account Change or Full Control permissions to the directory. If you do not grant the System account appropriate access to the database directory, Citadel will be unable to create and modify the database files it uses to store historical data and alarms.

4. Click the **OK** button.
5. Select **File»Save** to save the changes.

Note To log remote operator changes of a control as an event, select **Configure»Engine** in the Tag Configuration Editor. On the **Events** tab, place a checkmark in the **Generate Event when Remote User Changes Value** checkbox.

Viewing Alarms and Events

You can use several different approaches to display and manage alarms and events generated in LabVIEW DSC module applications. Some approaches operate through traditional VIs; others use capabilities built in to National Instruments networking. The multiplicity of approaches is provided not only for flexibility, but also for compatibility with existing BridgeVIEW applications.

- You can use the Tag Monitor to view alarms and events. Refer to the *Monitoring and Writing Tag Values* section of Chapter 3, *Using Tags to Manage I/O in LabVIEW*, for more information about the Tag Monitor.
- You can use a text viewer to view the `.log` file in the `syslog` directory. System events are logged to this file. When configured for logging, both alarms and events enter the RTDB and are then stored in the Citadel historical database.

- Alarms and events logged to Citadel can be viewed with the Historical Data Viewer in the Measurement & Automation Explorer (MAX) environment. For more information about Historical Data Viewer, refer to its online help in MAX.

Viewing Alarms and Events with the Alarm & Event Display Control

The alarm & event display is the easiest way to monitor and acknowledge alarms and events. The alarm & event display appears in the Tag Monitor and might also be on the front panel of your HMI application. The alarm & event display shows alarms and events from every computer and process you configure it to display.

The alarm & event display automatically monitors all alarms generated by a process for which you are monitoring one or more tags. To monitor alarms from a process you are *not* monitoring a tag in, you must first select the source of the alarms, as follows.

1. Right-click the alarm & event display and select **Select Processes** from the shortcut menu. The **Select Processes** dialog box appears.
2. In the **Available Processes** listbox, navigate to the process for which you want to view alarms, select it, and click the **Add** button. The process appears in the **Selected Processes** listbox.
3. Click the **OK** button.

Acknowledging Alarms in the Alarm & Event Display Control

Right-click an alarm and select an acknowledgement option from the shortcut menu to acknowledge alarms.

Filtering Alarms and Events in the Alarm & Event Display Control

You can set filter criteria so you only see certain alarms and events in a display.

1. Right-click the alarm & event display while the VI is running and select **Filter Options** from the shortcut menu.
2. Select among the filter options.
   a. Place a checkmark in the **Priority** checkbox and type values in **Min** and **Max** to monitor alarms with specific priorities.
   b. Place a checkmark in the **User Name** checkbox and type a user name if you want to restrict alarm monitoring to alarms generated

while that user is logged on. You can select only one user name at a time, but you can use asterisk (*) or question mark (?) wildcards to widen the scope of the alarms reported.

c. Place a checkmark in the **Ack User Name** checkbox and type a user name if you want to restrict alarm monitoring to alarms acknowledged by that user. You can select only one user name at a time, but you can use wildcards to widen the scope of the alarms reported.

d. Place a checkmark in the **Ack Comment** checkbox and type a comment if you want to restrict the alarms displayed to those with that acknowledgement comment.

e. Place a checkmark in the **Object Name** checkbox and type an tag name if you want to restrict alarm monitoring to alarms involving that tag name. You can enter only one tag name at a time, but you can use wildcards to widen the scope of the alarms reported. The tag name must be a completely qualified tag name, as displayed in the tag display pane above the alarm view.

f. Place a checkmark in the **Description** checkbox and type a description if you want to restrict monitoring to alarms that meet your criteria. You can select only one description category at a time, but you can use wildcards to widen the scope of the alarms reported. The categories HiHi, Hi, Lo, or LoLo are added as a prefix to any descriptions and are ignored by description filtering.

g. Place a checkmark in the **Area Name** checkbox and type an area name if you want to restrict monitoring to that alarm area. You can enter only one alarm area at a time.

h. Use the fields in the **Old Alarms** section if you want to display alarms after they have been acknowledged.

i. Select a **Show** option to display alarms only, events only, or both alarms and events.

j. Place a checkmark in the **Audible Alarms** checkbox if you want to enable a sound alert when an alarm takes place. The sound depends on your system setting for error sounds.

3. Click the **OK** button. The alarm & event display control displays only the alarms that meet all the filter criteria in the alarm view.

Using an Alarm Summary Display

An *alarm summary* is a collection of all the alarms that currently exist in the system. In addition, if a tag previously in alarm returns to normal but is unacknowledged, a notification is posted in the alarm summary.

Note The Value column displays the value of the tag when the tag first enters the alarm state, not the live value of the tag. The Value column does not update, even if the tag value subsequently changes.

The front panel of your HMI application should contain an **ACK** button for you to use with the alarm summary display listbox.

Using an Event History Display

An *event history* is a collection of all the alarms and events pertaining to tag values that have occurred in the LabVIEW DSC module since the Tag Engine started.

The front panel of your HMI application should contain an **ACK** button for you to use with the event history summary display listbox.

Viewing System Errors and Events

System errors are conditions on a system level (as opposed to a tag-level basis) that result in problematic functioning of the LabVIEW DSC module. When a system error occurs, LabVIEW prompts you with a dialog box. You can turn this dialog box on or off.

System events are changes in the system that cause a change in behavior that is not problematic. These include events reported by utilities such as the Tag Configuration Editor.

Detailed system error and event messages are logged to a system log file. The messages are written to an ASCII file with a `.log` extension in the `SYSLOG` directory. The LabVIEW DSC module automatically creates this directory, if it does not exist already. The system log file names take the format, `YYYYMMDDHHMM.log` where `YYYY` = year, `MM` = month, `DD` = day, `HH` = hour, and `MM` = minute.

5

Historical Data Logging and Extraction

The real-time database (RTDB) is contained in memory; there is no file created to hold the data. When the Tag Engine is stopped, the RTDB retains the last data received, but does not update any values until the Tag Engine begins to run again. Because data logged to the Citadel historical database are taken from the RTDB, no data can be logged to Citadel while the Tag Engine is stopped.

Citadel Historical Database

The LabVIEW Datalogging and Supervisory Control (DSC) module uses the National Instruments Citadel historical database. The LabVIEW DSC module also includes the Citadel ODBC driver that has special commands to perform data transforms, so you can retrieve, manipulate, and analyze historical data automatically from outside the LabVIEW environment. Refer to Appendix A, *Using SQL to Access Historical Data in Citadel*, for more information.

Under Windows 2000/NT/XP, Citadel runs on your computer as a service, accessible through the Service Manager.

The LabVIEW DSC module installs a National Instruments services manager, denoted by an icon located in the system tray of the Windows taskbar, near the computer clock. The right-most column of circles represents the Citadel Service. A green light indicates the service is running. A red light indicates the service is stopped. To start and stop the Citadel Service, right-click the service manager icon.

Caution Do *not* stop these services while the LabVIEW DSC module, the Tag Engine, or Lookout is running.

Data you configure to be logged to Citadel resides in a set of files in the target directory you set for logging. This data can include values from the application as well as alarms and events. You control which data is logged to what location through tag configuration and alarm and event

configuration. You can log data to your local computer or to a remote computer on your network, but the directory to which you want to log must be writable from the computer running the Tag Engine.

You access Citadel data through the Historical Trend Viewer, SQL queries, or any other ODBC-compliant application such as Microsoft Query, Microsoft Access, or even Microsoft Excel.

Logging Historical Data

Complete the following steps to log historical data.

1. Make sure you have configured your tag(s) for logging as described in the *Configuring a Tag to Log Data or Events* section of Chapter 3, *Using Tags to Manage I/O in LabVIEW*.
2. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
3. Select **Configure»Historical** to display the **Historical Logging Configuration** dialog box.
4. Select among the historical logging options. To open the context help window and view descriptions of these options, press <Ctrl-H> and move the cursor over any field.

Note If you log data to directories created in a secure file system, such as NTFS, you must grant the System account Change or Full Control permissions to the directory. If you do not grant the System account appropriate access to the database directory, Citadel will be unable to create and modify the database files it uses to store historical data and alarms.

5. Click the **OK** button.
6. Select **File»Save** to save the changes.
7. Open the Engine Manager (with the Tag Engine running, select **Tools»Datalogging & Supervisory Control»Launch Engine**).
8. Place checkmarks in the **Log** checkboxes to turn on historical logging.

Logging Data in Sets

To log and retrieve data in sets, you configure the Data Set Logger server to track your data sets, then use the Historical Data Viewer in Measurement & Automation Explorer (MAX) to retrieve your data set values. With the Data Set Logger, you can accomplish *batch logging*.

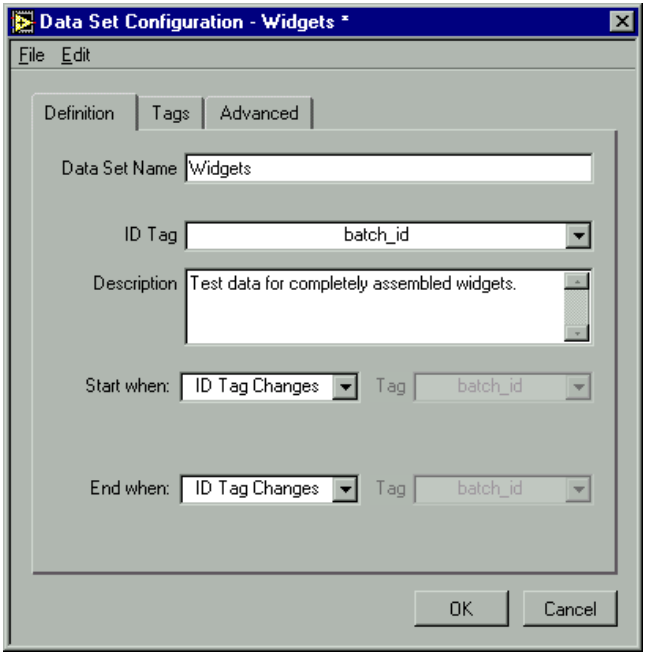
A group of tag values that are logged together during some finite time period is a *data set*. A data set might cover a batch of some sort and contain all the values generated during a single execution of a batch process. The *ID tag* for each data set denotes a particular data set and the time during which the data set run took place. An ID tag might be a batch number.

The Data Set Logger is a VI-based server that allows multiple data sets to execute simultaneously. It starts when the Tag Engine starts and stops when the Tag Engine stops, but executes only when a `.scf` file uses it.

Creating a Data Set for Logging

To create a data set for logging, follow these steps.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**) and make sure the active `.scf` file contains the tags you want to log in your data set.
2. Save your `.scf` file if you have added or removed tags since the last time you saved.
3. Select **Servers»Data Set Logger Configuration**. The following dialog box appears. If the dialog box opens with existing data set values, you can edit that data set or select **File»New** to create a new data set.



4. Enter values on the **Definition** tab.
   - **Data Set Name** is a string that provides information about the data being grouped together. You can use any number of different data set configurations, but each one must have a unique name.
   - **ID Tag** is a string or analog tag from your active `.scf` file. When you start logging a data set, the value of the **ID Tag** at that time becomes the identifier of that data set run. For example, an **ID Tag** might be the serial number of a unit under test, and the data set for that serial number might consist of the traces logged during testing of that unit. Because the same unit might be tested more than once, that **ID Tag** might be used more than once. The Data Set Logger handles this case by creating a unique internal ID for every run. However, you might want to assign a unique **ID Tag** for each run. For example, you could combine a serial number with a timestamp.

Note Analog ID tags are treated as double precision numbers when stored in the database.

   - **Description** is text information about the configuration.

- **Start when** and **End when** fields and their associated **Tag** fields specify the type of start/end condition, and a tag to monitor for fulfillment of that condition. When the start condition is met, a new run starts, provided that the previous run has ended. When the end condition is met, the run ends. The following options are available.

