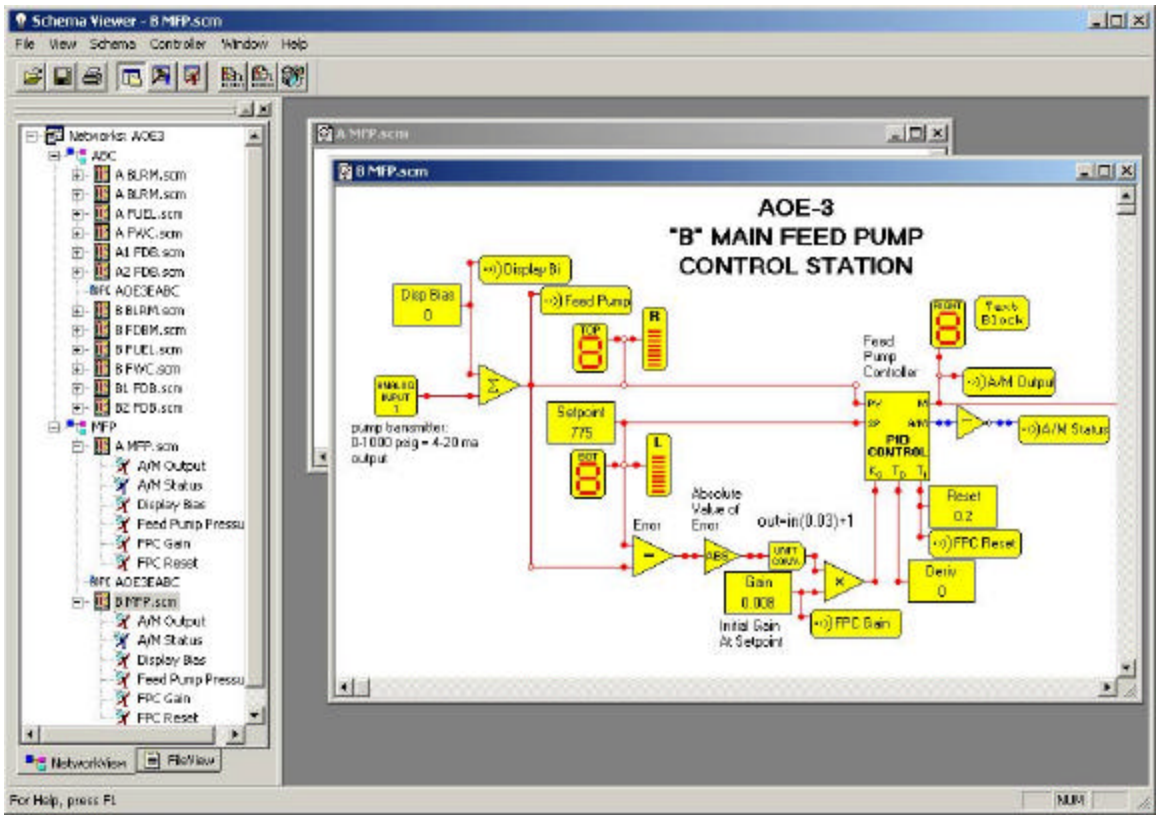
FAIRMOUNT AUTOMATION

Schema Viewer 2000
Instruction Bulletin



Fairmount Automation Controller Series, Model 2000

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1. CONTENTS

The Fairmount Automation Controller Series, Model 2000 *(FAC-2000)* is a general-purpose, highly configurable, multi-loop process controller. This instruction bulletin describes Fairmount Automation's *Schema Viewer®*—a software package used to download programs (i.e., schemas) into the *FAC-2000* controller.

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2. INTRODUCTION TO *Schema Viewer 2000™*

Schema Viewer is a communications utility used to download programs into the *FAC-2000* series controller. It also serves, as its name implies, as a viewer for control schemas developed using Fairmount Automation's *Design Pad 2000* software package. (A schema is a graphical representation of a control scheme to be executed by the *FAC-2000* controller.) In addition to exporting schemas into a controller, *Schema Viewer* can perform most of the controller communication functions available in *Design Pad*. These functions include controller calibration, execution code updating, schema importing and more.

2.1 HARDWARE AND SOFTWARE REQUIREMENTS

To use *Schema Viewer*, your computer must have:

- An 80486 (or compatible) CPU or greater
- 8MB (or more) of RAM
- A hard disk with 8MB of available disk space
- A serial communications port (to interface with the *FAC-2000* controller)
- A 1.44 floppy drive (for installation)
- Windows 95 or higher
- A Windows-compatible mouse

3. USING *SCHEMA VIEWER*

The following sections describe the functionality available in *Schema Viewer*.

3.1 Creating a Control Schema

A *schema* is a collection of interconnected functional operator blocks that form a control strategy. It is a graphical block-diagram that represents the algorithm that is to be run on the *FAC-2000* controller. To display a schema file, select the Open item in the File menu and choose a file with a `.scm` extension. *Schema Viewer* will display each file in a separate window.

A sample schema is shown in Figure 1. It contains a number of operator blocks, including a *PID Control* operator, an *Analog Input* operator, two *Bargraph* operators, several *Numeric Display* operators, and more. These operator blocks are interconnected—the output signal of one operator feeds the inputs of others. For instance, in Figure 1, the output of the *PID Control* operator feeds the *Right Numeric Display* operator.

Schemas contain two types of signals that connect operator blocks: analog signals (floating point values) drawn in red, and digital signals (boolean value, *i.e.*, true/false or high/low)

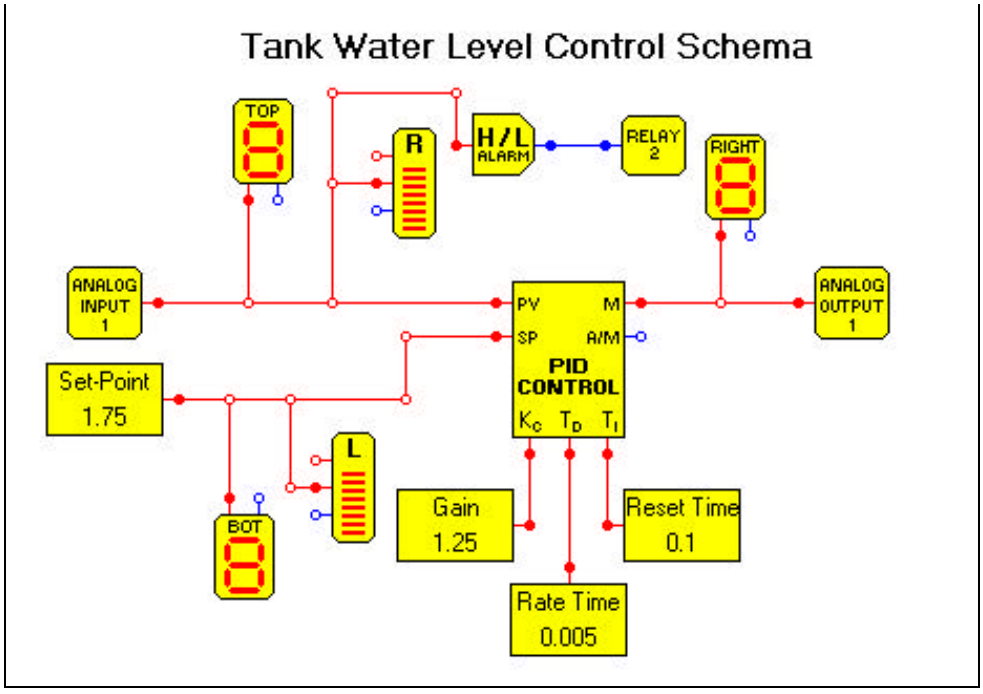


Figure 1. A typical *Schema Viewer* "program": a schema diagram of a simple PID controller.

drawn in blue. The signal connections are made at an operator's input or output pin. An I/O pin is drawn as a short line attached to a small circle: ⊸. The unfilled circle indicates that the pin is not connected. When the pin is connected, *Schema Viewer* fills in the circle: ●.

