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Chapter 1: Getting started with GreenWorx

This chapter is an introduction to the GreenWorx software. The layout of the software, terminology, and common operations are discussed.

The term GreenWorx is used for both the hardware – Fixture Control Modules, System Controller, System Extenders, etc. and also for the Windows application used to configure and control a GreenWorx installation. In places where it is important to distinguish the two, the term GreenWorx Software is used.

Software Installation

The GreenWorx software runs on any computer running the Windows operating system. It is installed like any other application program.

The installation places files in the programs area of the disk and also in your personal documents area. That area provides storage for your designs and also for configuration information used by the GreenWorx software. Those configuration files are stored in the GWX System Files subfolder. You should not delete that subfolder.

The Ribbon and the GreenWorx application window

Once GreenWorx is started the first thing you will notice is it uses a ribbon interface. This is the same interface style you may have seen in other modern Windows programs and if you are familiar with it then using it in GreenWorx will be very similar. If you have not worked with a ribbon interface then just think of it as a menu and toolbar combined into one.
The bar at the top of the window is called the *Ribbon*. It contains a number of *Categories* which can be selected by their tab. In the above picture you can see the *System Controller* category, then the *Power Meter* category, etc.

Within each category are a number of *panels*. In the picture you can see the *System Controller* panel, the *Event Enable Status* panel, the *Tools* panel, etc.

Within each panel are *buttons* – large and small - and other controls like dropdowns and checkboxes. In the above picture, in the *Tools* panel are buttons for the *Log Viewer* and the *Zone Log Viewer*.

At the left end of the ribbon is the GreenWorx logo in what is called the *Application Bubble* (yes, it is really is called that!) and when clicked opens the *Application Menu*.
The application menu is similar to the *File* menu in an application with and older style interface. This menu also contains two buttons at the lower right. The *GreenWorx Options* button when pressed opens the software configuration options dialog. The second button exits GreenWorx.

Above the ribbon is an area called the Quick Access Toolbar and you can customize it to contain small icons for GreenWorx buttons you use frequently.

To open the customization menu, click on the small down arrow – highlighted in a red circle in the above picture – and the standard ribbon application customization menu appears. If you are not familiar with how it works, use any search engine and look for instructions on customizing ribbon applications. Using the Quick Access Toolbar you can add small buttons for whatever set of commands that you find you use frequently. Initially the GreenWorx Quick Access Toolbar contains the zoom in and zoom out buttons. In the above picture, a button has also been added for the log viewer.

At the right end of the ribbon are two other buttons just below the standard minimize, maximize, and close buttons.

The *Style* button opens a menu that lets you change the color scheme used by the GreenWorx software. The other button – the “?” Inside the circle- opens the “About” dialog for the application and you can see the current version information listed there. The small down arrow next to the “?” button opens the Help menu that contains access to this User Guide and well as contact information for technical support.

The ribbon adapts to the size of the application window by contracting and expanding categories, buttons, and panels as needed. For example in the ribbon below the *Program* and *Full Program* panels of the *Program* category have been contracted.
You can still get at all the buttons in the category: Just click on the down arrow in the panel near the panel name. A sub-menu opens with the panel buttons available.

The GreenWorx application window is divided into two sections – a left pane that displays a list of fixture and sensor zones, and a right pane that displays different information depending upon what category is selected. The space allocated to these two panes can be adjusted by dragging the window splitter between the two panes to make one larger and the other smaller.

### Ribbon Categories

The ribbon categories are not simply a way to organize a menu. When a category is selected it also changes the kind of actions you can take and also what appears in the right pane of the window. For example, when in the Power Meter tab the application窗户 displays a power usage graph.

In general, the categories and their uses are:

- **System Controller**
  Shows a diagram of the GreenWorx installation. When the GreenWorx software is connected to the System Controller, the paths from the System Controller to the System Extenders are
highlighted. The buttons in this category are used for viewing and updating System Controller state.

- **Power Meter**
  Shows either a graph or list of power usage broken down by floor and / or zone. The category contains buttons for configuring these power usage tools.

- **Schedules**
  Shows a list of schedule entries for each of the four schedules that can be saved in the System Controller. The category buttons are used for viewing and modifying these schedules.

The next seven categories operate differently than the first three. When any of these categories are selected then the right pane of the window shows an iconic representation of the installation divided into floors, areas, buildings or whatever organization technique you have chosen. At the bottom of the window are tabs – one for each floor, area, or building. As part of the design process these tabs are created and icons representing the GreenWorx fixtures and input devices added to them.

To make them easier to see, here are the tabs at the bottom of the window.

The current tab is highlighted. If there are more tabs that can fit in the window width then you can use the buttons at the left end of the tab bar. The first button makes the 1\textsuperscript{st} tab current, the last button
makes the last tab current. The other two buttons move from the current tab one tab left or one tab right.

The remaining seven tabs and their usages are:

- **Design**
  Used when constructing an installation design. Buttons are used to add tabs, fixtures, input devices, and a set of drawing tools that can be used to highlight the tab backgrounds.

- **Program**
  Used to program devices and also to see the results of the last programming operation.

- **Verify**
  Used to verify that the devices in the design have programming that matches what is in the design file.

- **Test**
  Used to test communications between the system controller and each fixture in the installation.

- **Control**
  Used to control fixtures and zones and to request the state of selected fixtures in the installation.

- **Firmware Update**
  Used to update the firmware in fixtures and input devices. Also contains tools to verify that the firmware in fixtures and input devices is as expected.

- **Templates**
  Used to configure templates and see what template is used with which fixtures in the installation.

Each of these seven categories is described in at least one chapter in this User Guide.

**Common methods and Operations**

As you use GreenWorx you will become accustomed to common methods and operation used throughout the application. Here are the most common ones to become acquainted with immediately.

**Right-click menus**

In many cases you begin an action that affects one or more objects by clicking the right-mouse button on the object. When you do that a menu pops up with actions that can be taken on that object or set of objects. Not everything has a right-click menu but many objects do.
The Display Panel
In all ribbon categories except the first three – System Controller, Power Meter, and Schedules – the first panel is named View and is the same. This view panel is:

![Display Panel]

The use of the first two buttons should be obvious. The Icons and List buttons cause what is in the right pane to be shown as icons with tab backgrounds and any drawing elements you have added, or in a tabular format. This is very similar to viewing the Windows file system with Windows Explorer.

The Select button opens an Advanced Selection dialog where a selection of devices can be created. This is fully described in the Fixtures chapter.

The Tab button opens a menu where actions that affect the tab can be performed. The list of actions differs depending upon which category you are in.

The View Panel
In the above description of the Program, Verify, and Control categories it was mentioned that the right pane display area can show different things. For example, when the program category is selected, the display can show what needs to be programmed and also show what the results of the last programming operation were. The view panel lets you switch the display between these different views. Each category with a view panel has different options but similar actions. Here is the programming category view panel.

![View Panel]

Each View panel also has a legend button that shows what the various colors of icons mean when in the various views. For example, the Legend for the Program category is:
Option of Selected, Tab, or All

The Program category has two panels like this:

The Program and Program full actions can be performed on a selected set of fixtures, all fixtures on the current tab, or on all fixtures in the installation. The ability to perform an operation on Selected, Tab, and All is available in many places in GreenWorx.

Drag resizable dialogs

Many dialogs in GreenWorx are drag resizable. You can identify them by the icon in the lower right of the dialog. When you see that icon you can make the dialog larger by pressing and holding the left mouse button when the mouse pointer is over that icon, then dragging the dialog larger. Release the mouse button when the dialog is the size you want. If you computer monitor is large enough you can use this to see more of what the dialog is showing. Once you drag a dialog larger next time it is opened, it automatically is at that size.
Command Steps dialog
A number of operations in GreenWorx are carried out using the Command Steps dialog. This dialog shows the steps necessary to carry out an operation and which steps have completed without error – a blue checkmark, those steps that have failed – a red X, and the current step being worked on – and arrow.

While the command steps dialog is open, in most cases you are prevented from doing anything else with the GreenWorx User Interface until the operation is completed. If at any time you need to stop the current operation the Stop button does that. If the operation fails, or you stop it, sometimes it can be restarted. In those cases the Try again button is available.

Tip: There are a few cases where the Command Steps dialog doesn’t lock you out of doing anything as it remains on the screen. Most of those cases are long operations that operate on fixtures. In some of those cases you are given the opportunity to scroll around the current tab and to select others tabs but most operations from the ribbon and popup menus are disabled.

Working with lists
Many dialogs contains list of items organized in columns. Sometimes these lists are in dialogs and sometime in the right pane of the GreenWorx window. In either case, there are two operations you should know about: Column Sorting and Column Resizing.
In the above list there are four columns. If you click on the header above a column the list sorts that column into either ascending or descending order reordering the rows as needed. For example after clicking on the Time Today column the list appears as:

Not all lists can be sorted. Those that can’t be have non-clickable column headers.

You can also set the width of a column. Hover the mouse pointer over the break between the columns and the mouse pointer changes to a vertical line with left and right pointing arrows. Press the left mouse button down and drag the column wider or narrower.

**Tip:** When you set the width of a column, next time you see the list in that dialog or in the right window pane, the columns are sized as you left them. If you sort a column as described above by clicking the column header, that sort is **not** saved.
Becoming comfortable with the ribbon and categories

The GreenWorx software attempts to display a lot of information in a graphical manner without being so complex that the overall picture of the installation is lost. To make that practical, the ribbon interface was used to provide many different views on the installation. And it may take a bit of getting used to it to become comfortable with this approach.

The categories match the work flow of the installation. When designing an installation, you will be working generally with the Design category. When programming the Program category is used. When controlling the installation the Control category is used. Match what you are doing with the category for that and your work will be smoother.

Sometimes you can use an action that would normally be performed in a category different from the one you are in. For example, right-clicking on a zone name in the left pane and selecting a scene to activate. If, for example, you were in the Program category at that time, the display automatically changes to the Control category so you can visually see the results of that zone activation.

Terminology

A number of terms are used in this User Guide. Becoming introduced to them now might make the remainder of the user guide easier to follow.

**Button:** In a ribbon panel are a number of buttons. These are like toolbar buttons or menu choices in older style programs. Some buttons are large and have an icon associated with them. Others are small and are text only.

**Category:** One part of the ribbon. The ribbon at the top of the GreenWorx software application window contains the ribbon. Each category has a name that can be clicked on to make that category the current category.

**Communications Test (“Comm Test”):** A test to characterize the quality of communication between the System Controller and other parts of the GreenWorx installation.

**Connection Catalog:** A mechanism used by the GreenWorx software to maintain a list of GreenWorx installations in can connect to. This can be useful for a corporate or university campus when there are multiple installations to control.

**Design File:** The file that you open and modify with the GreenWorx software with the file type .gwx. It is sometimes called the Network File.
**Device**: A fixture or input device if the distinction between the two doesn’t matter.

**Firmware**: On board programming that resides in each FCM and input device. This can be updated remotely using facilities in GreenWorx.

**Fixture**: A lighting fixture. Installed in a lighting fixture is a Fixture Control Module that receives signals from the System Controller and cause fixture lighting to be set to a given level.

**Fixture Control Module (“FCM”)**: The connection between GreenWorx and a lighting fixture

**Input Device**: A keypad or sensor that sends messages – by sensor activation or a user pressing a button – to the System Controller. What happens when that message is received depends upon the configuration of the input device.

**Mask**: A mechanism to modify the behavior of schedules and input devices based upon time and user inputs.

**Online / Offline**: When the GreenWorx software is connected to the System Controller it is *online*. When it is not connected to the system controller then it is *offline*. Some operations can only be performed when online. The online/offline state of GreenWorx shows in the status bar of the application window at the right end.

**Panel**: Each ribbon category contains a number of panels which have a name at the bottom. Within the panel are grouped buttons that have a common use described by the panel name.

**Project Folder**: A windows file system folder that saves all parts of a design. The design file, templates, and background images.

**Save / Program**: A design file – the file that ends in .gwx – contains the entire configuration for an installation. That file can be stored in the Windows file system like any other file but it can also be stored in the memory of the System Controller. Saving the file in that way is done during programming of the System Controller. In this usage “program” and “Save” are used interchangeably.

**Scene**: The level that a zone can be set to. In the GreenWorx system the possible scenes are *High*, *Medium*, *Low*, and *Off* and to one of three user defined scenes.

**Schedule**: A set of time based events that the System Controller executes. Each schedule is composed of one or more schedule entries.

**Schedule Entry**: A single time based event that causes something – control of a zone or mask – to occur at a specified time.

**System Controller (“GSC”)**: The “brains” of a GreenWorx installation. The System Controller “runs” the installation by executing schedules and responding to input devices.
System Extender ("GSX"): An interface to bridge messages from one part of an installation to another. Very little configuration of System Extenders is necessary.

Template: A description – set of properties - of a lighting fixture and its controlling FCM.

Verify: Determine if what is in the design file matches what is programmed into the FCMs, Input Devices, or the System Controller.

Zone: A grouping of fixtures that can be controlled as a unit.

User authorization levels

The ribbon is configured differently depending upon the access level you have to the GreenWorx installation. The ribbon you see when you start GreenWorx and log into the system may not match the above pictures.

GreenWorx supports these levels of user access – from most restrictive to least restrictive. Each level has all the access rights of the levels below it. In brief, these are the access levels.

- User
  A user can control the installation manually but can’t change the setup of the installation.

- Facilities Manager
  A facilities manager can reprogram input devices and modify the calendar and schedules but not reconfigure zones or update firmware in any device.

- Installer
  An installer can configure and test all aspects of the GreenWorx installation including configuring zones, scenes, input devices, etc.

- Engineer
  An engineer has access to additional diagnostics tools unavailable at any other access level. While these tools are not in any way “dangerous” to the installation, the use and interpretation of their results is complex and not documented.

A later user guide chapter describes the User Manager in greater detail.

This User Guide

In various places in this User Guide you will see paragraphs headed with “Tip”, “Note” or “Important Note”. These tend to follow a discussion of some feature or dialog. Tips suggest ways to use the feature. Notes are additional information about the feature that may be useful to know. An Important
Note is something that you should carefully read – or re-read a few times – as it provides information about the feature that is important to understand when using it.

**What’s Next?**

The next chapter begins a very quick introduction to the installation design process. While many steps are only very briefly described you can see that an installation can be quickly created in only a few steps – from a blank design to one with fixtures and zones in only a few pages.

A series of chapters follow that covering all aspects of the design progress. This is followed by chapters on deploying the design: programming, verifying, testing, and finally documenting the installation.