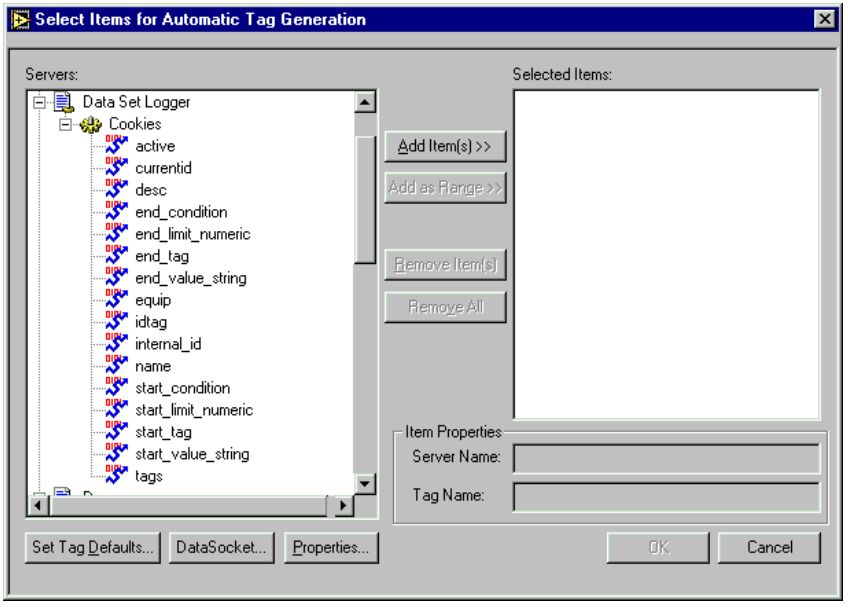
Table 5-1. Data Set Run Start/End Conditions

Value	Start/End Condition
0	**ID Tag Changes**—when the value of the **ID Tag** changes, a new run starts.
1	**Discrete Tag ON**—when the specified discrete tag's value changes from FALSE to TRUE, a new run starts.
2	**Discrete Tag OFF**—when the specified discrete tag's value changes from TRUE to FALSE, a new run starts.
3	**Analog Tag > Limit**—when the specified analog tag's value exceeds the user-provided limit, a new run starts.
4	**Analog Tag = Limit**—when the specified analog tag's value equals the user-provided limit, a new run starts. Be careful when using the **Analog Tag = Limit** setting, because comparisons are done with floating point numbers. For example, 6.9 does not equal 6.90001 with this option.
5	**Analog Tag < Limit**—when the specified analog tag's value is less than the user-provided limit, a new run starts. This option uses analog tags only.
6	**String Tag = Value**—when the specified text string tag's value equals the user-provided string, a run starts. Use only text strings for this option.
7	**Time of Day**—when the system's clock reads the specified time of day (0:00:00 to 23:59:59), a new run starts. No tag is used with this option.

5. Click the **Tags** tab, and click **Add** to select the tags you want included in your data set. All tags/traces to which a data set refers must be logged in the same database. To remove tags, select the tags you want to remove, and click on the **Remove** button.

Note You should use a data set configuration only with the `.scf` file you used to create it. Additionally, if you change the name of a tag in your `.scf` file, and that tag is used in a data set configuration, you must edit the data set configuration separately. Changes to a `.scf` file will not show up in the data set configuration tool until the `.scf` file is saved.

6. (Optional) Click the **Advanced** tab, and click **Add** to enter an item and a description of the equipment used during the data set run. This information is stored as text strings, with each new run.
7. Click **OK**.
8. Create at least one tag connection from your `.scf` file to a Data Set Logger server item. This ensures that the Data Set Logger server will run, because it will be launched by the Tag Engine.
   a. To convert a server item to a tag using the Tag Configuration Wizard, click the Configuration Wizard button in the Tag Configuration Editor. Each different data set configuration, with items, appears as a device under the Data Set Logger server, as shown in the following illustration.



b. Highlight the items you want to create tags from under your data set on the left, and click **Add Items**. Create at least one tag from the server items. You may find the **active**, **currentid**, and **internal_id** server items are most useful.

The Data Set Logger items are described in the following table.

Table 5-2. Data Set Logger Server Items

Item Name	Type	Description
active	read-only discrete	Value is TRUE after the start condition for a data set run has been met, until the end condition has been met.
currentid	read-only string	Reports the ID Tag value for the current data set run, while the data set run is active.
desc	read-write string	Contains the description of the data set. If written to, the description is updated at the start of the next data set run.
end_condition	read-write analog	Specifies the type of end condition to use for the next data set run. The allowed values are listed in Table 5-1. Depending on the end condition, certain other items may need to be updated as well.
end_limit_numeric	read-write analog	When end_condition uses numeric comparisons, this value is compared to the value of end_tag to determine if the end condition has been met.
end_tag	read-write string	Tag used to test for the end condition. The data type must be compatible with the type of condition.
end_value_string	read-write string	If the end_condition is configured as String Tag=Value, this value is compared to the value of end_tag to determine if the end condition has been met. The comparison is case sensitive. Use a text string for this value.
equip	read-write string	List of equipment for the current data run. Changes take effect when the next run starts.
idtag	read-write string	If written to, the data set configuration is modified to use this tag as the ID Tag when the next data set run starts.

Table 5-2. Data Set Logger Server Items (Continued)

Item Name	Type	Description
internal_id	read-only binary string	Contains an internally generated, 8-byte binary identifier that is unique for each data set, used to identify each data set run.
name	read-only string	Name of the data set configuration.
start_condition	read-write analog	Specifies the type of start condition to use at the beginning of the next data set run. The allowed values are listed in Table 5-1. Depending on the start condition, certain other items may need to be updated as well.
start_limit_numeric	read-write analog	When start_condition uses numeric comparisons, this value is compared to the value of start_tag to determine if the start condition has been met.
start_tag	read-write string	Name of the tag used to test for the start condition. The data type must be compatible with the type of condition.
start_value_string	read-write string	If the start_condition is configured as String Tag =Value, this value is compared to the value of start_tag to determine if the start condition has been met. The comparison is case sensitive. Use a text string for this value.
tags	read-write string	Provides the list of tags used in the data set, delimited by EOL (end-of-line) characters. If written to, the set of tags included in a data set will be used when the next data set run starts.

c. Add server items from each data set you have defined. Click **OK** when you are finished.

9. Restart the Tag Engine if it is running, so that your changes take effect.

Editing Data Sets for Logging

To edit an existing data set, follow these steps.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**) and make sure the active `.scf` file contains the tags you want to include in your data set.

2. Select **Servers»Data Set Logger Configuration**. If the dialog box does not open to the data set you want to edit, select **File»Open** to open the data set you want to edit.
3. Make any changes that you want to make to the configuration of the data set. Refer to the *Creating a Data Set for Logging* section of this document for more information about the configuration options.
4. Restart the Tag Engine if it is running, so that your changes take effect.

Considerations for the Data Set Logger

Nested data sets are not allowed. That is, you cannot include a data set within another data set. Also, if a data set starts but does not properly meet its end condition, it is an open-ended run and will not appear as a complete data set run when accessing completed data sets.

Retrieving Logged Data Sets

You can use the Historical Data Viewer in MAX to retrieve data that has been logged in sets using the Data Set Logger server. Refer to the Historical Data Viewer documentation in MAX for more information about it.

Archiving Historical Data

You can archive historical data in the following ways.

- Use the archiving feature of Historical Data Viewer in Measurement & Automation Explorer (MAX).
- Archive the database manually, by copying or moving the files. When you decide to archive historical data manually, copy the `.scf` file along with the historical files to the new location. Although you can retrieve historical data without the `.scf` file, you do not have the tag configuration information, such as engineering range and unit, unless you archive the `.scf` file as well. You *must* stop the Tag Engine and Citadel Service before archiving these files manually.

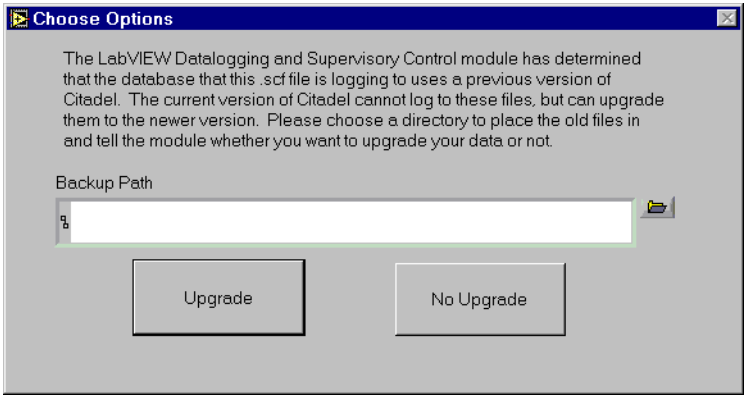
  When you create a `.scf` file, the default location for the data generated by the tags configured in that file is a directory called `data` located in the directory in which you saved the `.scf` file. Preferably, maintain the relative path between the `.scf` file and the historical files in the new archive location. For example, if the `.scf` file is in `c:\archive`, keep the historical database in `c:\archive\data`.

You need to archive files with the following extensions: `.ale`, `.adx`, `.dat`, `.mdx`, `.bak`, `.tbd`, `.tdx`, `.thd`. These files are not independently accessible. Put these files into the folder you have selected as the logging directory. However, if you copy those files into a folder with an already existing database, the files names will collide.

Converting Older Citadel Database Files

If you logged to Citadel database files from BridgeVIEW or Lookout versions earlier than 4.0, you must decide whether to update the older files to the current Citadel format. You can convert old database files to maintain data continuity, or you can start a new data directory and keep your old data segregated from new data.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**). When you first open a tag configuration file generated in BridgeVIEW, or set the logging directory to a directory containing an old database file, you are prompted to convert the file.
2. Select **Configure»Historical** and set the **Data Directory** to the path to the old file, or select **File»Open** to open the `.scf` file associated with the old file. The following dialog box appears.



3. Choose whether to convert the files.
   - Click **Upgrade** to convert your old data files to the new format. The time required for LabVIEW to convert your files depends on the amount of data. The updated data will show that all tag values were produced on the computer on which you are performing the conversion. New data logged will show the proper source for the data.

- Click **No Upgrade** if you do not want to convert the files. LabVIEW will create a new, empty database in your current data directory for logging data in the new format.

Whether or not you choose to convert your files, LabVIEW moves your old files to the path you enter in the **Backup Path** field. If you leave this field blank, LabVIEW moves the files to a subdirectory of your data directory called `archive`.

Viewing Historical Data

There are three methods for viewing historical data that has been logged to Citadel.

- Use the classic Historical Trend Viewer (HTV). The HTV is a utility that launches as a separate window in the LabVIEW DSC module environment. You can launch it from the **Tools** menu.

  The HTV display is limited to eight traces at once, but you can browse to different traces within the current `.scf`. The HTV hypercursor allows you to locate trend breaks, but not minimums or maximums. Refer to the *Accessing Historical Data Using the Historical Trend Viewer* section later in this chapter for more information.

- Use the Historical Data Viewer. The Historical Data Viewer exists in the Measurement & Automation Explorer (MAX) environment and requires no programming. The Historical Data Viewer allows multiple views (collections of traces and settings) that can be saved for future viewing.

  With the Historical Data Viewer, you can view any number of traces and browse to any traces within a single database. You can zoom out to any width, locate breaks, and jump to minimums and maximums of a trend. The Historical Data Viewer is documented in MAX.