Each operator block has a list of properties associated with it. These properties determine the characteristics and behavior of each operator. To view an operator's property sheet, position the mouse cursor on the operator and double-click the left mouse button. For example, the property sheet for the *Set-Point Constant* operator of Figure 1 is shown in Figure 2

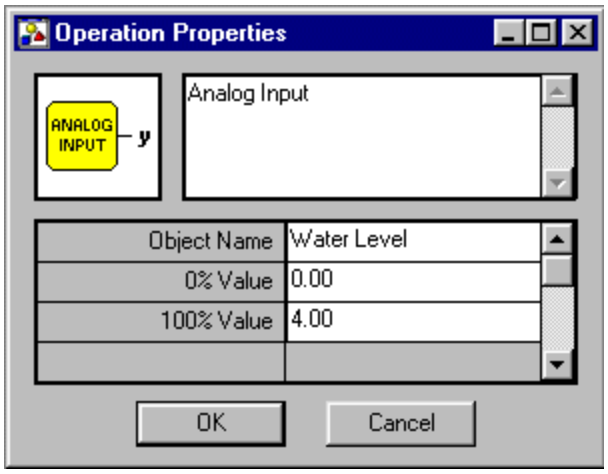


Figure 2. Properties of *Analog Input 1* object.

For a complete reference of schema operators, their associated properties, and other aspects of schema design, refer to the *Design Pad 2000 Professional* Instruction Bulletin (Fairmount Automation Technical Bulletin 9110-0002).

3.2 Controller Properties

A schema has a list of controller properties that determine the behavior of the *FAC-2000* as it executes the schema. These properties include the schema execution frequency, the behavior of faceplate keys, and the presentation of adjustable constants and A/M operators. To view the controller properties, select the Controller Options item from the Schema menu. *Schema Viewer* will respond with a Dialog Box resembling the one shown in Figure 3.

The General Tab of the Controller Options menu contains the following properties:

Loop sampling time: This parameter specifies the time in milliseconds between consecutive iterations of the schema. The minimum loop sampling time is 10

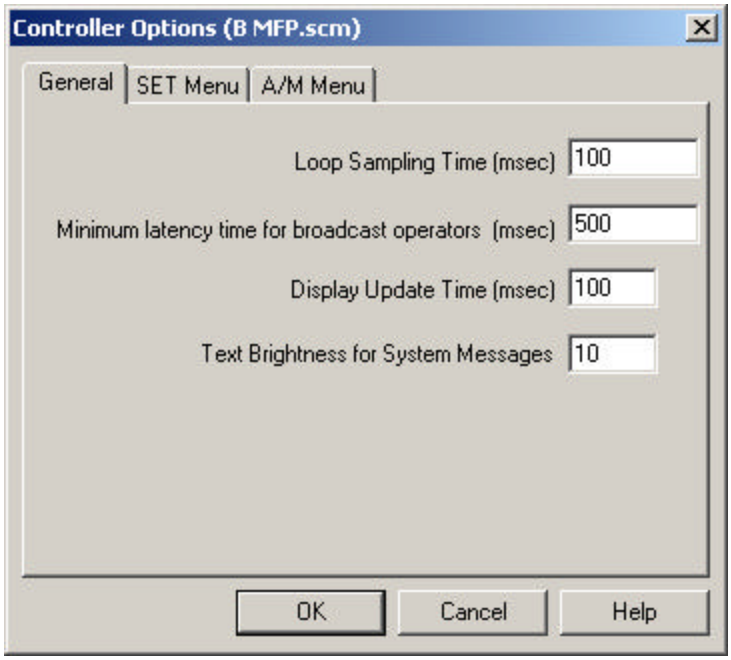


Figure 3. Controller Options dialog.

milliseconds; the maximum loop time is 28,800,000 milliseconds (8 hours).

Latency time for non-critical broadcast operators: This parameter specifies the time in milliseconds between network broadcasts (for non-critical broadcast messages).

Display update time: This parameter controls the refresh rate for the numeric and bargraph displays on the *FAC-2000* faceplate. It corresponds to the amount of time (in milliseconds) between display updates. The minimum update time is 100 milliseconds; the maximum update time is 28,800,000 milliseconds (8 hours).

Text brightness for system messages: The alphanumeric displays have a brightness setting between 0-15. This parameter controls the brightness setting for system messages. System messages include the *Set Menu* information, *A/M Menu* information, and any controller error conditions that may arise.

The SET Menu tab of the Controller Options dialog contains the following properties:

SET activation time: When the SET button is pressed (and held down for the *SET activation time*) on the *FAC-2000* faceplate, the alphanumeric displays present a list of constants that can be adjusted using the up/down arrow keys. This *SET activation time* parameter is the amount of time (in milliseconds) the SET button must be held down before the controller enters the *Set Menu*. A long activation time may lower the risk of unauthorized *Set Menu* access by personnel that are experimenting with the device—pushing buttons to "see what happens".

SET operation timeout: When the SET button is pressed on the *FAC-2000* faceplate, the alphanumeric displays present a list of constants that can be adjusted using the up/down arrow keys. After the constant values are adjusted, the user should press the SET button again to exit the *Set Menu*. If the operator leaves the unit without exiting SET mode, the *FAC-2000* will automatically exit *Set Mode* after this *SET operation timeout* time elapses. This *timeout* parameter is expressed in seconds. (The *FAC-2000* controller measures the elapsed time between keypad input. If the device is in *Set Mode* and the time of keypad inactivity exceeds this *timeout* value, the controller will automatically exit *Set Mode*.)

SET delay before key repeat: This parameter determines the behavior of the UP/DOWN arrow keys on the *FAC-2000* front panel. The UP/DOWN arrow keys are used to adjust a parameter value in SET mode—when a key is pressed, the parameter is increased or decreased by a pre-specified increment. If the arrow key is held down, the parameter value will be continually adjusted. This property specifies the time (in milliseconds) before automatic repeated increments begin.

SET key repeat time: As explained above, a parameter value will be continually changed (by a pre-specified increment) if the UP or DOWN arrow key is held down. This parameter specifies the time between parameter increments.

Adjustable constant ordering: The *Analog Constant* and *Digital Constant* operators have a property called 'Front Panel Access'. When this property is set to either 'Operator level' or 'Engineer level', the constant value can be adjusted from the *FAC-2000* faceplate, using the SET and arrow keys. When the SET key is pressed, a list of adjustable constants will be presented on the alphanumeric displays. ('Engineer level' constants are password-protected—they are not accessible until the correct password is entered.) This property specifies the ordering of this list.

The A/M Menu tab of the Controller Options dialog contains the following parameters:

A/M delay before key repeat: This parameter determines the behavior of the LEFT/RIGHT arrow keys on the *FAC-2000* front panel. The LEFT/RIGHT arrow keys are used to adjust the manual output value of an A/M operator or Controller block. When a LEFT/RIGHT key is pressed, the parameter is increased or decreased by a pre-specified increment. If the arrow key is held down, the parameter value will be continually adjusted. This property specifies the time (in milliseconds) before automatic repeated increments begin.

A/M key repeat time: As explained above, a manual output value will be continually changed (by a pre-specified increment) if the LEFT or RIGHT arrow key is held down. This parameter specifies the time between output increments.

A/M state in alphanumeric display: If this property is checked, the top-line of the alphanumeric displays will indicate if the controller is functioning in automatic, manual, or mixed mode. Otherwise, if this property is not checked, the *FAC-2000* controller will not display the operational mode.

A/M operator ordering: The *PID Controller*, *PI Controller*, *PD Controller* and *A/M Button* operators may function in automatic or manual modes. In general, a schema will contain only one of these objects. However, complex control schemes may require more than one. In the single A/M operator case, pressing the A/M key on the *FAC-2000* front panel will toggle between automatic and manual modes. In the multiple A/M operator case, a list of A/M objects will be presented on the alphanumeric displays when the A/M key is pressed. (The arrow keys are then used to select the desired A/M object.) This property specifies the ordering of this list.

3.3 Schema Properties

General information about a schema, including its author, creation date, and design notes is also available. To view this information, choose the Schema Properties item from the Schema menu. *Schema Viewer* will present a dialog box resembling the one shown in Figure 4.

