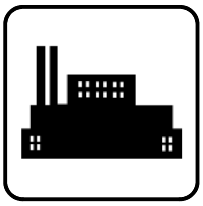
Software Manual

Automatic Transfer Switches



Models:

Surveyor Program

Applies to:

MPAC 1000™ Transfer Switch Controllers

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6214 4/03

Product Identification Information

Software Version Number

Record the software version number.

Software Version Number _____

x:in:007:001a

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Table of Contents, continued

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

⚠ DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

⚠ WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

⚠ CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

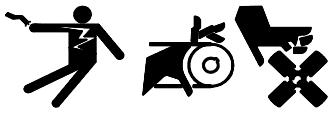
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Hazardous Voltage/ Electrical Shock

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Only authorized personnel should open the enclosure.

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Moving Parts

⚠ WARNING

Hazardous voltage. Moving rotor. Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Notice

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Introduction

This manual covers the installation and operation of the Surveyor Program for personal computers running the Windows® operating system. The Surveyor program allows remote monitoring and control of a transfer switch or a network of transfer switches equipped with MPAC 1000™ programmable transfer switch controllers.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this literature and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

Separate manuals provide specific information about transfer switch operating limits, specifications, and functions. The related manual numbers follow.

Manual	Part Number
Model KCT, KCP Operation and Installation Manual	TP-6126
Model KBT, KBP Bypass/Isolation Switch Operation and Installation Manual	TP-6128

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Service Assistance

For professional advice on generator power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Power Systems website at KohlerPowerSystems.com
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product
- Call toll free in the US and Canada 1-800-544-2444
- Outside the US and Canada, call the nearest regional office

Africa, Europe, Middle East
London Regional Office
Langley, Slough, England
Phone: (44) 1753-580-771
Fax: (44) 1753-580-036

Asia Pacific
Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 264-6422
Fax: (65) 264-6455

China
North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea
North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America
Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

X:in:008:001a

1.1 Introduction

The Surveyor program allows remote monitoring and control of a transfer switch or a network of transfer switches through an RS-485 connection. MPAC 1000™ programmable transfer switch controllers can be connected directly to a personal computer through an RS-485 connection or connected from a remote site using modems and RS-485 connections. An RS-232 to RS-485 converter is required to connect the controller's RS-485 connection to the PC serial port or to connect the transfer switch controller to the device modem.

The ATS Surveyor Program allows viewing and adjustment of selected settings for transfer switches equipped with the MPAC 1000™ programmable transfer switch controller. Use the software to:

- View and adjust:
  - Time delays
  - Voltage and frequency trip points
  - Exerciser settings
  - Date and time
  - Common alarms
  - Load control time delays
- View:
  - Source parameters
  - System status
  - Active time delays
  - DIP switch settings
  - Event history
  - Maintenance records
- Start and stop a system test, exercise, or peak shave sequence
- Transfer to the OFF position (programmed-transition models only)
- Assign programmable inputs and outputs
- Toggle Modbus®-controlled relay outputs

The Surveyor Program allows the user to view but not adjust some parameters, including the following:

- Source parameters (system voltage, frequency, number of phases or phase rotation)
- System start date
- Contactor and controller serial numbers
- Historical records
- Supervised transfer mode
- Extended engine start time delay enable/disable

The items listed above can only be changed using the Setup Program running on a PC connected to the ATS controller's RS-232 port.

The Surveyor Program cannot be used to view or adjust the transfer switch's communication settings, i.e. the network address or the network interface baud rate. Use the Setup Program to view and adjust ATS communication settings.

1.2 Requirements

1.2.1 System Requirements

The minimum system requirements to run the Surveyor Program are:

- 133 MHz or higher Intel® Pentium®-compatible CPU
- 32 MB RAM
- CD-ROM drive and 75 MB hard drive space available for installation
- 800 x 600 or better color monitor
- Windows® 2000 or Windows XP® operating system with Internet Explorer version 4.0 or higher
- COM port numbered between 1 and 255
- Baud rate 9600 or 19200

1.2.2 Hardware Requirements

The following hardware items are required for device connection and communication:

- Hardware key (also called a dongle; included with the software kit, see Section 1.2.4)
- RS-232 to RS-485 converter (included with software kit)
- Shielded #12-24 AWG twisted pair cable, Belden #9841 or equivalent, for the RS-485 connections (customer-provided)
- PC modem and device modem if remote connections are used (kits that include the modem and the necessary cables, adapters, and converters are available from the factory)
- USB-to-serial converter *only if* your PC has a USB port rather than a serial port (customer-provided; the Belkin USB Serial Adapter is one example)

1.2.3 Other Requirements

The ATS controller must use version 1.21 or higher of the ATS controller application software. Check the software version number in the System Information data window in either Surveyor or the Setup Program; see Section 3.17. An authorized distributor/dealer can load the latest version of application software onto the ATS controller.

The Setup program is required in order to configure the transfer switch communication settings at the time of installation.

1.2.4 Hardware Keys (Dongles)

A hardware key (or dongle) is required in order to run the program on your PC. One key is included with each software kit.

Note: Only the hardware keys supplied with the software kits will allow the program to run. Keys purchased elsewhere for other applications will not work.

Two types of keys are available: a parallel-port model or a USB-port model. See Figure 1-1. Check the available ports on your PC and select the kit that uses the appropriate key for your application. Figure 1-2 shows typical PC ports.

The parallel-port hardware key allows the connection of another device to the PC's parallel port. If the PC's parallel port is connected to another device, disconnect the device cable, connect the key to the PC's parallel port, and then connect the device cable to the key.

The USB-port hardware key does not allow the connection of other devices to that USB port.

Insert the key into the PC's parallel port or USB port before attempting to run the program.

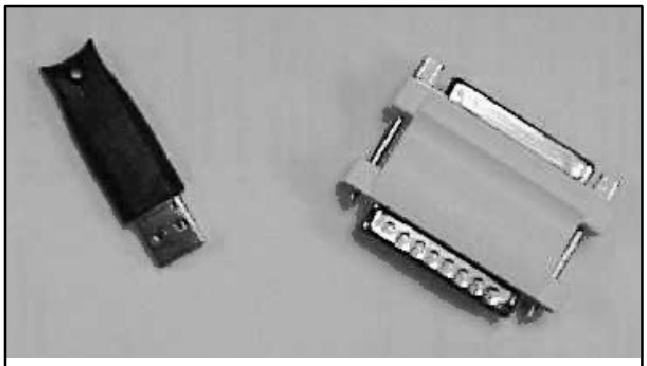


Figure 1-1 Hardware Keys (Dongles)

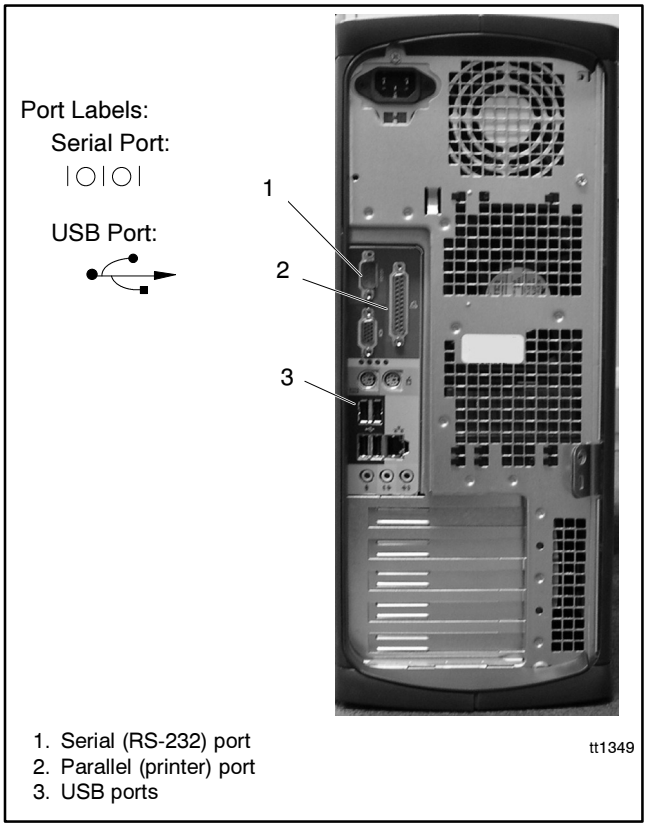


Figure 1-2 Typical Computer Ports

1.3 Transfer Switch Configuration

Use the Setup Program to configure the communication settings for each transfer switch. See TP-6135, Setup Program Operation/Installation Manual, for instructions to set these parameters through the Network Interface Port setup window.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

1. Use an RS-232 cable to connect the PC to the Serial port on the ATS. See Figure 1-3.

   Note: The Setup Program and the Surveyor Program use different connections to the ATS controller. The Setup Program requires an RS-232 connection to the serial port on the ATS controller. The Surveyor Program requires an RS-485 connection through terminal strip TB-1 on the ATS controller.

2. Assign a unique network address, from 1 through 247, to each transfer switch. See TP-6135, Setup Program Operation/Installation Manual.

3. Set the baud rate to 9600 or 19200 on each transfer switch. The baud rates must be the same on all connected transfer switches and the PC. (Set the PC's baud rate later through the *Site Management* window; see Section 2.6.2.)

1.4 Hardware Connections

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Modems, converters, and connectors are included in hardware kits available from the factory through an authorized distributor/dealer.

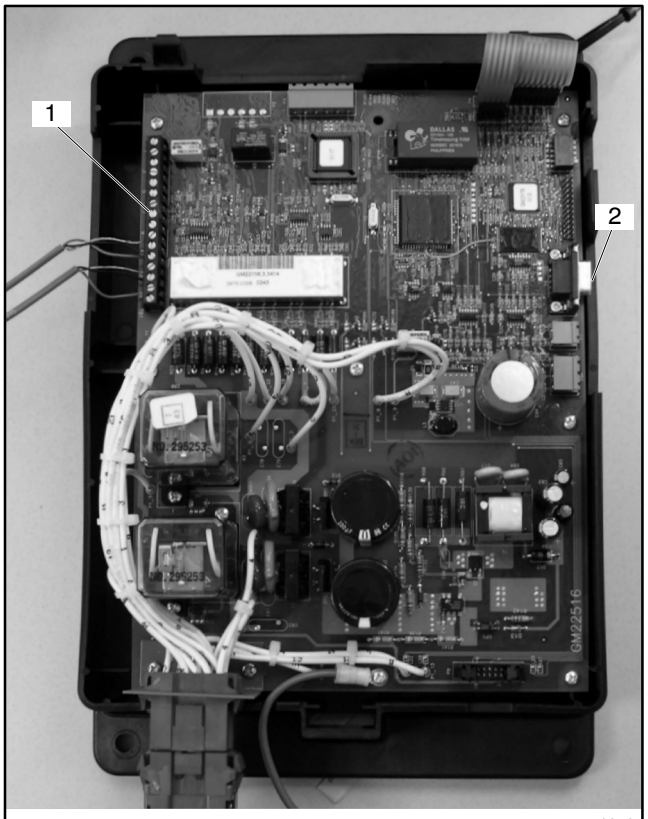
Use RS-485 connections to connect a PC running the Surveyor Program to one or more transfer switches. Use 12-24 AWG twisted-pair cable (Belden cable #9841 or equivalent, customer-supplied) for all RS-485 connections. See Figure 1-6 through Figure 1-8 for connection diagrams. See TT-1349, Installation Instructions, provided with the hardware and modem kits, for more information.

1.4.1 Transfer Switch Network Connections

Use the following procedure to connect up to 247 transfer switches in an RS-485 network.

Transfer Switch Network Connection Procedure

1. Locate terminal strip TB1 on the controller's main logic board. See Figure 1-3.
2. Connect the incoming RS-485 cable to terminals TB1-11 and TB1-12. Connect the cable shield to the ground terminal, TB1-10. See Figure 1-4.
3. If there is more than one transfer switch in the network, connect the outgoing RS-485 cable to terminals TB1-14 and TB1-15. Connect A(–) to A(–) and B (+) to B(+). Connect the cable shield to the ground terminal, TB1-13.
4. Tighten the connections to 0.5 Nm (4.4 in. lb.).



1. Terminal strip TB1 with RS-485 connections
2. Serial port (connection for Setup Program only; do not use for Surveyor Program)

Figure 1-3 ATS Controller (cover removed)

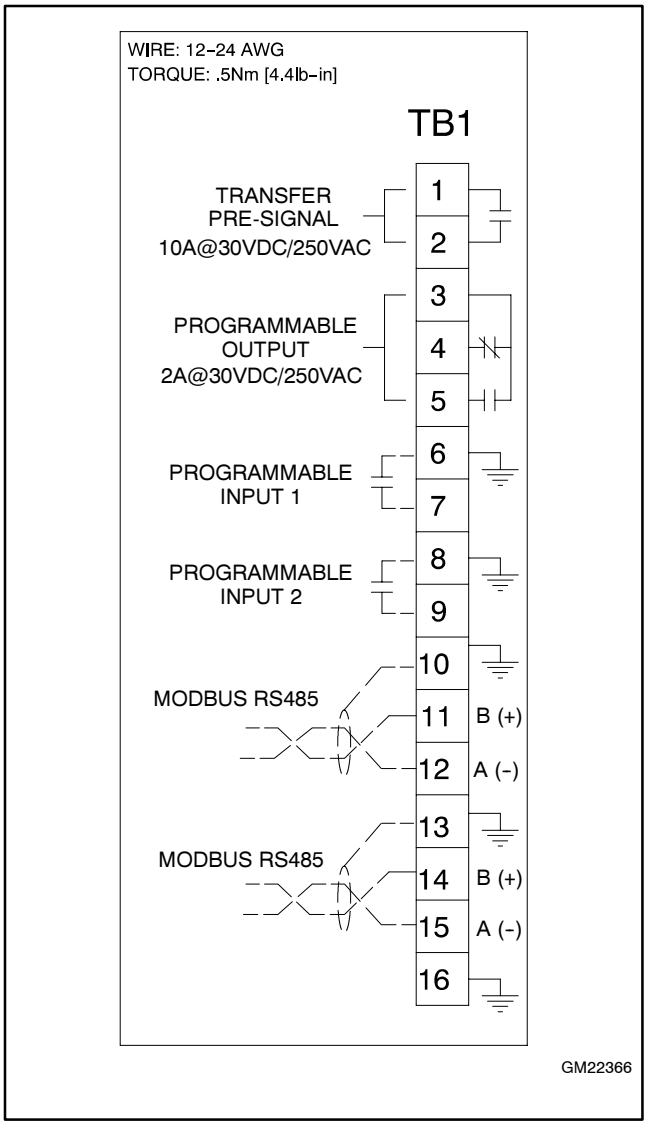


Figure 1-4 Terminal Strip TB1 Connections

1.4.2 Local Connection

Use an RS-232 to RS-485 converter to connect the RS-485 connection from an ATS or ATS network to the PC's RS-232 serial port. See Figure 1-5 for an illustration of an RS-232 to RS-485 converter. See Figure 1-6 and Figure 1-7 for connection diagrams.

1.4.3 Remote Connection

Use modems for communication over telephone lines. One PC modem and one device modem are required. See Figure 1-8.

Use an RS-232 to RS-485 converter to connect the device modem to the first transfer switch in the network. See Figure 1-5. Use a null modem cable, a null modem converter (included in the software kit), and an RS-232 cable to connect the device modem to the RS-232 to RS-485 converter's RS-232 connection. Then connect the converter's RS-485 connection to terminals TB1-11 and TB1-12 on the ATS controller.

Note: To communicate using the Surveyor Program, the device modem must be connected to the ATS controller's Modbus (RS-485) port using an RS-232 to RS-485 converter. Do not connect the device modem to the controller's RS-232 port.

Additional modem information is given in TT-1349, Installation Instructions, included with the modem kit.

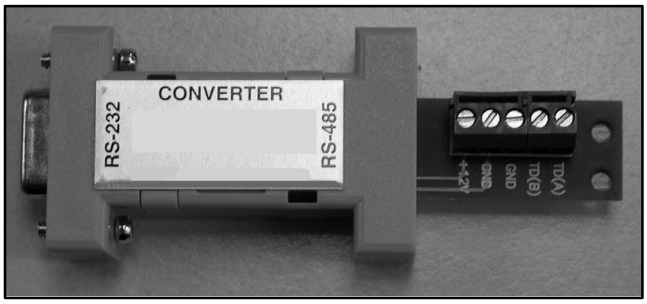
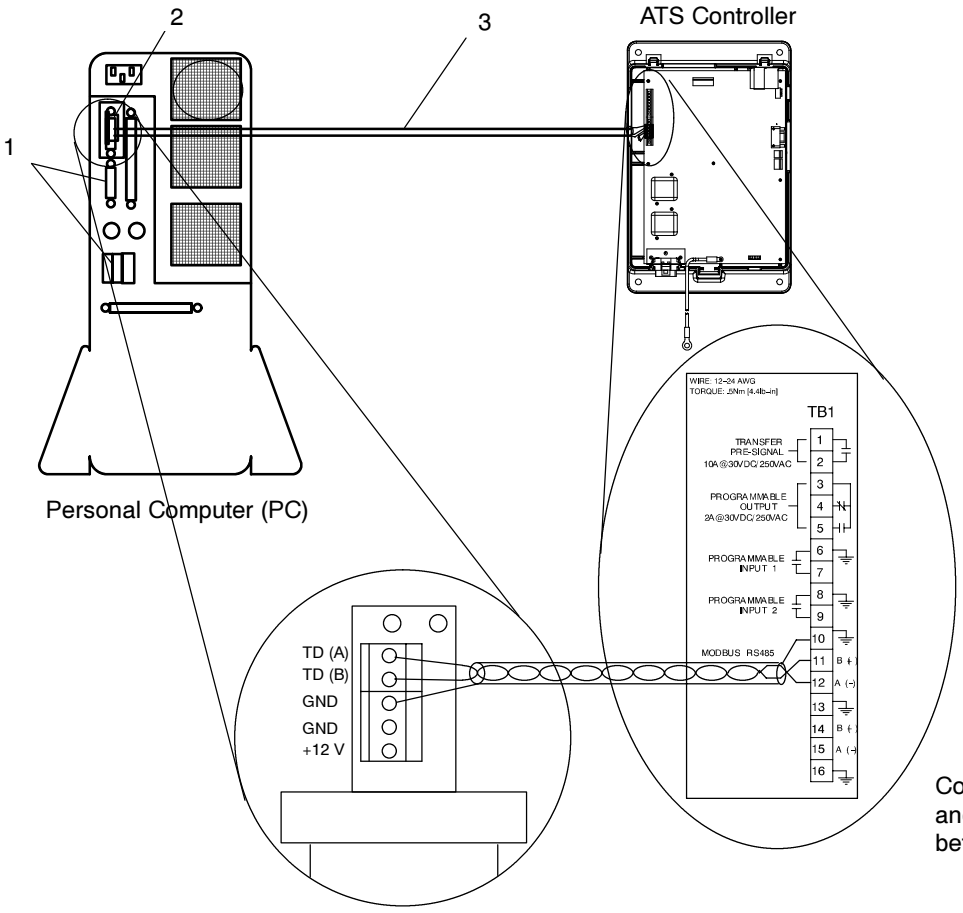


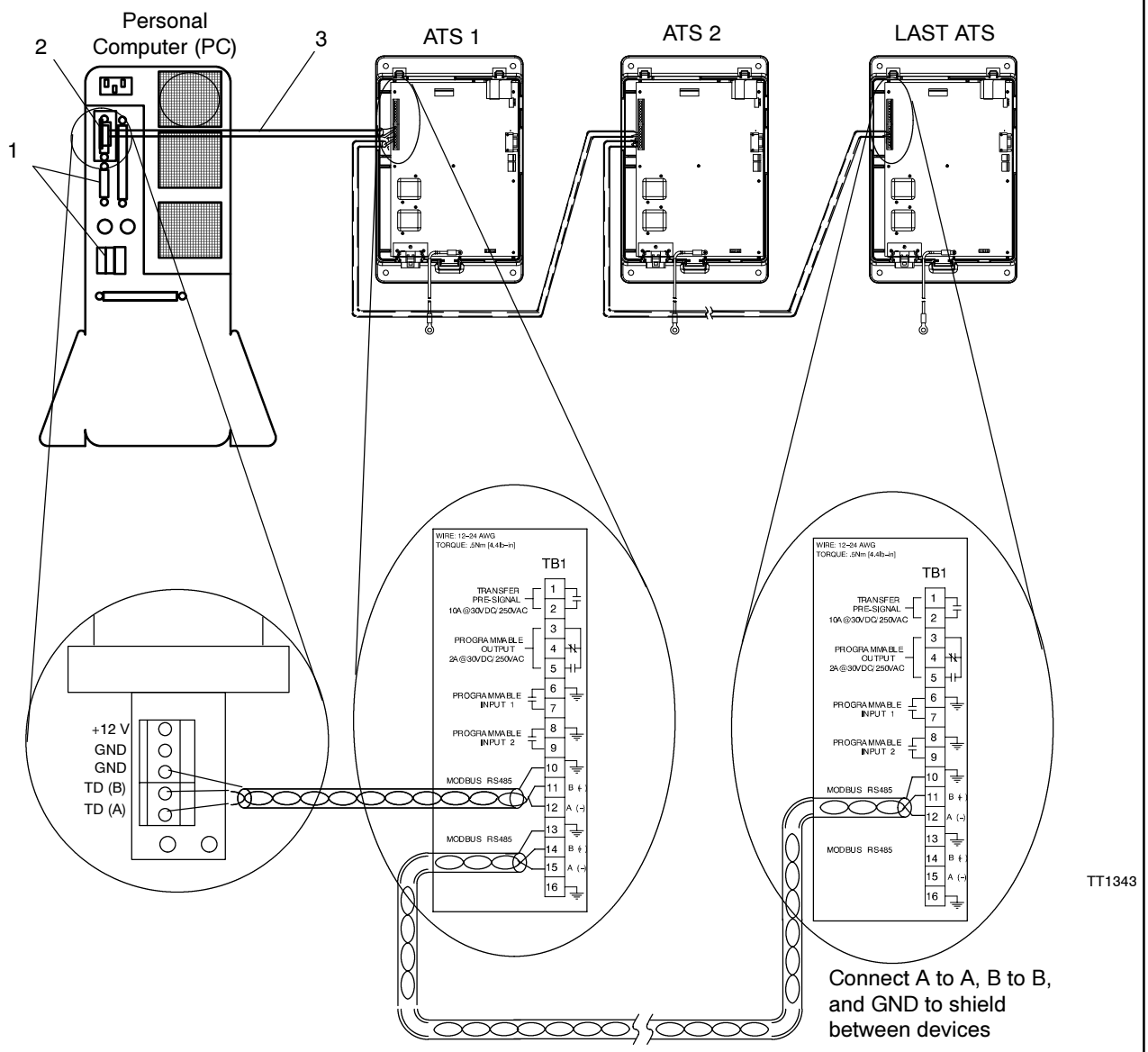
Figure 1-5 RS-232 to RS-485 Converter



Note: Install communication conductors in raceways, cables, or conduit separate from AC power conductors.