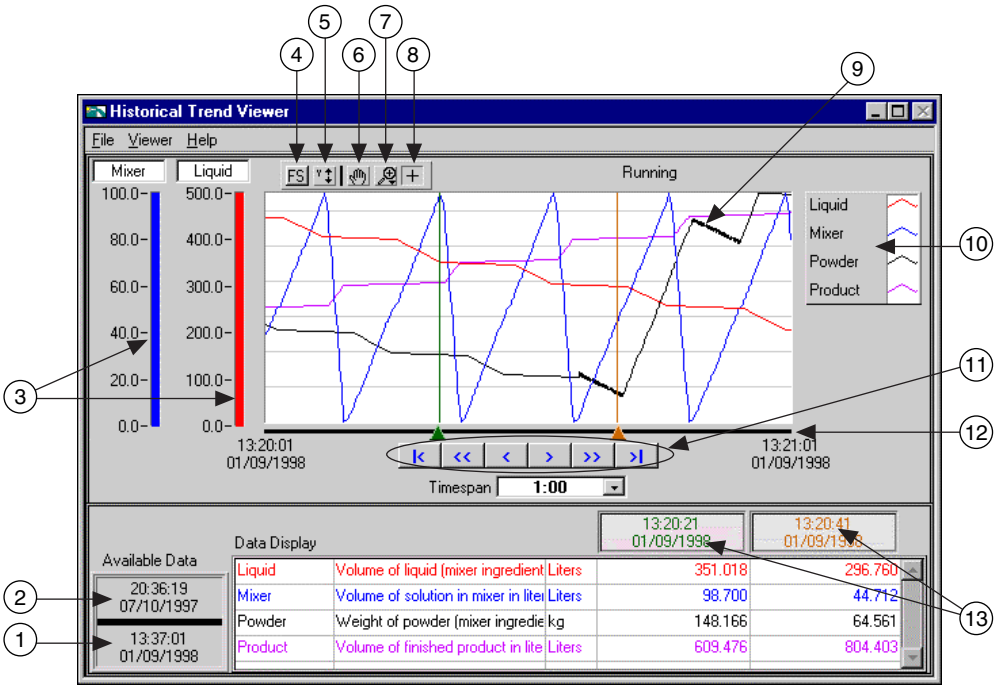
- Use an ODBC-compliant program to query the Citadel database. Refer to Appendix A, *Using SQL to Access Historical Data in Citadel*, for more information.

Your application might offer an alternative way to view historical data. Refer to the application documentation or consult the application developer for more information.

Accessing Historical Data Using the Historical Trend Viewer

The Historical Trend Viewer (HTV) is a stand-alone utility that enables you to look at historical data in your system. The HTV limits you to viewing no more than eight tags at a time, and you can view data from only one Citadel database at a time.

To open the HTV, select **Tools»Datalogging & Supervisory Control» View Historical Data**. The HTV is shown in the following illustration.



1	Stop time	5	Autoscale Y button	8	Cursor Movement tool	11	Panning buttons
2	Start time	6	Scrolling tool	9	Trend display	12	Time axis
3	Y-axis displays	7	Zoom button	10	Plot legend	13	Cursor displays
4	Full Scale button						

Figure 5-1. Historical Trend Viewer Environment

Selecting Tags to Display in the HTV

1. Open the HTV. The **Select Tags for HTV** dialog box appears. If the HTV is already open, select **File»Select Tags** to display the dialog box.
2. Enter a **Logging Computer**. The default is localhost, but you can browse to and select any registered computer on your network that is running Citadel.
3. Select either a `.scf` file or a directory of Citadel files. The default is to select a `.scf` file. The `.scf` file you select must point to a valid directory of Citadel files. If the Tag Engine is running, the `.scf` file being used by the Tag Engine is selected by default.
4. Select the tags you want to display in the **Available Tags** listbox and click the **Add** button to display them in the **Tags to Display** listbox on the right. The HTV displays the tags in the order that they are listed in the **Tags to Display** list.

   View configuration information about a tag by selecting it in the **Available Tags** listbox and clicking the **Tag Information** button.
5. Click the **OK** button.

Changing the HTV Time Axis with Panning Buttons

You can change the time axis for a trend within the HTV manually, or by using panning buttons. The panning buttons allow you to move backward and forward through the historical data in the trend. The buttons do not affect the timespan of the trend. For example, if the trend displays data from 9:45 to 9:55 on the same day, the timespan is ten minutes. Table 5-3 describes the panning button functions.

Table 5-3. Panning Button Functions

Button	Name	Description
|<	Retrieve oldest data	Displays the first available page of data.
<<	Back to closest point	Centers the display around the closest point to the left of the timespan. If there is no data in the previous time span, skips to the previous end of data.
<	Back one-half page	Moves the display back by half of the current timespan.
>	Forward one-half page	Moves the display forward by half of the current timespan.

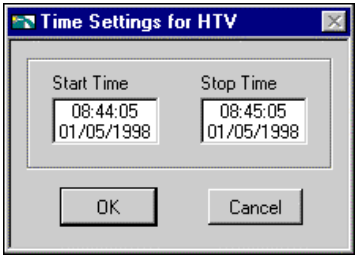
Table 5-3. Panning Button Functions (Continued)

Button	Name	Description
>>	Forward to closest point	Centers the display around the closest point to the right of the timespan. If there is no data in the next time span, it skips to the next start of data.
>|	Most recent data	Displays the most recent available page of data.

Changing the HTV Time Axis Manually

You also can change the time access for a trend within the HTV manually. To do so, select the text at either end of the time axis and change the data. You must enter the date in the correct format. If you make an error, the input is ignored.

You can select and enter the time and date on the time x-axis of the historical trend on the HTV directly. However, the HTV responds immediately to any changes you make. If you want to make manual edits to both the start and stop time on the time axis, you can select the **Viewer»Time & Date** option. When you select this option, the following dialog box appears and you can enter the start and stop time of the data displayed in the trend.



Changing the HTV Timespan of Data Displayed

The **Timespan** pull-down menu displays the amount of relative time between the start and end points of the time axis. To change the amount of time between these points, you either can manually reenter data in the start or end point on the time axis, or use the **Timespan** pull-down menu.

By default, **Timespan** contains the values 1:00, 5:00, 10:00, and 30:00. Select **Enter New** in **Timespan** if you want to enter a different amount of data to display.

Viewing an HTV Tag Value at a Specific Point in Time

The Data Display table on the HTV shows the tags displayed in the trend, the tag description, and, for analog tags, the engineering units associated with the tag. The two rightmost columns show the values of the tags at the two cursor locations in the trend. For discrete tags, the values in these columns are either `On` or `Off`. To move the cursors, drag the triangles at the bottom of the trend display.

Changing the HTV Y-Axis

The HTV displays two Y axes at any time. Each y-axis displays the color of the tag associated with it. All discrete tags show their ranges as going from `On` to `Off`. Click the y-axis to make it rotate through the tags displayed in the trend.

To change the range in the y-axis for analog and bit array tags, select the text at the top or bottom of the scale and type in the desired value. When you enter the value, that trend scale changes and the trend display updates. Discrete tags are displayed without y-axis scales, and ranges are shown as `On` or `Off`.

Changing the HTV Plot Colors and Style

Click the **Trend Legend**. The shortcut menu contains several options with which you can change the plot colors and styles used in the trend.

Zooming In on an HTV

The **HTV Trend** palette contains a **Zoom** button, shown at left, that allows you to zoom in on points of interest.

Click the Zoom button and select from the following options, clockwise from the top left, to zoom in and out of the trend:

- **Zoom to Rectangle**—Click a point on the display you want to be the corner of the zoom area and drag the tool until the rectangle covers the zoom area.
- **X-zoom**—Zooms in on an area of the graph along the x-axis.
- **Y-zoom**—Zooms in on an area of the graph along the y-axis.
- **Zoom Out about Point**—Click a point you want to zoom out from.

- **Zoom In about Point**—Click a point you want to zoom in on. Press the <Shift> key to change between Zoom In about Point and Zoom Out about Point.
- **Undo Zoom**—After you zoom in or out, use this option to return to the previous view.

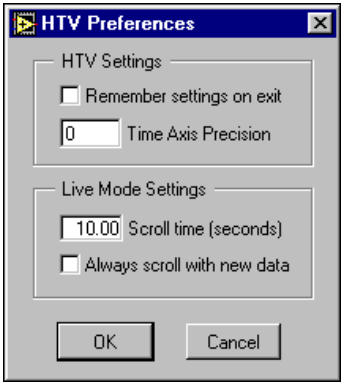
Exporting HTV Data to a Spreadsheet

From the HTV, select **File»Export**. The HTV exports the information currently displayed in the trend to a tab-delimited file. A dialog box prompts you for the name and location of the file to create.

The HTV resamples data in periodic intervals so that all tags have the same number of data points. The frequency defaults to a value according to the frequency of data in the historical files. If you want to override this value, enter the frequency you want in the dialog box.

Setting HTV Tag, Time, and Color Preferences

Set the preference for the HTV to remember settings for display time and color on exit by selecting **Viewer»Preferences**. When you exit the HTV, the state of the viewer is recorded.



Place a checkmark in the **Remember settings on exit** checkbox if you want to update your settings each time you exit the HTV.

Viewing Newly Logged HTV Data Automatically

You can use Live mode to watch incoming data after it has been logged. When historical logging is enabled, the **Live** button appears to the right of the panning buttons. When you click the **Live** button, the trend automatically updates periodically. Select **Viewer»Preferences** in the **HTV Preferences** dialog box to set how often the trend displays the new data. The default is 10 seconds. If **Always scroll with new data** contains a checkmark, the display updates when new data are logged.

While Live mode is turned on, the values for each tag are extrapolated to the last time the trend was updated. These extrapolated values are marked with an asterisk in the Data Display. When a cursor or slider is placed before the extrapolation begins for a tag, the asterisk is not present. Turning off Live mode also turns off extrapolation.

Printing Historical Data

You can print logged, historical data in the following ways:

- Print historical data trends from the HTV. Open the HTV by selecting **Tools»Datalogging & Supervisory Control»View Historical Data**. Refer to the online help for information about selecting tags, adjusting the timespan, and printing data.
- Print historical data trends from the Historical Data Viewer in MAX, which allows you to export data to a spreadsheet or to HTML format.
- Print historical data from a text file that you create by exporting to a spreadsheet file.
- Use an ODBC-compatible application to query the Citadel historical database and print the results. Refer to Appendix A, *Using SQL to Access Historical Data in Citadel*, for more information about using ODBC applications with the Citadel database.

6

Security

Your application implements security with user and group accounts.

A system with permission-based security is a system in which users are allowed various degrees of access to tools or data depending on the permission attached to their account name in the access property of the tool or data involved.

For example, the application developer controls access to a front panel control by giving access to individual user or group accounts.

Creating and Editing User and Group Accounts

You might need to create, delete, or edit user accounts. You use the User Account Manager to create and edit the properties of groups, create or edit the properties of user accounts, assign users to one or more groups, and otherwise manage security accounts for LabVIEW and Lookout applications. Only an administrator or someone whose account is a member of the Administrator group can create, revise, or delete system user accounts.

Note For user accounts to work consistently across your network, you must use the same `lookout.sec` file for all installed copies of Lookout or the LabVIEW Datalogging and Supervisory Control (DSC) module. Refer to the *Duplicating Security Files for Networked Computers* section of Chapter 7, *Networking and Running Applications*, for more information.

Creating User Accounts

1. Open the User Account Manager (**Tools»Datalogging & Supervisory Control»Security»Edit User Accounts**.)
2. Select **User»New User**.
3. Enter the domain name of the new user in the **Username** field.
4. Enter the **Full Name** of the user.
5. Enter job titles or other relevant information in the **Description** field.
6. Enter the user password in the **Password** field.

7. Enter the password a second time in the **Confirm Password** field to make sure there was no typing error in the first entry.
8. Set the **Security Level** for the new user. Security levels range from 0 to 10, with 10 being the highest possible security authorization. Assign level 10 access only to those people responsible for system security.
9. **Minutes idle until logoff** sets how long LabVIEW runs with no operator interaction before logging the current user off automatically. Setting this value to 0 (the default) means there is no timeout in effect.
10. You can set an expiration time for passwords. Users cannot reset their own password; a member of the Administrator group must set the password for them. The default is for passwords never to expire.
11. Place a checkmark in the **Account Disabled** checkbox if you want to disable a user account without removing the user from the system.
12. Click the **Groups** button to add this user to various local security groups. The **Group Memberships** dialog box appears.