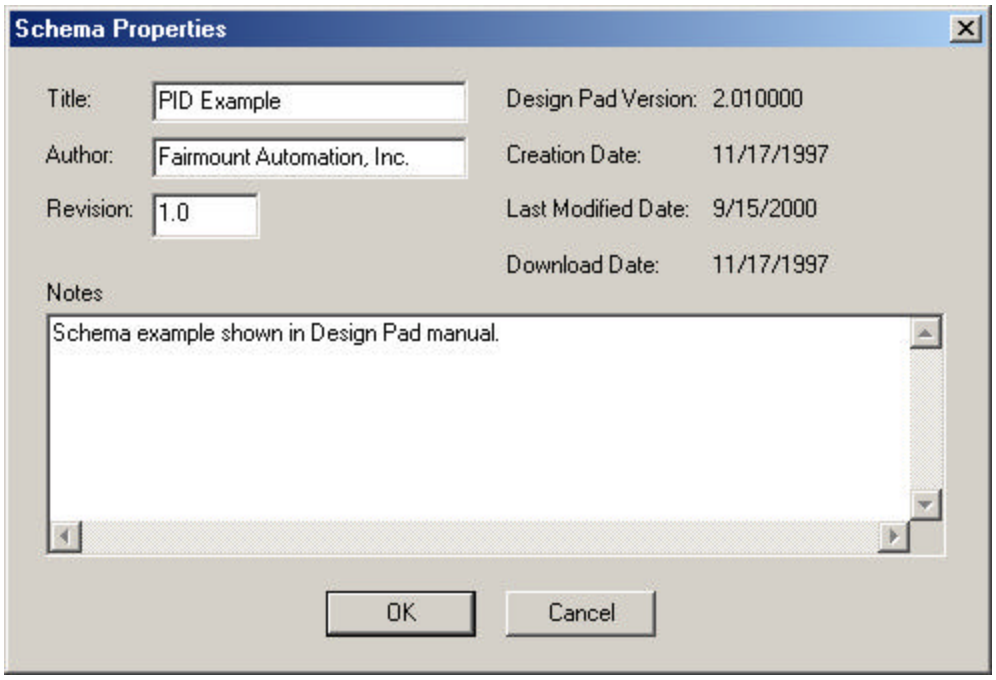


Figure 4. The schema properties dialog box.

3.4 Protected Schemas

Some schema documents may have been password protected to prevent unauthorized access. When *Schema Viewer* opens a password-protected file, it displays a blank document (as shown in Figure 5). In order to unlock it, you must click on the document window and then enter the correct password.

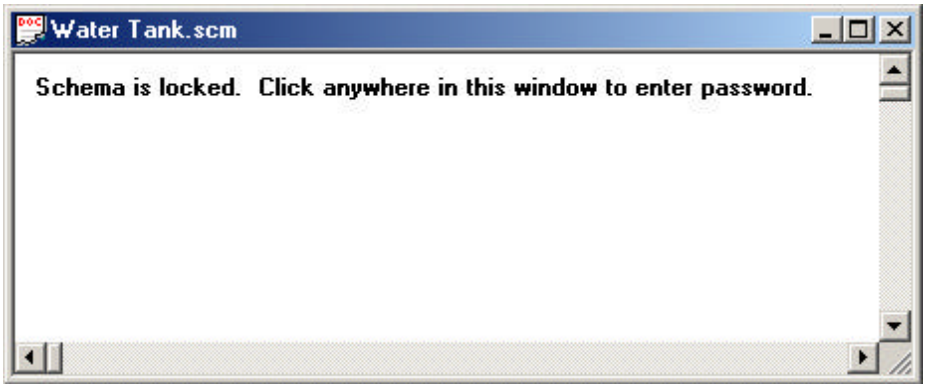


Figure 5. When Schema Viewer opens a locked schema document it does not display its contents.

NOTE: You may still be able to export a password-protected schema to a control station even if cannot view it.

4. Workspaces

Fairmount Automation's *FAIRNET* network protocol enables multiple control stations to communicate with one another over a dedicated bus. Before FAIRNET was released, schemas were generally designed for use in a single isolated control station. The new networked-controller architecture supports distributed control strategies requiring multiple controller stations to regulate many inter-related processes. *Schema Viewer 2000* uses *workspaces* to organize the collection of schemas that form a multi-station control strategy. But workspaces can be used to organize any collection of schemas—even schemas that are loosely related or not related at all.

In addition to organizing schemas, workspaces provide a means to explore the configuration of communication networks, OPC server nodes, human-machine interfaces (HMIs), and to access (communicate with) stations on a controller network.

4.1 The Workspace Window

View Workspace Window

The workspace document exists within the workspace window—a window normally docked on the left side of the application's client area (see Figure 6). To view the workspace window, select the Workspace item from the View menu. It may sometimes be useful to hide the workspace window to provide more room on the screen to view a schema document. To hide the workspace window, select the Workspace item from the View menu (or click on the window's close button). Notice that the Workspace item on the View menu toggles the visible state of the workspace window (when the window is visible, the menu item is checked, otherwise it is unchecked). The visible state of the workspace window can also be toggled with the toolbar menu button shown to the left.

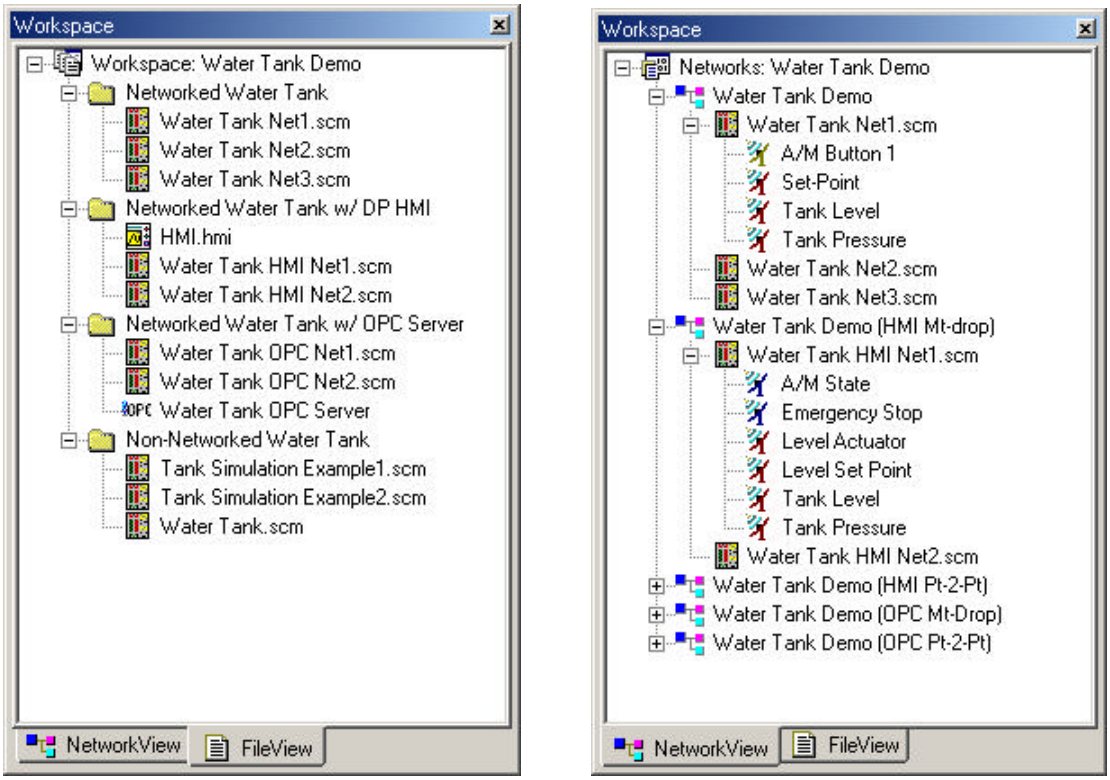


Figure 6. The workspace window, including (a) the *File-View* tab and (b) the *Network-View* tab.

Note: Hiding the workspace window does not close a *workspace* document—a *workspace* is still active while the workspace window is hidden.

The workspace window is always displayed on top of other windows in the *Schema Viewer* application. By default, it is docked on the left side of the screen. But it can be positioned (and resized) anywhere on the screen—it can be docked at the top, bottom, left side or right side of the client area or it can be floating anywhere on your computer screen (even outside of the application's client area). If the workspace window is docked and you wish to position it elsewhere, click on the window handle (two raised lines adjacent to the close button) and drag it to the desired location. To resize the workspace window while it is docked, click the right mouse button on the inner edge of the window and drag it to the desired location. When the workspace window is floating, you can resize it as you would any other window.