The User Guide tries to proceed in a manner that mirrors the development process: design before programming, programming before testing, testing before documentation. Sometimes this can’t be done and concepts are introduced briefly to be elaborated on later. Sometimes features are ignored and introduced later. When these sorts of things happen, a note is made that more information on that skipped feature is available in a subsequent chapter.

Each chapter of the user guide ends with a “What’s Next” section so you can get an idea of where we are in the process as well as a “Your Installation” section that offers some guidance on how to turn what you have learned in the chapter into what can be done for your specific installation.

**Your installation**

Before beginning creation of a design for your installation we recommend continuing with this User Guide. We hope it isn’t written using too much “techish” and attempts to explain, in addition to how to use a feature, what that feature is and why you would want to use it. If you are reading this then you have taken the first step in a good approach.
Chapter 2: Creating a Design

Now that the GreenWorx software has been installed and you have some beginning understanding of the terminology and common operations used with it, let's create a new design.

Rather than having to read this entire user guide – we do hope you will – in this chapter a complete design file is created with fixtures, an input device, three zones, and a schedule. To do this in only a few pages it is necessary, of course, to skip over many details. But even with the lack of detail, the general flow of GreenWorx is demonstrated. This hopefully gives you some context to understand the details of the next chapters.

Creating a design file

Unlike some Windows application you may have used, before you can start building a new design you must first create it. That is, when the GreenWorx software starts there is no blank or empty design already loaded and ready to be used. To create a new design file select New Project from the application menu.

The project name is used as an identifier of your design and it also becomes both the name of the design file – the .gwx file – and the name of the project folder.
Select a network id and password. These are used to ensure that all parts of your installation are controlled only by the System Controller for this installation. Press OK when all the settings are as desired. An empty design is created.

This empty design contains a single tab that by default is named Tab One. That name can be changed to a more descriptive name, let’s use Factory Floor. Double click on the “Tab One” text and change the name to “Factory Floor” and press enter when done. The tabs at the bottom of the right pane are now:

Adding fixtures

In this factory example there are 80 fixtures organized in a 10 by 8 grid. When in the Design category press the Add Devices button.

The fixtures for this example use the Dual Channel FCM configured for a 0/50/100 level fixture so that is selected as the Fixture Template. In the Fixture Count box, select to have the 80 fixtures organized in 8 rows or 10 columns each. Close the dialog with OK to add the fixtures.
The GreenWorx display now appears as:

Each of these fixtures has been assigned an id number – shown in the fixture icon – and has the entire configuration as defined in the chosen template. If you zoom in, large icons show that this is a two bulb fixture. Here is a small portion of the display showing it at zoom level 100%

Creating zones

Now that all the fixtures have been added, they can be divided into zones for control. In this factory there are a number of skylights and the desire is to create a daytime zone that turns the fixtures off near the skylights since they are not needed during the day. In addition there is a stock room in the lower right of the floor and that should be a separate zone as well so it can be controlled independently of the factory floor. All the remaining fixtures are in a third zone that is controlled to be at High during working hours and set to Low when the second shift ends and Off one hour later.
Creating a Design

Here is a simplified drawing – made not with GreenWorx but with a drawing program – with the intended Skylight and Stock Room zones marked. All other fixtures will be added to the Factory Floor zone.

To create these zones in GreenWorx start in the Design Category, and select the four fixtures in the upper left box – those in the above picture in the blue box with fixture numbers 13, 14, 23, and 24, then right click and select Add to new Zone.

A popup dialog requests the zone name. Enter “Skylight” and close the dialog with OK.
A new zone is created containing, at this point only those 4 fixtures. In the left pane the new zone name has been added.

To add the other twelve fixtures to this zone, select them and then right click on one of them and select *Add to “Skylight”*.

**Note:** You can select all the icons by left clicking on the first one then, while holding down the keyboard *ctrl* key, click each of the next 15.

The *Add to skylight* menu choice adds these fixtures to the Skylight zone. The other three zones are similarly created. Here is the left pane after the three zones were created.
To see what fixtures are in which zones, click on the zone name in the left pane and those fixtures in that zone appear in green. Here are three zones.
Add an Input device

Now that all fixtures have been added and divided into zones, let’s add a Zone Lighting Controller to control them. While remaining in the Design category, select the Inputs tab – click on that tab in the tab bar at the bottom of the right pane. Again, click the Add Devices button. This time instead of adding fixtures, a list of Input Device types are presented.

![Add Controller dialog](image)

Select Zone Lighting Controller and close the dialog with OK. The ZLC is added to the design and an icon appears for it in the right pane.

Before this ZLC can operate it must be configured. Right click on its icon and select Edit from the popup menu.
A multi-tabbed dialog opens with configuration for each of the ZLC’s four keypad buttons and four inputs. Select the Zone 1 tab.

This tab defines what zone the “Zone 1” button as silkscreened on the ZLC controls. In this case we have chosen the Skylight zone. The Zone 2 and Zone 3 tabs are similarly configured.
The action of the High, Medium, Low, and Off buttons should remain with the default values.

**Note:** You may be wondering what it means for a two ballast fixture with two bulbs to be set to four different levels. When the fixtures were added to this design, the template chosen makes these kinds of determinations. In this case, when set to Off, neither relay is energized. When set to Low or Medium only a single relay is energized. When set to High then both relays are energized. With this type of FCM, and this type of fixture, and with this configuration, then Low and Medium are the same. This is, of course, not the case with all FCMs and FCM configurations. This is all covered in much greater detail in the Templates chapter.

**Programming**

Before all these settings can take effect, the FCMs and the ZLC in this installation need to be programmed. This is accomplished from the Program category. In that category are facilities that can program all the selected fixtures and input devices.

Of course before that can be done GreenWorx must be connected to the System Controller. This is such a large topic let’s just assume that we are connected.

To program all the fixtures, the All Fixtures button in the Full Program panel starts the programming process.
**Note:** When in the Program category the icons color to show if they need to be programmed. All the fixtures in this design need to be programmed at this point to create the fixture zones. Fixtures that need to be programmed are shown in an orange color.

The ZLC also needs to be programmed and, in a similar fashion, a color is used to show this. In the case of Input Devices a colored bar is shown below the icon.

Programming is accomplished by the *Command Steps* dialog. This popup dialog shows the steps necessary to carry out an operation.
When programming completes, the Command Steps dialog closes.

Creating a schedule

In order to implement the requirements of this installation a schedule is needed. Select from the ribbon the Schedules category. Initially there are no entries in the schedule.
To add schedule entries, press the *Add Entry* button.

![Schedule Entry dialog](image)

This schedule entry sets the Factory Floor zone to High at 7am. With these selections made, close the dialog with OK. The schedule now contains a single schedule entry.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Time</th>
<th>Time Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Floor</td>
<td>Activate scene “High”</td>
<td>7:00 AM</td>
<td>7:00 AM</td>
</tr>
</tbody>
</table>

The other schedule entries can then be added based upon the installation requirements. When completed the schedule contains these entries.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Action</th>
<th>Time</th>
<th>Time Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Floor</td>
<td>Activate scene “High”</td>
<td>7:00 AM</td>
<td>7:00 AM</td>
</tr>
<tr>
<td>Skylight</td>
<td>Activate scene “Off”</td>
<td>Dawn + 60 minutes</td>
<td>8:14 AM</td>
</tr>
<tr>
<td>Skylight</td>
<td>Activate scene “High”</td>
<td>Dusk -45 minutes</td>
<td>5:17 PM</td>
</tr>
<tr>
<td>Factory Floor</td>
<td>Activate scene “Low”</td>
<td>10:00 PM</td>
<td>10:00 PM</td>
</tr>
<tr>
<td>Skylight</td>
<td>Activate scene “Low”</td>
<td>10:00 PM</td>
<td>10:00 PM</td>
</tr>
<tr>
<td>Factory Floor</td>
<td>Activate scene “Off”</td>
<td>11:00 PM</td>
<td>11:00 PM</td>
</tr>
<tr>
<td>Skylight</td>
<td>Activate scene “Off”</td>
<td>11:00 PM</td>
<td>11:00 PM</td>
</tr>
</tbody>
</table>
Programming the System Controller

In the same manner that fixtures and Input Devices had to be programmed until they operate as configured, the System Controller needs to be programmed to implement the schedule just designed.

Programming the System Controller is simple and is done with the Save button in the System Controller category.

When the Save button pressed the System Controller is programmed with all the settings. The programming dialog is shown so you can keep track of its progress.
Creating a Design

Controlling an installation

Now that all parts of this sample design have been created and programmed, the schedule is in effect and controls the zones based upon the scheduled times. The ZLC lets you manually control any of the three zones.

In addition, you can also control the zones from the GreenWorx software. Select the Control category, then in the left pane right click on a zone name, expand it, and right click on a scene name and select Activate from the popup menu.

A zone activate command is sent. In this example the Activate sets the Stock Room zone to High. The left pane when in the Control category shows the state of the fixtures, if known, by a color. Fixtures set to High show in yellow.

And that’s the end of this very quick introduction to GreenWorx.
Load and Connection Errors

Like any Windows program a GreenWorx design is saved as a disk file. In this case, with a GWX file type. Like other Windows programs you can load a file into GreenWorx using the File menu. Unlike how other programs operate, there are a number of unique features of a GreenWorx file that you should be aware of.

When the file is loaded into the GreenWorx software several problems may be detected if other files referenced by that design don’t exist. Also, when connected to the System Controller when a file is opened, the GreenWorx software detects if the file being loaded is or isn’t the same file that was used to program the System Controller. This can be very important since with the wrong file loaded you could inadvertently be programming the System Controller with an incorrect configuration.

The three popups for these problems and the reasons for them are shown below.

Missing backgrounds

On tabs where fixtures are seen an image file can be used as a background for the tab. If that image file is missing then this popup shows that problem. Background images must be saved in and loaded from the Project Folder.
Missing or mismatched Templates

When fixtures are added, a template is used to set their initial configuration. Those templates are stored in files of type GWT. If the referenced template files are missing or if the configuration of the FCMs that use the template differs from the configuration in the template then a popup shows this.

File doesn’t pair with the System Controller

As described above, a check is made to determine if the file being loaded is the one that was used to program the System Controller - we say it pairs with the System Controller. If this problem occurs a popup shows the problem.
You will better understand the reason for these popups after reading subsequent user guide chapters.

**What’s Next?**

The next chapter begins a series of chapters that cover all aspects of the design of an installation. The topics in those chapters – templates, tabs, fixtures, Input Devices, and schedules - are each examined in detail. That chapter set is then followed by a second set of chapters on working with the system controller, programming, testing, verifying and controlling the design created.

**Your installation**

There is not much in this chapter that is directly applicable to your installation other than the knowledge of the concepts introduced. The remainder of this user guide expands these concepts in breadth and depth.
Chapter 3: Tabs

This chapter describes how a GreenWorx installation can be organized to view as a series of displays where each display appears on a tab of a multi-tabbed window. Also discussed is how to improve the images of the design on those tabs using background images and drawing elements.

Tabs are completely a concept of the GreenWorx software. They have nothing to do with the actual installation of fixtures and their locations. Similarly, any organization or visual improvements to a tab – backgrounds and drawing elements – are also only there to help you visualize and manage the installation and have no effect on the action and operation of the GreenWorx installed system.

Organizing a GreenWorx installation

In the previous chapter a very brief overview of creating a design was given. As part of that, a tab was added to the design and fixture icons placed on it. Since it was a small design – 50 fixtures – all could be shown on a single tab.

In a real world design you may have multiple floors of a building controlled by GreenWorx with each floor containing over 100 fixtures. Or you may have one large factory floor divided up into areas and each area containing many fixtures. The GreenWorx software uses the concept of a Tab rather than a floor or a building or area since what appears on a tab and how that connects to the real world is up to you. Each tab in a design may be for a floor, or each tab may be for an area of a floor, or each tab for a building. It is really up to you. By naming the tabs descriptively you can better note what the tabs are used for. Some example tab names could be: “1st Floor” or “2nd Floor”, or “NW area”, or “Building A”.

Adding Tabs

Once a design file has been created, tabs are added to a design by selecting the Design category and the using the Tab dropdown menu.
Tabs

The Tab Add menu choice opens the New Tab dialog.

![New Tab dialog](image)

In this dialog enter a name for the tab – hopefully more descriptive than New Tab. You can create a blank tab or a copy of an existing tab. That copy can contain various elements as listed in the dialog checkbox options. If you have an installation that contains multiple floors – or areas or buildings – that are very similar you can build the first tab with fixture icons, backgrounds, drawing elements, and zones and then make copies of that tab for the other floors.

The Icon spacing option is a bit hard to describe without describing adding fixtures - all covered in the Fixtures chapter – but for now just know that a tab has an underlying grid system that lets you place and align icons. One property of that tab is an icon spacing option and that is used when adding fixtures to determine how they are placed. Once icons are placed you can move them anyplace so this spacing option is only used when placing newly added fixtures.

**Note:** The Tab dropdown menu is different when opened from other categories. The options to manipulate tabs – add, modify, and delete, are not part of the menu in those cases.

The tab bar

At the bottom of the right pane in the window is a bar that shows all the tabs in the design. Using it you can change to a different tab by clicking on the tab name. If there are more tabs than can display in the width of the window, then some tabs are not shown. The buttons at the left end of the tab bar are used to move to the 1st tab, the last tab, and one tab left or right.
You can rename tabs in one of two ways. From the Tab menu – shown above – you can open the tab properties and change the name of the tab. Or you can double-click on the tab name in the tab bar and you can edit the tab name directly.

You can place the tabs in any order that makes sense in your design. Moving tabs is done using drag and drop and is hard to describe since it is so visual but here are the steps.

1. With the mouse over the tab to be moved, hold down the left mouse button. The tab is selected and a small triangle appears at the top right of the tab name.
2. Without releasing the mouse drag the triangle to the new location of the tab. The tab will be moved before the triangle’s location
3. Let up on the left mouse button and the tab is moved.

The tab order is saved in the design file so you need only do this once and the tabs stay in that order next time you load the file.

**Tip:** You can also add a new tab by a right-click on the tab bar. In the popup menu is a New Tab option. This opens the same dialog as shown above.

**Special tabs – Inputs and All Fixtures**

In addition to the tabs that you add, there is always an Inputs tab and an All Fixtures tab. The Inputs tab shows icons for all the Input Devices in your design. The All Fixtures tab shows all the fixtures in your design regardless of what tab they are on and it shows them as a list and not as icons.

**Managing tabs – properties and deletion**

At any time, you can open the properties for tabs you added by either selecting Tab Properties from the tab menu or by a right-click on the tab name and selecting Properties from the popup menu.