1. Hardware key (dongle) GM29224 (parallel) or GM29225 (USB), included in software kit. Connect to the PC's parallel port or USB port. Parallel port dongles allow the connection of a printer or other device to the dongle.
2. RS-232 to RS-485 converter GM29361, included in software kit. Connect to the PC's serial port. Do not connect to the +12V terminal on the converter. (The converter is powered through the PC's serial port.)
3. Twisted-pair shielded cable, Belden #9841 or equivalent, customer-supplied. Connect terminal A to terminal A and terminal B to terminal B. Connect the cable shield to the GND terminals. Use a maximum cable length of 1219.2 m (4000 ft.) from the RS-485 converter to the last transfer switch.

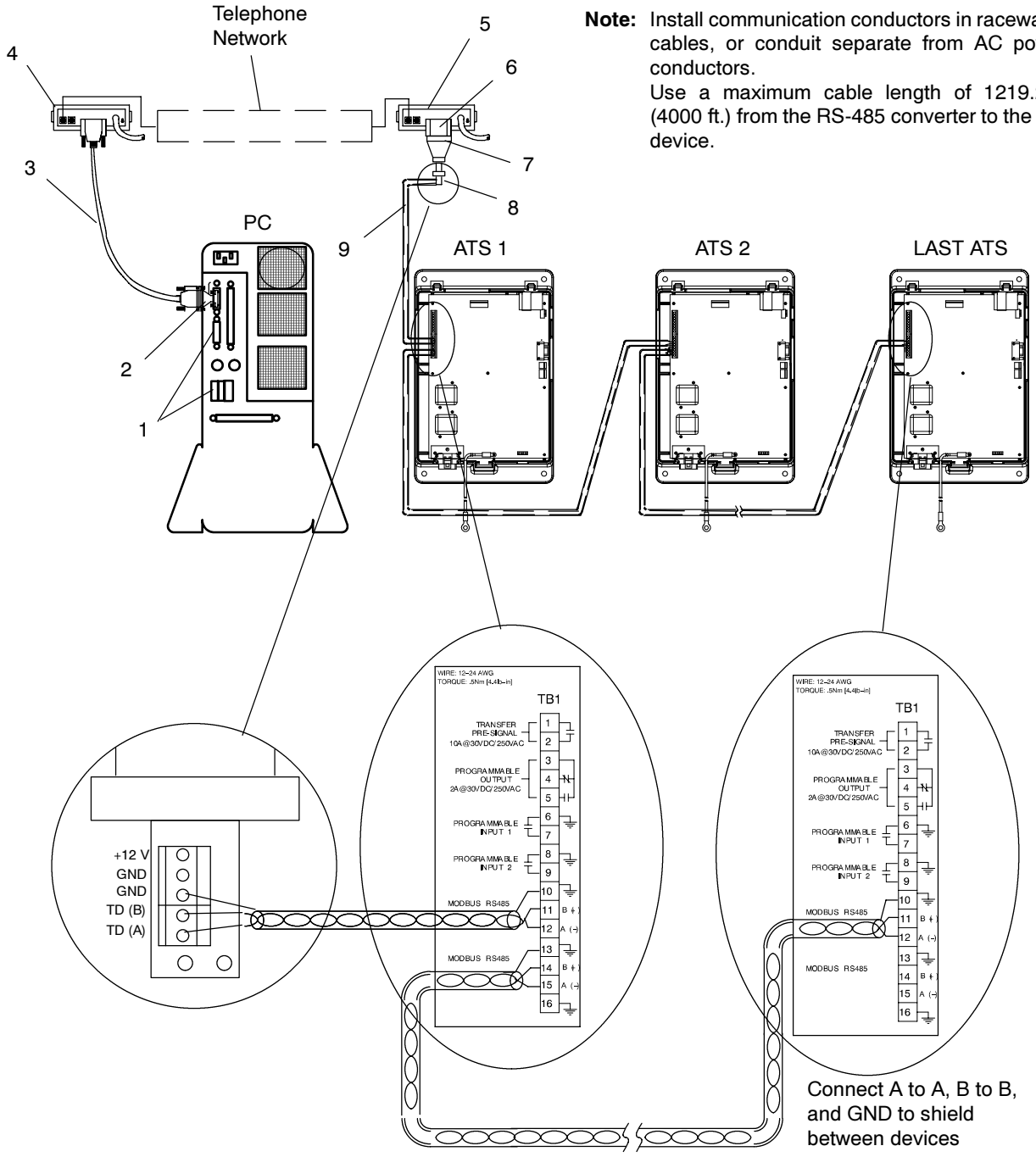
Figure 1-6 Local Single Connection



Note: Install communication conductors in raceways, cables, or conduit separate from AC power conductors.

1. Hardware key (dongle), GM29224 (parallel) or GM29225 (USB), included in software kit. Connect to the PC's parallel port or USB port. Parallel port dongles allow the connection of a printer or other device to the dongle.
2. RS-232 to RS-485 converter GM29361, included in software kit. Connect to the PC's serial port. Do not connect to the +12V terminal on the converter. (The converter is powered through the PC's serial port.)
3. Twisted-pair shielded cable, Belden #9841 or equivalent, customer-supplied. Connect terminal A to terminal A and terminal B to terminal B. Connect the cable shield to the GND terminals. Use a maximum cable length of 1219.2 m (4000 ft.) from the RS-485 converter to the last transfer switch.

Figure 1-7 Local Area Network Connection



Note: Install communication conductors in raceways, cables, or conduit separate from AC power conductors.
Use a maximum cable length of 1219.2 m (4000 ft.) from the RS-485 converter to the last device.

1. Hardware key (dongle), GM29224 (parallel) or GM 29225 (USB); included in software kit. Connect to the PC's parallel port or USB port. Parallel port dongles allow the connection of a printer or other device to the dongle.
2. Connector 294988 (9-pin female to 25-pin male converter). Use on 9-pin serial ports.
3. RS-232 cable GM29362.
4. PC Modem 294986 (60 Hz) or 353072 (50 Hz). Connect telephone line directly to PC's internal modem's Telco jack if not using an external modem.
5. Device modem 294987 (60 Hz) or 353071 (50 Hz)
6. Null converter GM29363
7. 9-pin to 25-pin connector GM29364
8. RS-232 to RS-485 converter GM29361. Included in software kit. Do not connect to the +12V terminal on the converter. (The converter is powered through the PC's serial port.)
9. Twisted-pair shielded cable, Belden #9841 or equivalent, customer-supplied . Connect terminal A to terminal A and terminal B to terminal B. Connect the cable shield to the GND terminals. Use a maximum cable length of 1220 m (4000 ft.) from the RS-485 converter to the last transfer switch.

Figure 1-8 Remote Connection

1.5 Software Installation and Removal

For simplicity, this manual and the software assumes that the PC has the CD-ROM drive installed as the D: drive and the hard drive installed as the C: drive. If your drive locations are different, type in the correct drive letter for your PC hard drive or CD-ROM drive when applicable during software installation or operation.

Note: When updating the Surveyor software to a new version, remove the old version of the software first. See Section 1.5.2, Software Removal. Then install the complete new version.

1.5.1 Installation

The Surveyor software CD-ROM contains various files that are used by the setup program to install the software on the PC. The setup program automatically installs a shortcut to run the program from the *Start* menu.

Follow the steps below to install Surveyor in Windows®.

Software Installation Procedure

1. Close all applications.
2. Insert the Surveyor Program CD-ROM into the PC's CD-ROM drive, the D: drive on most systems.
3. Open Windows® Explorer and double-click on the CD-ROM drive.
4. Double-click on the Setup application file.
5. The installation program will guide you through the installation process. Follow the instructions on the screen.
6. The program will prompt you to approve or change the directory for file installation. The setup program installs the main software files into the C:\Program Files\Kohler\Surveyor directory unless an alternate location is selected.
7. A window appears when the program is ready to install the drivers for the hardware keys. Click on *OK* to proceed. The program will not operate without the hardware key and driver.
8. Click the *OK* button after the setup is completed.
9. Remove the CD-ROM and store it in a safe location away from excessive heat, direct sunlight, and moisture.

Alternatively, use the PC's Add/Remove Programs utility. Click on the *Start* menu at the lower left corner of the screen and select *Settings>Control Panel.* Select *Add/Remove Programs* and follow the instructions on the screen to install the program files as instructed above.

When the program runs, it generates other files in the installation directory that the program uses to store system information.

Perform regular backups of the installation directory.

1.5.2 Software Removal

When updating the Surveyor software, remove the old version before installing the new one.

To remove the software from the PC, select *Settings>Control Panel>Add/Remove Programs* from the Start menu. Select the *Surveyor* group and click on *Add/Remove*. A program deletes Surveyor Program files from the installation directory.

Note: Do not simply delete the software files.

2.1 Introduction

This section provides general instructions for working with the Surveyor Program's tools and windows. Detailed descriptions of the individual data and setup windows are given in Section 3, Data Windows.

Note: Version 1.21 or higher of the ATS controller's application software is required for the Surveyor program to communicate successfully with the transfer switch. Check the software version number in the System Information data window; see Section 3.17.

2.1.1 User Account

The User account allows a user to change time delays and other transfer switch settings. A password is required to log on to this account. Change the password to ensure that only authorized personnel can change the transfer switch settings. See Section 2.4 for instructions to log on to the User account.

2.1.2 Guest Account

The Surveyor program allows guests to log on and monitor the system without changing any system settings or parameters. The setup windows, which allow users to change selected transfer switch settings, are disabled when the user logs on as a guest. See Section 2.4 for instructions to log into the Guest account.

2.1.3 Definitions

Device. A single transfer switch.

Site. A location including one or more transfer switches connected to the PC either through a direct RS-485 connection or through modems.

Local mode. Communication through a direct RS-485 connection between the transfer switch controller and a personal computer. See Section 1.4.

Remote mode. Communication through modem connections. See Section 1.4.

Data Window. A window that displays a set of transfer switch parameters or settings. For example, the source voltages, frequencies, number of phases, and phase rotation are displayed in the Source Info data window.

Setup Window. A window associated with an individual data window that allows the operator to change settings. Not all data windows have setup windows associated with them.

2.2 Guide to Using the Surveyor Program

The table in Figure 2-1 outlines the steps to set up the connections and use the program. The table is intended as a guide, not a complete set of instructions. Refer to the indicated sections of this manual for more detailed information for each step.

Guide to Using the Surveyor Program	
1.	**Configure the transfer switches.** Use the Setup Program; see TP-6135, Setup Program Operation/ Installation Manual, for instructions. Reference: Section 1.3. ● Use an RS-232 cable to connect the PC's serial port to the serial port on the ATS. ● Assign a unique network address to each transfer switch. ● Set the baud rate to 9600 or 19200 on each transfer switch. The baud rates must be the same on all connected transfer switches and the PC. (Set the PC's baud rate in step 6, below.)
2.	**Connect the hardware.** Reference: Section 1.4 and TT-1349. ● Connect as many as 247 transfer switches in an RS-485 network. ● Connect the RS-232 to RS-485 converter to the PC or the device modem. ● Connect the modems, if a remote connection will be used. ● Plug the hardware key into the PC's parallel or USB port.
3.	**Install the program.** Reference: Section 1.5. ● Close all applications. ● Insert the software CD-ROM. ● Use the PC's Add/Remove programs utility or click on the setup.exe file on the CD-ROM. ● Follow the instructions on the screen.
4.	**Start the program.** Reference: Section 2.3. ● Click on the *Start* button at the lower left corner of the computer screen. ● Select *Programs>Kohler>Surveyor*.
5.	**Log in.** Reference: Section 2.4. ● Enter the user name and password at the login screen. The default user name is *ATS* and the default password is *T340*. Change the username and password to prevent unauthorized access. ● Log in as *GUEST* to view system status and settings but not change any settings. The default password for the guest account is blank. Type the word GUEST in the username box and press the Enter key to log on. **Note:** User names and passwords are case-sensitive.

6.	**Set up the site(s).** Reference: Section 2.6.
	● From the menu toolbar at the top of the screen, select *File>Manage Sites*. See Section 2.6.1.
	● Click on New to set up one or more transfer switch sites:
	  ● Name the site.
	  ● Select the communications parameters (local or remote, COM port number, baud rate, and modem information).
	  ● Click on Add Device and enter the network address and description for each transfer switch at the site.
	  ● Click on OK when the site setup is complete.
	● Select a site and click on Edit to update settings or devices for an existing site.
	● Click on Done when all sites have been set up.

7.	**Connect to a site.** Reference: Section 2.8. ● Select *Connection>Connect* to display the list of sites. ● Click on one site to select it. ● Click on the Connect button at the bottom of the screen to establish communication with the site. The Site Overview window appears. **Note:** Only one site can be connected at a time. **Note:** A green icon in the lower right corner of the PC screen shows that the PC is connected to the site. If the icon is red, the connection was not successful. Check the the connections, the baud rates, and the COM port number.

Guide to Using the Surveyor Program	
8.	**Create data windows to display transfer switch system information and settings.** Reference: Sections 2.10 and 3. • Double click on one of the transfer switches listed in the Site Overview window. The Add Window screen for the selected switch appears on the screen. • To create data windows when the Site Overview window is closed, select *Window> New Window* from the menu toolbar at the top of the screen and then click on the desired transfer switch from the list on the left. • Click on a window from the list displayed on the screen. The selected display window will appear on the screen. See Section 3, Data Windows, for descriptions of data windows. • Repeat for additional data windows. • Arrange the windows on the screen by using *Window>Cascade Windows*, if desired, or by dragging and dropping windows.
9.	**Change settings, if necessary.** Reference: Sections 2.10 and 3. • Create the display window that shows the setting you want to change or click on it if it is already displayed on the screen. • Double-click on the selected window or select *Window>Setup* from the Menu toolbar at the top of the screen. The setup window will appear. **Note:** Setup windows are not available for all data windows. • Each adjustable parameter uses either a radio button, a check box, or a data entry box to change the setting. Click on the radio buttons or check boxes to change selected settings. The acceptable range of values is listed next to most data entry boxes; use the drop-down arrows to select a new setting or click in the box and type in a new value within the acceptable range. Refer to the appropriate sections following this procedure for more detailed instructions for each window and setting. • Click on *OK* or press the *Enter* key to apply the changes. Click on *Cancel* to discard the changes. • Watch the display window for the updated settings. The update time will vary with the number of windows displayed on the screen and the scan rate (see Section 2.9.3).
10.	**Save screens and settings** for future use, if desired. Reference: Section 2.6.3. • Select *File>Save Screen As.* • Type in a unique name (with no file extension) for the screen. • Click on the *Save* button.
11.	**Disconnect.** • Choose *Connection>Disconnect* to disconnect the PC from the controller.
12.	**Exit the program.** • Choose *File>Exit* to exit and close the Surveyor Program.

Figure 2-1 Guide to Using the Surveyor Program

2.3 Starting the Program

Start the program by clicking on the *Start* button at the lower left corner of the personal computer (PC) screen and selecting *Programs>Kohler>Surveyor*.

Alternatively, you can create a shortcut to the program on your PC's desktop and then click on the shortcut to start the program. To create the shortcut, go to *C:\Program Files\Kohler\Surveyor* (or the directory where the Surveyor program is installed). Right-click on the *SurveyorK* application file and select *Create Shortcut.* Then click on the newly created shortcut and drag it to your desktop.

2.4 Login

At startup, the program displays the login window shown in Figure 2-2. The default username is ATS, and the default password is T340. Enter the user name and password and click on the *OK* button. Change the user name and password to prevent unauthorized personnel from using the program to view system information or change system settings. See Section 2.9 for instructions.

Log in as GUEST to view system status and settings but not change any settings. The default password for the GUEST account is blank. Type in the user name GUEST and press the Enter key to log into the GUEST account.

Note: Usernames and passwords are case-sensitive. Check the PC's caps lock key before trying to log in.

Note: Change the user name and password to prevent unauthorized personnel from using the program to change system settings. The GUEST account password may also be changed, if desired. See Section 2.9.

Figure 2-2 Login Screen

2.5 Main Window

After login, the program displays the Main window shown in Figure 2-3. Use the buttons at the upper right corner to resize, minimize, or maximize the main window.

Use the pull-down menus at the top of the main window to access the commands shown in the following sections.

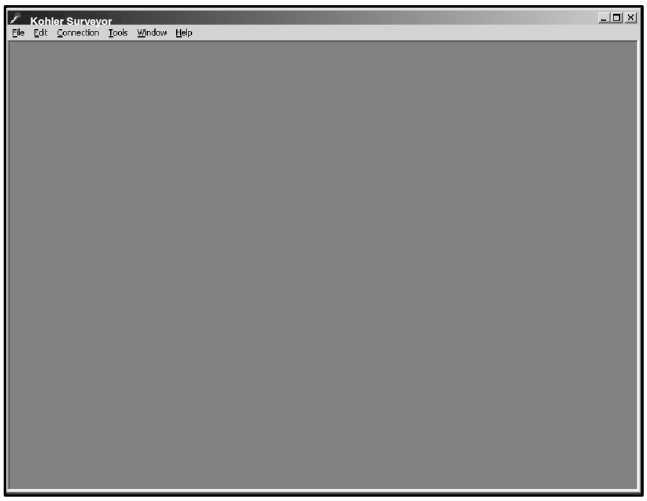


Figure 2-3 Main Window

2.6 File Menu

The file menu includes the following options:

- Manage Sites
- Open Screen
- Save Screen
- Save Screen As
- Exit

The Screen commands are disabled if no windows are displayed. See Figure 2-4.

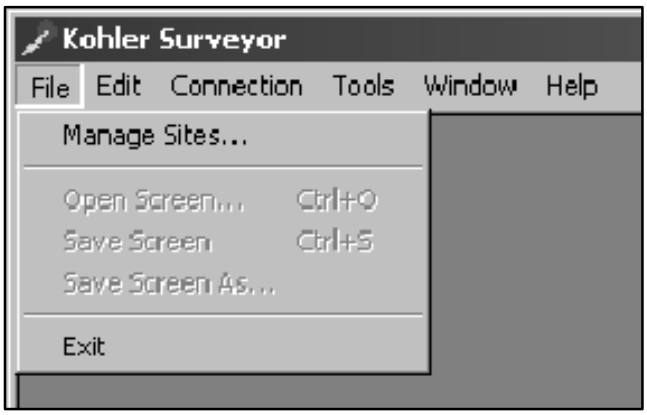


Figure 2-4 File Menu

2.6.1 Manage Sites

Use the *Manage Sites* command to define one or more sites before attempting to connect for the first time. A site is a location including one or more transfer switches connected to the PC either through a direct RS-485 connection or through modems.