The workspace window is used to manage a collection of controller schemas and controller communication networks. The workspace window has two sections: the *Files* section and the *Networks* section. A sample workspace window is shown in Figure 6—Figure 6a displays the workspace with the *Files* section active, and Figure 6b displays the workspace with the *Networks* section active. The files section lists all the schema documents, HMI documents, and OPC server configuration files that are part of the *workspace*. To activate the files section, click on the *Files* tab. The networks section of the workspace window lists

all the communication networks that the workspace manages. To activate the networks section, click on the *Networks* tab.

4.1.1 Opening and Closing Workspaces

Schema Viewer can only have a single workspace document open at any given time. If you would like to open a workspace document, you must first close the workspace document you are presently working with. To close a workspace, select the Close Workspace item from the File menu. When *Schema Viewer* closes a workspace, it also closes all other open documents and their associated windows.

To open an existing workspace, select the Open Workspace item from the File menu. *Schema Viewer* will provide you with the familiar Windows Open File dialog where you can browse for the desired workspace. If a workspace is open when you attempt to open another one, *Schema Viewer* will first close the open workspace and then prompt for the new workspace to open.

Schema Viewer maintains a list of recently opened workspace documents in the Recent Workspaces item of the File menu. To open a recently-accessed workspace document, select the Recent Workspaces item in the File menu. A sub-menu will appear listing the four most recently opened workspace documents. If the workspace you wish to open is on the list, select it. (You can change the number of entries in the recent-file list—see section 6.1.)

4.2 Workspace File View

The workspace window has two views: a *File View* (Figure 6a) and a *Network View* (Figure 6b). The file view displays all the schemas, HMI documents, and OPC server configuration files that are referenced in the workspace. It organizes these documents in a graphical hierarchical tree format, using folders to group related files. The file view displays the name of each document alongside a small graphic that indicates the type of document it is (for a schema file, for an HMI file, or for an OPC-server configuration file).

Schema (`.scm`) files and HMI (`.hmi`) files referenced in the workspace do not need to reside in the same disk directory as the workspace (`.dpw`) file. They can be located in different directories, in different drives, and/or in different computers on a local area network. The workspace file records a link to each document referenced in the workspace, rather than incorporating the document files within the workspace file. Since only a link is recorded, a problem could arise if the document referenced in the workspace no longer exists or has been moved to another location. If *Schema Viewer* cannot locate a file referenced in the workspace, it will prompt you for its new location.

The workspace *File View* offers a convenient location to access schema files and HMI files. You can open a document referenced in the workspace simply by double-clicking on the document name in the workspace window (or you can right-click on the workspace item and select Open File from the drop down menu). You can also perform a number of functions with the workspace documents without opening them at all. For instance, you can process (compile) a schema or export a schema to a control station. The available commands are displayed in a drop-down menu when you right-click on the document name.

4.3 Workspace Network View

The *Network View* displays all the communication networks that are part of the workspace (see Figure 6b). It organizes the communication networks in a graphical hierarchical tree format. The workspace is the root node of this tree and the networks it contains are its first-level sub-nodes. Each network can have sub-nodes representing the schema files for the control stations on that network or the HMI files and OPC server files for PC stations on that network. Each control station or PC on the network in turn can have sub-nodes representing the signals that the station is to broadcast on the associated network.

Each item in the *Network View* tree has descriptive text alongside a small graphic that indicates the type of entry it is. For network items, the tree displays the network name next to a graphic. For schema items, the tree displays the schema file name next to a graphic. For HMI items, the tree displays the HMI file next to a graphic. For OPC-server items, the tree displays the name of the configuration file next to a graphic. And for broadcast signal items, the tree displays the name of the signal next to a graphic (for analog broadcasts, including network-enabled *Constant* operators), graphic (for digital broadcasts), graphic (for mixed broadcasts, including network-enabled A/M Button operators).

4.3.1 Accessing Network Configuration Information

The workspace maintains configuration information on each of its networks (*e.g.*, the network type, the latency time for critical broadcasts, the schemas assigned to each network, the broadcast signals that traffic each network, *etc.*). *Schema Viewer* encodes this information in network configuration files and packages them with a schema to program a *FAC-2000* control station. (See section 5.2 to learn how to export a schema and its associated network configuration files to a controller). The network configuration files provide the control station with all the information it needs to participate in a controller network.

Schema Viewer provides two useful dialogs to obtain this “nuts and bolts” information about a controller network and its broadcast signals: the Network Properties dialog and the Network

Broadcast Signal Properties dialog. To access either dialog, first select the *Network View* tab in the workspace window. Next, right click on the subject network, and select the desired item (Network Properties or Network Broadcast Signal Properties) from the drop down menu. Figure 7 shows a sample Network Properties dialog. It displays the following information:

Network Name. The name of the network (displayed in the *Network View* tab of the workspace window).

Network ID. A unique identifier used to determine if a station belongs on the network. (When a controller is physically connected to a network, its Network ID must match that of other stations on the network.)

Network Version. An integer value that tracks changes in a network's configuration. *FAIRNET* uses this parameter to maintain a consistent set of configuration files for all stations on a network.

Network Type. *FAIRNET* supports point-to-point networking and multi-drop networking. In a point-to-point network, two devices are linked directly to one another over a two-way channel (communication with additional devices is not possible on this channel). In a multi-drop network, several devices (two or more) share a common communications channel. Devices can be added to (or removed from) the common channel as required. The *FAC-2000* controller includes one RS-232 port for point-to-point networking and one RS-485 port for multi-drop networking.

Critical Broadcast Latency Time. *FAIRNET* supports deterministic and non-

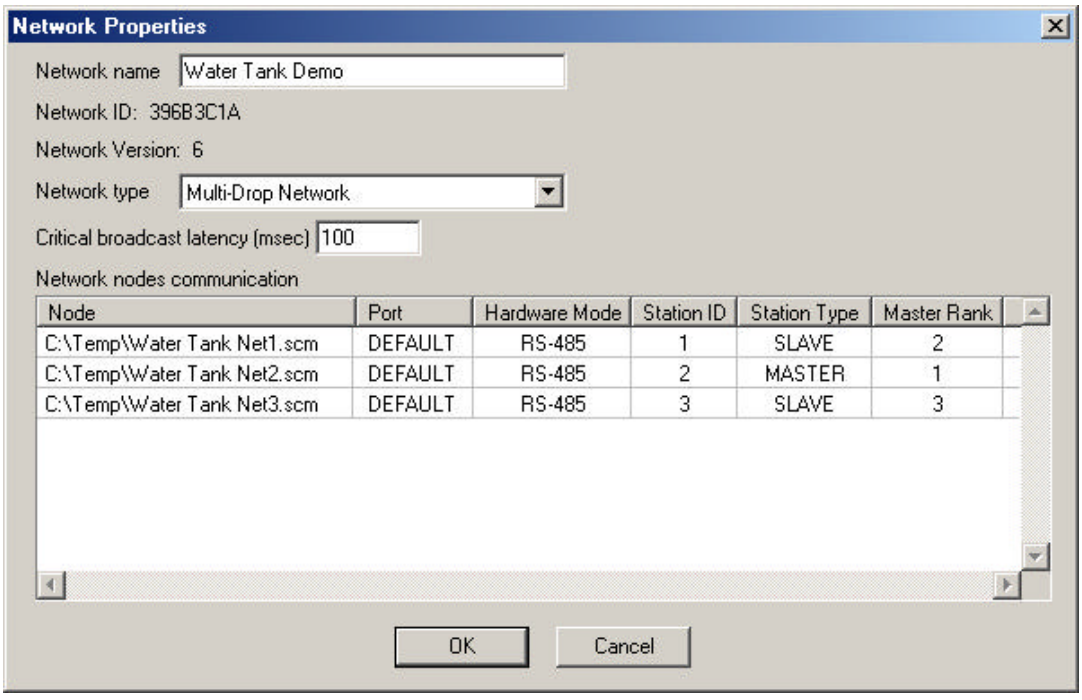


Figure 7. The network properties dialog.

deterministic messaging. Deterministic messages are reserved for the most critical signals in a networked control system. A *FAIRNET* network guarantees that these signals are transmitted at regular intervals. This parameter specifies the length of the interval between successive critical message transmissions (expressed in milliseconds).