To delete a tab, select Tab Delete from the Tab menu. A confirmation dialog makes you confirm the deletion. There is no Undo action from a tab deletion.
Tab backgrounds

Once a tab is created you can choose to add a background image to the tab. What would this be used for? If you have actual floor plans of the building GreenWorx is being installed in, and if you can create from them a picture image (JPG, PNG, etc) in a reasonable scale in a reasonable size, then you can use that as a background. Here is an example:

The icons for fixtures have been placed at the appropriate locations to match the plan. When used in this way the zoom in and zoon out actions scale the background as well as the icon positions so they remain in the “correct” locations. The above picture is at zoom level 25%. The picture below is at zoom level 50%
**Important Note:** When adding a background image it is very important that you add the background image at the best zoom level for the background. That is, when you add the background it is neither expanded nor contracted when the tab is at the same zoom level as when it was added. Next place icons on the background at that same zoom level. If you do that, then the zoom in and zoom out actions work as you expect.

The chapter on fixtures discusses in greater detail moving and placing icons on a tab.
### Drawing on a tab

The GreenWorx software contains a number of drawing tools to add lines, colors, boxes, text, and images to a tab. These are all accessed from the Drawing panel in the Design category.

The Line tool has a dropdown menu that lets you select the line color and line weight. The dropdown menu for the Rectangle tool lets you select the line color, line weight, and an optional fill color for the rectangle. The text tool lets you select the font used for the text.

To use a tool, click its button and the mouse pointer changes from the standard arrow into a cross. Then:

- When drawing a line, move the mouse pointer to the location the line starts, left mouse down and drag the line until it is as long as you want in the direction you want and then release the left mouse button.
- When drawing a rectangle, move the mouse pointer to the location the line starts, left mouse down and drag the rectangle until it is the size and position you want and then release the left mouse button.
- When adding text, move the mouse pointer to the location the text should start and then drag a rectangle that will hold the text. The rectangle must be large enough to hold the text. Once you complete the rectangle, a popup dialog appears where you can enter the text.
- To add an image, left click the mouse wherever you want the image to appear. A popup shows all the images available. Select one and close the dialog with OK.

**Tip:** Images added using the image tool come from a folder that is part of the GreenWorx installation. You can add your own images to that folder. Most popular image formats are supported - JPG, PNG, GIF, etc.

After a tool is used, the GreenWorx software remains in that same mode so drawing a series of lines or rectangles or text, etc. is simple: just complete the first one, and then begin the second, third, etc. When done using a tool, either click the same tool again, or click another tool to start using that, or click the Select tool to return the mouse to normal operation.

You can modify a drawing element by a right-click on the element — the line, the rectangle, etc — and select Modify from the popup menu. You can then change the properties of the element such as color or weight, etc.
There are two ways to delete drawing elements:

- Right click the mouse on the element and select *Delete* from the popup menu.
- Draw a selection rectangle around one or more drawing elements to select them – they appear in red – then press the *Clear Selected* tool. To draw a selection rectangle, make sure the mouse pointer is the standard arrow then press the left mouse button down and drag the rectangle larger. Release the mouse button when it encloses the elements you want deleted. Then click the *Clear Selected* tool.

You can move drawing elements by selecting them and then dragging them to a new location.

**Note:** the Lock Icons checkbox in the menu must not be ticked or you will be unable to delete or move drawing elements.

### Saving a tab image as a file

As part of the document for an installation, you can select from the Tab menu *Save Tab Image as File*. This can be done from any category that shows tabs. A JPG file is created showing the tab with all icons and drawing elements on it. The icons appear in the same colors as they are in the tab at the time you created this image file. A File-Save dialog is used so you can name the file.

**Tip:** This is not only a good way to document an installation – more on this in a later user guide chapter – but also to capture a picture of icons when their colors show information. For example, when showing the results of the last programming operation. You could view the programming results and then, rather than note down problem unit ids, just capture an image of the tab for later review.

### What’s Next?

The next user guide chapter begins the discussion of how fixtures and Input devices are added to a design and icons for them added to tabs. This discussion continues though the subsequent chapter where fixtures and Input devices are focused upon. But before that the next chapter focuses on Templates as they are used when adding fixtures to a design.

### Your installation

How should you organize your installation? By building? By floors? By areas? Or by something completely different? It really all depends upon the size of the installation and how it maps into the real
world. Often having a tab for each floor, as may be used in a multi-story parking structure is an excellent way to go. In a smaller installation maybe a single tab works. In a very large installation you may need to break each floor into sections and create tabs for each section. The goal is to choose a method that makes sense and is manageable in terms of size and number of fixtures.

A tab is not of an infinite size. It is very large but can’t be expand beyond the range of the scroll bars shown.
Chapter 4: Templates

In Chapter 2 a new design was created very quickly and the concept of Templates, their use, how they are created and managed was touched on only briefly. This chapter is all about Templates and how they are used in GreenWorx. Also in this chapter is more information about how fixtures in a zone respond when controlled to one of the four System Scenes – Off, Low, Medium, and High.

What is a Template?

A Template, as used in GreenWorx, is a mechanism to define the properties of a fixture. It captures how a fixture responds to the system levels of High, Medium, Low, and Off, the power usage of the fixture at the various levels, the icon used for it, and the settings for ballast / bulb health checking.

In our example parking structure even though there are hundreds of fixtures there are really only three types: a single bulb fixture, a dual bulb fixture, and a fixture control module that is wired to control several roof fixtures as a set.

Rather than needing describe the properties of each fixture in the installation, you can create a template of the fixture and use that when you add the fixtures to the design. Each fixture inherits its properties from that template. Furthermore if you update the template – perhaps you need to correct the power usage figure you used – then all the fixtures that use that template update with the changed values. This makes it much easier to create and update your design.

Fixtures and Fixture Control Modules

In general, your installation contains one Fixture Control Module (FCM) connected to each fixture. Depending upon the fixture and how you wish to use it you have a choice of what FCM to use. For example you may have a LED fixture so you would use a Fixture Dimmer Single module. If you are using a fluorescent fixture, the number of ballasts in the fixture determines the type of module to use – single, double, triple, or quad. Also important with relay modules, you must decide how the ballasts are wired. For example with a four bulb fixture, one ballast could control 2 bulbs and the other ballast the other two bulbs. Or you could wire it such that one ballast controls one bulb and the other ballast controls three bulbs. These choices go beyond simply choosing a specific type of FCM.

These kinds of choices make a difference in how the fixture responds to the system scenes of High, Medium, Low, and Off, as well as the power consumed in each of these scenes. This kind of information – the FCM chosen and how it is wired – is what the template specifies.
Template properties

The easiest way to see all the properties contained in a template is to look at one of the “stock” templates – those that are pre-defined in GreenWorx that come with the installation. To open the template manager, select the Templates category and then press the Template Manager button. The Template Manager tool opens.

In the list are all the templates you have access to. The ones not marked as “Local?” – the 3rd column in the list - are what is referred to as a “stock” templates. Select a template in the list and the information in the bottom section of the dialog updates. This contains the template name, what fixture module type it is used with, the icon selected for it and any notes about this template that were entered when it was created.

From the Template Manager you can create a new template – the New button – or create a new template that is a copy of an existing template – the New from Selected button – the new template uses the same settings as the selected template as the starting point. You can also modify a template – the Edit button – as long as it is one of your local templates. You can view but not modify a stock template.

Before we get into the specific settings that can be configured in the template there are three important items to discuss first.
First, a template is stored as a separate file from the GreenWorx design file (the “.gwx” file). A template file is of type “gwt”. GreenWorx ships with a number of templates and you will create the ones needed for your installation. If you are creating designs for more than one installation, if they are similar enough you can copy the template files from one project to another. Templates specific to a design should be saved in the project folder.

Second, a template is not magic! All it does is to provide a single place to view and edit the configuration of settings stored in each FCM. Changing a template will change the settings in the FCM but like all FCM changes they don’t become effective until they are programmed into the FCM. This is covered in the User Guide chapter on Programming.

Third, the last paragraph is not completely accurate but none-the-less important! The “real story” is that most of the settings in the template are stored in the FCM – the Light Level Table for example, but some are not – the power usage numbers. Those are only used by the GreenWorx software.

Now let’s look at the properties of the template named Triple Channel 0/33/66/100 – the last in the list above. A multi-tabbed dialog opens.

The Template Info tab

![Template Info tab](image-url)
The first tab is for the template name, what fixture module type it is a template for, the icons and notes. To change the name or notes just edit it, to change the type select a product type, and to change the icon use the Change button.

The Light Level Table tab

The last tab of the template contains the information on how the FCM responds to the various levels and to the system scenes. Again using the Triple Channel template as an example:

The top part of this dialog shows how the fixture responds to the various light level percentages. That is, what does each of the relays do when the FCM is told to go to a specific level? The way that this FCM is configured, a level of 0 energizes none of the relays. A level of 33 energizes only relay 1. A level of 66 energizes only relay 1 and 2. A level of 100 energizes all three relays.

Important Note: This is only showing what relays are on and which are off. This says nothing about what bulbs are wired to what relays.

If this was a 0-10 volt dimmable LED fixture then the voltage sent to the LED controlling ballast would be seen in the 6th column – labeled Voltage.
The lower section of the dialog determines how the FCM responds to the system scenes of High, Medium, Low, and Off. This is how that works:

1. The FCM receives a zone activation to a system scene. For example Medium.
2. The FCM looks in the system scene table to see what light level it should use for the level – in the case of Medium and that level is 66.
3. The FCM then looks in the Light Level table to determine what “66” means. In this example that would be to energize relay 1 and 2 and de-energize relay 3.

This procedure seems fairly obvious in this case since it has relays, but suppose a fixture controlled by a 0-10v dimmable ballast. What level is Medium? Is it 80% or 70% or 60%? What you put in the System Scene table makes that determination.

**Important Note:** Don’t become confused about the percentage numbers. We could configure the example the light level table with percentages of 10, 20, 30, and 40 instead of 0, 33, 66, and 100 and the fixture would have worked the same way as long as we entered into the System Scene table, 10, 20, 30, and 40 instead of 0, 33, 66, and 100. But you should use percentages that make sense for how the fixture is wired so as not to become confused.

While we are on the subject of the system scene table, let’s look at one for a single bulb fixture.

![System Scene Table](image)

Note that Low, Medium, and High all do the same thing – the single ballast is energized.
Why is the System Scene Table Important? Imagine an installation where most of the fixtures in a zone are single bulb fixtures but some – perhaps near entrance and exits are multi-bulb fixtures. By using the system scenes you can schedule the zone to go to High during the day and Low at night. The multi-bulb fixtures do something different – High has all bulbs on, Low some on and some off. But the single bulb fixtures remain on when set to Low or High. With System Scenes you decide how you want a zone to be set and the fixtures take care of themselves – they respond as best they can.

**Note:** A fixture can also be directly controlled to any of the light levels in the Light Level Table. This is done as part of user defined scenes and this is discussed in the chapter on Fixtures.

**The Power tab**

GreenWorx contains a number of monitoring features to help you see power consumption in the installation and how the power changes with the various scenes. These facilities are covered in a later User Guide chapter but they work with the power configuration of each FCM and that is specified here. This is the Power tab for the triple relay template we have been using as an example.

As described above, the Light Level Table determines only how the FCM responds to the system scenes and light levels. It doesn’t provide information about how the relays are wired to the ballasts. This tab is where – finally! - that is configured. Enter for each relay the number of bulbs it controls and the
wattage of each bulb. Also enter the fixture voltage. From these pieces of information and the light level table values, the wattage used by the fixture when set to any level can be computed.

The two corrective factors you can set are there to adjust this calculation and to make it more accurate with measured values. The computed wattage is multiplied by the ballast factor and then by the corrective factor. Since these values default to 1, they have no effect. If you have an actual measured wattage you can enter corrective factors to adjust the computed values to match the measured values.

The Health Monitor Tab

The last tab is the Health Monitor tab. It appears as:

Some Fixture Control Modules contain special hardware and firmware that monitors the ambient temperature and the wattage being drawn by the ballast/bulbs. If the FCM contains this hardware and firmware then it can be configured to:

- Monitor the temperature and if it exceeds a threshold turn the fixture load off. When the temperature drops well below the setpoint the fixture load then again responds to commands. It optionally can send a message to the System Controller when this happens.
• Monitor the wattage being used by each relay and if, after repeated checks, seems to be outside of the normal value, send an alert to the System Controller.

In addition to these alert messages, the FCM internally keeps track of these problems and those problems can be checked for by the GreenWorx software. This is covered in the User Guide chapter on Controlling the Installation.

Configuring the Load Monitor values is not difficult but is not for the inexperienced. The steps are outside the context of this User Guide. Refer to the GreenWorx Technical Note that details the procedure.

From the Template Manager you can modify an existing template – double click on the template in the list or select it and then press the Edit button.

If you make a modification to one or more templates, when you close the Template Manager a warning appears:

If you “go ahead” then all fixtures that use that modified template are updated. As the dialog says then the fixtures may need to be programmed. Why wouldn’t they always need to be programmed? If you changed a setting in the template like a power usage then the FCM will not need to be programmed because that setting is only used by the GreenWorx software and not the FCM.

Other facilities of the Templates category

The Templates Category contains a number of other facilities for working with templates. These are:

• Seeing what fixtures use which templates
  As in our example, not all fixtures in an installation will use the same template. The Templates category ribbon contains a dropdown that shows all the templates used in the installation design. As you change the selection in the dropdown, each fixture icon colors to show if it matches the selected template or not.
• Checking that fixtures match their templates
  Under normal circumstances the settings in each FCM match the settings in the template it uses. This operation is used to verify that.

• Applying a template to a selected set of fixtures
  During the design process you may find that you need to change a template and want to apply the changes to a set of fixtures. Or you may find that you need to assign a different template to a set of fixtures. This action does that.

• Appling a template to all fixtures on a tab
  The use of this is the same as the previous tool but operates on all fixtures on a tab. This can only be done when all fixtures on a tab can be assigned the same template. That is, they all use the same type of FCM.

When you load a file into GreenWorx two checks are made: First to see that the templates used by the file exist – are the needed gwt files found in the project folder - and second to see if the fixtures all match their templates. Warnings show up when a template is missing or when a fixture doesn’t match the template.

*What’s Next?*

Now that the necessary templates for an installation are created we can next turn to creating the fixtures in the design – one for each actual fixture in the installation - and place icons for them on the tabs in the design file.