    The default groups are Administrators, Guests, Operators, and System Operators. Any groups you have created are also shown.
13. To enter a user in a group, highlight the group in the **Not Member of** field and click the **Add** button. To remove a user from membership in a group, highlight a group in the **Member of** field and click the **Remove** button.

Note When you add an individual user whose individual account has a security level different than that of the group, that user has the higher of the security levels.

14. Click the **OK** button.

Creating Groups

1. Open the User Account Manager (**Tools»Datalogging & Supervisory Control»Security»Edit User Accounts**.)
2. Select **User»New Local Group**.
3. Assign a name to the group in the **Group Name** field.
4. Enter a description of the group in the **Description** field.
5. Assign the security level for members of this group in the **Security Level** field.

Note When you add an individual user whose individual account has a security level different than that of the group, that user has the higher of the security levels.

6. To add **Members**, click the **Add** button. The **Add Users and Groups** dialog box appears.
7. The **List Names From** listbox selects the domain to list user names from. At this time, you are restricted to your local domain.
8. Highlight the names you want to add in the **Names** field, and click the **Add** button to add those users to your group.

Modifying User and Group Accounts

The dialog boxes for editing users and groups are essentially the same as those for creating users and groups. Complete the following steps to modify user and group accounts.

1. Open the User Account Manager (**Tools»Datalogging & Supervisory Control»Security»Edit User Accounts**.)
2. Either double-click the user or group you want to edit, or highlight the user or group and select **User»Properties**. The **User Properties** dialog box appears and displays information about user activity.
3. Use the **User Properties** dialog box as you would the new user dialog box. Refer to the *Creating User Accounts* section for more information about the fields in this dialog box.
4. Click the **OK** button.

Special Pre-Defined User and Group Accounts

The National Instruments User Account Manager comes with several user accounts and groups built-in. The built-in user accounts include Administrator, Everyone, Guest, and (nobody). The built-in groups include Administrators, Guests, Operators, and System Operators. You cannot delete any of these accounts, though you can edit the properties of some of them.

The Administrator account overrides all other security settings and has access to everything in LabVIEW. This override extends to all individual accounts added to the Administrators group.

You cannot delete the Administrator account or change its security level. You can set the password and enter the name and a description of the Administrator. You can add or remove individual user accounts from the Administrator group.

The (nobody) account cannot be edited or deleted, and does not actually appear as an account in the User Account Manager. This account is what LabVIEW defaults to when no authorized user is logged on. It always has a security level of 0.

You can edit all the properties of the Guest user account and of the Guests, Operators, and System Operators groups.

Logging In and Out

To log in, select **Tools»User Name**. Type your account name and password. If you do not know your account name, or have forgotten your password, contact your LabVIEW administrator.

To log out, select **Tools»Datalogging & Supervisory Control» Security»Logout**, or select **Tools»User Name** and click **Logout**.

Accessing User Information

After you log into the LabVIEW DSC module, you can find out what your user privileges are, along with other user information, by selecting **Tools» Datalogging & Supervisory Control»Security»User Info**.

The default tab for the **User Information** dialog box lists the identity of the logged in user along with activity information for this user. Other tabs reveal the permissions set for a given user.

Changing Your Password

Administrators can change passwords by editing accounts in the User Account Manager. If you are not an Administrator, follow these steps.

1. Make sure you are logged in (**Tools»User Name**).
2. Select **Tools» Datalogging & Supervisory Control»Security»Change Password**.
3. Type your old password, your new password twice, then click **OK**.

Restricting Access to the LabVIEW Environment

After you set up your user and group accounts, you can implement security in several ways. You can configure access to most LabVIEW DSC module utilities and the Tag Engine on a per-user or group basis. In general, security set up by selecting **Tools»Datalogging & Supervisory Control»Options** or **Tools»Datalogging & Supervisory Control»**

Security applies to everything in the LabVIEW environment and security set up in the Tag Configuration Editor applies only to the `.scf` file.

Setting Permissions for Accessing Tools

Complete the following steps to set permissions for the Tag Configuration Editor, Tag Engine, Historical Trend Viewer, Tag Monitor, Server Browser, startup VIs, or server tester.

1. Log in as an administrator (**Tools»User Name**).
2. Select **Tools»Datalogging & Supervisory Control»Options**.
3. Click the **Advanced** tab.
4. Click the **Tools Access** button. The **Tools Access** dialog box appears.
5. Click the tab for the tool for which you want to configure permissions and click the **Edit** button. The standard LabVIEW DSC module **Access Rights** dialog box appears with the name of the tool for which you are configuring permissions above the list of users and groups.
6. This dialog box displays a list of access rights for specific users and groups.
   - To remove a user or group, select it and click the **Remove** button.
   - To change a user or group permission, select it and select from the options in the **Access** listbox.
   - To add a new user or group, click the **Add** button. The **Add Users and Groups** dialog box appears. Highlight the user or group you want to add and click the **Add** button. Set the **Access rights**. Click **Help** in the **Access Rights** dialog box for detailed information.
7. Click **OK** when you are finished.

Configuring Access to a Specific Tag

Complete the following steps to configure access to a specific tag.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Double-click the tag to display the **Tag Configuration** dialog box.
3. On the **General** tab, click the **Security** button to display the **Access Rights** dialog box.
4. Set the **Access rights**. Click **Help** in the **Access Rights** dialog box for more information.
5. Click the **OK** button twice and save your changes.

Note If you do not use a specific setting for a tag, it inherits the data access settings made for the `.scf` file. For more information, refer to the *Setting Data Access* section later in this chapter.

Setting SCF File Access

You can specify who can edit a particular `.scf` file. This permission is part of each `.scf` file and can vary from file to file.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Configure»Security**.
3. Click the **SCF File Access** tab, and click the **Edit** button. The **Tag Configuration File Access Rights** dialog box appears.
4. The large field in the center of this dialog box lists the groups and user accounts that have permission to work with the `.scf` file shown at the top of the dialog box.
   - To remove a user or group, select it and click the **Remove** button.
   - To change a user or group permission, select it and select from the options in the **Access** listbox.
   - To add a new user or group, click the **Add** button. The **Add Users and Groups** dialog box appears. Highlight the user or group you want to add and click the **Add** button. Set the **Access Rights**. Click **Help** in the **Access Rights** dialog box for more information.
5. Click **OK** when you are finished.

Setting Data Access

You can specify which users, groups, or computers are allowed to access a `.scf` file's tag data from DataSocket, Tag Monitor, Lookout, or other Tag Engines. You can also set up a proxy user account so that LabVIEW knows how to handle unidentified clients attempting to connect to tag data. The settings you make may depend on the programs and users that may attempt access, and under what circumstances.

The LabVIEW DSC module implements the following priority when checking access rights:

1. Does the computer have access? If not, access is denied. If so, the user access rights are verified.
2. Is the user recognized?
   a. If the same `lookout.sec` file exists on both the local and remote computers, the user is recognized. If the user is recognized, access

rights are assigned based on the configuration of that user's account.

b. If the user is not recognized, the proxy user settings are used.

The following situations are examples of how the LabVIEW DSC module handles various access attempts:

- A DataSocket connection to tag data: On a front panel, the access of the user currently logged in to LabVIEW is used. On a diagram, the "nobody" account is used, so the proxy user access rights are invoked.
- A Lookout user or LabVIEW DSC module user attempts access to your tag data from across the network, and both machines have the same `lookout.sec` file installed: In this case, your LabVIEW DSC module application applies the access rights assigned to that user's account.
- A Lookout user or LabVIEW DSC module user attempts access to your tag data from across the network, and both machines do *not* have the same `lookout.sec` file installed: In this case, the user is unrecognized by your LabVIEW DSC module application, and the proxy user access rights are applied.
- Someone using a program other than Lookout or the LabVIEW DSC module attempts to access your tag data from across the network: In this case, the user is unrecognized by your LabVIEW DSC module application, and the proxy user access rights are applied. This would also apply to a LabVIEW user without the LabVIEW DSC module installed.
- A separate Tag Engine connects through Logos networking to tags in your local Tag Engine: In this case, your LabVIEW DSC module application applies the access rights assigned to the *engine user* account as defined in the separate Tag Engine.
- The Tag Monitor is running: Tag Monitor uses the access rights of the user logged in whenever the Tag Monitor was launched. If the Tag Monitor is left running while a different user logs in to LabVIEW, the previous user's access rights remain in effect.

Setting Network Access for Specific Users, Groups, or Computers

You can grant or deny tag data access across the network for users, groups, or computers. All tags in a given `.scf` file inherit these settings, except for any tags you edit security settings for individually. The user and group access settings require that both the local and networked computer have the same `lookout.sec` file installed. *Host Access* controls whether a

particular computer can access data on your computer, no matter who is logged on that computer.

1. Open the Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**).
2. Select **Configure»Security**.
3. Click the **Data Access** tab, and click the **Edit** button. The **Access Rights** dialog box appears.
4. Configure the network security for user or group access. The large field in the center of this dialog box lists the groups and user accounts that have permission to work with the `.scf` file shown at the top of the dialog box.
   - To remove a user or group, select it and click the **Remove** button.
   - To change a user or group permission, select it and select from the options in the **Access** listbox.
   - To add a new user or group, click the **Add** button. The **Add Users and Groups** dialog box appears. Highlight the user or group you want to add and click the **Add** button. Set the **Access rights**. Click **Help** in the **Access Rights** dialog box for more information. Click **OK** when you are finished.
5. Configure the network security for Host Access. Click the **Configure Host Access** button in the **Host and Tag Data Access Rights** dialog box. In the **Configure Network Access** dialog box, allow or deny access for specific networked computers.
   - You can use the asterisk wildcard to enable or disable all computers or all computers in a set. For instance, entering `*.yourdomain.com` would select all the computers with that domain address. This is the same syntax used by the Server TCP/IP Access VI, available by selecting **Tools»Options**, then selecting **VI Server:TCP/IP Access**. Refer to the LabVIEW documentation for more information about the VI Server and wildcards you can use in the **TCP/IP Access List**.
   - You can browse the network and select individual computers by clicking the **Browse** button. The **Network Browser** dialog box appears. Click the network node to expand the network view, and select the computer you want to allow or disable access for. Click the **OK** button to add this computer to the access list.
6. If you have enabled BridgeVIEW 2.*x* networking in the Tag Configuration Editor (by selecting **Configure»Network» BridgeVIEW 2.x Networking»Allow Network Access**), it enables the **Advanced** button on the **Configure Network Access** dialog box.

Clicking this button opens the **Network Settings** dialog box that functions in the same way it did in BridgeVIEW 2.*x*.

7. Click the **OK** button.

Setting a Proxy User Account

The proxy user is the account used for unrecognized access to your data. For example, if you set the proxy user as Guest (default), then any unidentified client who attempts to access your data will be given the access rights you have assigned to the Guest account. Follow these steps to set proxy user access:

1. Select **Tools»Datalogging & Supervisory Control»Options** and click the **Advanced** tab.
2. Click **Proxy User**.
3. Specify the user name and password to use for the proxy user. The default setting for the proxy user is the built-in Guest account, which has no password unless you add one.
4. Click **OK**.

Note If you later change the password for the user account specified as the proxy user, you must change the password in the Set Proxy User dialog box as well.

Setting an Engine User Account

You can specify an *engine user* to ensure that your local Tag Engine has access to network tag data no matter who is logged in to the local LabVIEW DSC module application. If a locally-defined tag in the Tag Engine attempts to access tag data across the network using Logos, the local Tag Engine uses the engine user account. In this case, the tag on the local computer was created with the **Server Name** set to **Logos** in the Tag Configuration Editor.

If the remote machine recognizes that account (if it is defined in its `lookout.sec` file), it grants the access rights defined for that account. If the remote machine does not recognize that account (it is not defined in its `lookout.sec` file), it grants the proxy user access rights that are defined on the remote machine.