Network Nodes. Information about each node assigned to the network, including:

Node. The name of the node (schema document, HMI document, or OPC server configuration document)

Port. The PC COM port that *Schema Viewer* uses to communicate with the network node. For schema documents, the port should always be set to "DEFAULT". For HMI documents or OPC server configuration documents, this parameter indicates which PC port the HMI software uses to communicate with the network.

Hardware Mode. The hardware mode indicates the communications protocol (at the physical layer) that the node uses to participate in the network. For a point-to-point network, both nodes must use the RS-232 protocol. For a multi-drop network, all nodes must use either RS-485 or a *memory pipe* (all nodes must be one or the other). If a multi-drop network contains a schema document (*e.g.*, a *FAC-2000* control station), then all nodes must use RS-485. (The memory pipe option is reserved for virtual controller networks. A virtual network is a PC simulation of a controller network involving multiple applications that interact over a memory pipe. Each application represents a distinct station on the network.)

Station ID. An integer value that uniquely identifies each node in network. *FAIRNET* uses this parameter to determine the source and destination of a given communication message.

Station Type. *FAIRNET* uses a master/slave architecture to arbitrate communication messages. One device on the network—the master device—coordinates all the network traffic. All other devices are slaves to the network master—they transmit information on the network only when prompted to do so by the master device. *FAIRNET* automatically selects which station on the network will serve as the master.

Master Rank. Every station in a *FAIRNET* network has the capacity to function as the network master. If the master goes offline, one of the remaining slave devices on the network will automatically take on the master role. This parameter determines which device on the network assumes the master role (the active station with the lowest master rank).

Figure 8 shows a sample Network Broadcast Signal Properties dialog. It displays the following information:

Signal Name. The name of the broadcast signal (corresponds to a broadcast operator in a schema).

Message ID. A unique identifier assigned to each broadcast signal. (Digital broadcast signals from the same station may have duplicate message identifiers.)

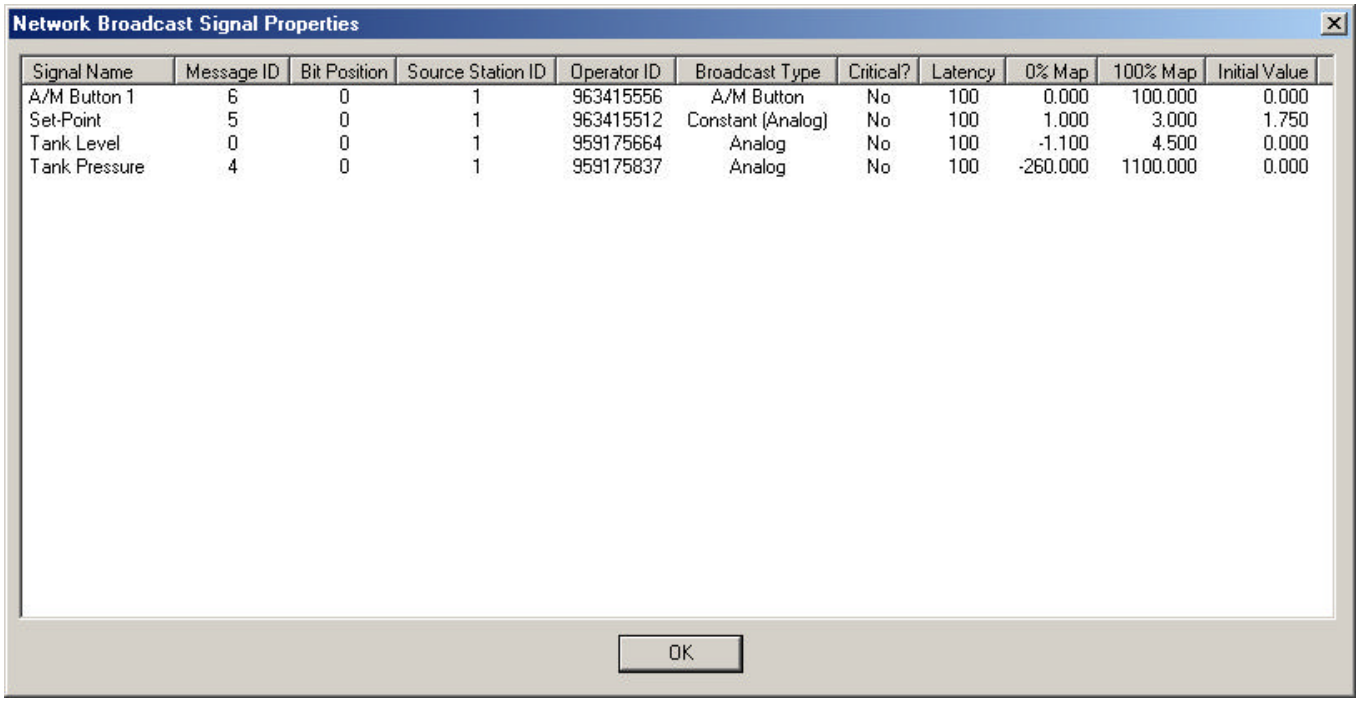
Bit Position. In order to optimize network usage, FAIRNET encodes digital broadcast signals from each station into 16-bit integer values (each integer value encodes the states of 16 digital signals). The bit position parameter indicates which bit in the encoded integer value represents the given digital broadcast signal.

Source Station ID. The station identifier for the node that transmits the given broadcast signal. (Each node in a controller network is assigned a unique *Station ID*—see the Network Properties dialog.)

Operator ID. A unique identifier used to associate broadcast and receiver operators.

Broadcast Type. The type of networking operator: analog broadcast, digital broadcast, mixed broadcast, network-enabled A/M Button, or network-enabled Constant.

Critical? *FAIRNET* supports deterministic and non-deterministic messaging. Deterministic messages are reserved for the most critical signals in a networked control system. A *FAIRNET* network guarantees that these signals are transmitted at regular intervals.



Signal Name	Message ID	Bit Position	Source Station ID	Operator ID	Broadcast Type	Critical?	Latency	0% Map	100% Map	Initial Value
A/M Button 1	6	0	1	963415556	A/M Button	No	100	0.000	100.000	0.000
Set-Point	5	0	1	963415512	Constant (Analog)	No	100	1.000	3.000	1.750
Tank Level	0	0	1	959175664	Analog	No	100	-1.100	4.500	0.000
Tank Pressure	4	0	1	959175837	Analog	No	100	-260.000	1100.000	0.000

Figure 8. Broadcast signal properties dialog.

FAIRNET also transmits non-critical messages at regular intervals but does not guarantee that it will always do so—occasionally, during periods of heavy network traffic, some non-critical message transmissions may be delayed. This parameter indicates if the given broadcast signal is or is not critical.

Latency. The time interval (in milliseconds) between successive broadcast transmissions. All critical broadcasts in a network have the same latency time (it is a property of the network). Non-critical broadcast message latency times can vary from one station to another (the non-critical broadcast message latency time is a property of the nnetwork node).

0% Map. The lower limit of the broadcast signal range.

100% Map. The upper limit of the broadcast signal range.

Initial Value. The initial broadcast signal value.

5. Communicating with a *FAC-2000* Controller

Schema Viewer has built-in communications software that enables two-way communication between a personal computer and a *FAC-2000* controller network. To take advantage of these communication features, connect a serial cable (Fairmount Automation Part Number 0100-4000) between an unused PC communications port and the COM1 input (for RS-232 communications) or the COM2 input (for RS-485 communications) of the *FAC-2000* unit.

The new *FAC-2000* embedded code incorporates many changes in order to enable controller networking. One significant modification is the protocol that the controllers use for communication. In the new protocol, *FAC-2000* controllers can process multiple communication messages simultaneously. In first-generation *FAC-2000* executable code versions (1.21 and below), controllers could only process a single communications message at a time. *Schema Viewer 2000* can communicate with controllers that use either first-generation or second-generation versions of the embedded code. (Older versions of *Schema Viewer* are only capable of communicating with controllers running a first-generation version of the embedded code.) When using *Schema Viewer 2000*, you must specify which communication mode to use: single-threaded mode for controllers with first-generation embedded code and multi-threaded mode for controllers with second-generation embedded code. You set the communications mode in the communications tab of the *Schema Viewer 2000* Preferences dialog (see section 6.3).