*Your installation*

Templates are the basis of the most important part of your installation: The Fixture Control Modules. A complete installation contains one System Controller, possibly several System Extenders, a number of input sensors and keypads, and many Fixture Control Modules. It is worth the time to carefully consider each type of fixture you will be using, what FCM is installed in it and how the fixture ballasts are wired to the bulbs. And all that essential information is what is expressed in a template. Our top tip is to carefully construct the templates needed before anything else!
Chapter 5: Fixtures

In the introductory chapter on creating a network design, the concept of fixtures was briefly introduced. This chapter covers fixtures in depth: What they are, how to add them to a design, creating zones and scenes, and working with several GreenWorx tools for selecting and marking fixtures.

What is a fixture?

In GreenWorx the term *Fixture* is used for a lighting fixture – fluorescent or LED, directly dimmable or step dimmable. Associated with each fixture is a Fixture Control Module (FCM) that provides the control connection to the fixture. The GreenWorx system provides a number of different FCM models depending upon the fixture type and the capabilities needed.

In the GreenWorx software each actual fixture in an installation is represented by a fixture object. That object has a number of properties. A number of actions can be performed using the software on that object – for example changing its level to High – and when connected to the System Controller the fixture responds. In this example, by changing its level to High.

Also in an installation are a number of input devices – keypads, occupancy sensors and photo sensors. GreenWorx calls these *Input Devices* and working with them is covered in the next chapter.

The GreenWorx software uses the term *Device* to refer to both fixture and an input device where the distinction doesn’t matter.

Adding Fixtures to a design

The first step in creating a design for an installation is to add the necessary number of fixture objects. Each fixture you add to the design is shown by an icon on one of the tabs created in your design. As described in the chapter on Tabs, each tab can represent, for example, a single floor, multiple floors, one area of a floor, or the whole installation. It depends upon your installation how you wish to organize the tabs.

When adding and working with fixtures as part of setting up your design the ribbon category *Design* has most of the tools you will use.

To add fixtures to a tab, select the tab they should appear on and then use the *Add Devices* button. The *Add Fixtures* dialog appears.
There are a lot of choices in this dialog to help you quickly add the fixtures you need. Before starting on the details let’s take a minute to discuss, in general, fixtures in an installation.

For the most part the typical GreenWorx installation contains a number of fixtures organized in some sort of rectangular array. For example each floor of a parking structure has a number of fixtures each spaced in a regular grid. The same with a university sports facility. Each of these fixtures types is the same – they are all the same type of fluorescent or induction fixture.

When installed, each GreenWorx FCM is assigned a unique id. That id consists of a number between 1 and 3750. This id number can also be expressed as a block number and a unit within that block. Regardless of how it is expressed, it represents the same id number. For the most part you need not be aware of these id numbers as the operations of the system is performed in terms of zones rather than individual fixtures. But there are important reasons to consider the id numbers when you add the fixtures.

When you add fixtures to a tab, one question is how you wish to assign the id numbers. Should you start each floor in its own block or just assign fixture numbers sequentially from floor to floor? Within a floor how should the id numbers map to the actual fixtures? Should numbers be assigned in a specific
sequence? Looking north should the fixtures be assigned with the Northwest corner being the lowest number, and then id numbers going from west to east, north to south, or some other organization? To illustrate this, consider these two fixture organizations:

In the block on the left the id numbers start in the upper left corner and proceed left to right and top to bottom. In the block on the right the numbers start at the lower right corner and then are assigned top to bottom and right to left.

Which organization should you use? How should blocks be used? The answer to both of these questions is beyond the scope of this user guide. The specific circumstance of each installation provides the answer to each question.

**Tip:** Whatever organization approach is used when assigning fixtures ids, keep it consistent thought the installation.

When adding fixtures you don’t specify the type of the FCM as you might expect. Instead you add fixtures by choosing a *template*. As described in the previous chapter, one part of that template is the type of FCM. By using templates when adding fixtures all the properties that have already been selected in the template are applied to all the added fixtures.

In the *Add Fixtures* dialog, once you have selected a template then next choice to make is how many of that fixture type to add. You can select this by a number ~100, or by a configuration ~ 10 by 10. If adding fixtures by a configuration then all the id assignment as described above becomes important and you can select how the layout is performed.

Before we press OK we need to discuss one more point. How do you want the tabs to appear after the fixture icons are added? This was touched upon in the Tabs chapter. Each tab can have a background displayed. The tab icons are drawn on top of this background. One method is to use as a background the actual floor plans of the installation. This *real world* method has several advantages. It makes it easier to associate the view seen in the GreenWorx software with the real world installation. A downside is that the display can become “busy” and the icons can be lost in the sea of other plan details.
Another method is a *representational* or *iconic* view. In this case the display shows an idealized view of the installation with the icons placed not in their actual positions but in positions that show their relations to one another.

If these two approaches are confusing here is an example we are all familiar with. Street maps are drawn to be as close to the actual roads as is possible in a small size drawing – if the actual road curves then the line on the map curves. In this case the picture mirrors the “real world” directly.

Contrast this with the New York City or London subway map. Those maps are iconic maps - the rail lines and stations are all shown on the map and you can see the relationship of each station to another but the layout of the tracks on the map isn’t at all like they are in the real world.

Which type of display should you use in the installation – an iconic picture of the installation or a real world picture using actual floor plans? Should you acquire the installation floor plans, use them as tab backgrounds, and place icons on the plan locations that show fixtures? Or should you create tabs with just a grid of icons representing the installation fixtures? Again, these questions are beyond the scope of this User Guide. The short answer is, of course, it depends upon the installation.

Why is this important to think about at this point? Once icons are added to your design they can stay where GreenWorx added them or you can drag and place them on the tab background at any locations you want. If you do plan to drag and place them – perhaps to create a real-world approximation of the installation area – then you might as well add them as a count. If you plan to create an iconic view then you should consider adding them as a configuration – n rows by m columns.

**Big Important Note:** It is very important that when the actual FCMs are installed in the fixtures that each FCM is installed in the right fixture. If you don’t do this then the entire id layout you have done in the GreenWorx software will not match the actual installation. If you select an icon in the GreenWorx software, right click, and control that fixture to High, you want the fixture represented by that icon to go to High. Unless the electricians installed the FCM with same id as was assigned in the GreenWorx software for that fixture then you will not get the expected results.

We can now finally press OK in the Add Fixtures dialog and icons for those fixtures are added to the tab.

**Working with fixtures in a tab**

Once the fixtures are added to a tab there are a number of operations you can do. The simpler ones are:
• **Zoom in and out**
  You can use the zoom in and out buttons in the ribbon to show the icons smaller or larger. If you have a background, the background picture scales appropriately for the zoom level so the icons stay in their correct positions. At the highest zoom level the fixtures are represented by descriptive icons – icons that look like the actual fixtures – and at lower zoom levels they are simple iconic squares.

• **Selecting icons**
  Icons are selected by clicking them with the mouse. If you hold down the keyboard ctrl key when clicking on icons, each icon is added to the selection. To start a new selection just click someplace on the tab background that isn’t on an icon. You can also select icons by clicking the left mouse button and holding it down on an area that doesn’t contain an icon and drag a selection rectangle around the icons to be selected. When you let up on the left mouse button then all the icons within the selection rectangle become selected.

• **Move and place icons**
  A single icon or a selection of icons can be repositioned by drag and drop. There is an underlying grid on the tab that you can use to help line up icon positions. The grid can be shown or hidden using the grid checkbox in the ribbon. Before you can drag icons for positioning you first must disable the icon position lock. Uncheck the Lock icons checkbox. When finishing an icon placement – dropping the icons – they can automatically position themselves to the grid if the Snap to Grid checkbox is ticked. If you have icons that are not aligned to the grid you can select them and then use the Move to Grid button to move them so each is aligned with the nearest grid square. When all icons are placed as you want, tick the Lock icons box to prevent accidental icon movement.

### Creating zones

Controlling individual fixtures is probably the operation you will do the least. GreenWorx is designed to work with zones and scenes and that is where all the power of this system comes into play. A Zone is a collection of one or more fixtures that you can operate as a unit. Each zone can be controlled to one of the fixed scenes - High, Medium, Low, and Off, or it can be controlled to one of three user created scenes. Within a user created scene each fixture can go to the same or a different level. This is an important concept so let’s take an example.
Suppose these 16 fixtures comprise one zone:

If you control the zone to High they all respond by going to High.

But suppose that this was a – very small – parking structure and you wanted to implement daylighting where the outside fixtures were off which the inside ones stayed on. Like this:

You could define two different zones, one of which is the four interior fixtures and the other zone is for the other 12 fixtures. Or you could define a scene, for example called “Daytime” that implements these levels. In that case you would have a single zone so you are controlling all 16 fixtures at once. They can all be set to High with one command, or after this scene is created as one of the three user scenes, with one command to set the 4 interior fixtures to High and the 12 exterior fixtures to Off.

Zones and scenes are a complex topic. What is the best way to create zones and scenes for your installation? Should each zone be independent or do some zones overlap? How are scenes used? These
are all complex questions and answers are beyond the scope of this User Guide. But these are the key questions of a GreenWorx installation and must be carefully considered before any design begins.

The remainder of this chapter focuses on the mechanics of working with fixtures in the GreenWorx software: how zones and scenes are created and the properties of fixtures you can configure.

Creating and Modifying Zones

Creating and modifying zones is a very graphical process and as such isn’t that simple to describe in this User Guide but we will try.

For this discussion assume that we have a very simple installation with 100 fixtures organized in a 10 by 10 rectangle. Assume we want to create several zones. One zone contains the center 16 fixtures, the second zone containing the outside 38 fixtures plus one more in from each corner, and the final zone containing the remaining 42. The outside zone will be called descriptively “Outside”, the inner zone called “Center” and the third zone called the “Daylight zone”. After adding the fixtures the GreenWorx display appears as:
There are two different ways to create zones. We will show the different ways in creating the first two zones.

Creating a zone: Method 1

Right click on “Fixture Zones” in the left hand pane and select New Zone from the popup menu.

The new zone dialog opens.

Enter the new zone name and close the dialog with OK.

**Tip:** Don’t name the zones “Zone 1”, “Zone 2” etc. Those default names are suggested by GreenWorx but they are very poor choices. Use descriptive names or you will become confused later.

The left pane changes to show the addition of that zone.

If you click on the new zone name, nothing changes in the right pane since no fixtures are yet in that zone. Now select the fixtures you want to add to the zone and select Add to “Center” to add those fixtures to the Center zone.

**Note:** When creating zones and scenes and you have more than one fixture selected, it doesn’t matter which fixture in the selection you right-click on to perform the operation.
Once you make that menu selection, the right pane changes to show the fixtures in the zone. They are colored green.
Creating a zone: Method 2

Method two is similar to the first method but you don’t have to first create the zone in the left pane. Just select the fixtures to be added to the zone, right click, and select *Add to new zone*.

The *New Zone* dialog opens and lets you name the zone. Enter a descriptive zone name and close the dialog with OK.
Now that you have two zones, the first question you may ask is: What fixtures are in which zones? GreenWorx make the answer to the question easy. Just select the zone name in the left pane and the fixtures in that zone appear in Green. Select a different zone and the fixtures in that zone appear in Green. For example, when “Center” is selected:

And when “Outside” is selected:
To modify a scene is simple. Just select the zone you want to modify in the left pane, then select the fixtures to be removed from the zone in the left pane, right click and select Remove from <zone name> and the fixtures are removed from the zone.

To add additional fixtures to a zone, select the zone in the left pane, then select the fixtures to be added in the right pane, right click on any of them and select Add to <zonename> and they are added to the zone.

Creating and Modifying Scenes

Once a zone has been created you can configure the three user specified scenes. Like zone creation, this is preformed graphically. Before showing scene creation let’s take a minute to say what a scene is.

A scene expresses what light level fixtures in a zone should change to when the zone scene is activated. The system scenes of High, Medium, Low, and Off control all fixtures in the zone to the same level. With a user scene each fixture in the zone can be at a different level and some fixtures don’t have to change to any level – they are not changed by the scene activation. This is an important point: Not all fixtures in a zone need to be part of a user scene.

Unlike zones, the three user scenes are always available in a zone and don’t need to be created. Expand a zone in the left pane and those three scenes appear:

GreenWorx gives then default names using the zone name and “Scene 1”, “Scene 2” and “Scene 3”. Like zones for scenes in use you should rename them to more descriptive names. To do that, right click on the scene name and select Rename Scene from the popup menu. A dialog appears that lets you enter a new name.

When you click on the scene name in the left pane, the right pane shows all the fixtures in the zone. They are all in green which shows while they are part of the zone they are not yet part of the scene.
Now select the fixtures in the zone you want to be set at a specific level and right click on any of them. Choose Set <scene name> to level and then choose the level they should be at.

What levels can you pick? In the chapter on Template the concept of the Light Level table and the System Scenes was introduced. When creating scenes you can select any of the levels supported by the fixture and not just the system scenes of Off, Low, Medium, and High. This may make no difference for fixtures that offers a limited selection of choices – like a 1 or 2 bulb fluorescent fixture - but with a dimming ballast you may have many level choices. Note in the above picture the popup menu contained percentages and not the system scene names.

Once you make the selection, the right pane changes to show the scene. All fixtures in the zone are colored: Green for those in the zone but not in the scene. For those in the scene the color used represents the level.

Continuing our example, after all the fixtures have been assigned a level in the scene the right pane appears as:
Some fixtures are off in the scene, others at 33% and others are at 100%. The ones that are off appear in gray, those at 33% appear in light brown, and those at 100% appear as yellow.

To modify a scene, the same process is used. Select the scene name in the left pane, and then use the right-click options of Remove from <scene name> and Set <scene name> to level.

**Zone coloring options**

GreenWorx offers an optional method to make visualizing your zones simpler. A zone can be assigned a color and the space around the icons in the zone can be colored with that zone color.

Right click on the zone name in the right pane and select Assign color to zone
And the standard Windows color selection dialog appears. Make a color selection and close the dialog with OK. Two things happen. The selected color appears next to the zone name in the left pane and the space around the zone fixtures also shows that color.

In this example colors have been added to each of the three zones.
How much of the tab is colored around the zone? It depends upon the properties of the tab. When the tab was created the grid spacing for added icons was specified. That controls how large the area around each fixture is colored.

**Tip:** There is one reason aside from visual display reasons to assign colors to zones. When controlling a zone – described in a chapter much further on – you can right click anywhere in a zone color and GreenWorx will know what zone you are attempting to control. Without zone colors GreenWorx can’t do this.

**Note:** Zone coloring isn’t at all useful if you have overlapping zones.

**Fixture properties**

Fixtures have a number of properties that can be examined and modified. Right click on a fixture and select *Edit Configuration* from the popup menu.