Choose *File>Manage Sites* to open the Site Management window. The Site Management window allows the user to create, delete, edit, or connect to a site. See Figure 2-5.

New. Use New to create sites and set up their communication parameters before connecting. Click on New to open a blank Site Setup form. See Figure 2-6.

All sites that have been set up are displayed on the left side of the Site Management screen. Up to 256 sites can be displayed. A scroll bar will appear on the side of the list box if there are more sites than can be displayed at one time. Click on a name in the list to select a site and then choose Delete, Edit, or Done.

Delete. Use Delete to remove the selected site from the list. The Delete button is disabled if no site is selected.

Edit. Use Edit to change the site name or communication parameters, or to add, edit, or delete individual devices from the selected site. Clicking on the Edit button opens the Site Setup screen shown in Figure 2-6. Refer to Section 2.6.2 for instructions to edit the parameters in this screen. Click on OK or press Enter to save any changes made to the sites. Click on Cancel to discard changes without saving. The Edit button is disabled if no site is selected.

Done. After creating and editing sites, select the Done button at the bottom of the screen to close the Site Management screen.

2.6.2 Creating or Editing a Site

Selecting New or Edit from the Site Management window opens the screen shown in Figure 2-6. Complete all fields that are not disabled (grayed out) in the Site Setup screen. When finished, click on OK or press Enter to save any changes made to the sites. Click on Cancel to discard changes without saving.

Site Name. Create a unique name to identify the site and type it into the Site Name box. Use a different name to identify each site.

Local Monitoring. Select Local if the site is connected directly to the PC using an RS-485 connection.

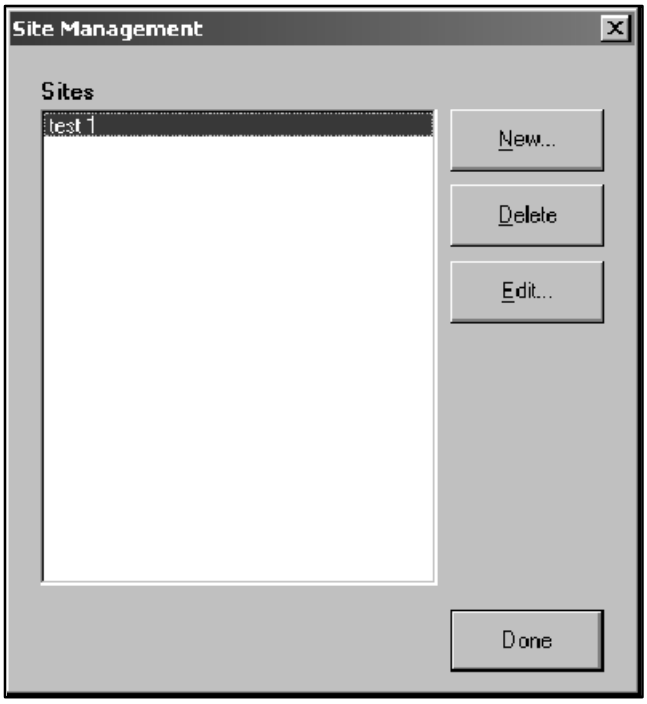


Figure 2-5 Site Management Form

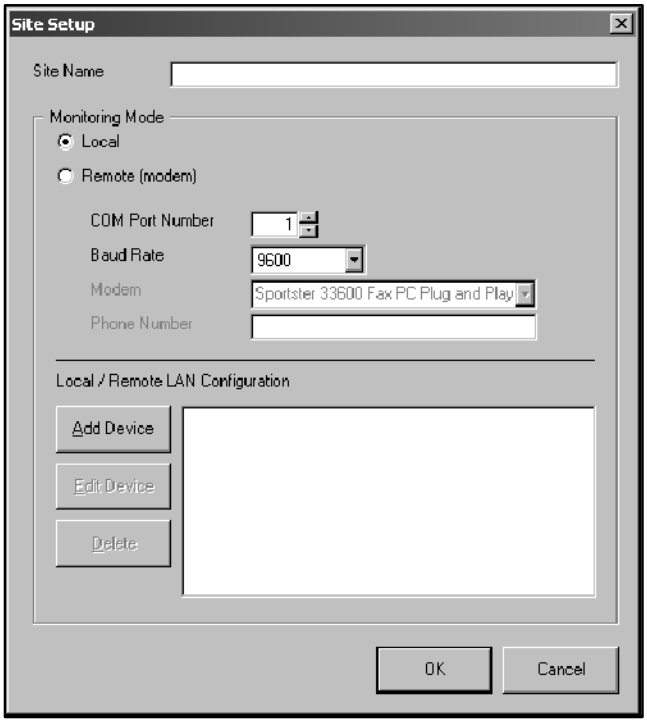


Figure 2-6 Site Setup Screen

Remote Monitoring. Select Remote if modems are used to connect the PC to the site.

COM Port Number. Select the COM port number used to connect the PC to the ATS controller or the modem. (Hint: Communications problems at startup are often caused by an incorrect COM port selection. If the PC

does not communicate with the ATS controller, try another COM port number. Numbers 1 through 6 are commonly used, but they can go as high as 256.)

Baud Rate. Click on the drop-down arrow next to the Baud Rate box to display a list of available baud rates. Select the baud rate to match the baud rate that has been set on the ATS controller.

Note: The controller's baud rate can only be changed using the Setup Program. See TP-6135, Setup Program Operation Manual.

Modem. Click on the down arrow next to the Modem box and select the modem used to communicate with the site. (Required for remote connections only.)

Phone Number. Type the phone number for the site modem into the Phone Number box, including the area code and any special characters needed to access an outside line, if necessary. (Required for remote connections only.)

Add Device. Click on Add Device to add a transfer switch to the site. All sites must have at least one transfer switch. The Device Form will appear. See Figure 2-7.

Address. Enter the transfer switch's network address (number 1–247). Each transfer switch in a site must have a unique network address. The network address must be set using the Setup Program.

Note: The Surveyor program cannot be used to assign or change a transfer switch's network address. Use the Setup Program and a computer connected to the ATS controller's RS-232 port to assign network addresses. See TP-6135, Setup Program Operation Manual.

Description. Type in a unique description for each transfer switch at the site. To avoid confusion, the description should match the device designation assigned to the transfer switch using the System Info data window in either Surveyor or the Setup Program.

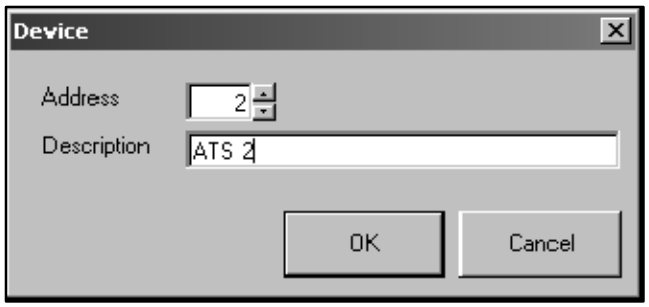


Figure 2-7 Device Form

2.6.3 Save Screen and Open Screen

A layout of data windows can be saved to a file for reuse. After creating the desired display windows and arranging them on the PC screen, use the following procedure to save the layout. Use the *Save Screen As* command to create a new file or *Save Screen* to update an existing Screen file.

Note: The *Save Screen* command does not save system settings (source parameters, time delay settings, etc.).

Procedure to Save a Screen to a File

1. Select *File>Save Screen As* from the menu bar as shown in Figure 2-4.
2. A dialogue box appears. See Figure 2-8. Type in a filename for the screen file. Choose a unique name that identifies the file for future reference. Screen files use the extension *.scn*. Do not type the filename extension; the program appends the extension to the filename automatically.
3. Click on the *Save* button.

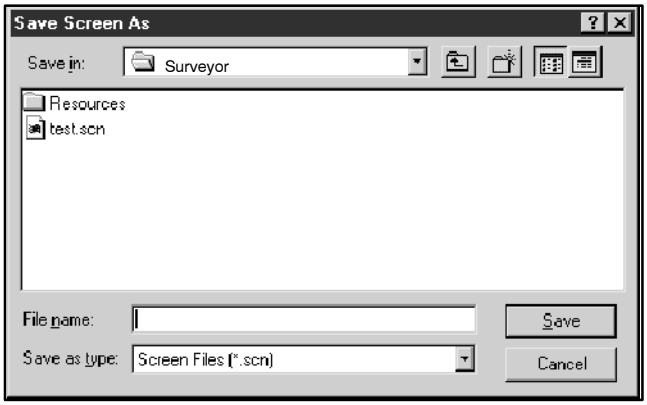


Figure 2-8 Save Screen

The *Open Screen* command opens a file containing previously created display windows.

Note: You must connect to a site before opening a screen file.

Select *File>Open Screen* and then select the appropriate file from the list on the screen. Use the drop-down arrows to change directories if the file is located in a different directory than the one displayed in the *Look in:* box. With the file selected, click on the *Open* button. The saved screens appear in the programs main window when the file opens.

2.6.4 Exit

Use the *File>Exit* command to exit the Surveyor Program after disconnecting from the ATS (see Section 2.8, Connection Menu). The program may prompt the operator to save the screen if the layout has been changed since the last time it was saved.

2.7 Edit Menu

The *Edit* menu allows the user to cut, copy, and paste selected text. See Figure 2-9. With some systems, the *Edit* commands can be accessed by clicking the right mouse button while the setup window is active. This function depends on the PC mouse properties.

The *Cut* and *Copy* commands are enabled only when text that can be cut or copied is selected. The *Paste* command is only enabled when there is text on the clipboard that is available to paste.

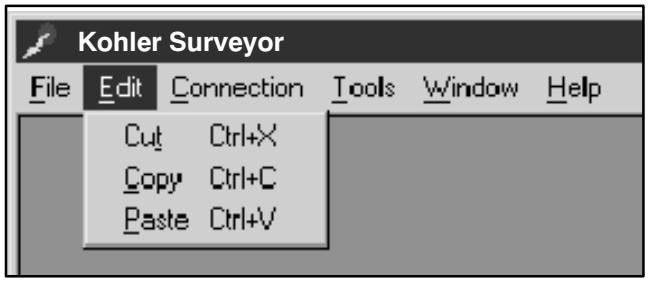


Figure 2-9 Edit Menu

2.8 Connection Menu

The *Connect* command attempts to open the communication port and establish communications with a site.

Note: Use the Setup Program to configure the communications settings for your system See TP-6135, Setup Program Operation and Installation.

Selecting *Connection>Connect* brings up the Site Selection window. See Figure 2-11. Click on one site in the list to select it, then click on the Connect button at the bottom of the window to connect to that site.

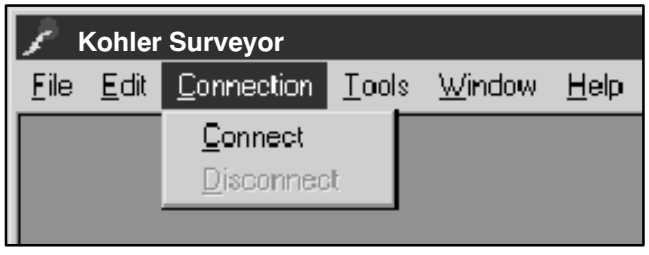


Figure 2-10 Connection Menu

The Site Overview window automatically appears after connection. See Section 3.2 for instructions for using the Site Overview window.

The *Disconnect* command closes the communication port. Disconnect before attempting to connect to another site.

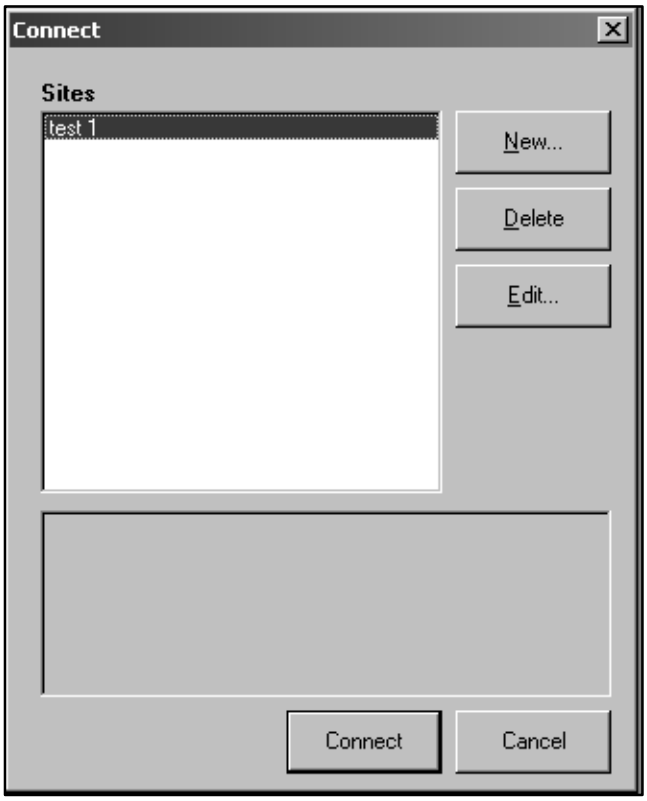


Figure 2-11 Site Selection Window

2.9 Tools Menu

Use the *Tools* menu to change the software user name and password and to set the PC's communication settings. See Figure 2-12.

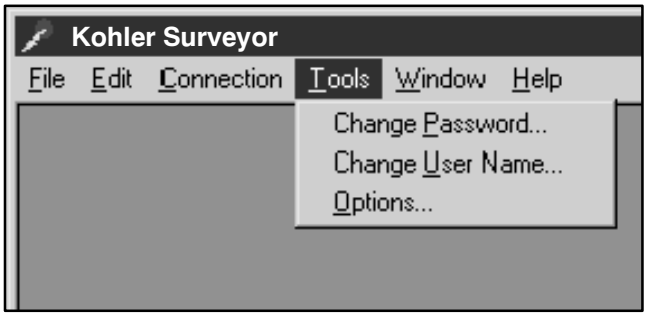


Figure 2-12 Tools Menu

2.9.1 Change Password

Use this window to change the password. See Figure 2-13. The window displays the name of the user

logged on to the program. Type in the old password, the new password, and the new password a second time for confirmation. To ensure confidentiality, the passwords do not appear on the screen. Click on the *OK* button to enter the new password. Click on the *Cancel* button to discard the changes and keep the old password.

Note: Passwords and user names are case sensitive. Check the *Caps Lock* key when typing passwords.

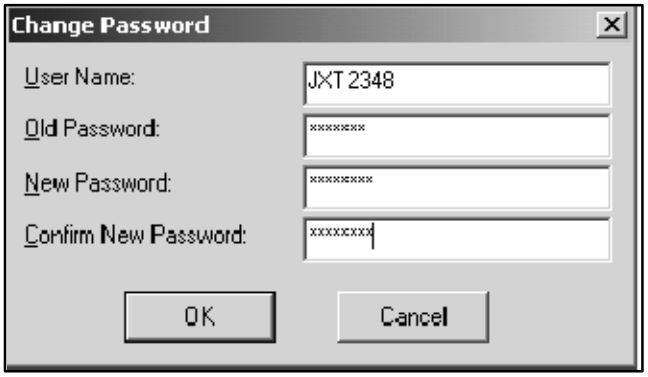


Figure 2-13 Change Password

2.9.2 Change User Name

Use this window to change the user name of the person who is logged in. See Figure 2-14. The window displays the current user name near the top. Type in the new user name and type it again in the second box to confirm it. The new names appear on the screen as they are typed. Click on *OK* to accept the new user names, or *Cancel* to discard the change and keep the old user name.

The program verifies that the new names match before accepting the change.

Note: Passwords and user names are case sensitive.

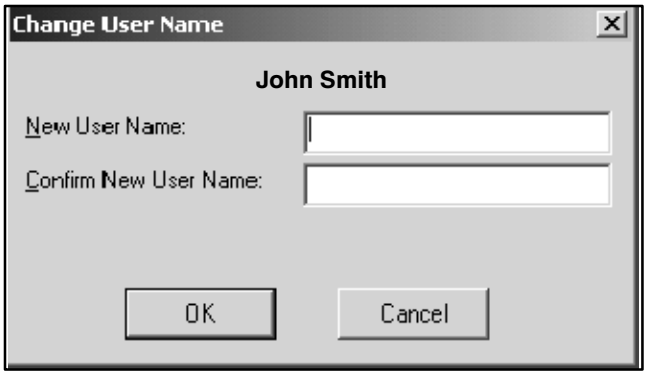


Figure 2-14 Change User Name

2.9.3 Options

The scan rate affects the time required to update settings and display windows. However, the update time is more strongly affected by the number of windows displayed on the screen.

Recommended scan rates are 200–300 milliseconds. Faster scan rates (less than 200 milliseconds) may cause data loss and are not recommended.

Click on the *OK* button to apply the changes.

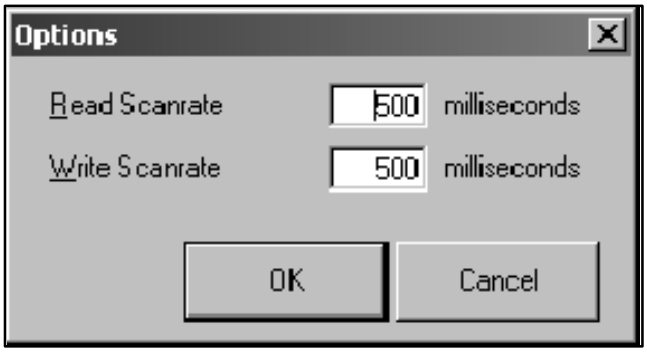


Figure 2-15 Options

2.10 Window Menu

Use the *Window* menu to create new windows, select a window, enter the setup screen for an existing window, arrange windows on the screen, and delete windows. This section gives general instructions for creating display and setup windows. Refer to Section 3, Data Windows, for detailed descriptions of the contents and use of of each window. See Figure 2-16.

Note: You must be connected to a site in order to add a window.

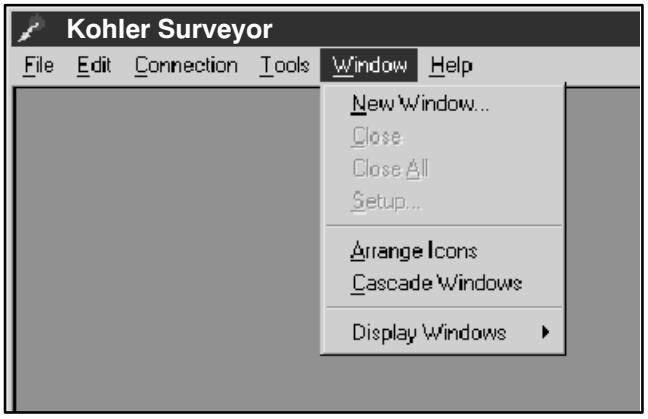


Figure 2-16 Window Menu

2.10.1 New Window

Connect to a site before trying to create windows. See Section 2.8.

Select *Window>New Window...* from the main window pull-down menus. The program displays the Add Window form shown in Figure 2-17.

The list on the left side of the window contains all transfer switches at the connected site. Click on one ATS in the list to select that transfer switch. Then select one or more data windows from the list on the right side of the screen. Select multiple items from the list by holding down the control (*Ctrl*) key and clicking on each item. Select blocks of items by clicking on the first item, then holding down the *Shift* key while clicking on the last item in the block. The selected data windows will be highlighted. Click on *OK* to open the highlighted data windows for the selected transfer switch.

To create data windows for a different transfer switch at the connected site, click on the transfer switch designation in the list on the left side of the screen. The available data windows for that transfer switch will be listed on the right side of the screen.