In this section, we describe all the PC-controller communication features available in *Schema Viewer 2000*.

Note. Prior versions of *Schema Viewer* prompted you for the PC communications port every time you initiated communication with a controller. In *Schema Viewer 2000*, you only need to specify the communications port once. You do so in the Communications tab of the *Schema Viewer 2000* Preferences dialog (see section 6.3).

5.1 Network Monitor Window

When *Schema Viewer 2000* communicates with a controller in multi-threaded mode, it displays communication results in the network monitor window. (When using single-threaded mode, *Schema Viewer* uses simple dialog boxes to convey information to you.) The network monitor window is normally docked at the bottom right corner of the *Schema Viewer* application window. It displays text messages that describe the results of PC-controller communications. For instance, when you execute the Analyze Network command (see section 5.7), the network monitor window will display the results of the analysis.

Network Monitor Window

You toggle the visible state of the network monitor window (shown or hidden) from the view menu. When you make the network monitor window visible, *Schema Viewer* displays a check mark next to the Network Monitor Window item in the View menu; it removes the check

mark when the window is not visible. You can also toggle the visible state of the message window by pressing the corresponding button on the toolbar menu (shown to the right).

The network monitor window is always displayed on top of other windows in the *Schema Viewer* application environment. By default, it is docked on the bottom-right side of the screen. But it can be positioned (and resized) anywhere on the screen—it can be docked at the top, bottom, left side or right side of the client area or it can be floating anywhere on your computer screen (even outside of the application's client message). If the network monitor window is docked and you wish to position it elsewhere, click on the window handle (two raised lines adjacent to the close button) and drag it to the desired location. To resize the network monitor window while it is docked, click the right mouse button on the inner edge of the window and drag it to the desired location. When the network monitor window is floating, you can resize it as you would any other window.

5.2 Exporting a Schema to the *FAC-2000* Controller

Schema Export

This section describes how to program *FAC-2000* controller, that is how to download a schema and associated network configuration files into the device.

Schema Viewer 2000 includes communication features to export a schema from a PC to a *FAC-2000* controller and also to retrieve (or import) a schema from a controller back to the PC. The import feature is useful if you wish to view or edit the schema that a *FAC-2000* controller is executing (and you don't have it available on the PC). However, it also allows others to gain access to the schema (if the schema has been password protected, unauthorized access will be denied). To completely prevent a third-party from accessing the schema, you can disable the import functionality entirely when you export a schema to a controller. If you disable the schema import functionality, nobody will be able to access the schema executing in the controller—including you.

To program the *FAC-2000* controller, first open the workspace document that references the desired schema and contains the associated network configuration information. (If the station will not be part of a controller network, you need not open the workspace document—you can simply open the desired schema document.) Next, select the Export Schema with Import Enabled item or the Export Schema with Import Disabled item from the Controller menu. *Schema Viewer* will display a progress dialog (see Figure 9) with information about the programming process. When the process is complete, *Schema Viewer* will automatically remove the dialog.

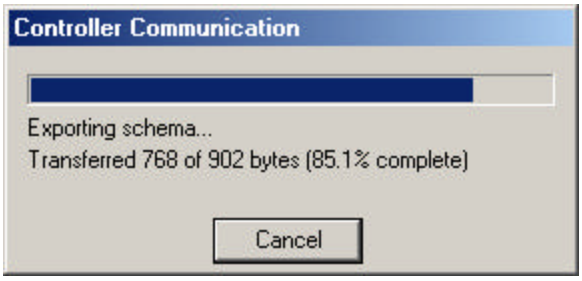
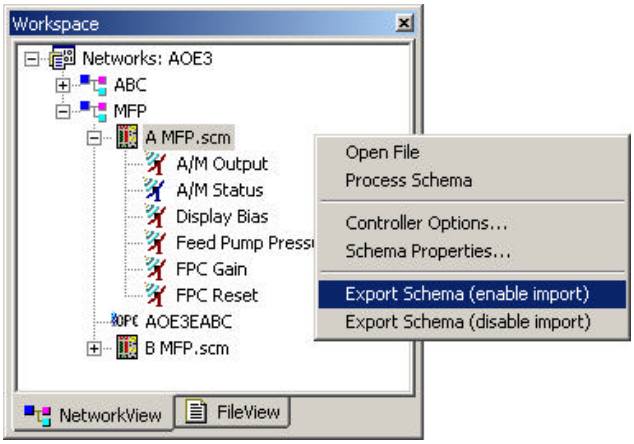


Figure 9. Progress dialog displayed while PC communicates with a *FAC-2000* control station..

When the *FAC-2000* receives a new schema, it verifies that it can properly execute it. Namely, it ensures that it can execute the schema faster than the user-defined loop sampling time, $?t$. For instance, a very complex schema with scores of operators may require more than the default $?t$ = 0.1sec to execute. In these cases, the *FAC-2000* controller will notify *Schema Viewer* that the loop time is too short. If this occurs, the schema must be erased from the controller. Otherwise, the *FAC-2000* may produce significant computational errors. The only recourse in this case is to use *Design Pad* to increase the schema loop time and to then re-download the schema into the device.



As an alternative to using the Controller menu, you can export a schema to a controller from the workspace window. If you use this method, you don't need to open the schema file. Just right-click on the desired schema document item in the workspace window and select one of the Export Schema items from the drop-down menu. (You can access the drop-down menu from both the *Files* and *Networks* tabs of the workspace window.)

5.3 Importing a Schema from the *FAC-2000* Controller

Occasionally, it may be useful to retrieve a schema executing in the controller and display it in *Schema Viewer*. To import a schema into *Schema Viewer*, connect the controller to your computer via serial cable and choose the Import Schema item from the Controller menu. If the schema executing in the device contains a communications password, you will be prompted to provide that password before *Schema Viewer* retrieves the schema. And if the schema was exported with import disabled, the controller will not allow you to import its schema at all.

When *Schema Viewer* has completed importing a controller's schema, it will display it in a new window, as an unnamed document.

5.4 Controller Calibration

The *FAC-2000* controller is calibrated at the factory prior to delivery. From time to time however, it may be necessary to re-calibrate the device. *Schema Viewer* provides two calibration methods for the controller's analog input and output channels. One method is fully automated; the other requires significant user interaction. Each method is described in detail in Fairmount Automation Technical Bulletin 9110-0003—the *FAC-2000* calibration procedure.

5.5 Updating the Controller Execution Code

Occasionally, Fairmount Automation will add new function blocks to its suite of schema operators. In order for schemas utilizing the new operators to work in the *FAC-2000*, the controller's execution code must be updated.

When Fairmount Automation makes changes to the controller software, it will distribute the execution code as a binary file. The file will be entitled `ctrlv###.$cc`, where ### is the execution code version number times 100. To determine the version of the code currently executing in your controller, select the Query Execution Code Version item from the Controller menu. (Of course, the query will fail if your computer is not properly connected to the controller.)

The process of updating the control code in the *FAC-2000* controller requires several minutes, will erase the schema file the controller is running, and will reset the controller. To do it, connect the controller to your computer via serial cable and select the Download Execution Code item from the Controller menu. After displaying a warning message, *Schema Viewer* will prompt you for the .$cc binary file. Locate the file, press the OK button, and wait *for Schema Viewer* to complete the code update.

5.6 FAC-2000 Network Licenses

The *FAC-2000* controller requires a network license to enable its networking features. Without a network license, a *FAC-2000* controller will not be able to communicate with other devices.

You can determine if a control station has a valid network license using the Query Network License Status command in the Controller menu. If the controller does not have a network license, you can obtain one electronically (via e-mail) by contacting Fairmount Automation. First you will need to extract a network key from the control station you wish to obtain a network license for. To do so, connect the controller unit to your PC via serial cable and select the Query Network License Key item from the Controller menu. *Schema Viewer* will query the controller and will prompt you with the dialog box shown in Figure 10. To obtain a license, complete the requested information, including your name, affiliated organization, and contact information (phone, fax, and address), as well as the controller particulars (model number, serial number, and a description of the application where it will be used). (*Schema Viewer* remembers your contact information from one session to another, so you will not have to repeatedly enter it.) Once you have completed the form, you can save the information to a text file (to include in a subsequent e-mail) or *Schema Viewer* can automatically prepare an e-mail message and launch your e-mail software for immediate transmission. Send all license requests to licensing@FairmountAutomation.com. A Fairmount Automation representative will reply to your request with a network license file for the controller. When you receive the license file, you export it to the device using the Download Network License File command from the Controller menu.