Follow these steps to set up an engine user account.

1. Select **Tools»Datalogging & Supervisory Control»Options** and click the **Advanced** tab.
2. Click **Engine User**.

3. Specify the user name and password to use for the engine user. The default setting for the engine user is the built-in Administrator account.
4. Click **OK**.

Note If you later change the password for the user account specified as the engine user, you must change the password in the Set Engine User dialog box as well.

Setting Tag Configuration Editor Access

Click the **Tag Editor Access** tab to set who has access to the Tag Configuration Editor.

1. While logged in as Administrator, select **Tools»Datalogging & Supervisory Control»Options**.
2. Click the **Advanced** tab, then click the **Tools Access** button.
3. On the **Tag Configuration Editor** tab, and click the **Edit** button. The **Access Rights** dialog box appears.
4. The large field in the center of this dialog box lists the groups and user accounts that have permission to work with the `.scf` file shown at the top of the dialog box.
   - To remove a user or group, select it and click the **Remove** button.
   - To change a user or group permission, select it and select from the options in the **Access** listbox.
   - To add a new user or group, click the **Add** button. The **Add Users and Groups** dialog box appears. Highlight the user or group you want to add and click the **Add** button. Set the **Access rights**. Click **Help** in the **Access Rights** dialog box for more information.
5. Click **OK** when you are finished.

Setting Startup Login Options

You can set several login options, such as whether the last user is logged in automatically when LabVIEW starts or whether a dialog box appears at startup so you must log in manually.

1. Log in as an administrator (**Tools»User Name**).
2. Select **Tools»Datalogging & Supervisory Control»Options.**
3. Click the **Advanced** tab.
4. Click the **Security Preferences** button.
5. Click the **Startup** tab.

6. Set the login option to use when LabVIEW starts.
7. Click **OK** twice.

Disabling Special Keys

Complete the following steps to prevent anyone logged in below a certain security level from using the special key combinations, including <Ctrl-Alt-Delete>, <Ctrl-Esc>, <Alt-Esc>, <Alt-Tab>, <Alt-Enter>, <Ctrl-Alt-Esc>, and the Windows logo key.

1. Log in as an administrator (**Tools»User Name**).
2. Select **Tools»Datalogging & Supervisory Control»Options**.
3. Click the **Advanced** tab.
4. Click the **Security Preferences** button.
5. Click the **Advanced** tab.
6. Set the security level at which you want to disable special keys.
7. Click **OK**.

7

Networking and Running Applications

This chapter describes how to set up applications for use on a network. You can run LabVIEW Datalogging and Supervisory Control (DSC) module applications using the LabVIEW DSC module Run-Time System, which has built-in support for the special LabVIEW DSC module capabilities. You cannot run LabVIEW DSC module applications using just the LabVIEW Run-Time Engine.

Setting up Networked Applications

To use a LabVIEW DSC module application on a network, you need to register the computers or devices on your network that use the Logos networking protocol, make sure the clocks of all your computers or devices are synchronized, make sure your security files are compatible on your networked computers, verify network paths and names, and make sure you have all necessary services running. BridgeVIEW 2.*x* networking is available, though not recommended, as explained in the *Importing Network Tags* section of Chapter 3, *Using Tags to Manage I/O in LabVIEW*.

Logos Networking Technology

National Instruments uses a special networking technology known as the Logos networking protocol, installed as a service on your computer when you install the LabVIEW DSC module. The Logos networking protocol functions across the network without you performing any special configuration or work; you can browse to any Logos data on your network from a software client with Logos capability (such as the Tag Configuration Editor or the Tag Configuration Wizard).

Note LabVIEW without the DSC module can acquire Logos data through DataSocket, but cannot act as a Logos server. The LabVIEW DSC module allows you to connect tags and data directly through the Logos networking protocol and can act as a Logos server.

The LabVIEW DSC module also adds OPC functionality to LabVIEW, allowing LabVIEW DSC module tags to connect to OPC servers. Again, you do not need to perform any special configuration operations to use this OPC capability. The Tag Configuration Editor and the Tag Configuration Wizard can browse for any OPC servers on the network and access those tags.

Registering Networked Computers

To access LabVIEW and Lookout applications or FieldPoint hardware using the Logos networking protocol, the FieldPoint device or the computer running an application must be registered. You can register computers through the Tag Configuration Editor, the Tag Monitor, the LabVIEW DSC module options, or the Server Browser.

Note Some computers, particularly on a local subnet, automatically appear as registered computers.

Complete the following steps to register or unregister a computer.

1. Log in as Administrator or with administrator privileges (**Tools»User Name**).
2. Select **Tools»Datalogging & Supervisory Control»Options**, click the **Advanced** tab, and click **Registered Computers**. Optionally, you can open one of the following utilities:
   - Tag Configuration Editor (**Tools»Datalogging & Supervisory Control»Configure Tags**), then select **Configure»Network» Registered Computers**.
   - Tag Monitor (**Tools»Datalogging & Supervisory Control» Monitor Tags**), then right-click the **Network Neighborhood** node, and select **Register Computer** from the shortcut menu.
   - Server Browser (**Tools»Datalogging & Supervisory Control» Advanced»Server Browser**), then click the **Register Computer** button.
3. Complete the following steps to add a computer to the list of registered computers.
   a. Click the **Add** button in the **Registered Machines** dialog box. The **Register Computer** dialog box appears.
   b. Enter the computer you want to access in the **Computer Name** field, or browse for the computer in the network tree.
   c. Click the **Register** button, then click **OK** when you are finished.

4. Complete the following steps to remove a computer from the list of registered computers.
   a. In the **Registered Machines** dialog box, select the computer you want to remove.
   b. Click the **Remove** button, then click **OK**.

You also can unregister a computer in the Tag Monitor by right-clicking it and selecting **Unregister** from the shortcut menu.

Setting up Time Synchronization for Networked Computers

To keep data properly time stamped, make sure the times on your computers are properly synchronized. The National Instruments time synchronization service is installed as a service in Windows 2000/NT/XP that runs every time you run your computer. Time synchronization runs as a background process in Windows Me/9*x*.

Determining Time Server Search Order

Suppose you have four computers you need to have synchronized. You should choose a primary time synchronization server and backup(s). Make sure that the order of search for time servers is the same for all the computers on your network you want to synchronize, including the primary time synchronization server. If a time server fails, the other computers synchronize to the next one in line.

Note If you have both Windows 2000/NT/XP and Windows Me/9*x* computers on the same network, you might have better results if a Windows 2000/NT/XP computer is the primary time synchronization server.

Suppose you have computers A, B, C and D, where A is the primary time synchronization computer, B is the time synchronization computer if A fails, and so on. In this scenario you would use the time server search order shown in Table 7-1.

Table 7-1. Time Synchronization Order

Computer A	Computer B	Computer C	Computer D
None listed	A	A	A
—	—	B	B
—	—	—	C

As the primary time server, Computer A would have no other servers listed. If Computer A is running, it should synchronize to itself. Computer B should synchronize to Computer A, if A is running. If A is not running, B should synchronize to itself. Computer C should synchronize to Computer A if it is running, Computer B if A is not running, and to itself if neither A nor B is running. This pattern should be used for all the computers you want in one synchronized set.

Configuring Time Synchronization

1. Select **Tools»Datalogging & Supervisory Control»Options**.
2. Click the **Advanced** tab.
3. Click the **Time Synchronization** button. The **Time Server Search Order** dialog box appears.

   Any computer that is running the time synchronization service can serve as a time server or a time client. The primary time server is the first computer listed in the **Time Server Search Order** field. If no computer is set as a primary time server, your computer synchronizes to itself.
4. To add a computer to the **Time Server Search Order** field, click the **Add** button. If you know the name of the computer you want to add, you can type it into the **Computer name** field. If you do not know the exact name of the computer, you can browse for it in the network tree contained in the **Select a Computer** field.

   To remove a computer from the **Time Server Search Order** field, highlight the computer name and click the **Remove** button.
5. To change the order in which your computers search for a time synchronization server, select the computer name and click the **Up** or **Down** buttons.
   - If you have some computers running Windows Me/9*x* and other computers running Windows 2000/NT/XP in your network, you should list Windows 2000/NT/XP computers first in the server search list. Time synchronization works better between Windows Me/9*x* and Windows 2000/NT/XP systems when the Windows 2000/NT/XP computer is the server.
   - You do not need to include a computer running LabVIEW in its own list of time synchronization services.
6. Use **Sleep Time (seconds)** to set how long each computer waits between each synchronization. You should set the primary time synchronization server sleep time to 60 seconds.

If the primary server is off-line for some reason, a computer scheduled to synchronize automatically seeks out the second computer on the synchronization server list. At the time of the next synchronization, the computer first looks for the primary server before seeking a secondary synchronization server.

7. Click the **OK** button.
8. Repeat steps 1 through 7 for all computers on your network that you want to synchronize to make sure that the order of search for time servers is the same for all the computers, including the primary time synchronization server.

Duplicating Security Files for Networked Computers

For user accounts to work consistently across your network, you must use the same `lookout.sec` file for all your installed copies of Lookout or the LabVIEW DSC module. After you create the `lookout.sec` file, make a copy of it from the `windows\system` directory of Windows Me/9*x* systems, and the `WINNT\system32` directory for Windows 2000/NT/XP systems. Place a copy of the file in the `windows\system` or `WINNT\system32` directory of each of the other computers with which you want to be able to use these user accounts.

Preserving Network Paths in Deployed Applications

LabVIEW DSC module applications use computer network names to log data and access data sources. When you run applications on a computer system different from your development system, either make sure that all the names and paths on your deployment system are identical to the names and paths on your development system, or make the necessary alterations in your applications to match the network names and data paths of your deployed system.

Monitoring NI Services

The National Instruments Logos networking protocol requires three background services that run in Windows outside of any National Instruments applications. These services are known as Citadel Server, Classified Ads, and Time Synchronization. In the Windows 2000/NT/XP task manager, these services appear as `lkcitdl.exe`, `lkads.exe`, and `lktsrv.exe`. Under Windows 2000/NT/XP, these services run automatically. If you need to interact with these services, you can use the Services utility, found in **Start»Settings»Control Panel»Services**.

The LabVIEW DSC module installs a National Instruments services manager, denoted by an icon located in the system tray of the Windows taskbar, near the computer clock. The columns of circles from left to right represent Classified Ads, Time Server, and Citadel Service. A green light indicates the service is running. A red light indicates the service is stopped. When you right-click this icon, a shortcut menu appears from which you can start or stop any of the NI services.

Caution Do *not* stop these services while the LabVIEW DSC module, the Tag Engine, or Lookout is running.

Viewing Client Connections

To see what computers are currently accessing data from a LabVIEW DSC module application, use the Engine Manager. For more information, refer to the *Viewing Tag Engine Status* section in Chapter 3, *Using Tags to Manage I/O in LabVIEW*.

Troubleshooting Communication Problems

If you encounter communication problems over a network, the following points may be of help to you.

- Make sure each networked machine can access the others across the network.
- Because the protocol used for network communication between networked Tag Engines is based on TCP/IP, make sure each computer has TCP/IP configured correctly on it.
- Each machine must have a unique IP address and a host name assigned to it. TCP/IP utilities such as `ping` (all operating systems) and `nslookup` (only Windows 2000/NT/XP) can be used to verify the address and the host name.

Tip Execute `ping /?` from a command prompt to access `ping` command help. Execute `nslookup` <Enter>, then `?` at the prompt to access `nslookup` help.

- If your computers are separated by a firewall, some adjustments will be required. For more information about networking across firewalls, refer to the Developer Zone's Resource Library at `ni.com/zone`.
- Use Tag Monitor to monitor communication and determine whether data is accessible via Logos.

Configuring Startup VIs

Startup VIs are VIs that run automatically when LabVIEW starts.