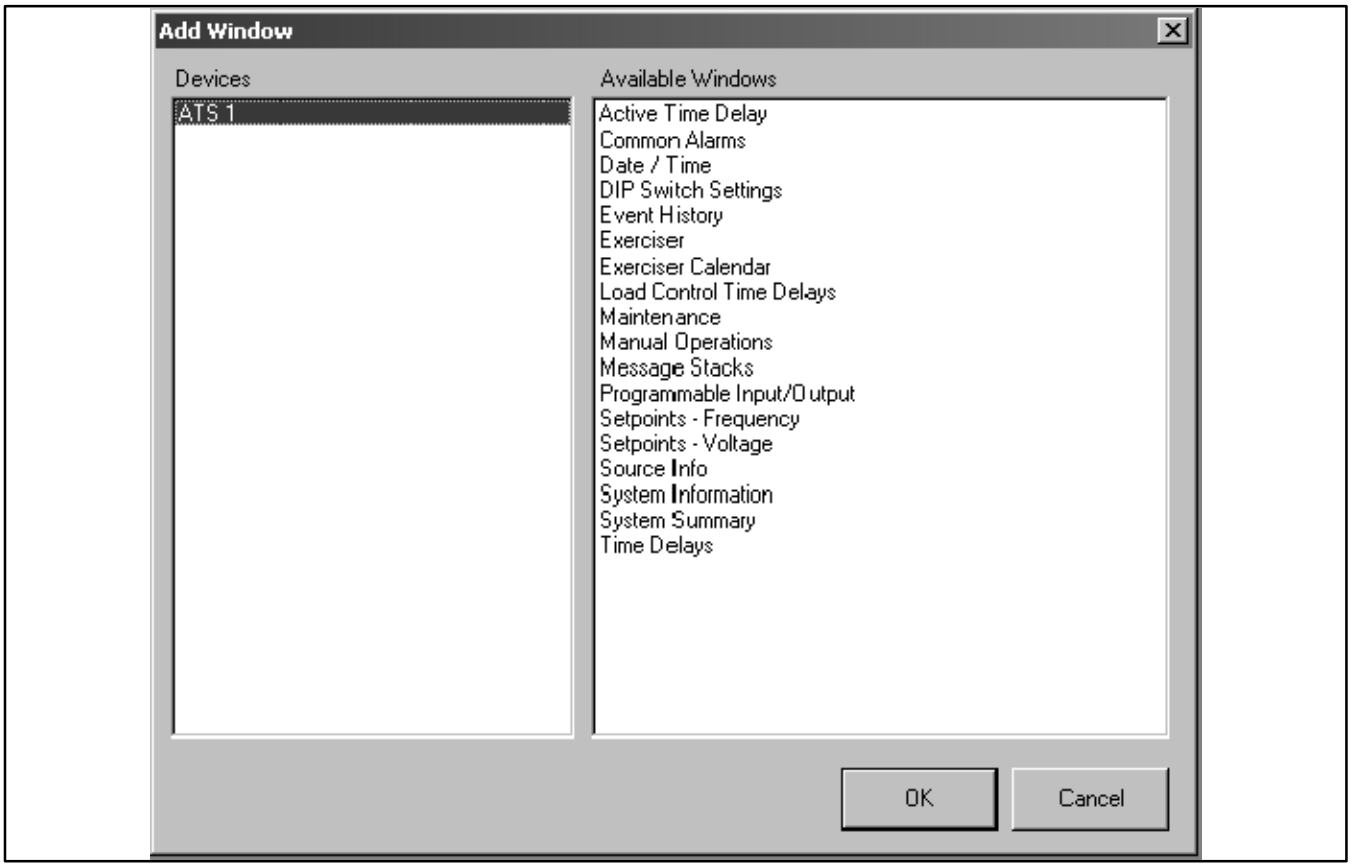


Figure 2-17 Add Window Form

Windows that have already been added to the user screen do not appear on the list. If all windows have been added to the user screen, the list is empty.

Click on *Cancel* or the **X** button at the upper right corner of the form to return to the main window.

See Section 3, Data Windows, for detailed instructions for the different windows.

2.10.2 Setup Windows

The setup window allows you to change user-adjustable settings within the window. For example, the Time Delays setup window allows you to change the engine start and transfer time delays.

Note: The display window for a function must be selected before the setup window be opened. Some display windows do not have setup windows associated with them.

First select the display window for the ATS function that you want to work with. Then choose *Window>Setup* or double-click on the active display window to open the setup window for that function.

The setup windows use several methods to enter system information and settings. This section gives general instructions about how to use the different methods to enter information.

Radio Buttons. A radio button appears as an open circle. Position the cursor inside the open circle and left-click to select the desired option. The selected radio button has a dark dot in the center. Radio buttons allow the selection of only one of the options in a set. Selecting one radio button in a set of options deselects, or turns off, all of the other options.

Check Boxes. Check boxes are open rectangular boxes. A selected check box contains a check mark. Position the cursor inside the box and click to select or deselect the option. Check boxes allow the selection of any or all of the options in the set. Selecting one option with a check box will not deselect the other options in a set.

Data Entry Boxes. Data entry boxes allow you to type in text or numerical data from the keyboard. Position the cursor inside the box, left-click, and type in the new information. If the box already contains information, double-click to highlight the text before typing the new information. Some items show the acceptable range of settings after the data entry box. Verify that the data you enter falls within the range shown. If the setting does not fall within the acceptable range, the system will not accept the change.

Drop-Down Arrows. A drop-down arrow appears as a down arrow in a box at the end of a line. Position the cursor on the down arrow and click to display a selection list. Click on an item in the list to select it. The selected item appears in the box next to the arrow.

Up and Down Arrows. Up and down arrows appear in boxes after a data entry box containing a numerical setting. Click on the up arrow to increase the number or the down arrow to decrease the number. You can also double-click inside the data box and type in the setting directly, provided it falls within the acceptable range.

OK and Cancel Buttons. The *OK* and *Cancel* buttons appear at the bottom of each window. The software does not enter changes until the *OK* button is clicked. Make changes to the selections or data entry boxes, and then click on *OK* to accept the changes and enter them into the system. If the *OK* box is highlighted on the screen, pressing the *Enter* key will also enter the changes. Click on *Cancel* to discard the changes without entering them into the system.

Confirmation Boxes. Clicking on *OK* to enter some changes prompts a confirmation box to appear on the screen before the system enters the changes. Double check your selections and their effect on the system before clicking on *OK* to confirm the changes.

2.10.3 Arrange Icons

Minimizing windows by clicking on the _ symbol in the upper right corner of the window reduces the window to an icon. Select *Window>Arrange Icons* to arrange the icons neatly at the bottom of the main window.

2.10.4 Cascade Windows

Choose *Window>Cascade Windows* to arrange the windows on the screen. The *Cascade Windows* command is enabled only when two or more display windows are on the screen.

2.10.5 Display Windows

Choose *Windows>Display Windows* to see a list of all windows that have been created on the screen. Select a window from the list to bring it to the top and activate it.

2.11 Help Menu

Choose *Help>About...* for information about the software such as the version number and copyright information. See Figure 2-18. (*Help Topics* option is not available at the time of manual printing.)

The *About...* box displays the software name, version number, build date, and copyright information. See Figure 2-19. Record the software version number on the inside front cover of this manual for future reference.

Click on the *System Info* button to launch the Microsoft® system information application if it is available on your PC.

Click on the *OK* button to close the window.

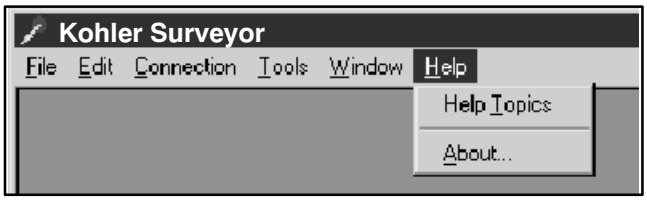


Figure 2-18 Help Menu

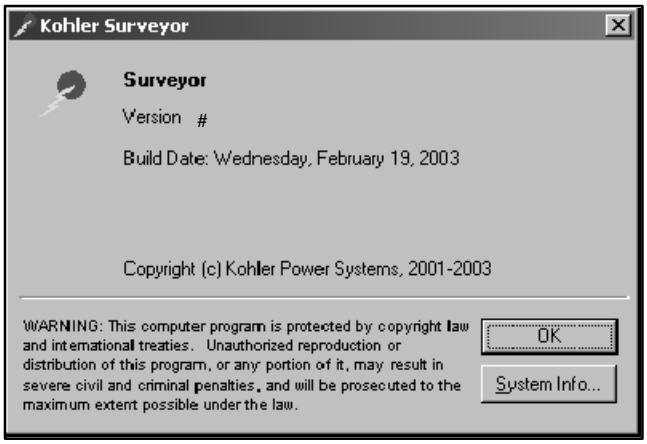


Figure 2-19 About Box

2.12 System Tray

An icon in the box at the lower right corner of the screen indicates whether the PC is connected to the controller. See Figure 2-20. A green icon indicates that the PC is connected to and communicating with the controller. A red icon indicates that the devices are not connected. Check the null modem cable and the selected COM port (see Section 2.9.3, Options) if there are connection problems.

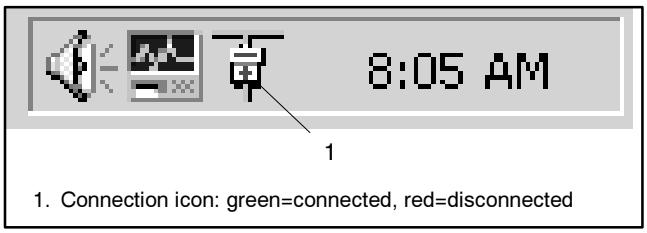


Figure 2-20 System Tray

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2.13 Messages

Message windows indicate problems with user names or passwords as typed. Click on *OK* to remove the message box and then try again. Possible messages include:

- **Login.** See Figure 2-21. *The user name or password is incorrect. User names and passwords are case sensitive.* Check the spelling of the user name and password and verify that the *Caps Lock* on the keyboard is not activated before retyping. This message also appears if the user tries to enter an old user name/password combination.

- **Change Password.** See Figure 2-22. *The new passwords typed do not match.* Check the spelling and capitalization of the new password carefully, and then retype it in both boxes of the Change Password window.

  Note: Passwords are case sensitive. Check the *Caps Lock* key before typing the password.

- **Change User Name.** See Figure 2-23. *The new user names typed do not match.* Check the spelling and capitalization of the new user name and retype it.

- **Save Screen.** See Figure 2-24. The message shown in Figure 2-24 appears at exit if any display windows have been added or removed. The *Save Screen* command allow the display windows to be saved and reopened rather than recreating the windows individually at each use of the program. Select *Yes* to save, *No* to exit without saving, or *Cancel* to cancel the exit command and return to the program. See Section 2.6.1, Save and Open Screen, for more information about saving screens.

Figure 2-21 Login

Figure 2-22 Change Password

Figure 2-23 Change User Name

Figure 2-24 Save Screen

3.1 Introduction

This section describes display and setup windows. Select *Window>New Window* and select an item from the list to create a display window. Double-click on an active display window or choose *Window>Setup* to create the setup window. Refer to Section 2.10, WIndow Menu, for more information about creating and working with setup windows.

A summary table in Section 3.20, Software Window Summary, lists all of the items contained in each window, and indicates whether each item is included in both the display and setup windows. Use the table as a guide to identify the location of individual settings, time delays, or other parameters.

3.2 Site Overview Window

Connecting to a site opens the Site Overview window shown in Figure 3-1. The Site Overview window diplays the ATS position (Normal, Off, or Emergency), the available sources, and system status for each transfer switch at the connected site.

Site Name. The site name appears at the top of the window. The site name was assigned using the Site Setup Form under the Site Management window. See Section 2.6.1.

Addr (address). The Addr (address) column shows the network address for each ATS at the site. The network address must be assigned using the Setup Program. It cannot be changed through the Surveyor Program.

Description. The Description column displays the ATS description that was assigned when the site was created. See Section 2.6.2, Creating or Editing a Site. Assign a unique description to each ATS for identification.

Position. The Position column shows the contactor positon, Normal, Emergency, or Off (programmed-transition models only). The color of this column also indicates position: green when the contactor is in the Normal position, yellow when the contactor is in Off, and red when the contactor is in Emergency..

Normal Available, Emergency Available. An X in the Normal Available and/or Emergency Available columns shows that the indicated source is avialable.

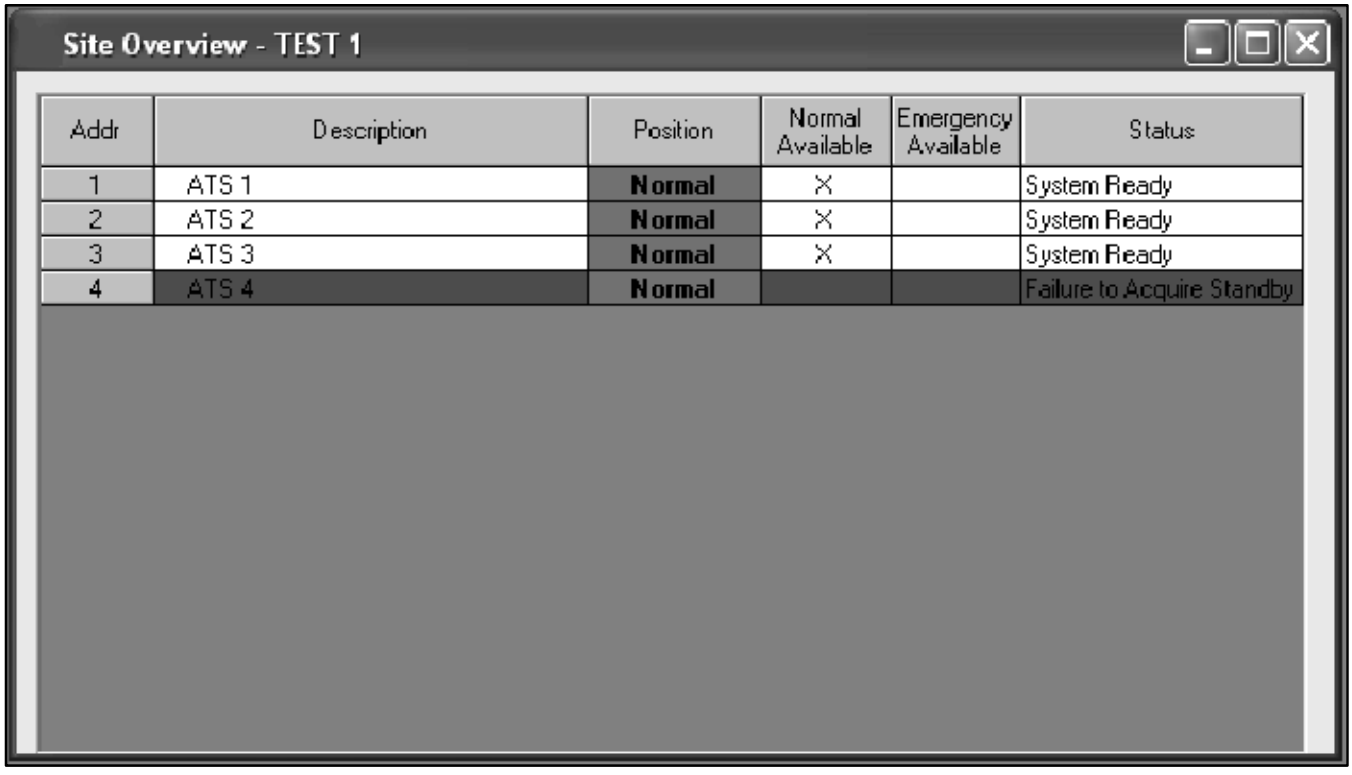


Figure 3-1 Site Overview Window

Status. The Status column displays a messages indicating the condition of the transfer switch. The status message is drawn from the System State, which is also displayed in the System Summary data window.

Some possible system status messages are:

- System Ready
- Test Running
- Exercise
- Time Delay Active
- Fault
- Lost Communications
- Peak Shave
- Failure to Acquire Standby
- Failure to Transfer

If one of the transfer switches indicates a fault condition, the status box for that switch displays a fault message and the display flashes red.

Add Window. Double-click on a line in the Site Overview table to open the Add Window form for an individual transfer switch. See Figure 3-2. Use the Add Window form to open any available data window for the selected transfer switch. Select one or more data windows from the list. Select multiple items from the list by holding down the control (*Ctrl*) key and clicking on each item. Select blocks of items by clicking on the first item, then holding down the *Shift* key while clicking on the last item in the block. The selected data windows will be highlighted. Click on *OK* to open the highlighted data windows for the selected transfer switch.

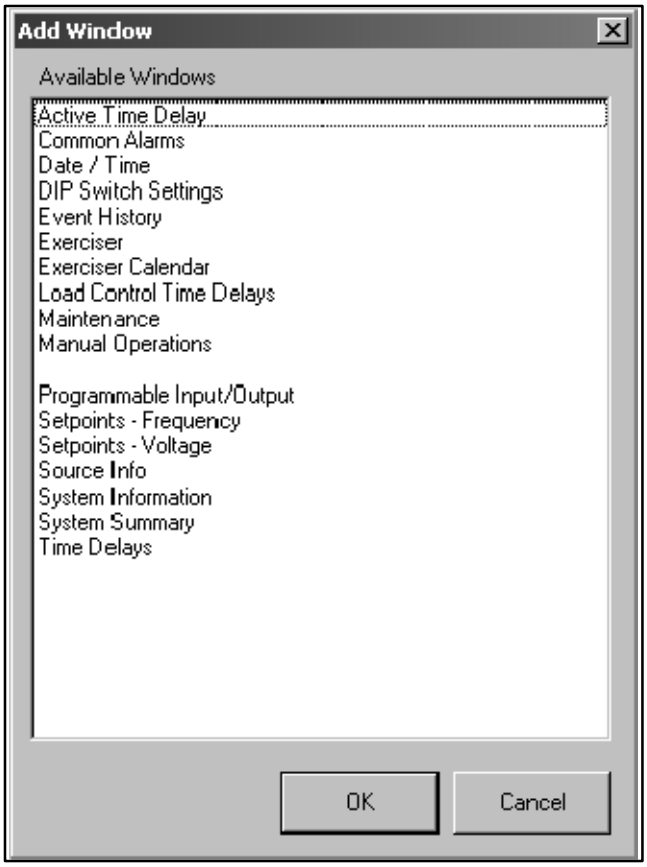


Figure 3-2 Add Window Form

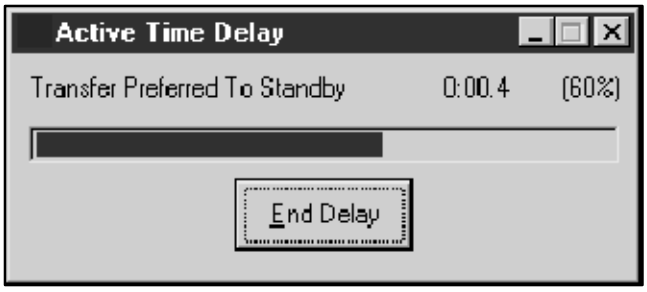


Figure 3-3 Active Time Delay Display

3.3 Active Time Delay

The Active Time Delay window displays the name of the time delay that is currently being executed, the amount of time remaining for that delay, and the percent time elapsed. The bar shows the progression of the time delay as it runs. See Figure 3-3.

Clicking on the *End Time Delay* button ends only the active time delay. Subsequent programmed time delays will start and run until completion or until the *End Time Delay* button is activated for each delay.

The *End Time Delay* button will not end an exercise or a programmed-transition (off-to-standby or off-to-preferred) time delay.

3.4 Common Alarms

Use the Common Alarms windows to assign and view the events assigned to the controller's common alarm. Any fault condition assigned to the Common Alarm triggers the Common Alarm programmable output. See Section 3.13.4, Programmable Outputs, for more information about programmable outputs.

3.4.1 Common Alarms Display Window

This window displays the events that are assigned to the controller's common alarm. See Figure 3-4 for an example of the Common Alarms Display window with a number of assigned events.

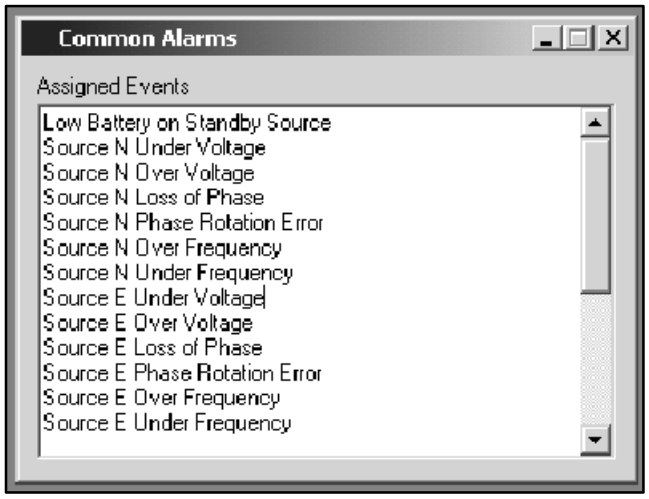


Figure 3-4 Common Alarms Display

3.4.2 Common Alarm Setup Window

The common alarms setup window displays a list of all events that can be assigned as common alarms. See Figure 3-5. Select an event from the list and click on the *Add* button to assign it as a common alarm. The event will move from the Available window to the Assigned window. Use the *Remove* button to remove an assigned event.

To assign or remove a block of events, click on the first event in the list, then hold down the *Shift* key and click on the last event in the block. To select several individual events, hold down the control (*Ctrl*) key while clicking on each event. Use the *Add* or *Remove* key to move all of the highlighted events.