**Tip:** You can also double click on an icon to open its properties. It is a good idea to have the *Lock Icons* setting for the tab enabled. Unless you are extra careful sometimes you can fool the system into thinking you are moving the icon as well.
Note: The set of tabs you see depends upon what authorization level you are working, in fact at some levels you can’t view the configuration of a fixture at all.

Very little in this dialog can be modified. The Panel, Circuit, and Description are text fields that can be edited to help you identify this particular fixture. The only use that the GreenWorx software makes with these text fields is in the Advanced Selection dialog described below. As such you can consider them optional and you need not change the default values.

The three checkboxes at the bottom of the dialog are the most important properties of a fixture that you can modify. These three checkboxes are:

- Controllable
  Some fixtures in an installation are not controllable. They are always on. These are needed because of lighting safety requirements for example. So why even create fixture icons for them? It would be much more work to add icons only for those fixtures that are controllable and, more importantly, GreenWorx uses their power data when computing installation power usage. Yes, adding non-controllable fixtures and assigning the unit ids does “waste” ids but adding them and “using up” an id is a small price to pay for the convenience of having them show up on the display and having them taken into account in power calculations. And at some later date you
may change them controllable fixtures. Just because you added them to your design doesn’t mean that have to have a FCM installed in them!

It is important to mark non-controllable fixtures as such. If you do this then the GreenWorx software can alert you when you attempt to perform an operation that only apply to controllable fixtures and a non-controllable fixture is in the selection.

- **Installed**
  This is a very useful property during initial deployment of your design into an actual installation. If some fixtures are installed and other are not – perhaps they haven’t be put in or they are part of the plan but for installation at a later date – then if a fixture selection includes non-installed fixtures, and an operation is attempted that in some way requires communication with the actual FCMs, GreenWorx can warn you that it will not work.

- **Need Replacement**
  During the life of an installation some modules may fail, some ballasts may fail, some bulbs in the fixture may fail. When that happens you write in a notebook the ids and locations of those fixtures that need maintenance. Or you could mark them as Needing Replacement. Doing this gives you a quick way to make the note and gives you a way to quickly find them using the Advanced Selection dialog and hide/show dialog described below.

### Hiding and Showing fixtures

On the tab display all icons look the same – either small squares or larger icons – and the properties described in the previous selection don’t “show up”. Using the Show dialog you can show or hide only certain types of fixtures. Press the ribbon Show button and this dialog opens:

![Show Devices dialog](image)

This dialog contains what icons are seen on the tab. You can hide any type of fixture or show only certain types. Want to see only the controllable fixtures and hide the non-controllable? Just tick Controllable and have Not Controllable not ticked. Want to see only those fixtures marked as needing replacement? Just have the Working box not ticked.
After you close this dialog with OK, the tab is redisplayed showing on those fixtures that meet the entire criterion selected.

**Note:** This method hides or shows icons. This is different than having icons that meet some criterion selected. Creating that type of selection is described in the next section.

**Selecting fixtures with the select dialog**

In addition to the selecting icons with the mouse, GreenWorx includes an advanced selection dialog. Press the *Select* button in the ribbon to open the Advanced Select dialog.
From this dialog you can select fixtures that meet one or more criterion. In the Select What box the criterion for that selection is configured. For example, you could select only fixtures that use one type of FCM, those that use a certain template, and FCMs with a specific firmware version. Each selected criterion limits the selected fixtures since to be selected a fixture must meet all the chosen criterion.

You can also save a selection with a name – the Save Selection box at the bottom of the dialog. When forming a new selection you can start with an empty selection or modify an existing selection or a named selection.

Why would you want to save a selection? For example, you may be having an issue with some fixtures and want to note down what those fixtures are so later you can go back and look at their properties. You could just grab a notebook and write down their unit ids but perhaps a better method would be to create a selection for them and save that selection with a name for future reference.

This selection facility is available in all ribbon categories.

Other fixture actions

In addition to all that is described above, there are several other actions you can perform on fixtures when designing. These are accessed from the right-click popup menu.

- Deleting one or more fixtures
  Make a selection then right click on one of the selected devices and select Delete Device. A confirmation dialog appears. There is no undo action for device delete.

- Change the fixture icon
  Makea selection then right click on one of the selected devices and select Icon – Change. A dialog appears that lets you select from all available icons.

- Move fixtures from one tab to another
  To reorganize your design – perhaps you want to split one tab into two, you can make a selection and then right click and select Icon – Move to tab. A dialog appears that lets you select the destination tab.

- Make a second icon for a fixture.
  This action should only be used in special circumstances as it creates a second icon for a fixture on the tab. Why would you want to do that? In some special circumstances you may have one FCM control multiple fixtures. In this case in order to create a realistic tab display you may want more than one icon. All of the icons would act identically so that when the underlying fixture changes state all icons change state. This can become confusing when creating zones and scenes if you forget that there is really only a single FCM in use so take care.
What’s Next?

As described in the introduction to this chapter, all the GreenWorx products in an installation are either Fixtures or Input Devices. The next chapter describes what those Input Devices are and how they are added to and configured in an installation.

Your installation

The most complex part of a GreenWorx installation is deciding how to divide it up into zones. Great care should be paid to this important part of the project. It may appear necessary upon first examination that many zones are needed but with some careful analysis of use you may find that fewer zones will do the job and are easier to configure.

If you find you have overlapping zones take extra care as their actions can become confusing when they are being controlled by, for example, occupancy sensors.

There are no hard and fast rules about zones. Remember that GreenWorx is a highly configurable and reconfigurable system so if the zones you choose turn out not to be exactly what you need, old zones can be modified or eliminated and new zones created all without leaving your computer.
Chapter 6: Input Devices

In the previous chapter devices that receive messages - Fixtures - were described. In this chapter those GreenWorx devices that generate messages – keypads and sensors – are described and the GreenWorx support for them detailed.

What is an Input Device?

An Input Device is any device in a GreenWorx installation that generates messages in response to some event. For example, a user presses a button on a keypad or an occupancy sensor registers that a person or vehicle has moved across its area of interest.

Each Input Device is configured as to what action should be taken when a message from it is received by the System Controller. For example, a user presses the “Zone 1” and “High” buttons on a Zone Lighting Controller and that causes a zone active command to be sent that sets the fixtures of Zone 1 to High. Or an occupancy sensor sends a “I see motion” message that results in a command to turn a zone to High and when it sends a “I no longer see motion” message the zone is set to Low.

GreenWorx has these input devices available:

- An Input Sense Module (or “ISM”) that has 2 or 4 contact closure inputs.
- A Voltage Sense Module (or “VSM”) that has 2 or 4 inputs that respond the changes in voltage
- A Zone Lighting Controller (or “ZLC”) that has buttons for selecting 4 zones and within those zones the ability to control to High, Medium, Low, and Off. A ZLC also has four contact closure inputs that can be configured.
- A Zone Wall Controller (or “ZWC”) that has a single paddle to control one zone with High or Off.

Each of these input devices are added to the GreenWorx design and configured. Once configured both they and the System Controller must be programmed for them to operate.

Adding Input Devices

Unlike fixtures where a tab must be created before they are added, Input Devices are always added to the Inputs tab. Also like fixtures, Input Devices have an id but they are always added to block 15.

To add an input device select the Inputs tab and then press the Add Devices button. The Add dialog opens.
**Input Devices**

Choose the type of input device, the starting id and the number to add. You can add a description in order to better keep track of the user of the input device. For example, *1st Floor Keypad*, or *NW occupancy sensor*. The description appears below the icon so you should use a descriptive name if possible.

Unlike fixtures icons, input devices appear a bit more, well, iconic on the Inputs tab.

![Input Device Icons](image)

**Configuring Input Devices**

To configure an Input Device, right click on it and select Edit from the popup menu and a multi-tabbed dialog opens. The first tab is exactly the same as with fixtures. You can edit the description, and also the properties of *installed* and *needs replacement* are there to be modified.

The number and type of tabs in the dialog depend upon what kind of input device you are configuring. Let’s begin with the ISM and VSM since they are configured identically. With a two input device there are two tabs for configuration – one for each input. When not configured, the tab for the 1st input appears as:
The first thing to do is to choose the type of input connected to the ISM. The choices are:

- General (open / close)
- General (open only)
- General (close only)
- Photo sensor
- Occupancy sensor

The choice you make determines the options available in the configuration.

The second change to make in the dialog is to provide a name for what this input connects to. As always, the more descriptive name the better. Once the input type is selected then the events associated with that input can be configured.

Note that each input has two options for the *open* event and two for the *close* event. This can be useful if, for example, you want to control two different zones upon action of the input device. Each event has four possibilities:

- Nothing
- Control zone
- Set mask
- Clear mask

Masks will be described in the chapter on masks so for now let’s concentrate on controlling zones and ignore those action choices as well as the Masks display and Masks button.

In this configuration, when the input closes the “Daylight Zone” is set to Medium. After the open event is configured:

With this configuration in place, once programmed, this is the timeline of what happens:

1. The contact is closed. Perhaps this happens as the result of a driveway sensor
2. A message is sent from the ISM to the System Controller saying “<input> closed on <this> ISM”.
3. The System Controller acknowledges that it received the message. If it doesn’t the ISM resends a number of times until it is confirmed.
4. The System Controller then looks up what should happen when “<input> closed on <that> ISM” and carries out the action.
5. A Zone Active medium command is sent to the “Daylight Zone”.

If you only need to configure the first event and don’t need the second, just leave the action in the second event as Nothing.
If the input type is *Open Only* then only the Open actions are shown. Likewise if *Close Only* is chosen then only the Close events are seen.

Occupancy Sensors are configured a bit differently.

Each input still has two events associated with it but each event now says what happens when the occupancy sensor “closes” – detects motion – and when it “opens” – no motion after ‘n’ minutes where ‘n’ minutes is set by some mechanism in the sensor itself. The only choice is to control a zone or to do nothing.

In the above examples the configuration chosen controlled the zones using the system scenes. However you can configure to use the three user specified scenes as well.

For the 4 input ISM and VSM there are four tabs rather than two. The ZLC inputs are configured exactly the same as the ISM and VSM.

### Configuring the ZLC keypad

As described above, the Zone Lighting Controller combines a 4 button keypad with four inputs like a ISM4 or VSM4. The ZLC keypad is contains two columns of 4 buttons each and is used like this:

1. A zone button is pressed. This sends no message but sets the zone for the next operation
2. A scene button is pressed next. These scene buttons are silkscreened to say “High”, “Medium”, “Low” and “Off”. When the scene button is pressed a command is sent to the System Controller saying “<this> ZLC <this> zone button and <this> scene button have been pressed”.
3. The System Controller acknowledges receipt of the message
4. The System Controller then looks up what should happen when “<this> ZLC <this> zone button and <this> scene button have been pressed” and carries out the action.

When not configured the tabs for the 4 buttons on the ZLC look like this:
The Zone 1 tab is for when the 1st zone button is pressed. The four actions, labeled High, Medium, Low, and Off contain the action that happens when those buttons are pressed.

**Note:** Even though the ZLC is silkscreened to say “Zone1”, “Zone2”, etc and “High”, “Medium”, etc that doesn’t really mean anything! The choice of zones is up to the configuration made in GreenWorx. Likewise the scenes could be anything. For the “High” button you could choose any scene including one of the three user specified scenes.

The dropdown at the top of the tab selects which zone is controlled and scene choices are made in the four group boxes below. As in the case of the ISM above let’s ignore the *Set Mask, Clear Mask* actions, the masks display and the *Mask* button for now.

Choose a zone for that zone button then the action of each scene button. A button can be configured to control a zone or to do nothing.
Sensor Zones

As described above each time an input is activated it sends a message to the system controller. The system controller then decides what to do. Without jumping ahead too much in this User Guide, let’s just say for now that there is a method – masks – that allow you to say, in effect, that during certain hours selected sensors should not send any messages. This will all be described in great detail later but for now just accept that such a mechanism exists.

This brings up an important point: Sensors always communicate with the system controller even if that communication doesn’t result in anything happening. In a large installation this could become a problem with sensors reporting very often. There would be many messages communicated and that may slow the ability for the system controller to send the commands it needs to implement, for example, schedules.

To solve this problem you can group input device inputs into sets that can be told to not to send messages until enabled to do at some point. These groupings are called Sensor Zones.

To create a Sensor Zone press the Sensor Zones button in the ribbon.

To create a new sensor zone, press then New button.
This dialog lists all the sensor inputs in the left box. All the inputs that are in the sensor zone are listed in the right box. Move those inputs you want to be included in the sensor zone to the right box using the -> arrow. Remove them from the right box with the <- arrow. To include all use the >> button and to exclude all use the << button.

Note that the names listed in the left box use the descriptive names you specified for the inputs. In this example at least for the inputs for the input device named NW Occupancy sensor. You can also give the Sensor Zone a name. When finished close the dialog with OK.

Note: One input device sensor can appear in multiple sensor zones.
Sensor zones, like fixture zones, also appear in the left pane of the GreenWorx application window:

- Daylight Zone Scene 2
- Daylight Zone Scene 3
- Sensors Zones
  - Sensor Sensor Zone 1

**Tip:** Sensor zones are an optional configuration. In most installations with few sensors they are usually not needed.

**Other actions with Input Devices**

In addition to the configuration described above there is one more action you can take with input devices. You can add an icon for an individual input to another tab in your design. Why would you want to do that? If you are creating “real world” looking tabs it might be a convenience to have icons for the inputs to better keep track of where they are and to be able to quickly access their properties. These icons appear as octagons.

To add an icon for an input, right click on the input device and follow the menus to the input and action:
After selecting Add a dialog opens that lets you choose the tab to add the icon on. The Find operation changes the display to the tab where the icon appears and selects it. The icons for inputs created in this way can be used as a shortcut to the input device properties. Right-click on the icon and select Edit and you will be viewing the Input Device properties even though you started the action on a fixture tab.

What’s Next?

All static parts of the installation design have now been created and we next turn to the dynamic aspects of the installation: Scheduling.

Your installation

Like Fixtures, Input Devices are where the action is in a GreenWorx installation. The requirements of the installation dictate the type and quantity of Input Devices needed. The most import thing is to well understand these requirements and how Input Devices interact with your zones. The best advice is as always: Plan well!
Chapter 7: GreenWorx Schedules and Calendar

This chapter describes the GreenWorx scheduling tools, showing the general concepts of schedules and the supporting User Interface.