1. Select **Tools»Datalogging & Supervisory Control»Advanced» Startup VIs** to display the **Configure Startup VIs** window.
2. Click the **Add** button.
3. Navigate to the VI you want to run when LabVIEW starts and click the **Open** button.
4. Place or remove checkmarks from the **Show Panel** and **Run** checkboxes.

   If you remove the checkmark from the **Show Panel** checkbox, the VI must open a reference to itself to continue running after it is loaded. Refer to the LabVIEW documentation for information about using the VI Server to open a reference.
5. Select a VI in the **Startup VIs** listbox and click the **Move Up** or **Move Down** buttons to change the order in which the VI loads.
6. Click the **OK** button.

A

Using SQL to Access Historical Data in Citadel

This chapter describes Structured Query Language (SQL), Open Database Connectivity (ODBC), and accessing Citadel data using both SQL and ODBC.

Introduction

The Citadel historical database includes an ODBC driver, which enables other applications to directly retrieve data from Citadel using SQL queries.

What is ODBC?

ODBC is a standard developed by Microsoft. It defines the mechanisms for accessing data residing in database management systems (DBMSs). Nearly all Windows applications that can retrieve data from a database support ODBC.

What is SQL?

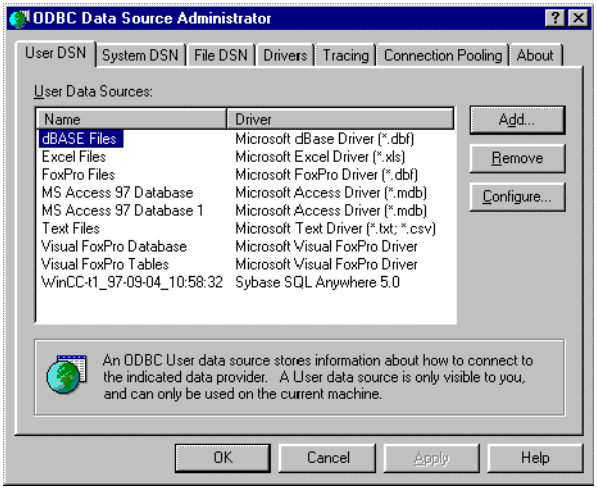
SQL is an industry-standard language used for retrieving, updating, and managing data. In LabVIEW with the Enterprise Connectivity toolkit and in Lookout, you can use SQL to build queries to extract data from Citadel. The Citadel ODBC driver also includes many built-in data transforms to simplify statistical analysis of retrieved data.

Creating a Citadel ODBC Data Source

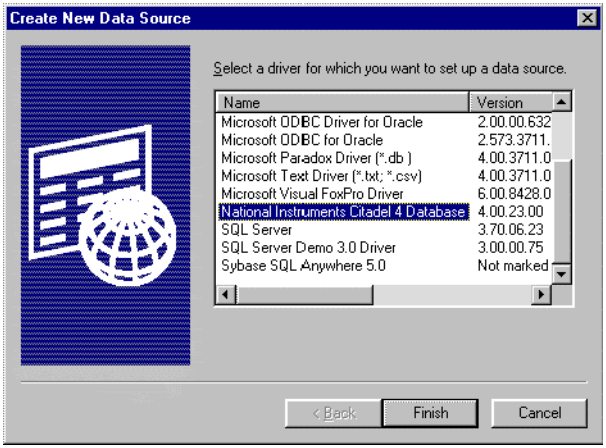
Complete the following steps to create a Citadel ODBC data source for use with the LabVIEW Datalogging and Supervisory Control (DSC) module.

1. Click the Windows **Start** button and select **Settings»Control Panel**.
2. Run the ODBC applet. It might be called **ODBC** or **ODBC Data Sources** or something similar, depending on your operating system version number.

Note Shut down all ODBC applications, such as databases, spreadsheets, word processors, and Microsoft Query, before you run the ODBC applet.

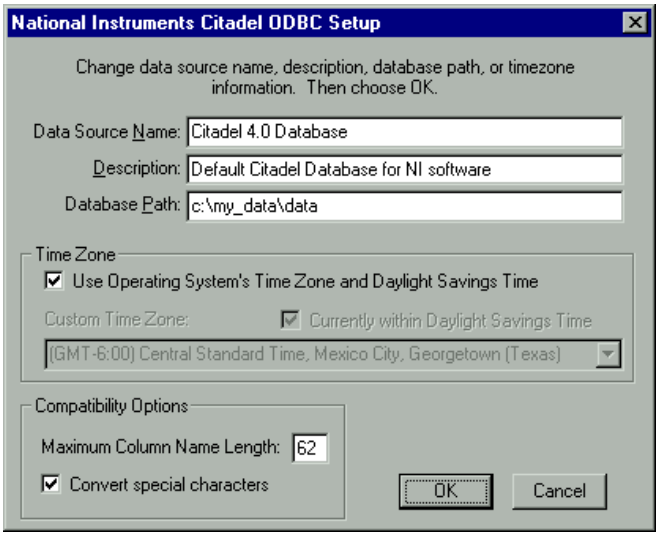


3. Click the **User DSN** tab or the **System DSN** tab, depending on which type of data source you want to create. User DSNs are only visible to the user who created them on the current machine. System DSNs are available to all users on the current machine.
4. Click the **Add** button. The following dialog box appears.



5. Select **National Instruments Citadel 4 Database**, then click **Finish**.

6. In the **National Instruments Citadel ODBC Setup** dialog box, fill in the **Data Source Name**, **Description**, and **Database Path** fields.
   a. The **Data Source Name** is the name that ODBC applications use to select the data source.
   b. **Description** is a free-form text string you can enter to describe the data source.
   c. **Database Path** should match the location of the Citadel database you intend to access. Use a fully qualified path to a remote computer if you are accessing the Citadel database on a remote computer, such as `\\tripper\c:\data`.



   The **Data Source Name** must be different from any other ODBC data source name. The **Description** is arbitrary. The **Database Path** gives the location of the folder where the data for this source are stored. If your `.scf` files use different data locations, you probably want to configure one ODBC data source for each.

7. Click the **OK** button in the **Setup** dialog box, then click the **OK** button in the **ODBC Data Source Administrator** dialog box.

Note Some applications are not completely ODBC compliant. If you plan to use Microsoft Query, Microsoft Access, or Visual Basic, make sure **Maximum Column Name Length** does not exceed 62 characters. These applications cannot handle longer names. Applications that are completely ODBC compliant can handle names up to 126 characters

long. All traces whose names exceed the **Maximum Column Name Length** are excluded from queries.

Because tags might include network path information in their names, you might exceed the 62 and 126 character limitations of ODBC. Consideration given to naming and organizing objects can minimize the risk of encountering this difficulty.

If you plan to use Microsoft Access or Visual Basic, select **Convert special characters** to force your tag names into an accepted format by replacing characters within the names with the characters in Table A-1.

Table A-1. Special Access SQL Characters

Special Character	Converted Character
period (.)	at sign (@)

The special characters changed in ODBC 4. If you are converting SQL queries from an earlier version earlier of the ODBC driver, you might have to rewrite any SQL queries you set up in your earlier processes.

Accessing Citadel Data

Traces Table

The ODBC driver presents Citadel data to other applications as a traces table. The table contains a field or column for each tag logged to the Citadel database and three fields you can use to specify query criteria and to time stamp retrieved data: **Interval**, **LocalTime**, and **UTCTime**.

Interval specifies the query value sample rate. **Interval** can range from 10 ms to several years. **Interval** defaults to 1 (one day). **WEEK** is a standard seven days, but **MONTH** and **YEAR** account for different month lengths and leap years.

Because Citadel is event-driven, it only logs a value when the value changes. Using **Interval**, you can query Citadel for values evenly spaced over a period of time.

LocalTime and **UTCTime** are time-stamps that indicate when values are logged. Citadel stores the time in **UTCTime** format and derives **LocalTime** from the stored time.

The following `where clause` query uses **Interval** and **LocalTime** to select data over a specified time at one-minute intervals.

```
SELECT * FROM Traces
WHERE LocalTime>"12/1 10:00"
   AND LocalTime<"12/2 13:00"
   AND Interval="1:00"
```

Points Table

The Points table is used to retrieve the actual values logged for a tag and the times they were logged. Because logging to Citadel takes place asynchronously, there is no correlation between the timestamps for one tag and another. For this reason, when querying the Points table, you can query only one tag at a time.

The *where* clause using **LocalTime** and **UTCTime** is supported for the Points table; however, **Interval** is not relevant to the Points table. The data transforms are also not relevant to the Points table and are not supported.

An example of a query using the Points table could be

```
SELECT LocalTime, "\\computername\process\Pot1" FROM
Points
WHERE LocalTime > "12/1 10:00" AND
                  LocalTime < "12/2 10:00"
```

Data Transforms

Queries can include special commands that perform data transforms to manipulate and analyze historical data. Table A-2 lists data transform commands.

Table A-2. Data Transform Commands

Command	Transformation
Min{Datapoint}	Returns the minimum for *Datapoint* across the interval.
Max{Datapoint}	Returns the maximum for *Datapoint* across the interval.
Avg{Datapoint}	Returns the average for *Datapoint* across the interval.
Stdev{Datapoint}	Returns the standard deviation for *Datapoint* across the interval.
Starts{Datapoint}	Returns the number of starts (that is, the number of transitions from OFF to ON) for *Datapoint* across the interval. For numeric points, 0.0 is interpreted as OFF, and all other numbers are treated as ON.

Table A-2. Data Transform Commands (Continued)

Command	Transformation
Stops{Datapoint}	Returns the number of stops (that is, the number of transitions from ON to OFF) for *Datapoint* across the interval.
ETM{Datapoint}	Returns the amount of time *Datapoint* was in the ON state across the interval.
Qual{Datapoint}	There might be gaps in the historical data traces in Citadel because of machine shutdown, Tag Engine shutdown, or a similar occurrences. Qual returns the ratio of time for which valid data exist for *Datapoint* across the interval to the length of the interval itself. If valid data exist for only one-half of the interval, Qual returns 0.5.

Using these data transforms, you can directly calculate and retrieve complex information from the database such as averages and standard deviations, so you do not need to extract raw data and then manipulate them in another application.

For example, you need to know how many times a compressor motor started in December. You also need to know its total run time for the month. Use the following query to get answers:

```
SELECT
"Starts{\\computername\processname\PLC.MotorRun}",
       "ETM{\\computername\processname\PLC.MotorRun}"
FROM Traces
WHERE LocalTime>="12/1/95"
  AND LocalTime<"1/1/96"
  AND Interval="31"
```

SQL Examples

The following examples are typical query statements; however, queries might be much more involved, depending on your system requirements.

```
SELECT *
FROM Traces
```

Retrieves the current value of every data member logged to Citadel. Because your query does not occur at the same moment in time as a PLC poll, signals scanned from PLCs are not included in the retrieved data.

```
SELECT *
FROM Traces
WHERE Interval="0:01"
```

Retrieves the value of every tag logged today in one-second increments. Notice that the interval value is enclosed in quotation marks.

```
SELECT LocalTime, "\\computername\processname\Pot1"
FROM Traces
WHERE LocalTime>"12/2/2000 16:50"
AND Interval="0:01"
```

Retrieves and time stamps the value of Pot1 in one-second increments from 4:50 p.m. to now. Names are enclosed by quotes.

```
SELECT LocalTime, "\\computername\processname\AB1.I:3",
"Max{\\computername\processname\AB1.I:3}"
FROM Traces
WHERE LocalTime>"10/1/95"
AND LocalTime<"11/1/95"
AND Interval="1:00"
```