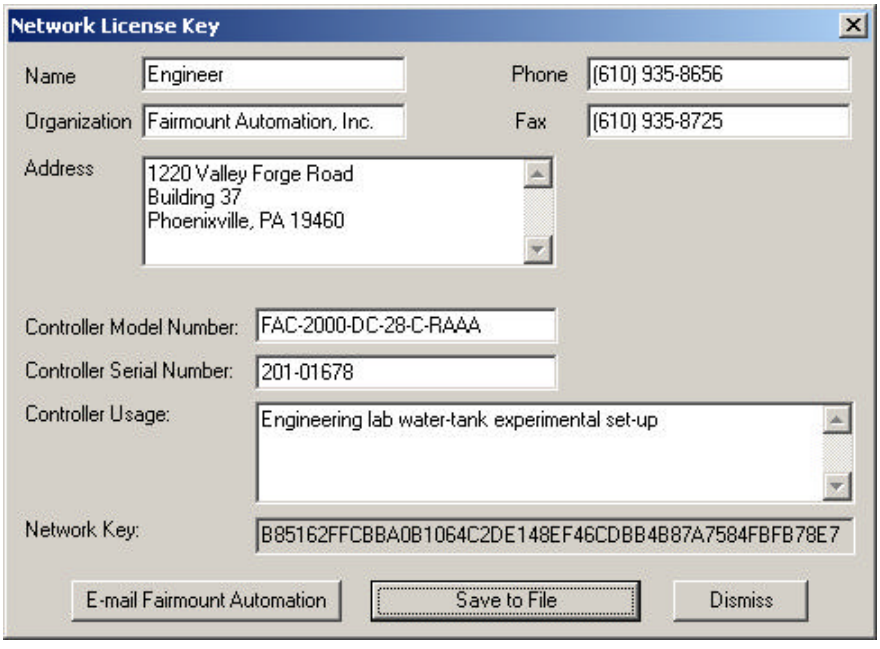


Figure 10. The network License Key dialog used to request a FAIRNET network license.

5.7 Analyzing Network Performance

Schema Viewer provides a convenient mechanism to analyze the performance of a FAIRNET network. The analysis includes statistics on transmission error rates, message transmission duration, and message transmission frequency. To initiate the analysis, first connect the network's master station to your PC using the RS-232 link (COM1 on the FAC-2000). Then, select the *Networks* tab in the workspace window, right-click on the desired network, and select the Analyze Network Messaging item from the drop-down menu. The master station will collect communication statistics over a period of 40 seconds and will then report the results to *Schema Viewer*; *Schema Viewer* displays these results in its network monitor window.

Figure 11, shows the results of a two-station FAIRNET network. The results include a summary section with a count of all network messages that were transmitted during the analysis period, the number of messages that were not correctly processed, and the number of data errors that occurred. It also includes a detailed breakdown of each type of message that was transmitted during the analysis period. For each message type, *Schema Viewer* displays

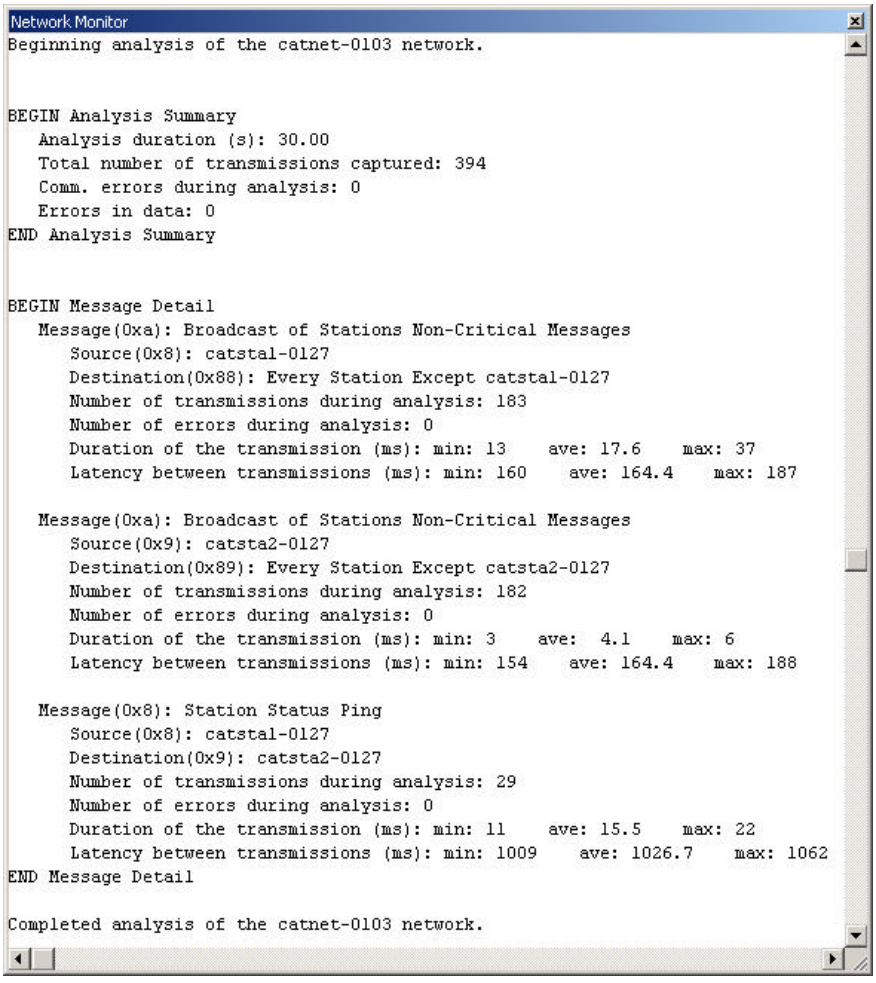


Figure 11. Results of FAIRNET analysis.

the number of times it was transmitted; the number of times an error occurred during its transmission; the minimum, maximum, and average time (in milliseconds) time it took to transmit the message; and the minimum, maximum, and average time (in milliseconds) between consecutive transmissions of the same message type.

5.8 Other Communication Features

Schema Viewer offers additional communication features to query and/or alter the state of the *FAC-2000* controller. These additional features are described below.

When you first received a *FAC-2000* controller from the factory, you may have noticed that the device does not contain a schema file to execute. When you powered a unit in this state, the alphanumeric displays contained the message "Awaiting Schema Download". You can return a programmed unit into this state by erasing the schema it is executing. To delete a controller's schema, connect the controller to your PC via serial cable and select the Erase Schema item from the Controller menu. (When communicating with a controller code first-generation code, you will need to restart the device in order for the command to take effect.)

You can restart the *FAC-2000* controller in one of two ways: Cycle the power to the device; or use *Schema Viewer*'s soft-reset feature. To reset the device, select the Re-start Device item from the Controller menu.

Fairmount Automation assigns a unique serial number to every *FAC-2000* controller it manufactures. This serial number is stamped on the bottom face of the controller. You can obtain the controller's serial number by visually inspecting the device or by querying it with *Schema Viewer*. To query the device with *Schema Viewer*, select the Query Serial Number item from the Controller menu.

6. Customizing *Schema Viewer*

You can customize some of functionality in *Schema Viewer* in its Preferences dialog (see Figure 12-Figure 15). To access this dialog, select the Preferences item from the File menu. The *Schema Viewer* features that you can customize are described in the following sections.

6.1 *Schema Viewer* Preferences: General Section

The general section of the *Schema Viewer* Preferences dialog includes the following parameters:

Reload last workspace at startup. If this item is selected, *Schema Viewer* will automatically open the workspace that was active during a previous *Schema Viewer* session. If it is not selected, *Schema Viewer* will not open any documents at startup.

Recent File List Size. *Schema Viewer* maintains a list of recently opened files (schema documents or HMI documents) in its file menu. This parameter determines how many recent files *Schema Viewer* should track. The maximum list size is 16 files.