Getting started with a schedule

Before diving into the technical aspects of how schedules are supported in GreenWorx it is best to take a few minutes to look at what a schedule is and how it can be used to reflect the usage patterns of your installation.

Consider the example parking structure we have been building in this User Guide. Our example parking structure is connected to a university. In a very simplified view, this is the kind of usage seen:

- Students being arriving for early classes around 7am
- Most classes conclude for the day by 9pm
- Saturday until later afternoon is typically like a weekday
- Sunday is little used
- During school vacations and holidays the parking structure is little used beyond the 1st floor

Looking at this we can start to set the requirements of the schedule:

1. Monday to Friday 6am to 10pm is high usage and should be scheduled as such.
2. Monday to Friday, the night hours from 10pm until 6am should be schedule as low usage
3. Saturday from 6am to 5pm is high usage
4. Sundays and Holidays are low usage and the floors other than the first floor should be scheduled for low usage.

Let’s define a schedule as a list of one or more time based actions. We will call these time based actions schedule entries. Two schedule entries that express some of the requirements above would be:

- At 6am set zone All Floors to High
- At 10pm set zone All Floors to Nighttime

A GreenWorx schedule entry can, as in these examples, be based upon a fixed time – 6am, 10pm – or based upon a computed time for dawn or dusk. As part of the installation configuration, you supply the location of the installation and the time of sunrise and sunset for your location are determined. You can create schedule entries relative to these times – plus or minus ‘n’ minutes. For example: Dusk + 30 minutes or Dawn - 40 minutes.
Note that given your installation it may not be very light at Dawn or very dark at Dusk so you should take that into account when working with these sun relative times.

There are two very important concepts that you can see from the two example schedule entries above. The first is that zones are not scheduled to go “on” or “off”. Zones are set to various scenes – High, Medium, Low, Off, or the 3 user defined scenes – at a specified time. Each zone is always set to some scene. That may be the “High” scene or it may be the “Off” scene. You will find much less confusion in GreenWorx scheduling if you think in terms of Zones and Scenes and not in terms of ON and OFF.

The second important concept is that a schedule entry is only about time and not date. So where does the date come into this? How are the requirements for different actions on Sundays and Holidays expressed? The answer to this is the GreenWorx Calendar and that is the first technical aspect of scheduling to be discussed.

The GreenWorx Calendar

To open the calendar press the Edit Calendar button in the Schedules ribbon. The Calendar opens as:
Schedules and Calendar

GreenWorx has the capability to create up to four different schedules. Each day of the year GreenWorx makes one of those 4 schedules the Current Schedule. Let’s take an example to make this clearer.

Schedule 1 contains these two schedule entries:
- At 6am set zone All Floors to High
- At 10pm set zone All Floors to Nighttime

Schedule 2 contains this two schedule entries:
- At 6am set zone All Floors to High
- At 5pm set zone All Floors to Nighttime

When do we want schedule 1 to be used and when do we want schedule 2 to be used? In our example, schedule 1 is used Monday to Friday. Schedule 2 is used on Saturday. Which Monday? Which Saturday? This is what the GreenWorx Calendar controls: Each day of the year is controlled by one of the four schedules. There is no day that is not controlled by a schedule.

In the above picture, the calendar is shown for a given year – in this case 2013 - and each day is assigned a color. By the use of color, the schedule used for each day is quickly determined. For example, most weekdays and Saturdays are assigned to the blue schedule called “Weekdays”.

Up until now we have used “Schedule 1” and “Schedule 2” but you can give your schedules more descriptive names. How that is done is described in this chapter a bit later.

From the above picture of the calendar dialog, you can see at a glance that on October 2nd the “Weekday” schedule is used and on February 24th the “Sundays” schedule is used.

The calendar also shows Holidays by the day of the month number in red. There is a file external to GreenWorx that defines what days are holidays and that file can be customized during system installation to match your specific installation requirements. The example university parking structure could show school closed days as “holidays”. Also on the calendar is the start and end dates for Daylight Saving Time - this is only for your convenience.

To assign a day to a schedule just select it in the calendar – mouse click on it – and it turns red to show you that it is selected. You can select as many days as you want and then press one of the four “Assign to” buttons to select that schedule for those days.

The GreenWorx calendar, when programmed into the System Controller, is not for a single year but for 20 years. You can advance the calendar from year to year by using the year buttons at the right side of the dialog. What this means is that GreenWorx lets you take into account the date changes from year to year without needing to reprogram the System Controller each year. For example, while US Thanksgiving is always the 4th Thursday of November the date moves around – in 2013 it is November
28\textsuperscript{th}, in 2014 it is November 27\textsuperscript{th}. If your facility was closed on Thanksgiving then that date – whatever it is – could be chosen in each year of the calendar and assigned to a schedule used when the facility is closed.

In addition to manually selecting days and assigning them a schedule, you can also use the Calendar Quick Setup tool to do mass assignment of days to schedules. Start this tool using the button labeled Calendar Quick Setup. This dialog opens:

![Calendar Quick Setup dialog](image)

As you can see from the dialog, you can assign \textit{every} Monday to one of the four schedules, \textit{every} Tuesday to one of the four schedules, etc. Those dates that are configured as Holidays – that external Holiday file mentioned above – can be assigned to a schedule. Please note that once you close this dialog with \textit{OK}, the calendar is updated and will lose any specific date assignments you may have made.

**Assigning Schedule Names**

As mentioned above it is a good practice to give more meaningful names to your schedules rather than “Schedule A”, “Schedule B”, etc. This is done by pressing the \textit{Schedule Names} button in the ribbon.
All you need do is to modify the schedule names to what makes sense for your installation and close the dialog with OK.

*Where we are now...*

At this point we have looked at scheduling in general – how a GreenWorx schedule contains one or more schedule entries and these schedule entries control zones as specified times. We have also seen that GreenWorx has up to four schedules and each day of the year, for the current and next 19 years, is assigned a specific schedule that is used on that day.

Now we turn to creating those schedules and how you can view them in GreenWorx.
The GreenWorx Schedule category

When you select the Schedules category in GreenWorx the GreenWorx application window appears as:

In the left pane are your zones as always, the right pane shows the entries in a schedule. The schedule shown is the schedule selected in the dropdown in the ribbon. To view a different schedule, select a different one in the dropdown in the ribbon.

Each schedule entry takes up one row in the right pane. Each row shows the 3 parts of the schedule entry: the zone effected, the action taken and the time it happens. The 4th column shows the time it happens today and that is the same as the time shown in the 3rd column if it is a fixed time – 6am – or the computed time if it is based upon dawn or dusk. The “Time Today” column is only there for your information to help show you what the time would be - remember that Dawn in December is at a much different time that Dawn in June.

To modify a schedule entry, first select it then double-click on it and its properties open:
For now, ignore all the “Masks” options and buttons - they are covered in a later chapter. To change the schedule entry all you need do is to select the desired zone and scene. Then choose the time. Close the dialog with OK and the schedule entry is modified.

To add a new schedule entry the “Add Entry” button is used and a similar dialog appears. To delete a schedule entry, select it and use the “Delete Entry” button.

**Tip:** If prior to adding a new schedule entry you select an existing schedule entry by clicking on its row, then the new schedule entry dialog is pre-loaded with that schedule entry’s settings. This makes it easy to create a new schedule entry that is very similar – perhaps only changing the time – from an existing entry.

**Schedule Tools**

There are several additional tools available in the Schedules category.

- **Copy**
  The Copy operation copies entries from one schedule to another. One use of this might be if you have created a schedule and you want to use *almost* that same set of schedule entries in
another schedule. Open the Copy Schedule tool and you can choose which schedule to copy from and paste its entries into the current schedule.

- **Clear**
  The Clear operation deletes all the schedule entries from the schedule you are viewing. You could just select each entry and delete it but this is a quicker way to delete all the schedule entries.

- **Time**
  The Time dialog lets you retrieve and set the System Controller time and location. It is the same dialog available in the System Controller category.

The Simulate Tool is designed to help you understand the effects of your schedule as one or more days progress. It can be hard to see a schedule in time order since the rows in the schedule display are not necessarily in time order. And because of sun relative times, it can be tricky to put them in order. That’s what the schedule simulation tool does. Press the Simulate button and this dialog appears.

![Simulation](image)

Choose a start day and the number of days to simulate for.
**Tip:** The calendar at the top works like other Calendars in Windows. Just click on a date to select it, show the next or previous month by using the left and right arrows at the top. Click on the month name to quickly select a different month or year.

In this example, you can see the effects of the “Weekdays” schedule on Saturday and the “Sundays” schedule on the next day with each day showing the times that the sun relative schedule entries happen. Note that the line in the simulation report shows the date and includes the name of the schedule that is active that day.
Saving the schedule to the System Controller

All the schedule information – the schedule names, calendar, and schedule entries for each schedule are saved in the design file. Before the schedule can be executed by the System Controller it is necessary to save it to the System Controller. This procedure is covered in the chapter on Online Operations. The Schedule Verify operation is also covered in that chapter.

Getting schedules to operate as you expect

Schedules are the active part of a GreenWorx installation. Once all the fixtures and input devices are installed and programmed, the schedule is one of the areas where the usage of the facility is expressed. Getting it correct can be difficult since the exact requirements may not always be known completely. It may be necessary to attempt a schedule, monitor its use and then see how that works. There are three tools in GreenWorx that may help you. The first of which we already covered: Schedule simulation. The other two are the logging facilities in GreenWorx – both the Send and Receive Log and the Zone Log.

The logs are covered fully in the Monitoring Tools chapter but here is the idea: Leave GreenWorx connected to the System Controller for a period of a few days or a week and monitor the logs to see the effect of the schedule on the installation. Also, as long as GreenWorx is connected to the System Controller, as schedule entries happen, the fixture icons update to show what state they are in by their color. For example, at a glance you can see that this floor of the parking structure is all set to high.
While from this you can see that a power saving scene has been activated.

Keep track of the time and monitor the installation and you can see how your schedule is affecting it.
What’s Next?

We have covered how to create a design, add fixtures, input devices, and now schedules. There is one additional topic to cover before starting to work with the System Controller and that’s Masks. They are the next chapter in the user guide.

Your installation

Before starting on scheduling for your installation, it is best to think in general how your installation is used. Then reduce those thoughts to a list of requirements. Next, see how those requirements fit with the GreenWorx scheduling model – each day assigned to a schedule. See how many schedules you might need. In the example that we have been following though this User Guide, we needed only three: Weekdays – which in this case includes Saturdays - Sundays, and School Closed days.

Next use the calendar to assign each day to a schedule and then use the scheduling tools to create the necessary schedule entries to carry out the requirements.

Finally we recommend you use the simulation tool to better get an idea of how the schedule operates over time.
Chapter 8: Masks

This chapter describes the concept of Masks: What they are, how they can be used and how they are implemented in GreenWorx.

A mask, as used in GreenWorx, is a method to provide input into an installation that overrides or controls the normal action of a schedule or input device. The best way to more fully explain masks is by looking at three examples.

Example 1: Controlling an input device’s action

Suppose in an installation in an aircraft hanger there is a parts room. This room has been configured as a zone and during normal working hours the room fixtures are set to High. After hours the fixtures are off. For after hours use of the room a Wall Switch input device was installed to allow the lights to be turned on as needed.

During working hours what you don’t want to happen is for someone to inadvertently turn the lights off using the switch – the room is big and they may not realize that others are in there. In effect what you want is to have that switch operate only between 6pm and 6am. This can be accomplished using a mask.

Example 2: Controlling a schedule

Suppose in a university sports facility the high bay lights normally are set to a low level or off at 10pm and this is accomplished by a schedule. But for exceptional reasons tonight you want those lights to be unaffected by that schedule. You want to have a button on a Zone Lighting Controller be designated as an “override button”. Press that button and the schedule no longer affects the lights until the next day. This can be accomplished by a mask: the ZLC button controls the mask and the schedule is controlled by that mask.

Example 3: Zone auto off

Suppose in that in another university sports facility the lights are not controlled by a schedule but by user demand – they push a button for the lights to go on. What you want to happen is that the lights automatically go off 1 hour after being turned on. In addition, a minute before the lights go off they should blink as a warning. All this also can be accomplished by a mask - a mask configured as a timer.

As we describe in how masks are configured in GreenWorx we will return to these three examples and show the configuration necessary to implement the desired actions.
Masks in GreenWorx

To configure masks in GreenWorx, press the Masks button in the System Controller ribbon category.

The first thing to note is that there are a total of eight masks that can be configured for an installation. Each mask has a name – the default name of “Mask x” should be changed to be something more descriptive for your installation as we have done above, a choice of how the mask is used, and two other options: a timer and a blink option.

As described above masks are used for two different but similar purposes: acting to control the action of an input device or a schedule, and as a means to configure an auto off mechanism. Let’s look at the configuration of each.

A mask as a control

In the above dialog masks 1 and 2 can be used to control the action of an input device or schedule. As the choice in the dialog dropdown says concisely, whatever action is controlled by this mask, if the mask is set then that action is disabled and the action is enabled if the mask is clear.

We say “set” and “clear” and you can think of then as “1” and “0”, “Checked” and” Unchecked”, or “True” and “False” if you prefer. The key point is that a mask takes on only one of two possible values.
In example 1 at the start of the chapter – disabling the action of a wall switch during working hours - if a mask was associated with that wall switch and if that mask was “set” during working hours then that wall switch would be disabled and no one could use it to turn the storage room lights out.

In example 2 at the start of the chapter, if the 10pm schedule entry was associated with a mask then if that mask was set that schedule entry wouldn’t happen.

One important point that has not entered our discussion yet: **More than one mask can be used simultaneously in controlling an input device or a schedule.** When used this way if any masks are set then the action is disabled. Only when all the associated masks are clear does the input device or schedule entry become enabled.

**A mask as a timer**

When using a mask as a timer, as the dialog dropdown choice says: “Timer if set”. If the mask is set, then any fixture that responds to a zone control command transmitted by the System Controller that is associated with this mask, automatically changes to the “off” scene after ‘n’ minutes. Where ‘n’ is the number of minutes the mask is configured for. In the above dialog, mask 3 it is configured for 60 minutes. In addition when using a mask as an auto off timer, you can enable the option for the lights to blink one minute prior to changing to the “off” scene.

This is the method used to implement the auto off as described in the 3rd example at the start of the chapter.

The above descriptions of masks were very incomplete as you can see, the immediately obvious questions are: How does a mask become set or clear? How does a schedule entry or input device become “associated” with a mask? These questions are answered next.
Input devices and masks

In the chapter on Input devices, all discussion of Masks was ignored. Now that Masks are understood we can return to Input Device configuration.