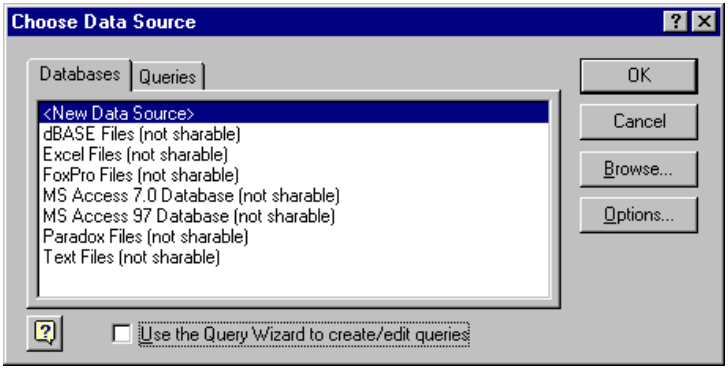
Retrieves and time stamps an Allen-Bradley PLC input in one-minute intervals for the month of October. This query also indicates the highest occurring input value of each minute.

```
SELECT LocalTime,
"\\computername\processname\OVEN1_SP",
"\\computername\processname\PLC.OVEN1_PV",
"Max{\\computername\processname\PLC.OVEN1_PV}",
"Min{\\computername\processname\PLC.OVEN1_PV}",
"Avg{\\computername\processname\PLC.OVEN1_PV}"
FROM Traces
WHERE LocalTime>"12/2/2000 14:00"
   AND LocalTime<="12/2/2000 17:00"
   AND Interval="1:00:00"
```

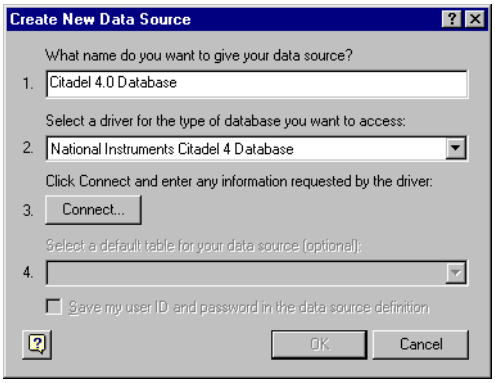
Retrieves an oven temperature at 3:00 p.m., 4:00 p.m., and 5:00 p.m. and shows the highest, lowest, and average temperatures for every hour between 2:00 p.m. and 3:00 p.m., 3:00 p.m. and 4:00 p.m., and 4:00 p.m. and 5:00 p.m.

Accessing Citadel Data with Microsoft Query

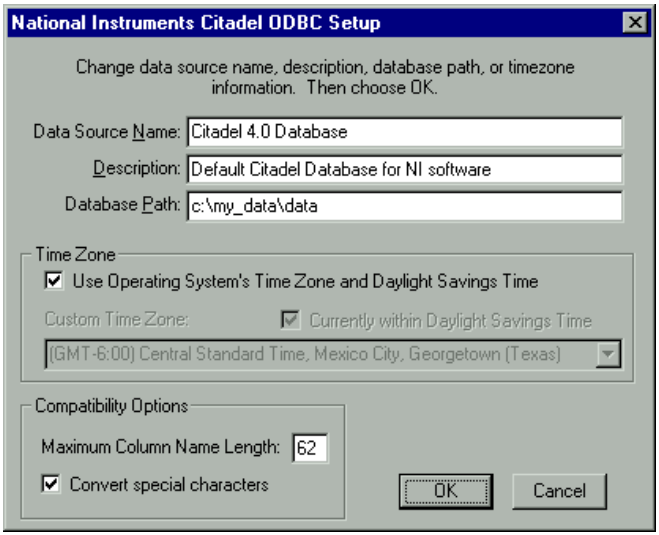
1. Launch Microsoft Query.
2. Select **File»New**. If the Citadel data source is not visible, you must create it. If it is visible, skip to step 3.
   a. Select the `<New Data Source>` entry in the **Databases** tab. Make sure the **Use the Query Wizard to create/edit queries** option is *not* selected.



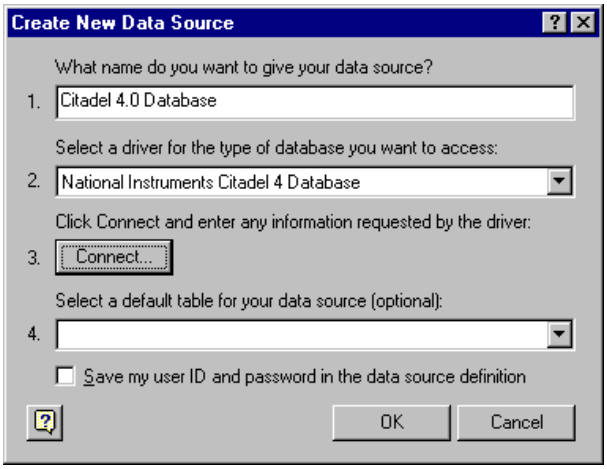
   b. The **Create New Data Source** dialog box appears. Fill in the fields as shown in the following illustration.



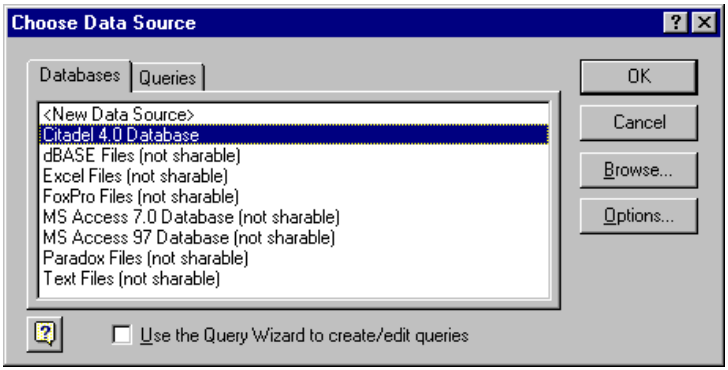
   c. Click the **Connect** button. The **National Instruments Citadel ODBC Setup** dialog box appears. Fill in the fields as shown in the following illustration. Enter the location of the database in the **Database Path** field.



d. Click the **OK** button. The **Create New Data Source** dialog box reappears, and should look like the following illustration.



e. Do *not* select a default table or save your ID and password. Click the **OK** button. The **Choose Data Source** dialog box appears, this time with the Citadel database as one of the data source choices. Select Citadel as the data source and click the **OK** button.

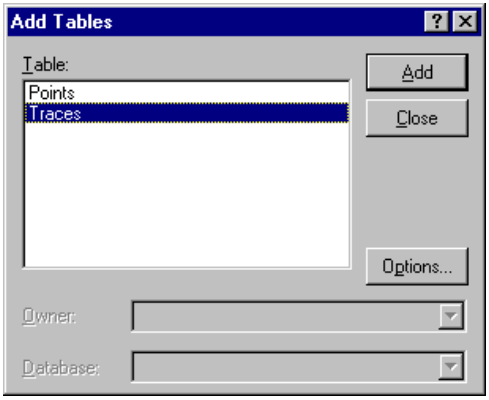


3. Select the `Citadel` data source. Make sure the **Use the Query Wizard to create/edit queries** option is *not* selected.

Note If Microsoft Query is unable to connect to Citadel, make sure you have logged data to Citadel and entered the correct database path in the **ODBC Setup** dialog box.

Note If Citadel is not listed in the **Data Source** dialog box, make sure you have created Citadel as a data source. Refer to the *Creating a Citadel ODBC Data Source* section for more information.

4. In the **Add Tables** dialog box, double-click **Traces** or **Points**, depending on whether you want to view raw data (**Points**) or resampled data (**Traces**). In the following figure, **Traces** are used.



5. Close the dialog box.

   Microsoft Query presents the full Query Window with the `Traces` and `Points` tables. The names in these tables are a comprehensive list of all name values that have been logged to Citadel.

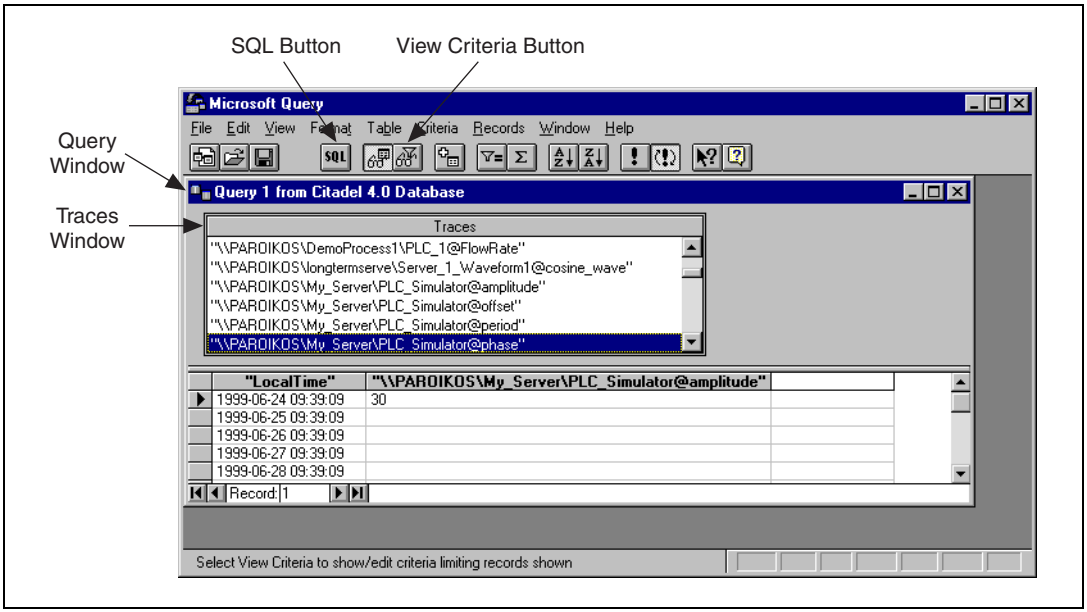


Figure A-1. The Query Window with Traces Table

6. To view a trace, double-click or drag the field you want to view to a blank column in the data pane. In Figure A-1, `LocalTime` and `"\\PAROIKOS\My_Server\PLC_Simulator@amplitude"` have been dragged down.

7. To view a data transform value, enter the function directly into a blank column. For example, to view the minimum value of `PLC_Simulator.amplitude`, you would enter `"min{\\PAROIKOS\My_Server\PLC_Simulator@amplitude}"`. You must include the quotation marks and braces.

   The data set in Figure A-1 was retrieved using no specific criteria, so the ODBC driver used the default. Although there are several ways to specify criteria, this example uses the criteria pane.

8. Click the **View Criteria** button. The pane appears in the **Query** window.

9. Add a field to the criteria pane by double-clicking the field, or by dragging it to the blank column in the criteria pane. In the following example, an Interval criteria of one minute was chosen.

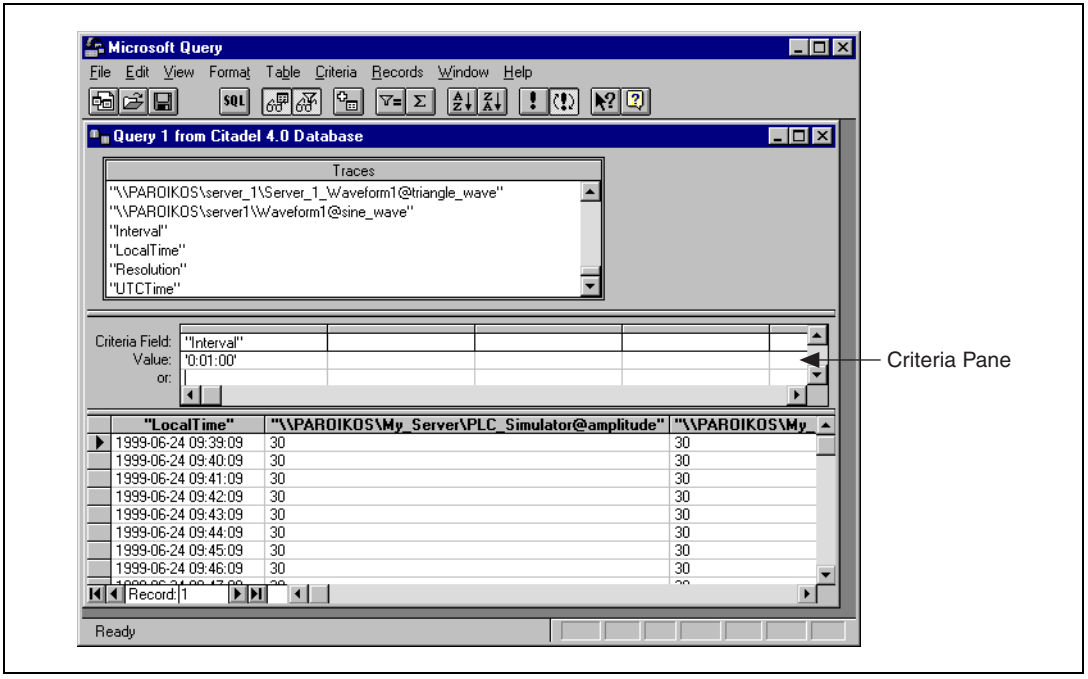
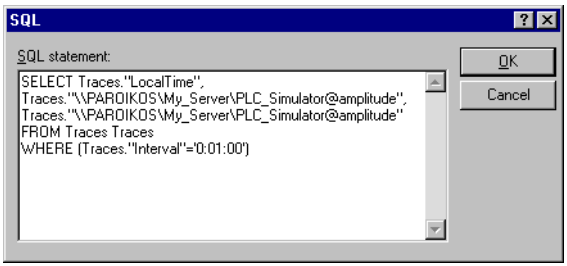


Figure A-2. Query Window with Criteria Pane

When you enter qualifying criteria values, use the syntax demonstrated in *SQL Examples* earlier in this chapter. Refer to the following figure for more information.