Recent Workspace List Size. *Schema Viewer* maintains a list of recently opened workspace documents in its file menu. This parameter determines how many recent workspaces *Schema Viewer* should track. The maximum list size is 16 workspaces.

Schema Export Button on Toolbar. When you export a schema to a FAC-2000 control station, you can enable or disable schema importing from that station (see sections 5.2 and 5.3). To export a schema you can use the Controller menu or the toolbar button  . This preference item defines what the schema export button does: either download with import enabled, or download with import enabled.

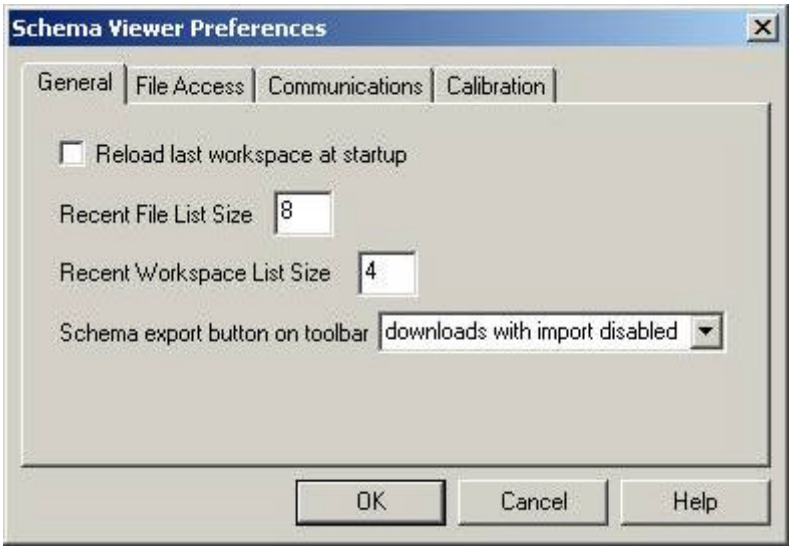


Figure 12. *Schema Viewer* Preferences (General Tab).

6.2 *Schema Viewer* Preferences: File Access Section

The file access section of the *Schema Viewer* Preferences dialog includes the following parameters:

Default Document Directory. This item specifies the directory that *Schema Viewer* should reference whenever it displays the File Open dialog.

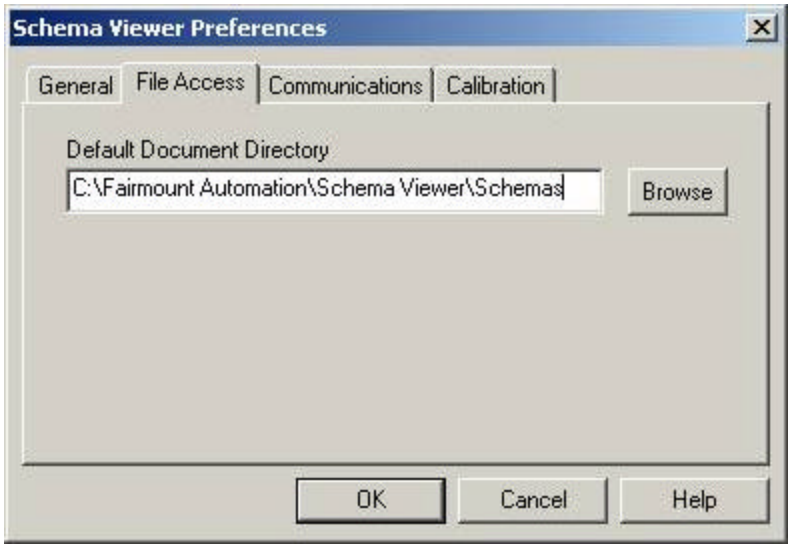


Figure 13. *Schema Viewer* Preferences dialog (File Access tab).

6.3 *Schema Viewer* Preferences: Communications Section

The communications section of the *Schema Viewer* Preferences dialog includes the following parameters:

Default Communications Port. Indicates the default PC COM port that *Schema Viewer* should use when communicating with a *FAC-2000* control station.

Default Communications Hardware Mode. Indicates the communications protocol (RS-232 or RS-485) that *Schema Viewer* should use when communicating with a *FAC-2000* control station..

Controller Communications Mode. *Schema Viewer* supports two methods of communicating with *FAC-2000* control stations: single-threaded mode and multi-threaded mode. *FAC-2000* controllers executing first-generation executable code versions (version 1.21 and below) communicate in single-threaded mode. *FAC-2000* controllers executing second-generation executable code versions (version 2.00 and above) communicate in multi-threaded mode. Prior versions of *Schema Viewer* cannot communicate in multi-threaded mode.

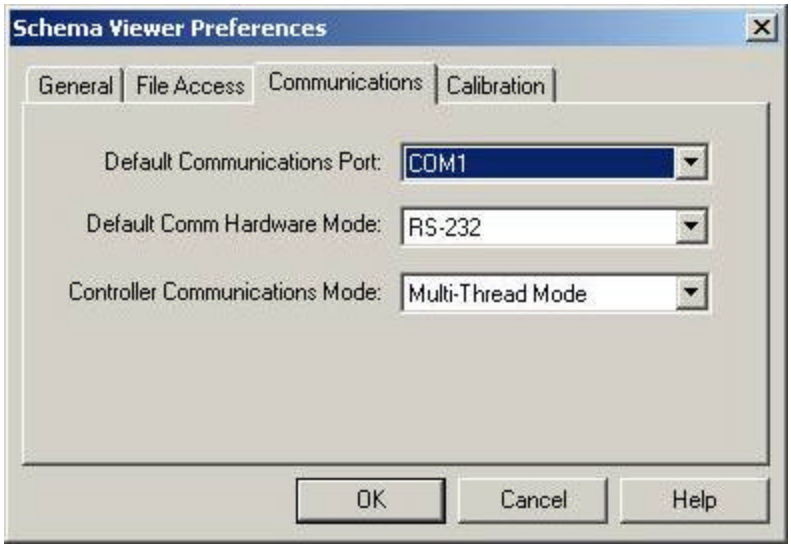


Figure 14. *Schema Viewer* Preferences dialog (Communications tab).

6.4 Calibration Tab

Default Power Supply COM Port. Indicates the PC COM port that *Schema Viewer* should use during the calibration process to manipulate the power supply settings.

Default Meter/Switch Unit COM Port. Indicates the PC COM port that *Schema Viewer* should use during the calibration process to manipulate the electronic meter or switch unit.

Maximum Calibration Error. Indicates the maximum allowable calibration error (in mA) for the analog inputs and analog outputs on the *FAC-2000* controller .

Default Path for Calibration File Results. After *Schema Viewer* completes the calibration process, it generates a file summarizing the calibration results for each analog channel. This parameter specifies the directory where the calibration results should be saved.

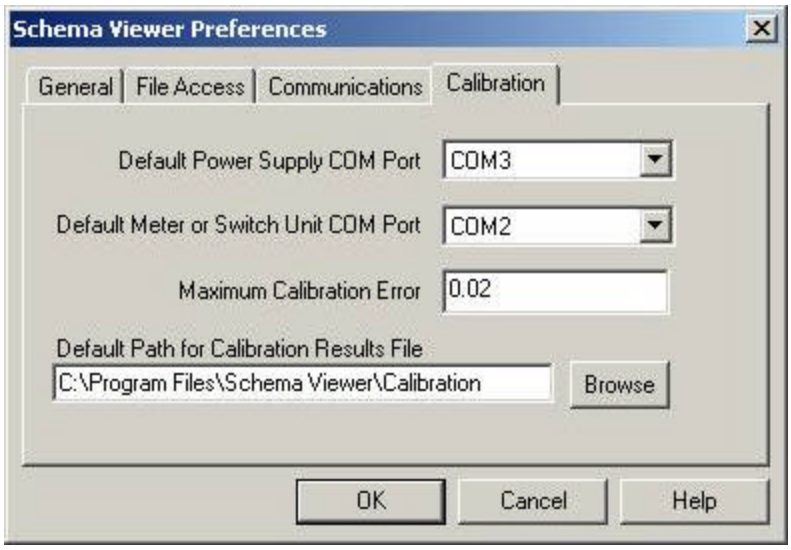


Figure 15. *Schema Viewer* Preferences dialog (Calibration).

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