Input Devices carry out an action when they are used – a sensor triggers it or a user pressed a button – and normally that is to control a zone. But Input Devices can also be used to set or clear masks. In addition the action of Input Devices can be controlled by the current state of a mask.

To configure an input device’s input to be controlled by a mask, open its properties dialog.

To have one or more masks to become associated with this input device event, press the Masks button.
Select one or more masks and then close the dialog with OK. Any masks you select display in the “Masks” area of the input event configuration. Configured in this way, if the mask is Set when the Input Device sends a message to the System Controller, then the message is ignored.

An input device can also set or clear a mask. In the Action dropdown where up until now we have only selected Nothing or Control Zone, the options Set Mask and Clear Mask can be used. When these options are selected then the masks to be effected are chosen. For example,

![Image of input device with Action dropdown set to Set Mask]

**Note:** Occupancy sensor events can’t control masks. Only General and Photo events can.

It is important to remember that an installation has only 8 masks. One mask can be used to control many input devices – it isn’t one mask per device. For example you could use a single mask to control the action of a number of occupancy sensors in a parking structure.

### Schedules and masks

To associate a mask with a schedule entry, open the properties of the schedule entry.

![Image of schedule entry with mask options]
As with associating masks with input devices, press the mask button in the schedule entry properties dialog – the Mask button at the bottom of the dialog not the one in the Action group who’s use will be described in a bit - and select any masks needed and close the dialog with OK. Any masks associated with the schedule entry display in the masks area as above.

When viewing a schedule in GreenWorx, any masks associated with a schedule entry are shown in additional columns.

In addition to the Zone, Action, Time, and Time Today columns there are eight additional columns – one for each mask. If there is an “X” in the column for a schedule entry row then that mask is associated with that schedule entry. By having a separate column for each mask you can use the column sorting facilities of the list – click on the column header – to quickly see all schedule entries associated with each mask.

There is one additional topic to be covered in order to have all the tools needed to implement the three examples at the start of this chapter: Scheduling a mask action.

In the first and second examples at the start of the chapter, there is a time element also involved. In the first example the action wants to be limited to after working hours. In the second example the action of the mask wants to be cleared the next day. Both of these are accomplished by scheduling the setting and clearing of masks.

As described in the chapter on schedules, to create a new schedule entry first select a schedule and then a new entry is added by the New button.
Instead of controlling a zone, chose the Schedule Mask option, then choose the action to clear or set the mask, and finally choose the masks to be affected using the Masks button – this time use the Masks button at the top of the dialog in the Action group. Select the time that the mask set or clear happens and then close the dialog with OK. A new schedule entry is added to the schedule.

In the second example at the start of the chapter, the mask that is set by the push of a button disabled a schedule entry. It would be necessary to schedule the clear of that mask at, for example 6am, so the schedule entry is in operation the next day.

**Advanced Topics**

You can create complex scenarios with Masks. For example, a schedule entry that sets or clears a mask could itself be enabled or disabled by another mask. Using this you could create a “super override” that suspends not only the action of input devices and schedule entries that control zones, but also the schedule entries that themselves set or clear masks. This could be used by the installation described in the third example at the start of the chapter to prevent the auto off disable being reset the next day. This can become very complex and you are advised to plan these sorts of things carefully!

When working with masks that operate as timers note that the timer doesn’t happen unless that mask is set. Why is this important? Again an example: Suppose in the aircraft hangar from example one at the start of the chapter the parts rooms lights were normally off and the wall switch was used to turn them on. Also suppose that during the day you wanted them, if turned on to stay on for the remainder of the
day – they could be scheduled to go off at the end of working hours. But at night you wanted the lights to come on when the wall switch is pressed and to auto off 10 minutes later. In this case you would create a mask as a timer and have a schedule entry that set the mask scheduled for the end of working hours and another schedule entry that clears the mask at the start of working hours. With this configuration, if the switch is used during the day the lights come on and the auto off timer has no effect since the mask is clear. But after working hours when the mask is set – by the schedule – it is active and the one hour auto off happens.

Viewing and modifying masks in GreenWorx

When connected to the System Controller you can view the current state of the masks – set or clear – by opening the same dialog used to configure them. At the right side of the dialog are checkboxes that show the state of the masks. The box is ticked if the mask is set and not if the mask is clear. Use the Read button to read the mask state from the system controller. If you make any changes you can use the Write button to update the System Controller to the changes.

What’s Next?

All parts of your installation design have now been completed and in the next chapter we turn to working with the GreenWorx System Controller and then programming all the parts of the GreenWorx installation with your design. After that we can begin to look at the tools that are used to monitor and control the installation.

Your installation

When planning an installation the suggestion is to note down any control needed for exceptional circumstances – disabling input devices or schedule entries. These then are implemented using masks. Since masks are a limited resource it is best to compile this requirements list before attempting to implement it. In this way common conditions can be determined – all these input devices need to be disabled during these times – rather than attempting to implement the plan as each input device is configured.

In the same manner, any masks that are timers should be considered as a group to minimize the number of different timers needed. Could a 10 minute timer and a 15 minute timer be changed to both be 15 minutes? This sort of pre-planning will save much trouble later.
Chapter 9: Online Operations

Up until now all the previous User Guide chapters described using the GreenWorx software to create an installation design. All operations were done offline from the System Controller.

In this chapter we see how to connect to the System Controller (GSC) directly and also through a connection catalog. Also, the options for where the design file is stored are considered, including the implications of the using the Project Folder concept.

Connecting to the System Controller directly

To connect to the system controller you must first configure the GreenWorx software for the type of connection needed. Select from the application menu GreenWorx Options, or in the ribbon System Controller category, press the Connection Setup button.

![GSC Connection](image)

You can connect to the GSC using either a network connection or by a serial port – the GSC has a USB port on it that operates with a Virtual Serial port in Windows that a device driver creates.
If you intend to connect to the GSC using the serial port you must determine that port number. You can either use the Windows Device Manager, or GreenWorx can often find the port for you. Press the *Find Port used by GSC* button.

If you intend to connect to the GSC by a network connection you must know the IP address of the GSC and the network port number. Determining these numbers is outside the scope of this User Guide. If the GCS can be accessed by a DNS lookup then choose that option and enter that name.

Once you have selected the connection type, press the *Test Connection* button to see if the choices are correct. A popup either confirms correct connection or shows a failure.

This connection was a failure.

![Connection failed message](image)

This connection was successful.

![Connection successful message](image)

Once you have chosen a connection method and tested it, close the dialog with OK. At this point you are still offline. To actually connect, press the *Connect* button in the ribbon – first button in the first panel in the System Controller category. And the connection process begins.

**Connecting using a Connection Catalog**

The connection catalog is a database created by the GreenWorx Connection Catalog Editor – described in its own User Guide – and lists all the locations and the connection methods that you can use. This database was created when the installation was commissioned and configured by the installation team.

As part of the GreenWorx options, the path to the connection catalog and an indication that it should be used for all connections is given. For information on GreenWorx options see chapter 19 in this user guide.
Once GreenWorx is configured to use a connection catalog, press the Connect button – 1st button in the 1st panel of the System Controller category. The catalog connection dialog opens.

The contents of the dialog depends upon what is in the connection catalog. In this example there are four locations – that is, four System Controllers – you can connect to. The installation team has given them hopefully descriptive names. Press the button for the one you wish to connect to.

Connection, part 1

Regardless of which method is used – direct or catalog connection - the connection dialog opens and a number of actions take place. The connection dialog shows each step of the process.
If the GSC can be connected to and it responds, then the next step asks you to log in. Stored in the GSC memory is a list of authorized users and their privilege level. Enter your username and password.

![GreenWorx Login](image)

Next, a number of checks on the health of the GSC are carried out.

Before continuing on with connection we need to pause here and discuss files and the management of them as well as the different actions taken during connection depending upon the user privilege level.

**Warning Rough Water Ahead!** The following discussion on files, file storage in the GSC and in the local and networked file systems, and login privilege level can be complex. But it is import for installers to understand. If configured properly then the life of the facilities manager in using GreenWorx will be made much simpler.

**GreenWorx files**

To review, during the design process for a GreenWorx installation we have worked with these file types:

- The design file: .gwx
- The template files: .gwt
- Tab backgrounds: image file types like jpg

And while you may have only a single gwx file you may have several template and tab background files.
What happens if you lose one of these files? Well it isn’t good but it depends upon which file you lose. If you lose a template file you haven’t lost much since the entire template information is stored in the fixtures that use that template. You can no longer change the template and have those changes automatically be made to the fixtures that use that template. If you lose a tab background file then you will not see the background on that tab when you load the file. Again, it is a loss but not fatal.

But if the GWX file is lost than that really isn’t good as you will have lost the entire configuration of the installation fixtures and input devices, and all the schedules and masks. It is possible to recreate the file from the installation but it isn’t simple nor can it retrieve all the information. Simply put, you don’t want to lose the GWX file.

What GreenWorx does to help preserve the design file is to store it into spare GSC memory. That way, years can pass without an installation needing any maintenance but if at some point the installation needs to be modified and you – or those that follow you – will not have lost the design file. There are two limitations to GSC file storage.

- Only the GWX file is saved and not the template or tab backgrounds.
- The GSC memory allocated for this is limited and if the GWX file becomes too large then it can’t be stored.

In the chapter on Creating an Installation Design, the concept of a Project Folder was introduced. The idea is to have a single folder where all the various files that comprise the design are stored – the gwx files, the template files created just for this installation, and the tab backgrounds if you use them. When a new design is created, GreenWorx offers to create a project folder and uses that for saving any template files you create and accessing any tab backgrounds you have.

File storage, project folders, and login level

During connection to the GSC you may be given an option to load or to not load that stored file and may or may not be given the option of where to store it on your local or networked disk.

If you login as a User or Facilities Manager you are not given an option to load the file from the GSC. The file is loaded from the GSC or where the connection catalog directs it to be loaded from. Nor are you given the option of where it should be placed on the disk. Both of those options are preconfigured for that level of access.

For Installers and Engineers, you are given the option to load or not to load the design file saved in the GSC. And if you do load the stored design file you are given a chance to determine where in the computer’s file system to store it. If the connection is though a connection catalog, then the default choices come from how the catalog was configured.
This brings up an important consideration: If only the GWX file is stored in the GSC memory, what about the tab backgrounds and template files? Where does GreenWorx find them when the loaded GWX file needs them?

As part of the GreenWorx options, a path is given to the root of the projects storage folder. This could be the path on a local disk or a network path. In Windows a network path starts with a "\" and then contains the networked computer and then the path to a folder. For example, "\BOOKSTORE\Users\Marsha\GreenWorx"

Any project created by GreenWorx is created as a sub-folder of the folder listed as the “Project Storage Folder” in the GreenWorx options.

When GreenWorx loads a GWX file from the GSC memory, it is tagged with the project name and is stored in the folder for that project. That folder is named with the project name and is a sub-folder in the projects storage folder. An example might make this clearer.

Suppose GreenWorx is configured to use” \BOOKSTORE\Users\Marsha\GreenWorx Projects” as the project storage folder. Also suppose that a project called “B3” is stored in the GSC.

When the GWX file is loaded from the GSC it is stored in the sub-folder: “BOOKSTORE\Users\Marsha\GreenWorx Projects\B3”. If the installation team had placed all the template files and tab background images file in that folder then everything just works!

Why is any of this important? It is important for the installation team to decide where project files should be stored so that all users and facilities managers can get access to them. It is doubly important when working with multiple installations accessed by the GreenWorx software using a connection catalog.

The important points to take away from this admittedly difficult topic are these:

- A GreenWorx design may consist of more than one file. Store all the files in one folder. That folder is called the Project Folder

- The path to the folder containing all the Project folders is given in GreenWorx options

- The project folder root can be on the local disk but it can also be on a networked drive. Using a networked drive may be necessary if more than one user will run GreenWorx to login and work with an installation. Using a networked drive means that everyone can get to the project folders. This requires the installation team to put the GreenWorx software on all machines used
by the Facilities Manager and their staff and to configure the GreenWorx software to use the same project storage path.

**Note:** You can also configure GreenWorx not to store the GWX file into the GSC memory. You may need to do this because the file size exceeds the capacity of the GCS memory. Or you may want to handle maintaining – that is, not losing – the file yourself. There is a GreenWorx option for this.

**Note also:** The connection catalog contains information about where project files can be found if they are not loaded from the GSC and, if the GSC file store is used, where to locally store the loaded file. See the Catalog Editor user guide for all the details.

**Connection, part 2**

Once the connection has been made to the GSC and the initial health checks completed then, if logged in as a Facilities Managers or a Users, the design file is loaded as configured in the connection catalog and/or by the GreenWorx options.

For an Installer or Engineer, information about the file stored in the GSC appears.

![File Saved in GSC](image)

The key pieces of information are the project name, the filename of the GWX file, the size of the file and the date and time it was last saved to the GSC. If this is a file you want to use then click *Load File*. A progress bar appears at the bottom of the Connect dialog to track loading the file from the GSC memory.
The next steps in the connection process are these:

- **Check expected versions**
  As part of the Site Info the expected versions of each part of the GSC and GSX can be specified. These expected versions are checked against the actual versions of the GSC and GSXs.

- **Check expected network extenders**
  As part of the Site Info the expected GSX’s can be designated. If a network extender has gone offline this is detected. This step also checks that each GSX is connected to the power line phases in the expected manner. If something has changed – possibly because a network extender was replaced and rewired – this check determines if it is connected to the expected power line phases and in the expected manner.

- **Check acceptable noise.**
  Power line noise can be a problem in communication between the GSC and FCMs and Input Devices. During connection the powerline noise is sampled and if over a set threshold, then this connection step shows as failed.

- **Check system controller programming.**
  The GSC is programmed from a network file. If you do not elect to load the file from the GSC, and a file is already loaded into the GreenWorx software before you connect, then a check is made to see if the loaded file and the file used to program the GCS are the same. If they are not
then this connection step is marked as failed.

- Read occupancy sensor table.
  The state of all occupancy sensors may be known by the system controller and that state is read.

If a step during connection fails then a red mark is made at that step. If a connection step is skipped a yellow mark is made at that step. If the step is successful then a green mark is made at that step.

Not all failures prevent connection. For example, the GSC has a number of error conditions it looks for. If any of these counters are non-zero then that step is marked in red. Some of these counters are important but many are not.

If you are having difficulty in connecting, the connection log – accessed by the Connect Log button – may be helpful for technical support.

Once the connection is completed the right pane shows that you are connected to the GSC and the GSC is connected to the GSXs. The Connect button changes to a Disconnect button.