As soon as you specify criteria, Microsoft Query retrieves the specified data. You can save the query at any stage of development, and as you build the query, the application builds an SQL statement.

10. Click the **SQL** button to view or edit the query statement.



Accessing Citadel Data from Other Software

Refer to National Instruments Developer Zone, at `ni.com/zone` for information about using Citadel with other software such as Microsoft Excel, Microsoft Access, or Visual Basic. Use a search phrase such as `Citadel SQL`.

B

Technical Support Resources

Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of `ni.com`.

NI Developer Zone

The NI Developer Zone at `ni.com/zone` is the essential resource for building measurement and automation systems. At the NI Developer Zone, you can easily access the latest example programs, system configurators, tutorials, technical news, as well as a community of developers ready to share their own techniques.

Customer Education

National Instruments provides a number of alternatives to satisfy your training needs, from self-paced tutorials, videos, and interactive CDs to instructor-led hands-on courses at locations around the world. Visit the Customer Education section of `ni.com` for online course schedules, syllabi, training centers, and class registration.

System Integration

If you have time constraints, limited in-house technical resources, or other dilemmas, you may prefer to employ consulting or system integration services. You can rely on the expertise available through our worldwide network of Alliance Program members. To find out more about our Alliance system integration solutions, visit the System Integration section of `ni.com`.

Worldwide Support

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of `ni.com`. Branch office Web sites provide up-to-date contact information, support phone numbers, e-mail addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. Phone numbers for our worldwide offices are listed at the front of this manual.

Glossary

Prefix	Meanings	Value
m-	milli-	10^{-3}
c-	centi-	10^{-2}

A

A	amperes.
access level	Numeric value between 0 and 10 that can be used to control access to an HMI.
ACK (Acknowledge)	The sequence action that indicates recognition of a new alarm.
alarm	An abnormal process condition. In the LabVIEW DSC module, an alarm occurs if a tag value goes out of its defined alarm limits or if a tag has bad status.
Alarm Summary	A display of tags currently in alarm, or a display of tags previously in an unacknowledged alarm state that have returned to a normal state.
analog tag	A continuous value representation of a connection to a real-world I/O point or memory variable. This type of tag can vary continuously over a range of values within a signal range.
application	The application created using the LabVIEW Datalogging and Supervisory Control Module Development System and run in the LabVIEW Datalogging and Supervisory Control Module Runtime System environment.

B

batch process	Process or production run that results in a batch of logged data, also known as a data set.

bit array tag	A multibit value representation of a connection to a real-world I/O point or memory variable. In the LabVIEW DSC module, this type of tag can be comprised of up to 32 discrete values.

C

Citadel	A database for storing historical tag values.

D

DAQ	Data Acquisition.
data set	A group of tag values logged together as a set during a specified period of time.
DataSocket	Both a technology and a group of tools that facilitates the exchange of data and information between an application and a number of different data sources and targets. It provides one common API to a number of different communication protocols.
DDE	Microsoft Dynamic Data Exchange protocol.
deadband	In process instrumentation, the range through which an input signal can vary, upon reversal of direction, without initiating an observable change in output signal. Deadband is usually expressed in percent of range. *See also* log deadband and update deadband.
device server	An application that communicates with and manages a peripheral hardware device such as a Programmable Logic Control (PLC), remote I/O device or plug-in device. Device servers pass tag values to the Tag Engine in real time.
discrete tag	A two-state (on/off) value representation of a connection to a real-world I/O point. In the LabVIEW DSC module, this type of tag can be either a one (TRUE) or a zero (FALSE).
DSC	Datalogging and Supervisory Control.
dynamic attributes	Tag attributes that do not require the Tag Engine to be restarted when they are edited or reconfigured. Examples of dynamic attributes include enabling logging operations, alarm attributes, and some scaling attributes. *See also* static attributes.

E

Engine	*See* Tag Engine.
engine user	You can specify an *engine user* to ensure that your local Tag Engine has access to network tag data no matter who is logged in to the local LabVIEW DSC module application. If a locally-defined tag in the Tag Engine attempts to access tag data across the network using Logos, the local Tag Engine uses the engine user account.
engineering units (EU)	Terms of data measurement, as degrees Celsius, pounds, grams and so on.
event	Something that happens to a tag. Events include tags going into or out of alarm state and the user setting a tag value.

G

group	*See* tag group or I/O group.

H

historical trend	A plot of data (values versus time) showing values that were logged to disk.
Historical Trend Viewer (HTV)	A utility that accesses historical data from the Citadel historical database.
host access	*Host Access* controls whether a particular computer can access data on your computer, no matter who is logged on that computer.
Human Machine Interface (HMI)	A graphical user interface for the user to interact with the LabVIEW Datalogging and Supervisory Control module system.

I

IA	Industrial Automation.
IAK server	Also known as DLL-based servers or Industrial Automation Servers (IAS).
ID tag	When logging data sets, the *ID tag* for each data set denotes a particular data set and the time during which the data set run took place.
input tag	A tag that accepts Real-Time Database values from a device server.

input/output (I/O) tag	A tag that accepts Real-Time Database values from a device server and sends values to the server.
IP	Internet Protocol.
I/O group	A set of related server items, all of which share the same server update rate and deadband.
item	A channel or variable in a real-world device that is monitored or controlled by a device server.

L

LabVIEW Datalogging and Supervisory Control Module Run-Time System	An execution environment for applications created using the LabVIEW Datalogging and Supervisory Control Module Development System.
LabVIEW RT	LabVIEW Real-Time software.
log deadband	The range through which a tag value must change before it is logged to Citadel.
log resolution	The smallest change in a tag value stored in the historical database.

M

m	meters.
Man Machine Interface (MMI)	*See* Human Machine Interface (HMI).
MAX	Measurement and Automation Explorer, a National Instruments configuration environment.
memory tag	A tag not connected to a real-world I/O point. Memory tags are used for user-defined calculations. *See also* tag and network tag.

N

network tag	A tag remotely connected to any type of tag on another Tag Engine. *See also* tag and memory tag.

O

ODBC	Open Database Connectivity. A standard developed by Microsoft, it defines the mechanisms for accessing data residing in database management systems
OPC	OLE for Process Control. A COM-based standard defined by the OPC Foundation that specifies how to interact with device servers. COM is a Microsoft 32-bit Windows technology.
operator	The person who initiates and monitors the operation of a process.
output tag	A tag that sends values to a device server when it is updated in the Real-Time Database.

P

Panel Wizard	A utility in the LabVIEW Datalogging and Supervisory Control module that automates the process of creating front panel controls.
PID	*See* Proportional Integral Derivative (PID) Control.
PLC	*See* programmable logic controller (PLC).
polling	A method of periodically observing each I/O point or user interface control to determine if it is ready to receive data or request computer action.
programmable logic controller (PLC)	A device with multiple inputs and outputs that contains a program you can alter. LabVIEW DSC module device servers establish communication with PLCs.
Proportional Integral Derivative (PID) Control	A combination of proportional, integral, and derivative control actions. Refers to a control method in which the controller output is proportional to the error, its time history, and the rate at which it is changing. The error is the difference between the observed and desired values of a variable that is under control action.
proxy user	You can specify a *proxy user* account as a way to handle unrecognized access requests to your data.

R

Real-Time Database (RTDB)	An in-memory snapshot of all tags in the system.
real-time trend	A plot of data (values versus time) that is updated as each new point is acquired in the Real-Time Database.
reentrant execution	Mode in which calls to multiple instances of a subVI can run in parallel with distinct and separate data storage.
RTDB	*See* Real-Time Database (RTDB).

S

s	seconds.
sampling period	The time interval between observations in a periodic sampling control system.
SCADA	Supervisory Control and Data Acquisition.
scf	A `.scf` file is a configuration file that stores tag information and Tag Engine parameters.
SCXI	SCXI Signal Conditioning eXtensions for Instrumentation; the National Instruments product line for conditioning low-level signals within an external chassis near sensors.
sensor	A device that produces a voltage or current output representative of some physical property being measured, such as speed, temperature, or flow.
SQL	Structured Query Language. SQL is an industry-standard language used for retrieving, updating, and managing data. You can use SQL to build queries to extract data from Citadel.
static attributes	Tag attributes that require the Tag Engine to be restarted if they are edited or reconfigured. Examples of static attributes include general attributes and I/O connection attributes, such as server, device, or item. *See also* dynamic attributes.
string tag	An ASCII or binary character representation of a connection to a real-world I/O point.

supervisory control	Control in which the control loops operate independently subject to intermittent corrective action.
synchronized	To keep data properly time stamped, make sure the times on your computer clocks are properly synchronized.
system developer	The creator of the application to be run in the LabVIEW Datalogging and Supervisory Control Module Runtime System.
system errors	Errors that happen in the LabVIEW Datalogging and Supervisory Control module system, like a server going down. System errors are displayed in a dialog box, on the Engine User Interface, and also are logged in a `syslog` file.
system events	Events that occur in the LabVIEW DSC module, like an operator logging on or a utility starting up. System events are logged in a `syslog` file.

T

tag	A connection to a real-world I/O point or a memory variable. Tags can be one of four data types: analog, binary, discrete, or string.
tag attributes	Parameters pertaining to a tag, like its alarm, limits, or engineering units. Tag attributes are configured in the Tag Configuration Editor but can be changed dynamically using the Tag Attributes VIs.
Tag Configuration Editor	A utility to configure various parameters of a tag, such as connection information, scaling, or logging.
Tag Engine	Maintains the Real-Time Database of all tag values and alarm states. The Tag Engine runs as a separate process, independent of the HMI application.
tag group	A set of tags primarily used for reporting and acknowledging alarms. A tag can be associated with only one tag group. All tags belong to the group `<ALL>` by default.
Tag Monitor	A utility to view the current value of a tag, along with its status and alarm state.
tag status	A value that describes the validity of a tag value. A negative status represents an error, a positive status represents a warning, and a status of zero represents a good tag value.

TCP/IP	Transmission Control Protocol on top of the Internet Protocol. Enables communication between different types of computers and computer networks.
timestamp	The exact time and date at which a tag value was sampled. Tag values are stored with their timestamps in the RTDB.
trend	A view of data over time. Trends can display real-time or historical data.

U

update deadband	The range through which a tag value must change before it is updated in the Real-Time Database.
URL	Uniform Resource Locator. A URL is the way Logos networking protocol locates data.

V

V	Volts.
VI	Virtual Instrument. Program in LabVIEW that models the appearance and function of a physical instrument.

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