Refer to Figure 3-6 for a typical list of events that can be assigned as common alarms.

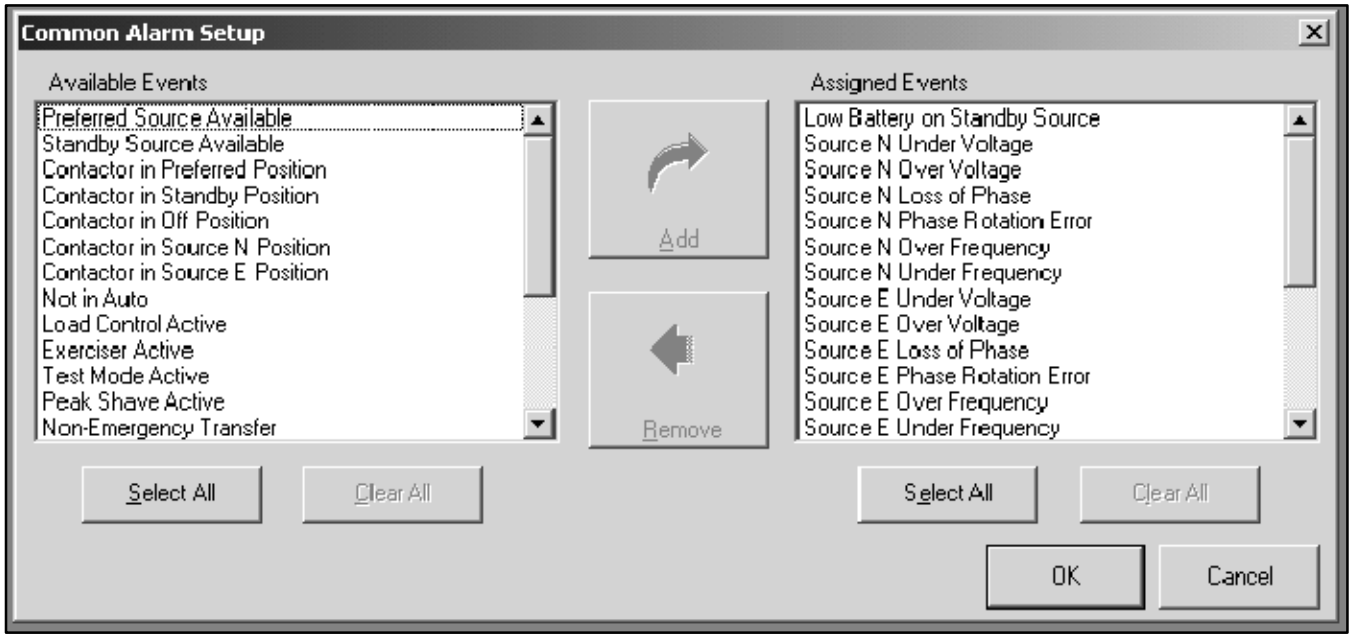


Figure 3-5 Common Alarm Setup

Preferred Source Available	Source N Undervoltage
Contactor in Preferred Position	Source N Overvoltage
Contactor in Standby Position	Source N Loss of Phase
Contactor in Off Position	Source N Phase Rotation Error
Contactor in Source N Position	Source N Overfrequency
Contactor in Source E Position	Source N Underfrequency
Not in Auto	Source E Undervoltage
Load Control Active	Source E Overvoltage
Exerciser Started	Source E Loss of Phase
Test Mode Active	Source E Phase Rotation Error
Peak Shave Active	Source E Overfrequency
Non-Emergency Transfer	Source E Underfrequency
Load Bank Activate	Failure to Acquire Standby
In-Phase Monitor Waiting for Synch	Failure to Transfer
Modbus-controlled RDO #1	I/O Module Comms Lost
Modbus-controlled RDO #2	I/O Module Not Found
Modbus-controlled RDO #3	I/O Module Not Installed
Modbus-controlled RDO #4	Aux. Switch Fault
System Ready	Aux. Switch Open
Source N Available	Remote Common Alarm
Source E Available	Critical (immediate) Service Required
Low Battery on Standby Source	Non-Critical Service Required

Figure 3-6 Typical Common Alarms

3.5 Date/Time Windows

View and set the controller's time and date settings, or set the controller's clock to match the personal computer's (PC) clock.

3.5.1 Date/Time Display

The Date/Time display shows the controller's time and date settings. The controller's settings do not necessarily match those of the PC. See Figure 3-7.

3.5.2 Date/Time Setup

Use the drop-down arrow to display a date list and click on a date from the list to select it, or select *Today* at the bottom of the calendar. Another way to enter the date is to select the date, month, and year one item at a time and type the current information into the date box. See Figure 3-8. Click on the *OK* button or press *Enter* to enter the settings. The clock does not reset until *OK* is entered.

Use the up and down arrows to set the time or click the *System Clock* button to set the controller's clock to match the PC's time.

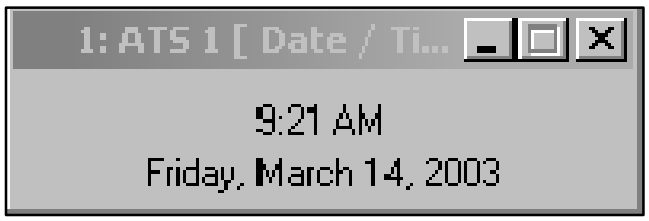


Figure 3-7 Date/Time Display

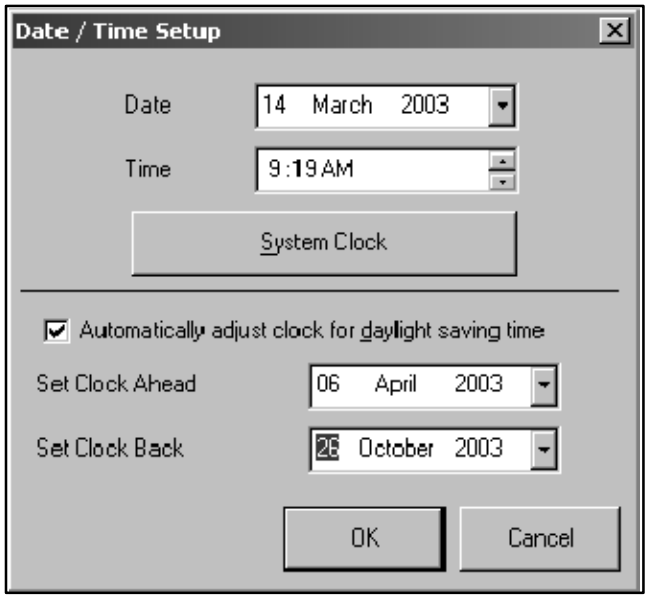


Figure 3-8 Date/Time Setup

3.5.3 Daylight Saving Time

To set the system to automatically reset the clock for Daylight Saving Time, click in the box so that a check mark appears. Enter the dates to set the clock ahead in the spring and back in the fall. Use the drop-down arrows to bring up a calendar or type the dates into the box in the same way as described for setting the current date.

Note: In succeeding years, the controller will reset the clock on the day of the week according to the date set for the first year. For example, if April 7, 2002 is entered, the clock will reset on the first Sunday in April, 2003, and succeeding years.

The clock resets at 2 a.m. If an exercise is scheduled to begin between 2 and 3 a.m. on the day that the time changes, that exercise run will be missed.

3.6 DIP Switch Settings

The DIP switch settings window (see Figure 3-9) displays the positions of the controller's DIP switches:

- Maintenance Switch: Transfer Inhibited (displayed in red) or Permitted
- Test: Loaded or Unloaded
- Exercise: Inhibited or Permitted
- Manual Exercise: 1 Week or 2 week
- Exercise: Loaded or Unloaded

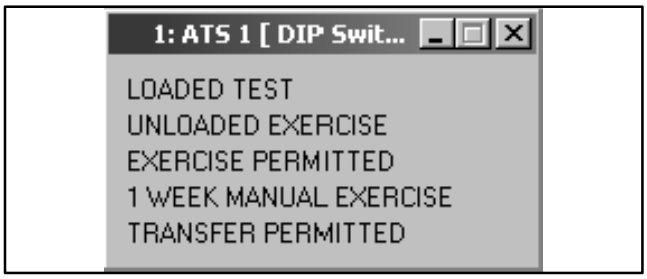


Figure 3-9 DIP Switch Settings

3.7 Event History

The Event History window displays the time, date, and duration of the last loss of the preferred source. The window also displays all events in the controller's event log, with the time, date, and up to two other parameters associated with the event. The window displays up to 100 events. See Figure 3-10.

The message *EEPROM Access Warning* may appear in the event log. If the EEPROM warning message appears repeatedly, call for service.

Press the *Save History* button to save the event log in an ASCII text file. The system allows the user to select the location to save the file.

The *Clear History* button is disabled. The history cannot be cleared using the ATS Surveyor Program.

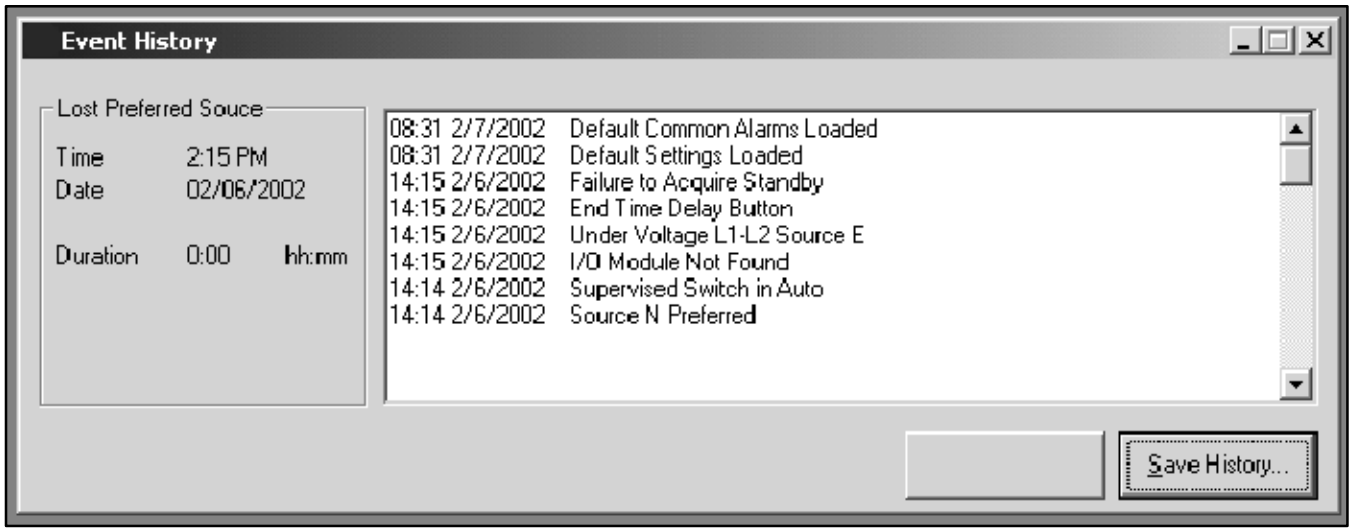
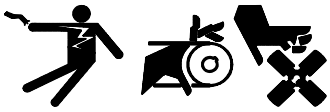


Figure 3-10 Event History Display

3.8 Exerciser

View and adjust the plant exerciser settings that are not directly related to the Calendar mode.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

3.8.1 Exerciser Display Window

The plant exerciser display window (see Figure 3-11) displays the following:

- Exerciser Mode: Manual Mode, Calendar Mode, or Calendar Mode with Override
- Warnings Window:
  - EXERCISE INHIBITED: displays in red if the Exercise Inhibit DIP switch is set to the ON position
  - TRANSFER INHIBITED: displays in red if the Transfer Inhibit DIP switch is set to the ON position
- Manual Exercise:
  - Next Run Date
  - Next Run Time
  - Period
  - Loaded/Unloaded
  - Run Time

Figure 3-11 Exerciser Display

The period, 1 week or 2 weeks, determines how often the exerciser runs. The run time shows the duration of each exercise run. The 1 week/2 week period and loaded/unloaded exercise are set by DIP switches on the controller's main logic board. See the ATS operation and installation manual for more information about DIP switches.

3.8.2 Exerciser Setup Window

Use the plant exerciser setup window (see Figure 3-12) to set or adjust the following:

- Exerciser Mode: Manual Mode, Calendar Mode, or Calendar Mode with Override
- Manual Exercise:
  - Next Run Date
  - Next Run Time
  - Period
  - Loaded/Unloaded
  - Run Time

The *Manual Exercise Disable* and *Set/End* buttons allow control of the manual exerciser through the software. Selecting the *Disable* button clears the manual exercise settings. Clicking on the *Push to*

Set/End button when the exerciser is in manual mode has the same effect as pressing the *Exercise* button on the ATS user interface, starting or ending an exercise run.

Use the *Calendar Mode* or *Calendar Mode with Override* buttons in the exercise setup window to enter the exerciser Calendar mode. Refer to Section 3.9, Exercise Calendar, for more information about the Calendar and Calendar with Override modes.

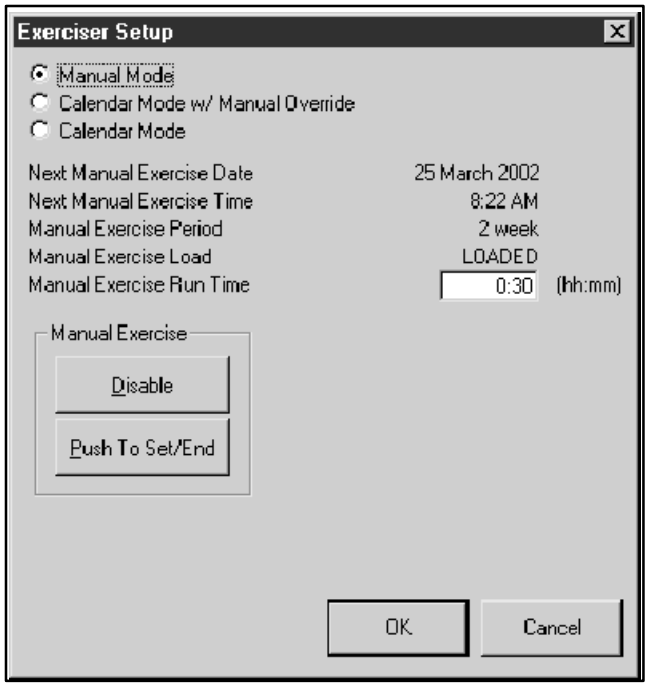


Figure 3-12 Exerciser Setup

3.9 Exercise Calendar

The calendar provides a method to schedule the exerciser that is more flexible than using the 1 week/ 2 week DIP switch on the transfer switch's main logic board. Use the calendar mode to plan up to 21 exercise events that repeat daily, weekly, or monthly, and choose whether each event runs with or without load.

Use the *Calendar Mode* or *Calendar Mode with Override* buttons in the Exercise Setup window to enter the exerciser Calendar modes.

The Calendar Mode and Calendar Mode with Override settings override the 1 week/2 week and loaded/ unloaded DIP switch settings.

Exercise Button Function in Calendar Modes

- **Calendar Mode.** In Calendar mode, pressing the *Exercise* button does not change the exercise mode or settings. The Exercise LED flashes quickly for two seconds if the *Exercise* button is pressed when the system is in Calendar Mode.

- **Calendar Mode with Override.** In Calendar Mode with Override, pressing and holding the *Exercise* button on the ATS user interface until the Exercise LED flashes overrides and disables the calendar settings. The calendar settings are saved for future use, but the exerciser runs in manual mode until reset to Calendar Mode or Calendar Mode with Override through the software.

3.9.1 Calendar Display Window

The Calendar Display Window (see Figure 3-13) shows the following plant exerciser information. If an exercise event is disabled, the line is grayed out.

- Event No.
- Start Date
- Start Time
- Run Time
- Loaded or Unloaded
- Exercise period/Interval

3.9.2 Calendar Setup Window

Use the setup window to set up to 21 exerciser run times, intervals, repeat rates, and loaded/unloaded condition. See Figure 3-14 for the Calendar Setup window.

Enabled or Disabled. Clicking on this box so that the check mark disappears disables that scheduled exercise event so that it does not run. The event remains on the calendar so that it can be enabled again at a later time.

Start Date. There are several ways to select the start date. Clicking on the month or year reveals up and down arrows that allow you to step up or down to the desired month or year. Selecting the drop-down arrow to right of the data entry box brings up a calendar. Click on the red circle at the bottom to select the current day or use the arrow buttons at the top of the calendar to step to the desired month and then click on the desired start date.

Start Time. Click on the hour, minute, or AM/PM so that the desired section is highlighted on the screen. Then use the arrows to step to the desired hour, minute, or AM/PM setting or type in the setting from the keyboard.

Run Time. This setting determines the duration of the exercise run. Run times over 60 minutes will be automatically converted to hours:minutes. The maximum run time is 24 hours.

Loaded or Unloaded. A check in the box in the Loaded column indicates a loaded exercise. If the box is not checked, the exercise will start and run the generator set without transferring the load. Click on the box to select or deselect it. This setting overrides the loaded/ unloaded DIP switch setting on the main logic board.

Interval. (daily, weekly, monthly, or the same day every month) This setting overrides the 1 week/2 week DIP switch setting on the controller's main logic board. This setting works with the repeat rate to set the time interval between exercise runs.

The Day of Month selection allows you to set the exerciser to run on the same day every month. For example, the exerciser can be set to run the first Sunday of every month. Use caution with the Day of Month selection. For example, selecting Day of Month on the 5th Friday of the month will cause the exerciser to run only during months that have five Fridays.

Repeat Rate. The repeat rate and interval set the time interval between exercise runs. For example, if *Day* is selected in the interval column, and 5 is entered as the repeat rate, then the exercise will repeat every 5 days. Double-click inside the Repeat Rate data box to highlight the contents, then type in a number between 1 and 12. Attempts to enter a number outside the acceptable range cause the box to turn red. Values outside the acceptable range are not accepted by the program.

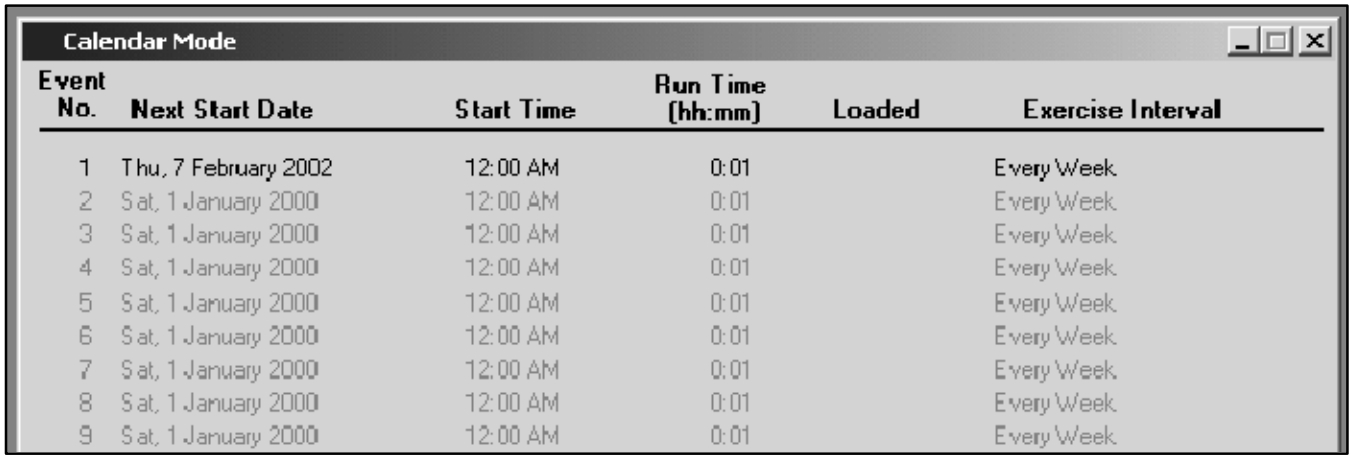


Figure 3-13 Exercise Calendar Display

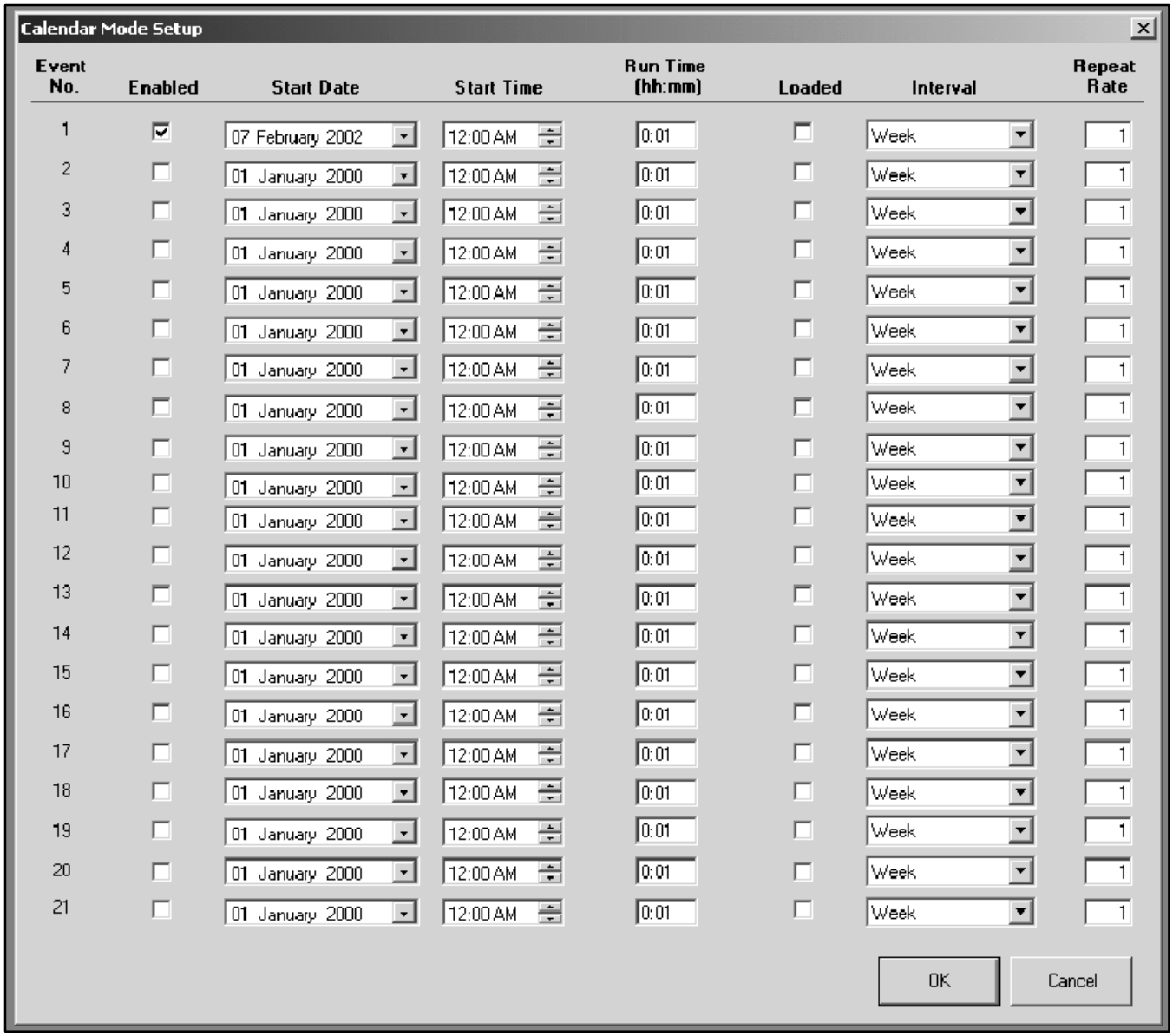


Figure 3-14 Exercise Calendar Setup

3.10 Load Control Time Delays

Use the Load Control Time Delay windows to view and adjust the time delays for the load control outputs on the controller's main logic board and on the optional input/output modules. See Section 3.13, Programmable Input/ Output, to assign load control outputs to the I/O modules. Figure 3-15 shows the Display window. Use Figure 3-36 for time delay descriptions.

Two time delay settings apply to each output: the load disconnect time before transfer and the reconnect time after transfer. These time delays allow selected loads to be disconnected and reconnected in steps rather than all at once.

3.10.1 Setup

Use the Setup window to set the duration of each load control time delay before and after transfer. Enter a time between 0 seconds and 60 minutes into each data entry box. See Figure 3-16.

3.10.2 Display

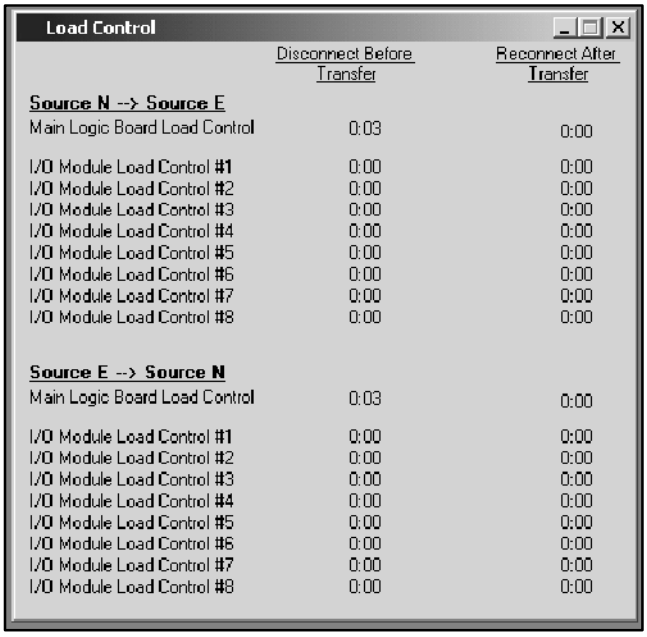


Figure 3-15 Load Control Time Delay Display

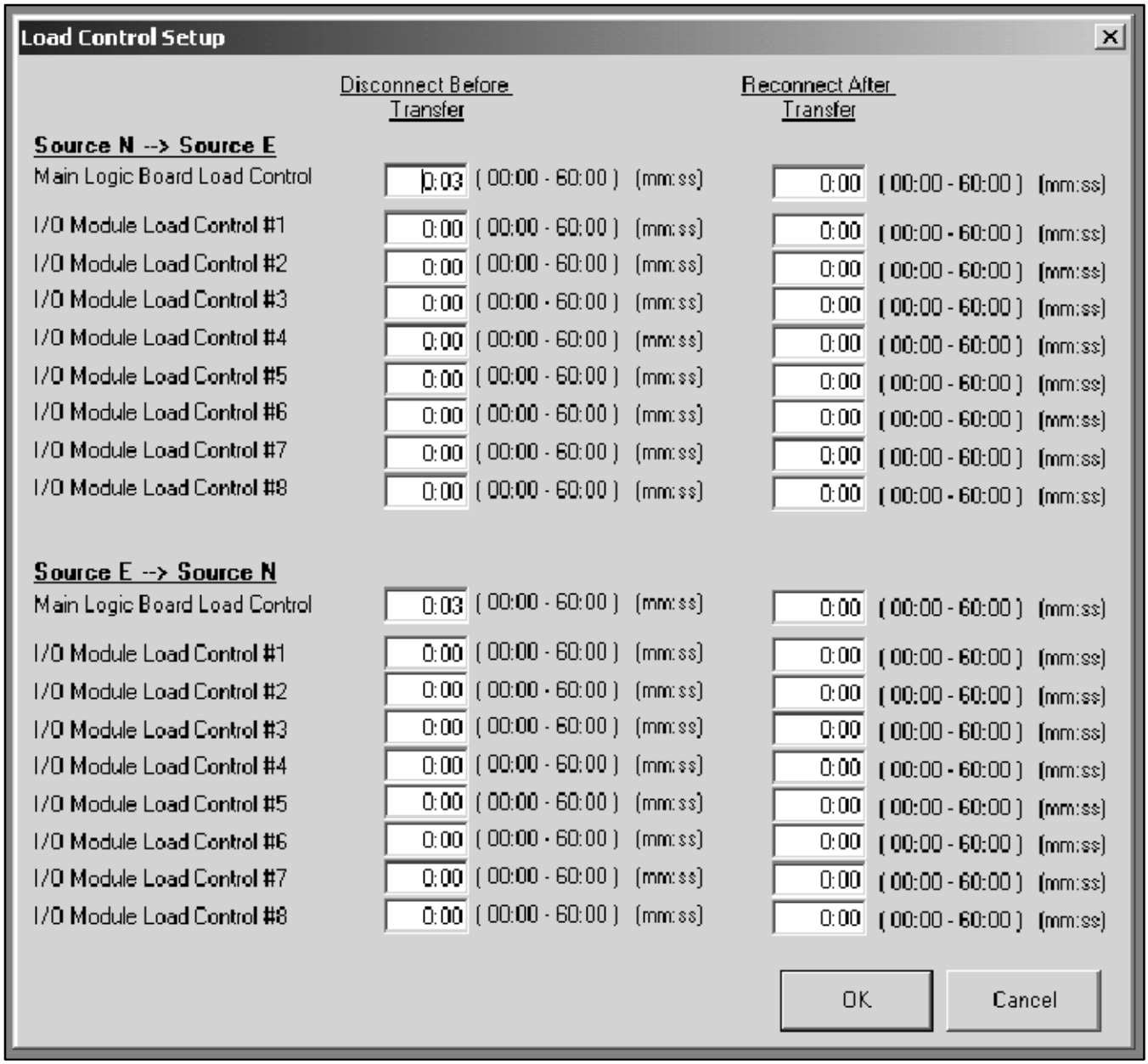


Figure 3-16 Load Control Time Delay Setup

3.11 Maintenance

3.11.1 Maintenance Display Window

The Maintenance Display window shows the totals and the maintenance records since the last maintenance reset for the items listed in Figure 3-18. Figure 3-17 shows the Display window.

The Maintenance Setup window is disabled. The ATS Surveyor Program cannot be used to reset maintenance records or reload default settings.

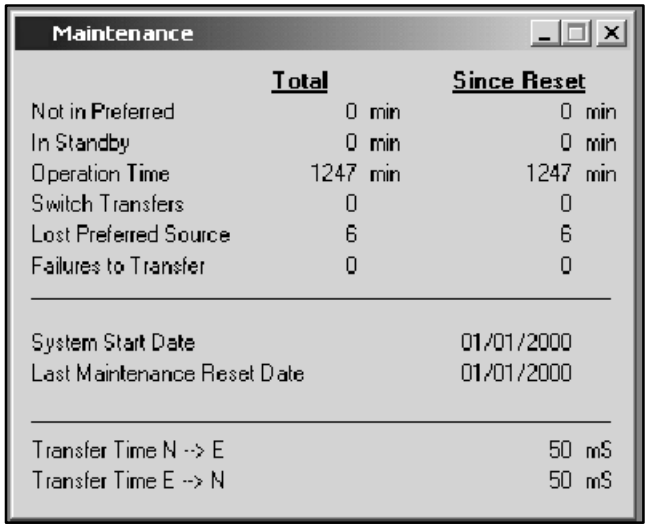
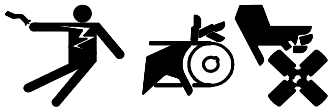


Figure 3-17 Maintenance Display

3.12 Manual Operation

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Historical Data Types		
Item	**Units**	**Description**
Time in Operation	Minutes	Minutes the switch has been under power since leaving the factory
In Standby	Minutes	Minutes the switch operated in the Emergency position
Hours Not in Preferred	Minutes	Minutes the switch operated in any position other than the preferred position
Switch Transfers	—	Number of transfers the switch has completed
Failure to Transfer	—	The number of time that the contactor failed to transfer when commanded
Lost Preferred Source	—	Number of times the switch has lost the preferred power source
System Startup Date	—	The date the system was first started on site
Last Maintenance Reset Date	—	Date of last maintenance record reset
Transfer time N to E	mS	Milliseconds (not adjustable)
Transfer time E to N	mS	Milliseconds (not adjustable)

Figure 3-18 Maintenance Records

The Manual Operation window (see Figure 3-19) includes the following items:

- Peak Shave Start and Stop buttons
- System Test Start and Stop buttons
- Programmed-Transition Transfer to OFF button
- Modbus® Controlled Relay Outputs

Note: A user logged on as Guest cannot access the Manual Operation window.

Manual transfer operations are inhibited if the Maintenance DIP swith is set to inhibit transfer.

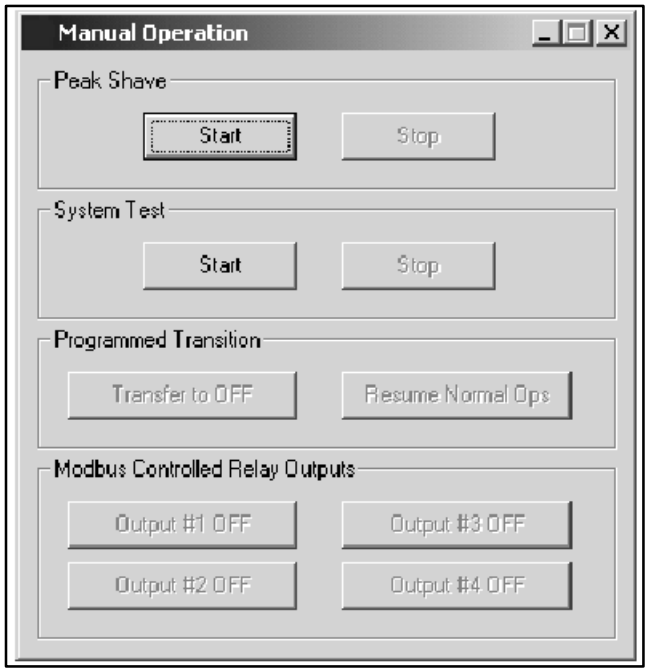


Figure 3-19 Manual Operation

Peak Shave. Select the *Start* button to activate the peak shave function and initiate peak shave operation. The ATS starts the standby generator set and transfers the load to the standby source until the peak shave input is deactivated through the software. Refer to the transfer switch operation and installation manual for more information about the Peak Shave sequence of operation.

Note: A peak shave input signal overrides the software buttons.

Test. Use the software buttons to start or end a system test. The *Test* button on the user interface remains functional, so that a test started by the software can be ended by pressing the *Test* button on the user interface, and a test started by pressing the button on the user interface can be ended by clicking on the *Stop* button in the software.

Note: A test input signal overrides the software buttons.

Programmed Transition. The programmed-transition buttons are disabled if the transfer switch is not a programmed-transition model. Select the *Transfer to OFF* button to force the transfer switch from the Emergency (Source E) position to the OFF position. The switch then transfers to Source N if it is available. The *Transfer to OFF* button does not function when the transfer switch is in the normal (Source N) position.

Note: A forced transfer to OFF input signal overrides the software buttons.

Select the *Resume Normal Ops* button to end the *Transfer to OFF* function. The ATS will transfer to the preferred source, if available, according to the controller settings.

Refer to the ATS operation and installation manual for more information about the Forced Transfer to OFF (load shed) sequence of operation.

Modbus®-Controlled Relay Outputs. The buttons allow activation of Modbus®-controlled outputs assigned to the programmable outputs on the Main Logic Board or I/O Modules. The button displays *Output OFF* when the output is off. Clicking on the button activates the output. The button displays *Output ON*. Click on it again to deactivate the output.

Modbus® is a registered trademark of Schneider Electric.

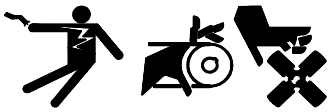
3.13 Programmable Input/Output

View and assign main logic board and programmable (I/O) module input and output functions. Refer to the transfer switch Operation and Installation Manual for I/O connection instructions.

Note: Each programmable input and output requires a connection to the transfer switch. Do not change the programmable input/output assignments without verifying the transfer switch input and output connections.

Note: A user logged on as Guest cannot change the programmable input/output assignments.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

3.13.1 I/O Display Window

The Programmable Input/Output window shows which input and output functions are assigned to the controller main logic board terminal strip input and output terminals and to the I/O Module input and output terminals.

The I/O module address identifies the I/O board and must match the address DIP switch settings on the I/O board.

Bypass/isolation switches have only one programmable input available for reassignment on the main logic board. Programmable input 1 is used for a safety interlock circuit on bypass/isolation switches and is not available for customer use.

3.13.2 I/O Setup Window

Use the Programmable I/O Setup Window to assign input and output functions to the main logic board and I/O module input and output terminals. See Figure 3-21.

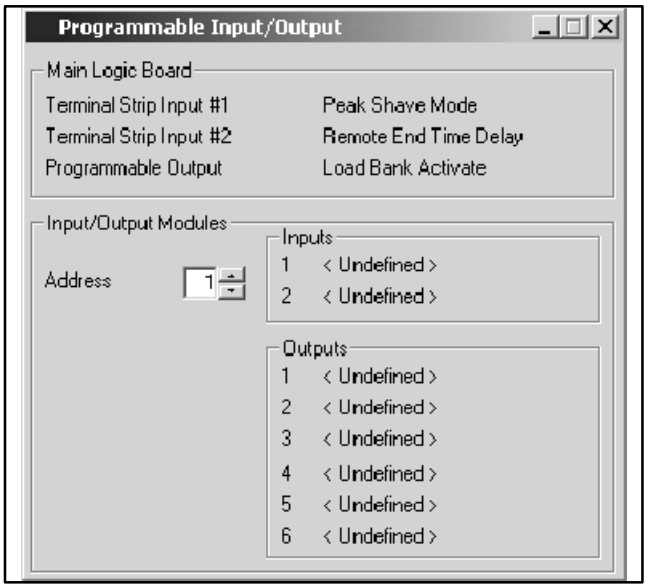


Figure 3-20 Programmable Input/Output Display

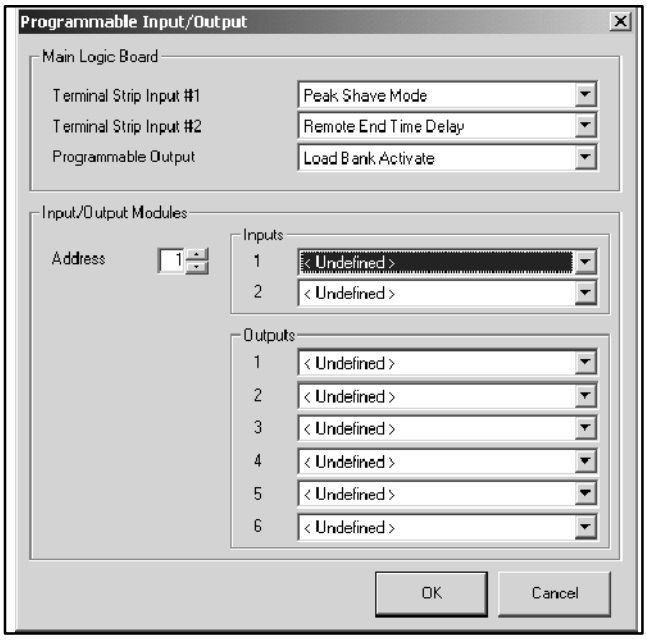


Figure 3-21 Programmable Input/Output Setup

The main logic board provides 2 programmable inputs and 1 programmable output. Use the Setup window to assign functions to the following controller main logic board inputs and output:

- Terminal strip Input 1 (See note.)
- Terminal strip Input 2
- Programmable output

Note: Terminal strip input 1 is available for field-connection and assignment on standard switches only. On bypass/isolation switches, terminal strip Input 1 is factory-assigned and connected to the Bypass Contactor Disable function. *Do not change the assignment of MLB input #1 on bypass/isolation switches!*

Each I/O module provides 2 programmable inputs and 6 programmable outputs. As many as 4 I/O modules can be added to the ATS, for total of 10 programmable inputs (9 for bypass/isolation switches) and 25 programmable outputs. Use the dropdown arrows to select a function for each input or output. Use the up and down arrows to move to the next I/O module and assign functions for that board.

Click on the *OK* button to accept the I/O assignments or *Cancel* to discard the changes.

Note: Be sure to select the address of the I/O module before assigning I/O module inputs and outputs. The address resets to 1 each time the *OK* button is clicked.

The same input or output function can be assigned to multiple locations on either the controller board or any attached I/O module. Inputs or outputs assigned the same function will operate together.

3.13.3 Programmable Inputs

The available input functions are listed in Figure 3-22 and described in more detail after the table.

Battery Low Fault
Peak Shave
Inhibit Transfer
Remote Bypass
Remote Test
Forced Transfer to OFF
Remote Common Fault
Bypass Contactor Disable (factory-set for bypass switches *only*)
Three-Source System Disable

Figure 3-22 Programmable Inputs

Battery Low Fault. Indicates that a low battery signal (contact closure) has been received from an external device. The Service Required LED illuminates steadily and the system records an event in the Event Log.

Peak Shave Active. Starts the generator set and transfers to the standby source. The system attempts to transfer to the preferred source when the input is removed or the connected source fails. Ignores the Time Delay Engine Start and standby-to-preferred time delays if the peak shave delay bypass is selected.

Inhibit Transfer. Prevents all transfers and causes the Not-in-Auto LED to flash. This input has the same effect as the Maintenance DIP switch.

Remote Bypass. Functions the same way as the *End Time Delay* button on the user interface, ending any time delay that is operating when the input is activated except for the programmed transition off-to-preferred and off-to-standby time delays. If more than one time delay is programmed, a separate input signal must be sent to end each time delay.

Remote Test. Has the same effect as pressing the *Test* button on the User Interface. It initiates a system test, which simulates a preferred source failure and tests the transfer switch operation. If a system test is running, this input will stop the test. To stop tests initiated by this input, either deactivate the input or press the *Test* button on the user interface.

Forced Transfer to OFF Position. (Programmed transition units only.) Bypasses all time delays and immediately moves the contactor from Source E to the OFF position. The ATS will proceed to transfer to Source N if it is available. When this input is removed, the system transfers to the preferred source if it is available. If the preferred source is not available but the standby source is available, the system transfers to the standby source.

Remote Common Fault. Any common fault input causes the Service Required LED to flash.

Bypass Contactor Switch Disable. Disables the transfer switch on bypass/isolation switches while the contactor is being inserted or removed. This input is used only on bypass/isolation switches. It is factory-assigned to programmable input 1 on the main logic board (MLB) terminal strip (TB1 terminals 6 and 7). *Do not reassign MLB input 1 on bypass isolation switches!*

Three-Source System Disable. Prevents the second ATS in a three-source system from starting either generator set when the Normal source connected to the

first ATS is available. The three-source system disable output from ATS 1 is connected to the three-source system disable input on ATS 2. See TT-1340, External Battery Supply Module Installation Instructions, for more information about three-source systems.

3.13.4 Programmable Outputs

Programmable monitoring, control, and fault detection outputs are available through the MLB terminal strip on the controller or through the programmable input/output (I/O) modules. The table in Figure 3-23 lists the available programmable outputs.

Not-in-Auto. Any of the following conditions triggers the Not-in-Auto output:

- The maintenance switch is activated, preventing automatic transfer.
- Forced transfer to OFF is activated (programmed-transition models only).
- The Supervised Transfer Control switch is in the Manual position (non-automatic switches).

Load Control Active. Any of the following conditions triggers the Load Control Active output:

- A pre- or post-transfer signal is active.
- Programmable load control outputs are active.
- Peak shave/area protection is engaged.

Load Bank Control. This output allows the application of a load bank to the generator set during the exercise period if the exerciser is not set to transfer the actual load.

The controller deactivates the load bank control and transfers to the standby source if the preferred source is lost during an exercise period.

Start Source N Generator. Use this engine start output signal for systems that use a generator set for Source N (Normal Source). This output is always assigned to the same generator set regardless of the preferred source selector switch position.

Peak Shave/Area Protection Active. Indicates that the system is running on the standby source as a result of a peak shave command.

Non-Emergency Transfer. Active during peak shave, loaded exercise, and loaded test sequences.

Synchronization Output Command. Provides a contact closure after the in-phase monitor synch output time delay to indicate that the synch output time delay has expired.

Load Control Outputs. Allows controlled disconnection of selected loads before transfer and reconnection in steps after transfer. The Load Control Time Delays determine the disconnect time before transfer and reconnect time after transfer. If one source is lost, the outputs are activated immediately and then deactivated after the reconnect time delays. Set the disconnect time before transfer and reconnect time after transfer through the Load Control Time Delay window. The times are adjustable from 1 second to 60 minutes. See Section 3.10, Load Control Time Delays, for information about setting the load control time delays.

Select up to nine sequential load control outputs, 0–8. Load control output 0 is always assigned to the main logic board pre-transfer signal output (TB1 terminals 1 and 2). Outputs 0–8 can be assigned to any position on an I/O module board or to the programmable output on the controller board terminal strip. The same function can be assigned to more than one output.

Modbus®-Controlled Relay Driver Outputs (SCRDOs). Use these outputs to transmit signals from a Modbus® master through the ATS controller (acting as a Modbus slave) to connected equipment. Contact Kohler Co. for Modbus communications protocol information.

I/O Module Not Found. If the system does not detect an I/O module at an expected address, the Service Required LED flashes and the software logs the message *I/O Module Not Found*. Check that the number of I/O modules installed matches the number expected by the setup program. Check that the I/O modules are connected and the address DIP switches are set correctly. Check the diagnostic LED to verify that the module is receiving power and communicating with the controller.

I/O Module Not Installed. If the software detects an I/O module that is connected but not expected by the setup program, the Service Required LED flashes and the software logs the message *I/O Module Not Installed*. The system ignores the board if it does not find the setup definition. Check that the number of I/O modules expected in the Setup Program matches the number of

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modules installed on the transfer switch. Check that the I/O module address DIP switches are set correctly. Check the diagnostic LED.

I/O Module Communications Lost. If communication to an I/O module that was previously installed and working is lost, the Service Required LED flashes and the software logs the message *I/O Module Communications Lost.* Check the I/O module connections and diagnostic LED.

Common Alarm. The common alarm output is activated when any of the fault conditions assigned in the Common Alarms window occurs. See Section 3.4, Common Alarms, for more information about assigning common alarms.

Three-Source System Disable. The three-source system disable output provides a signal to prevent the second ATS in a three-source system from starting one of the generator sets when the Normal source connected to the first ATS is available. See TT-1340, External Battery Supply Module Installation Instructions, for more information about three-source systems.

Programmable Output	Type
Preferred Source Available	Monitor
Standby Source Available	Monitor
Contactor Preferred Selected	Monitor
Contactor Standby Selected	Monitor
Contactor in OFF position*	Monitor
Contactor Source N Selected	Monitor
Contactor Source E Selected	Monitor
Not in Auto	Monitor
Load Control Active	Monitor
Low Backup Battery Indicator	Monitor
Exerciser Active	Monitor
Test Active	Monitor
Peak Shave/Area Protection Active	Monitor
Non-Emergency Transfer	Monitor
Load Bank Control	Control
Start Source N Generator	Control
Start Source E Generator	Control
Synchronization Output Command	Control
Common Alarm	Fault
Undervoltage Source N	Fault
Overvoltage Source N	Fault
Loss of Phase Source N	Fault
Phase Rotation Error Source N	Fault
Overfrequency Source N	Fault
Underfrequency Source N	Fault
Undervoltage Source N	Fault
Overvoltage Source E	Fault
Loss of Phase Source E	Fault
Phase Rotation Error Source E	Fault
Overfrequency Source E	Fault
Underfrequency Source E	Fault
Failure to Acquire Standby Source	Fault
I/O Module Lost	Fault
I/O Module Not Found	Fault
I/O Module Not Installed	Fault
Failure to Transfer	Fault
Auxiliary Switch Fault	Fault
Auxiliary Switch Open	Fault
Load Shed Control Output	Control
Software-Controlled Relay Driver Output #1 †	Control
Software-Controlled Relay Driver Output #2 †	Control
Software-Controlled Relay Driver Output #3 †	Control
Software-Controlled Relay Driver Output #4 †	Control
Three-Source System Disable	Control

* Programmed-transition switches only
† Abbreviated SCRDO #1-4

Figure 3-23 Available Programmable Outputs

3.14 Setpoints, Frequency

The controller senses frequency on both sources with an accuracy of ±2%. The Frequency Setpoints display window shows the setpoints in percent of the nominal or the pickup value, and also shows the resulting setting in Hz. Figure 3-24 shows the frequency setpoints display window with the factory default settings.

A fault occurs if the frequency of either source falls outside the dropout or pickup settings for a length of time longer than the frequency dropout time. If the fault occurs on the active source, the system attempts to transfer the load to the alternate source.

3.14.1 Display

The display window shows the pickup and dropout settings as percentages of the nominal or pickup frequency as indicated. The resulting values in Hz are displayed in the column on the right.

The frequency dropout time is displayed in seconds.

3.14.2 Setup

Note: A user logged on as Guest cannot access the setup window or change the Frequency Setpoints.

Open the setup window to change the overfrequency pickup and dropout settings, the underfrequency pickup and dropout settings, and the frequency dropout time for each source. The adjustment range is shown to the right of each data box. The values shown in Figure 3-25 are the factory default settings.

Click on the data box to be changed and type in the new value, in percent of nominal or pickup frequency as indicated to the right of the box. The resulting frequency will be displayed in the last column. Click on *OK* to apply the new settings or *Cancel* to discard the changes.

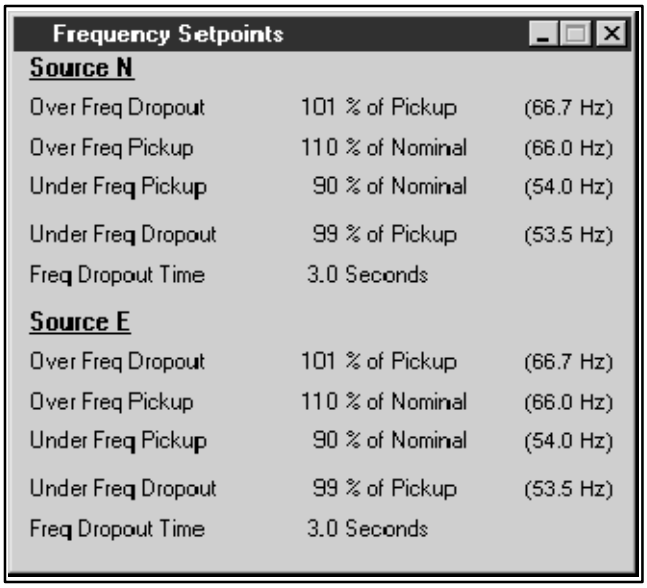

Figure 3-24 Frequency Setpoints Display (default settings shown)

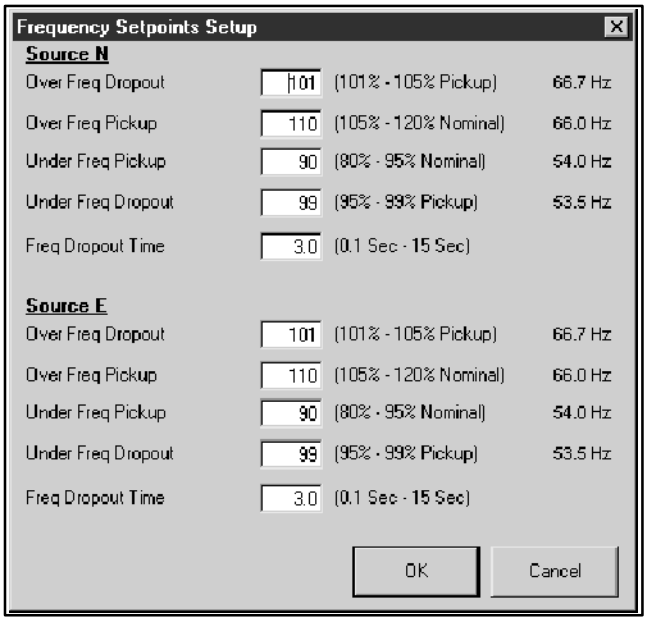

Figure 3-25 Frequency Setpoints Setup (default settings shown)

3.15 Setpoints, Voltage

A fault occurs when the voltage of either source falls outside the dropout or pickup settings for a length of time longer than the debounce time. If the fault occurs on the active source, the system attempts to transfer the load to the alternate source. The debounce time prevents nuisance transfers caused by brief voltage spikes and dips.

3.15.1 Display

Figure 3-26 shows the voltage setpoints display window with the factory default settings. The display window shows the pickup and dropout settings as percentages of the nominal dropout or pickup voltage as indicated. The resulting voltages are shown in the column on the right.

The voltage debounce time is displayed in seconds.

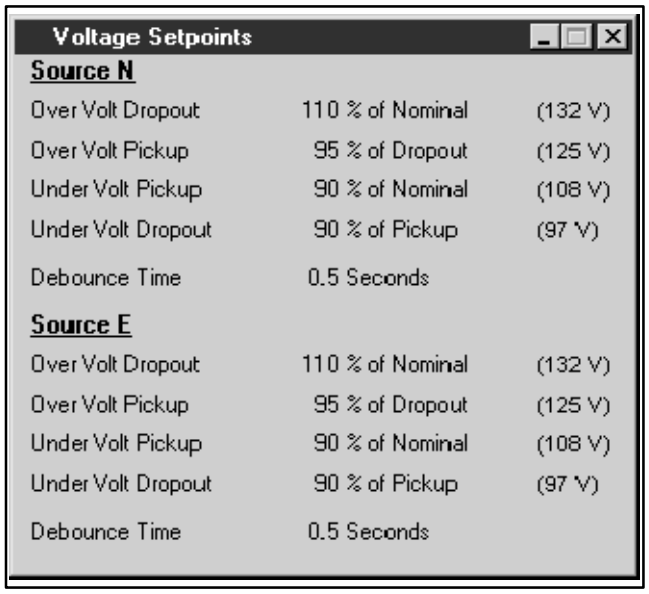

Figure 3-26 Voltage Setpoints Display (default settings shown)

3.15.2 Setup

Note: A user logged on as Guest cannot access the setup window or change the Voltage Setpoints.

Open the Setup window to change the overvoltage pickup and dropout settings, the undervoltage pickup and dropout settings, and the debounce time for each source. The adjustment range is shown to the right of each data box. The values shown in Figure 3-27 are the factory default settings.

Click on the data box to be changed and type in the new value, in percent of nominal, pickup, or dropout voltage as indicated to the right of the box. The resulting voltage will be displayed in the last column. Click on *OK* to apply the new settings or *Cancel* to discard the changes.

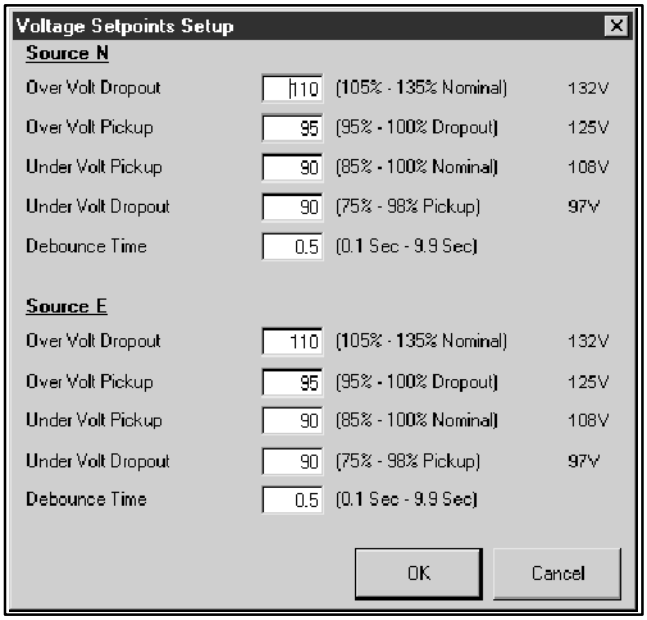

Figure 3-27 Voltage Setpoints Setup (default settings shown)

3.16 Source Info

The software provides source voltage, frequency, and phase information for Source N and Source E.

The controller senses voltages on all phases of both sources over a range of 110 to 600 VAC with an accuracy of ±2%. The controller senses frequency on both sources with an accuracy of ±2%.

3.16.1 Source Info Display

The Source Info display window shows the following information for each source. See Figure 3-28. Single-phase systems will display only the single-phase parameters shown in Figure 3-29.

- Measured voltage
- Measured frequency
- Number of phases
- Expected phase rotation
- Actual phase rotation
- Nominal system voltage
- Nominal system frequency

Note: A user logged on as Guest cannot change the Source Info settings.

Single- or Three-Phase Operation

Sources can be either single-phase or three-phase. Single-phase systems will display only the single-phase parameters as shown in Figure 3-29.

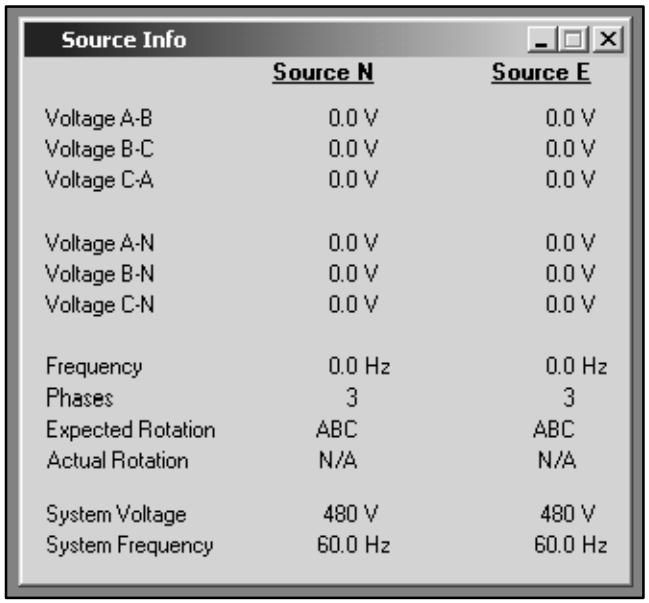

Figure 3-28 Source Info Display, Three-Phase Source

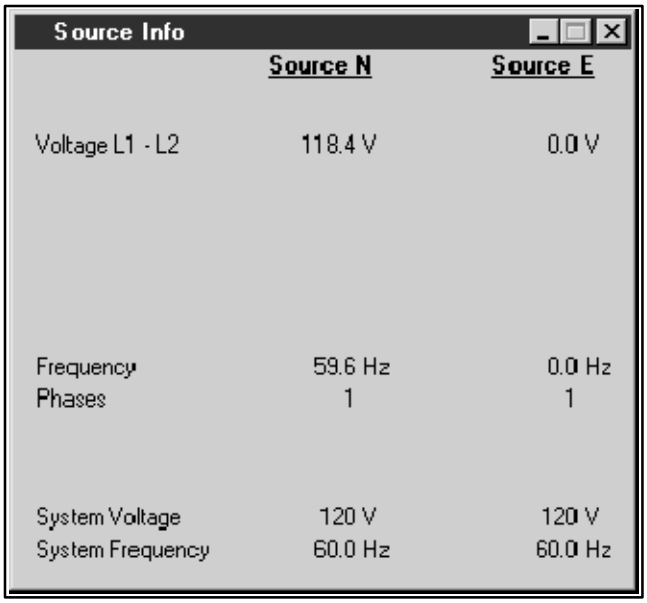

Figure 3-29 Source Info Display, Single-Phase Source

3.17 System Information

The System Information windows include load descriptions, ATS information, and software version numbers.

3.17.1 System Information Display

The Source Information Display window (see Figure 3-30) lists the following items:

- System designation
- System location
- Load branch
- Load description
- ATS serial number
- ATS contactor serial number
- ATS Controller serial number
- Software version numbers
- I/O module software version numbers

3.17.2 System Information Setup

Note: A user logged on as Guest cannot access the setup window or change the system information settings.

The System Information Setup window (see Figure 3-31) allows changes to the following information:

- System designation
- System location
- Load branch
- Load description

The serial numbers for the transfer switch, contactor, and controller are entered at the factory. Software version numbers are read from the hardware and cannot be changed with the setup software.

Type in unique descriptions to clearly identify the system, location, and connected loads. Descriptions are limited to 20 alphanumeric characters, including spaces.

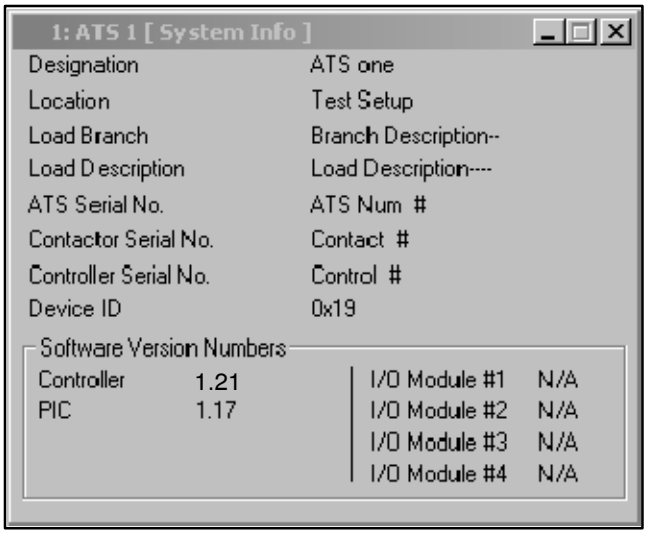

Figure 3-30 System Info Display

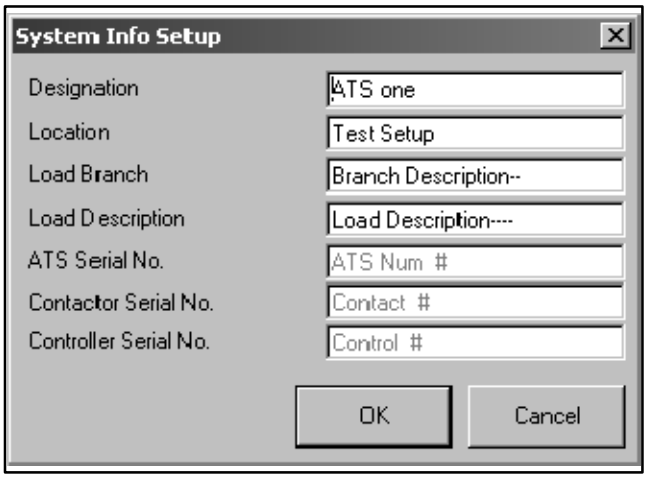

Figure 3-31 System Info Setup

3.18 System Summary

The system summary windows include various system settings affecting the overall setup of the ATS. The ATS Surveyor software does not allow changes to the parameters displayed in the System Summary Window. Use the Setup Program if changes are required.

3.18.1 System Summary Display

The Display window shows the transfer switch status. See Figure 3-32.

The Ext. Eng. Time Delay indicates whether the extended engine start time delays are enabled or disabled. The extended time delays can only be enabled using the Setup Program.

Note: Install an External Battery Supply Module (EBSM) connected to a battery onto the transfer switch before selecting extended time delays. The transfer switch controller requires an external battery for power during the extended engine start time delay.

System State may indicate System Ready or a fault condition such as Failure to Acquire Standby. The controller obtains the system state from the hardware. Figure 3-33 lists some typical System State messages.

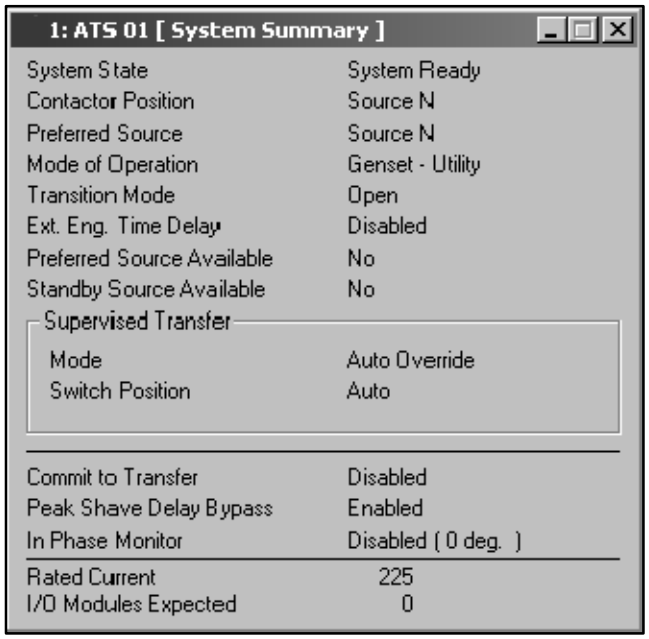

Figure 3-32 System Summary Display

System State Message	Notes
System Ready	Ready, no fault conditions
Failure to Acquire Standby	See the transfer switch operation and installation manual.
Failure to Transfer	
I/O Module Comms Lost	See Section 3.13.4, Programmable Outputs.
I/O Module Not Found	
I/O Module Not Installed	
Aux. Switch Fault	See the transfer switch operation and installation manual.
Aux. Switch Open	
Low Battery on Standby Source	Low battery on the standby generator set.
Common Alarm	See Section 3.4, Common Alarms.

Figure 3-33 Typical System State Messages

Mode of Operation

The system operates in any one of three modes, which are defined by the power sources. The three modes of operation are:

- Generator Set-to-Utility Mode
- Utility-to-Utility Mode
- Generator Set-to-Generator Set Mode

The generator set-to-utility mode of operation uses one generator set, which is connected to the Emergency side of the contactor (Source E). The utility source is connected to the Normal side of the transfer switch.

The generator set-generator set mode uses two generator sets and requires the assignment of a second engine start output.

The utility-utility mode is designed for to use utility power for both Source N and Source E.

Transition Mode

The transition mode, open or programmed, must match the transfer switch model. Models KCT and KBT are open-transition switches. Models KCP and KBP are programmed-transition switches.

A programmed-transition transfer switch provides an off period between disconnecting the load and transferring it to the other power source. The adjustable time-off

period allows residual voltages in the load circuits to decay before connecting to the second source. During the off period, the ATS main contacts are open and neither source powers the load. The off-to-standby and off- to-preferred time delays control the length of the off period. The *End Time Delay* button and *Remote Bypass* command do not override the off-to-Standby and off-to-preferred time delays.

Extended Engine Time Delay

If the *Extended Engine Time Delay* is enabled, the maximum engine start time delay is increased from 6 to 60 seconds. Use the *Time Delay* data window to set the engine start time delay to a maximum of 60 seconds.

Note: An External Battery Supply Module (EBSM) must be installed on the transfer switch in order to use extended engine time delays. An external battery is required to power the ATS controller during an engine start time delay longer than 6 seconds.

Install an External Battery Supply Module with a battery, then use the Setup Program to enable the extended engine time delay.

Commit to Transfer

If *Commit to Transfer* is enabled, the ATS will complete a transfer sequence to a valid standby source once initiated, even if the preferred source returns before the transfer sequence is complete. When this parameter is selected, the pre-transfer load control signal operates as if the preferred source failed.

If *Commit to Transfer* is not selected, the ATS will not transfer to the standby source if the preferred source is lost but returns before the transfer sequence is complete.

Peak Shave Delay Bypass

A check in the box indicates that the *Peak Shave Delay Bypass* is selected.

The *Peak Shave Delay Bypass* operates during the Peak Shave/Area Protection transfer sequence. The bypass ignores the engine start and standby-to-preferred time delays so that the ATS transfers immediately back to the preferred source when the peak shave/area protection signal is removed.

The peak shave delay bypass has no effect on the load control, programmed-transition, or preferred-to-standby time delays. See the ATS Operation/ Installation manual for more information about the Peak Shave/Area Protection sequence of operation.

In-Phase Monitor

The *In-Phase Monitor* operates when both sources are available, such as when transferring from the standby back to the preferred source. The in-phase monitor assures that transfer occurs when the phase angles of the two sources match within a set range (see Transfer Angle, below), the source frequencies differ no more than 2 Hz, and both source voltages are within 70% of the expected line voltage.

Note: Programmed-transition switches do not use the in-phase monitor option.

Transfer Angle. The in-phase monitor allows transfer only if the difference between the source phase angles is less than or equal to the transfer angle.

Transition Time. The in-phase monitor continues to monitor and try to synch until the transfer is successful. There is no time-out period. If the source voltages or frequencies are out of range, the system waits for both sources to stabilize and then tries to synch.

Rated Current

Displays the nominal (rated) current for the system, 1–4000 Amps.

I/O Modules Expected

Displays the number of input/output modules that are configured in the system, 0–4.

3.19 Time Delays

The monitoring program allows a user to view and adjust the ATS time delays.

Note: A user logged on as Guest cannot change the time delay settings.

3.19.1 Time Delay Display Window

The Time Delay Display window (see Figure 3-34) includes the following ATS delays:

- Engine Start
- Engine Cooldown
- Preferred to Standby
- Standby to Preferred
- Acquire Standby Source
- In-phase Monitor Synchronization Output

For programmed-transition models, the following additional time delays are shown:

- Off to Standby
- Off to Preferred

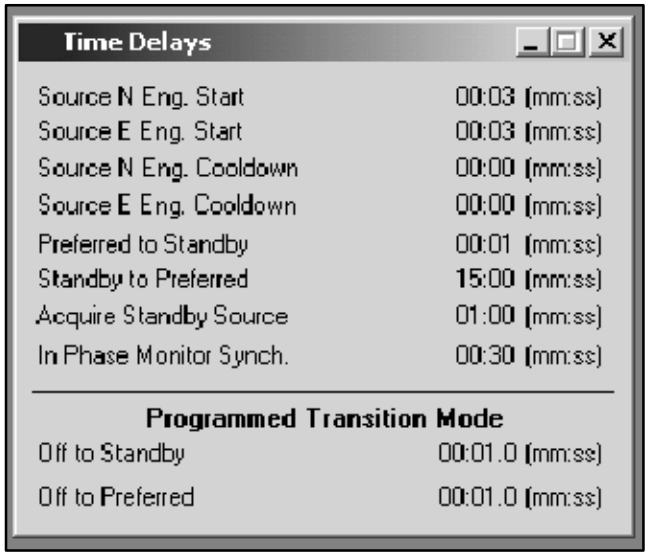

Figure 3-34 Time Delays Display

3.19.2 Time Delay Setup Window

Note: A user logged on as Guest cannot access the setup wondow or change the time delay settings.

The Time Delay Setup window (see Figure 3-35) allows the user to change the following ATS delays:

- Engine Start
- Preferred to Standby
- Standby to Preferred
- Engine Cooldown
- Acquire Standby Source
- Inphase Monitor Output

For programmed-transition models, the setup window allows the following additional time delays to be set:

- Off to Standby
- Off to Preferred

To change the length of a time delay, double-click inside the data entry box and type in the new setting in minutes:seconds. Verify that the new setting falls within the range shown after the data entry box. Values outside the range will not be accepted. Click on the *OK* button or press the *Enter* key to enter the change.

Note: Extended time delays (longer than 6 seconds) require the use of an External Battery Supply Module (EBSM) Kit with a battery. Use the Setup Program to enable Extended Engine Time Delay in the System Summary data window after connecting the battery to allow longer engine start time delays.

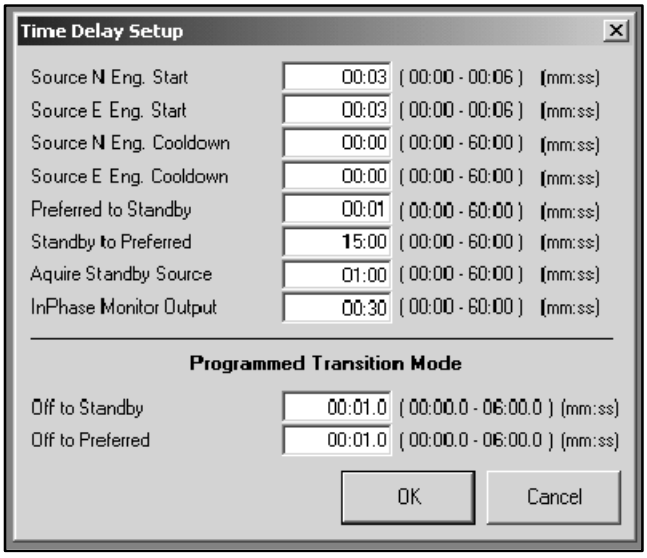

Figure 3-35 Time Delay Setup

3.19.3 Time Delay Default Settings and Adjustment Ranges

The table in Figure 3-36 lists system time delays and their factory settings. Use the system configuration software to adjust the time delays within the ranges shown in the table. Refer to the software operation instructions.

Time Delay	Default	Adjustment Range	Description
Source N Engine start	3 sec.	0–6 sec. *	Delay between the loss of Source E and the activation of the Source N engine start command.
Source E Engine start	3 sec.		Delay between the loss of Source N and the activation of the Source E engine start command.
Source N Engine cooldown	0 min.	0–60 min.	Delay between transfer to Source E and the deactivation of the Source N engine start signal. Allows the generator set to run without load to cool the engine.
Source E Engine cooldown	0 min.		Delay between transfer to Source N and the deactivation of the Source E engine start signal. Allows the generator set to run without load to cool the engine.
Preferred to standby	1 sec.		Delay between the controller's detection of an available standby source and the transfer to that source. Can be set to allow time for the standby source to stabilize before transfer. (The controller remains powered as long as either source is available.)
Standby to preferred	15 min.		Delay between the controller's detection of an available preferred source and the transfer to that source. Allows stabilization of the preferred source before transfer.
Acquire standby source	1 min.		Time allowed for the generator set to start during an exercise period. If the generator set does not start during this time period, a generator fault is logged and the exercise cycle continues.
In-phase monitor synch output	3 sec.		Delay between the start of the in-phase monitor synch cycle and the activation of the synchronization command output.
Off to standby (programmed-transition only)	1 sec.		Time in the off position before transfer to the standby source. Programmed transition models only.
Off to preferred (programmed-transition only)	1 sec.		Time in the off position before transfer to the preferred source. Programmed transition models only.

* Engine start time delays can be extended up to 60 seconds *only if* an External Battery Supply Module is installed and the Extended Engine Time Delay parameter in the System Summary data window is enabled. (The Setup Program must be used to enable the Extended Engine Time Delay.)

Figure 3-36 Time Delays

3.20 Software Window Summary

Window	Display	Setup	Item	Notes
Active Time Delay	✓		Name of active time delay	See Section 3.3, Active Time Delay
	✓		Time remaining, seconds	
	✓		Percent time delay elapsed	
	✓		Elapsed time graphic display	
	✓		End Delay	Button ends an active time delay Does not end programmed-transition time delays or an exercise run See Section 3.3, Active Time Delay
Common Alarms	✓	✓	Assigned Events	Lists events that are assigned as common faults
		✓	Available Events	Use setup to choose common faults from a list of all available events
Date/Time	✓	✓	Date	Does not necessarily match the PC's date Can synch with PC Daylight Savings Time feature available
	✓	✓	Time	Does not necessarily match the PC clock Can synch with PC
		✓	System Clock	Select button to set time and date to match the PC system clock
		✓	Daylight Saving Time	Check box to select DST and date boxes to set clock ahead and back
DIP Switch Settings	✓		Transfer Inhibited (Red)/Permitted (Black)	Displays the positions of the controller DIP switches
	✓		Loaded/Unloaded Test	
	✓		Exercise Inhibited/Permitted	
	✓		1 Week/2 Week Manual Exercise	
	✓		Loaded/Unloaded Exercise	
Event History	✓		Lost Preferred Source	Displays time, date, and duration of last occurrence
	✓		Other Events	Displays up to 100 events
			Clear History	Disabled in the Surveyor Program
	✓		Save History	Button
Exerciser	✓	✓	Manual Mode	Select exerciser mode
	✓	✓	Calendar Mode with Override	Select button in setup window to enter Calendar Mode with Override
	✓	✓	Calendar Mode	Select button in setup window to enter Calendar Mode
	✓		Exercise Inhibited	Displays if the Inhibit Exercise DIP switch is activated
	✓		Transfer Inhibited	Displays if the Inhibit Transfer DIP switch is activated
	✓	✓	Next Manual Exercise Start Date	See Section 3.8
	✓	✓	Next Manual Exercise Start Time	
	✓	✓	Manual Exercise Period	
	✓	✓	Manual Exercise Loaded/Unloaded	DIP switch setting
	✓	✓	Manual Exercise Run Time	Hrs:min.
		✓	Manual Exercise Disable	Button
		✓	Push to Set/End	Button allows remote start/stop of exercise run

Window	Display	Setup	Item	Notes
Exerciser Calendar	✓		Event Number	See Section 3.8, Exerciser
	✓	✓	Next Start Date	
	✓	✓	Start Time	
	✓	✓	Run Time (hr:min)	
	✓	✓	Loaded (Unloaded)	
	✓	✓	Exercise Interval	
		✓	Repeat Rate	
Load Control Time Delays	✓	✓	Main Logic Board Load Control	Separate time delays for disconnect before transfer and reconnect after transfer
	✓	✓	I/O Module Load Control #1-8	Separate time delays for transfers from Source N to E and from Source E to N
Maintenance	✓		Not in Preferred	Hours, total and since last reset
	✓		In Standby	
	✓		Operation Time	Total and since last reset
	✓		Switch Transfers	
	✓		Lost Preferred Source	
	✓		Failures to Transfer	
	✓		System Start Date	Month/Day/Year; factory setting
	✓		Last Maintenance Reset Date	Month/Day/Year
	✓		Transfer Time N to E	Milliseconds (mS); factory setting
	✓		Transfer Time E to N	
Manual Operation	✓		Peak Shave	Start and Stop buttons Disabled if transfer inhibit DIP switch is set to ON
	✓		System Test	Start and Stop buttons Disabled if transfer inhibit DIP switch is set to ON
	✓		Programmed Transition	Transfer to Off and Resume Normal Ops Buttons Disabled in standard-transition models or if transfer inhibit DIP switch is set to ON
	✓		Modbus® -Controlled Relay Outputs	Buttons 1 through 4 to toggle relay outputs on or off
Programmable Input/Output	✓	✓	Terminal Strip Input #1	Main Logic Board
	✓	✓	Terminal Strip Input #2	
	✓	✓	Programmable Output	
	✓	✓	I/O Module Address	Input/Output Modules
	✓	✓	Input Event #1	
	✓	✓	Input Event #2	
	✓	✓	Outputs 1-6	
Setpoints-Frequency	✓	✓	Underfreq Dropout	See Section 3.14, Setpoints-Frequency
	✓	✓	Underfreq Pickup	
	✓	✓	Overfreq Dropout	
	✓	✓	Overfreq Pickup	
	✓	✓	Freq Dropout Time	
Setpoints-Voltage	✓	✓	Undervoltage Dropout	See Section 3.15, Setpoints-Voltage
	✓	✓	Undervoltage Pickup	
	✓	✓	Overvoltage Dropout	
	✓	✓	Overvoltage Pickup	
	✓	✓	Voltage Debounce Time	

Window	Display	Setup	Item	Notes
Site Overview	✓		Address	Network address, read from the ATS controller
	✓		Description	The ATS description, entered in the Device Form. See Section 2.6.2.
	✓		Status	Displays ATS status. Flashes red to indicate a fault condition.
	✓		Position	Shows the transfer switch position and also uses colors for quick switch position identification: Normal position = green Off position = yellow Emergency position = red
	✓		Normal Available	An X in this column indicates that the Normal source is available
	✓		Emergency Available	An X in this column indicates that the Emerency source is available
Source Info	✓		Voltage A–B	Measured voltages, three-phase systems
	✓		Voltage B–C	
	✓		Voltage C–A	
	✓		Voltage A–N	
	✓		Voltage B–N	
	✓		Voltage C–N	
	✓		Voltage L1–L2	Measured voltage, single-phase systems
	✓		Frequency	Measured frequency
	✓		Actual Rotation	Three-phase systems
	✓		Phases	Number of phases detected
	✓		Expected Rotation	ABC or CBA
	✓		System Voltage	Nominal system voltage
	✓		System Frequency	Nominal system frequency
System Information	✓	✓	Designation	Enter unique descriptions to identify the transfer switch and loads
	✓	✓	Location	
	✓	✓	Load Branch	
	✓	✓	Load Description	
	✓		ATS Serial No.	Factory-set, not accessible in the field
	✓		Contactor Serial No.	
	✓		Controller Serial No.	
	✓		Device ID	
	✓		Software Version Nos.	

Window	Display	Setup	Item	Notes
System Summary	✓		System State	See Section 3.18, System Summary
	✓		Contactor Position	N, E, or OFF (programmed-transition only)
	✓		Preferred Source	N or E
	✓		Mode of Operation	Generator Set to Utility, Utility to Utility, or Generator Set to Generator Set
	✓		Transition Mode	Open or Programmed-Transition
	✓		Ext. Eng. Time Delay	Extended Engine Time Delay: Enabled (requires external battery supply; see Section 3.18) or Disabled
	✓		Preferred Source Available	Yes= source is available, No = source is not available
	✓		Standby Source Available	Yes= source is available, No = source is not available
	✓		Supervised Transfer Mode	Automatic Override or Non-Automatic
	✓		Supervised Transfer Swtich Position	Auto or Manual
	✓		Commit to Transfer	Enabled or Disabled
	✓		Peak Shave Delay Bypass	Enabled or Disabled
	✓		In-Phase Monitor	Enabled or Disabled
	✓		In-Phase Monitor Transfer Angle	-20 to 20 degrees, leading or lagging
	✓		Rated Current	Amps
	✓		Number of I/O Modules Expected	Maximum of 4
Time Delays	✓	✓	Source N Engine Start	See Section 3.19, Time Delays
	✓	✓	Source E Engine Start	
	✓	✓	Preferred to Standby	
	✓	✓	Standby to Preferred	
	✓	✓	Source N Engine Cooldown	
	✓	✓	Source E Engine Cooldown	
	✓	✓	Acquire Standby Source	
	✓	✓	In-Phase Monitor Output	
	✓	✓	Off to Standby	Programmed-transition models only
	✓	✓	Off to Preferred	

Figure 3-37 Window Summary

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
API	American Petroleum Institute
approx.	approximate, approximately
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
A/V	audiovisual
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dBA	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lbs.	foot pounds (torque)
ft./min.	feet per minute
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temperature, high engine temperature
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lbs.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard

k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips head crimptite (screw)
PHH	Phillips hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent-magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

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