If a connection to a GSX isn’t available but should be, then the GSX is shown in red.
Site Info

The term *Site Info* is used in the above discussion in several places. The *Site Info* is a place where the specific of the installation hardware is described. This is covered in the User Guide chapter on *Deploying the Design*.

*What’s Next?*

Now that you are connected to the GSC many more actions are possible. In the next chapters the topics of programming, verifying, testing and controlling the installation are covered.

*Your installation*

One of the most important considerations for your installation is how GreenWorx is used by the Facilities Staff and how they connect and access the design. This goes way beyond this User Guide or GreenWorx in general as it must address the needs of the staff and management of the facility. The connection catalog and GreenWorx options may help you configure the installation to best meet these needs.
Chapter 10: Programming

In the first several chapters of this user guide a design was created, organized, and populated with fixtures and input devices. Schedule and Masks also were configured to control it.

In this chapter and the next several chapters, that design is implemented by programming, testing, and controlling it using the facilities in GreenWorx.

It is best to consider this chapter and the next three as steps in a process: devices are programmed, the programming is verified, the devices are tested, and finally devices are controlled.

We begin with programming. Programming is the process by which all the settings and configurations of a device are written to the actual device – fixture or input device – by sending messages to the device using the System Controller.

The Program category

The Program category in the GreenWorx Software appears as:

The Display panel has been described in a previous chapter.

The View panel controls how the icons on tabs appear. When the Program category is the current category, you can see two different views of each icon showing:

- If a device needs to be programmed or not
- If a device programming completed correctly or incorrectly when it was last attempted to be programmed.

How does GreenWorx know that a device needs to be programmed? It records when you make a change – for example, adding a fixture to a zone or reconfiguring input devices – and if that change was made after the device was last programmed then it now needs to reprogrammed.
How does GreenWorx know the results of the last programming operation? During programming GreenWorx determines if the programming of a device was successful or not. That information is saved in the design file.

How are these two different views seen? Select which view to see by ticking one of the two checkboxes in the View panel. Ticking one automatically clears the other – you can’t see both at once.

When viewing *Needs Programming*, fixture icons are colored orange if they need programming and green otherwise. For example,

![Example of Needs Programming view](image)

The two icons at the right side need to be programmed.

When viewing *Programming Results*, fixture icons are colored red if there was a problem with programming and green otherwise. The two fixtures at the right side didn’t program correctly.

![Example of Programming Results view](image)

Also in the View panel is a *Clear View* button. This clears the status kept for the last programming operation. Once the status is cleared all the icons that were colored green or red are shown in white since their status is unknown. The View panel legend helps if you forget these color choices.
Input devices – shown on the Inputs tab - also use colors to show their need for programming and programming operation status. The only difference is that the color is shown as a bar under the icon.

What is programmed in a FCM?

The memory in a FCM is divided into two parts: An id part and a configuration part. The id part contains the unique information that makes it possible for the System Controller to locate and communicate with a specific FCM. The configuration part contains information about which zones and scenes this FCM is part of.

Let’s consider a typical GreenWorx installation for a high-bay factory or a parking structure. In both of these applications many of the FCMs are programmed identically. There may be 100 FCMs on a floor but each FCM that is in the same zone is programmed identically as the other FCMs in that zone.

The GreenWorx software has the ability to simultaneously program more than one FCM as long as they are all to be programmed identically. This can drastically reduce the amount of time needed to program a large installation. Also, given a set of FCMs to program, GreenWorx determines which FCMs are programmed identically and manages the programming in a way to complete it in the quickest manner.

The only factor to be aware of is that simultaneous programming is only for the configuration memory. If the id portion of the FCM memory was included in the programming, then no FCMs would be programmed identically since the id memory is different in each FCM.

Which style of programming should you use? If you are changing zones and scenes, then programming only the configuration memory and allowing GreenWorx to program FCMs in the best manner possible should be used. But if you change anything in a FCM’s id memory like the the panel, circuit and description text fields you can edit in the fixture properties dialog – see the user guide chapter on Fixtures – then you must program each FCM independently.

GreenWorx lets you make the choice of programming method to use. In the Program category ribbon are two panels – Program and Full Program – that contain identical buttons. Program has GreenWorx
program only the configuration memory and to perform that programming in the best manner possible. *Full Program* programs each FCM independently.

**Selecting fixtures to program**

In the two *program* panels are three buttons which start the programming process on possibly different numbers of fixtures. The first button, labeled *Selected fixtures*, programs only those fixtures you have selected in the tab. The second button, labeled *Tab fixtures*, programs all the fixtures on this tab. The last button, labeled *All Fixtures*, programs all fixtures in the design.

You can also program a single fixture by right-clicking on it and selecting *Program* from the popup menu. In this case the full memory of the fixture is always programmed.

**Programming Input Devices**

Like fixtures, *Input Devices* also need to be programmed. They contain the same *id* memory and *configuration* memory like fixtures. However some of their configuration is saved not in the Input Device memory itself, but in the System Controller. But that doesn’t mean that they don’t have to be programmed using the same facilities used with fixtures. The only difference is that the Full Memory style of programming is always used with Input Devices.

**Programming the System Controller**

As described in the user guide chapters on *Schedules* and *Input Devices*, much of the programming for them is stored in the System Controller. The System Controller must be programmed before the Schedules and Input Devices function as you have configured them.

Unlike fixtures or input device, there are no options when programming the System Controller. In the *System Controller* ribbon category is a button labeled *Save*. Press that button to begin the process. Since the System Controller contains many different settings, programming is a multi-step process.
During this process, depending upon how GreenWorx is configured and your login level, the design file is saved to the System Controller memory. This is all exhaustively described in the previous chapter of this user guide.

When you make changes to pieces of the design whose settings are saved in the System Controller— for example a schedule – GreenWorx reminds you that those changes do not take effect until the System Controlled is programmed.

**Tip:** When these sorts “helpful” messages become too annoying, just tick the *Don’t show the message again this session* box and GreenWorx will stop being helpful. At least for a while…
What’s Next?

Now that all fixtures and input devices are programmed, the next step is to verify that programming matches what is stored in a design file.

Your installation

Programming a set of fixtures can take a bit of time but until completed the installation does not operate as you expect. This is also the first time that the System Controller communicates with each fixture and that can have unexpected surprises. Pay close attention to results of programming as it tells you where any problems with FCM installation or communications may be.
Chapter 11: Verifying

Verify is the term used in GreenWorx for when the configuration stored in an object – fixtures, input devices, the system controller – is compared with the configuration stored in the design file for that object.

In the previous chapter, programming of fixtures, input devices, and the System Controller was described. As part of that process, GreenWorx makes sure that the programming was completed correctly. So why should you ever need to verify that the file matches the installation devices?

Saying this rather inelegantly: Things always go wrong. The facilities manager reconfigures an input device and a few days – or weeks or months – later additional hardware is installed and the installer uses an old copy of the design file and that input device change is lost. Or one or more failed devices are replaced and the default configuration in their memory is much different than the design file. Problems like these always happen especially with systems like GreenWorx that run unattended for months and years autonomously before anyone works with them again and no one remembers what changes were made years ago.

There are several Verify mechanisms in GreenWorx:

- Verify that fixture and input device programming matches the design file
- Verify that the System Controller Programming matches the design file
- Verify, separately from the whole System Controller programming, that schedules match the design file.

If nothing ever goes wrong, then Verify is never needed. But in the real world something always goes wrong so it isn’t a good idea to skip this chapter.

The Verify category

The Verify category in the GreenWorx Software appears as:
The **Verify** category looks very similar to the Program category.

The View panel controls how the icons on tabs appear. When the **Verify** category is the current category, each icon shows the result of the last verify operation if known.

How is a verify operation carried out? GreenWorx examines the memory of each device to be verified and makes sure that it matches the configuration specified in the design file. This *examination* can take the form of reading the memory byte by byte or by having the device compute a checksum of its memory and comparing that to a checksum calculated from the configuration in the design file.

**Note:** If you are not familiar with a checksum, it is simply a calculated value on the memory of a device. The same calculation is made on the configuration for that device as saved in the design file. If the two checksums agree then it is assumed that the memory in the device and the configuration in the design file matches.

In the **Verify** category, fixture icons are colored green if they verify, red if they don’t. If the device can’t be contacted it is colored black to show it is unavailable. For example,

![Diagram of fixture icons](image)

The upper right icon is black to show it is unavailable – has not responded to messages – and the second from the right in the bottom row is red to show it has not verified.

Also in the View panel is a **Clear View** button. This clears the status kept for the last verify operation. Once the status is cleared all the icons that were colored green or red are shown in white since their status is unknown. The View panel legend helps if you forget these color choices.
Input devices – shown on the Inputs tab - also use colors to show their verify status. The only difference is that the color is shown as a bar under the icon.

Verify Details

Knowing that a fixture or input device doesn’t verify is useful, but which configuration settings are the cause of the problem? And how can the issue be resolved? GreenWorx helps you answer both questions.

If you want to find out the reason for a device not verifying, right-click on it and select Verify from the popup menu. After the verification processes concludes a Verify Details dialog shows the reason for the verification failure.
In this example, verification was performed on a fixture and the verification failed. In the upper right corner is an icon that tells two things: If the difference is major or minor and how the communications was with the device. In this case GreenWorx has classified the difference as minor and the communication during the verification was good.

The list shows what caused the verification to fail. In this case the *Minimum Off Level* setting was in the design 33% and in the actual device 0%. If there was more than one reason for the failure of the verification, each would be listed.

This dialog gives you two ways to resolve the issue:

- **Make file match device**: The memory in the device is read and the configuration is captured and saved in the design file.
- **Make device match file**: The device is programmed with the configuration settings stored in the design file.

After either operation, the device is marked as verified since the file and the device match. You don’t have to resolve the verification problem if you don’t want to at this point – you can close the dialog with OK without performing either action.

If you select more than one device to verify, at the conclusion of the verification a summary dialog shows the results:

You can direct GreenWorx to perform the same action on all non-verified devices. Those actions are the same as in the single unit verify described above.
Selecting fixtures to verify

In the verify panel are three buttons which start the verification process on possibly different numbers of fixtures. The first button, labeled Selected fixtures, verifies only those fixtures you have selected in the tab. The second button, labeled Tab fixtures, verifies all the fixtures on this tab. The last button, labeled All Fixtures, verifies all fixtures in the design.

Verifying Input Devices

Like fixtures, Input Devices can also be verified. However some of their configuration is saved not in the Input Device memory itself, but in the System Controller. When an input device is verified the memory in the device is read as well as the System Controller memory and two results dialog are shown. The first shows differences in the memory of the input device – same as with fixtures – and the second dialog those differences between the Input Device and the System Controller are shown. For example,

In this case the design file specifies a configuration for the 1st input 1st close event and that does not match what is saved in the System Controller. The same two options as seen before are available to resolve the verification issue.
Reading fixtures: The opposite of programming

When devices are programmed, the configuration stored in the design file is written to the actual devices. As described above verification is used check that they are the same. There may be some circumstances where you find that you want to just accept what is in the fixtures and have that saved in the design file without verifying each one. This action, think of it as the opposite of programming, is started by using the buttons in the Read panel. The three ribbon buttons – Selected, Tab, and All - in this panel determine which fixtures to read.

Verifying the System Controller

As described in other chapters, the System Controller contains many different settings, a calendar and schedules, and the configuration for input devices. All of this configuration can be verified with the design file using System Controller verification. To start a verify use the Verify button on the System Controller category.

The verification checklist dialog shows the status of the verification. In the picture below you can see that the Power Outage Recovery Time Limit setting – described in the Working with the GSC chapter – is not as configured in the design file. You can resolve this by programming the system controller with the Save button to the left of the Verify button.
Schedule Verification

In addition to the System Controller verify described in the previous section, you can also verify the schedules alone. In the Schedule category use the Verify button to begin the process.

A popup tells you the number of schedule entries read from the System Controller and then the report dialog shows any differences. Choose the schedule to see from the Show Schedule dropdown. The entries in the list are color coded to show which schedule entries are the same in the design file and the
System Controller, which are in the design file only and not in the System Controller, and which are in the System Controller only. They key at the top of the dialog shows the color code.

To resolve the schedule verification issues there are two choices:

- You can close the verification report dialog and program the System Controller.
- You can use the Read from System Controller button in the report dialog as shown above. This reads the schedule entries from the system controller and saves them in the design file. This is similar to the Read operation described above for devices.

**What’s Next?**

Now that all fixtures and input devices are programmed, the next step is to test that there is acceptable communication with all fixtures and input devices, as well as proper operation of them.

**Your installation**

Verification is a tool that can really help avoid problems. If you get in the habit of using the verification tools – especially the System Controller verification which is very quick – you can prevent problems that happen when changes are made and not saved or changes are made by different people.
Chapter 12: Testing

In the previous two chapters, programming and verifying of fixtures, input devices, and the System Controller was described. In this chapter we turn our attention to testing fixtures and input devices and the facilities in GreenWorx for checking fixture function and communication between the System Controller and the devices in your installation.

Communication between the System Controller and devices is the cornerstone of a GreenWorx installation. Usually this communication is problem free but in some circumstances there may be issues related to powerline noise or signal attenuation. The tools described in this chapter are used to make sure that good communication exists between the system controller and each device.

Also in this chapter are the facilities to test the function of devices. Does a fixture actually go to High when controlled to High? Does it go off when told to? Also, do input devices send commands when the sensor is activated or a keypad button is pressed?

Finally, at the end of this chapter a tool is described that can create a report of the communication and function of each fixture in an installation. This report, in one easy to read format, shows any fixtures that have problems – poor communications, incorrect programming, or a failed ballast or a burned out bulb.

The Test category

The Test category in the GreenWorx Software appears as:

The Test category looks very similar to the Verify category.

The View panel controls how the icons on tabs appear. When the Test category is the current category, each icon shows the result of the last communications test operation if known.

In the test category, fixture icons are colored according to how well the communications is between the System Controller and the fixture. Green is used for good communication, orange for low communication, red for poor communication, and black if the fixture doesn’t respond at all.
For example,

The upper right icon is black to show it is unavailable – it has not responded to messages. In the second row the two icons at the right are orange to show less than good communication.

Also in the View panel is a *Clear View* button. This clears the status kept for the last communication test. Once the status is cleared then all the icons are shown in white since their status is unknown. The View panel legend helps if you forget these color choices.

Input devices – shown on the Inputs tab - also use colors to show the results of the last communication test. The only difference is that the color is shown as a bar under the icon.
Running a Communication Test

The first step to running a communication test is to set what constitutes *good and less than good* communication. This is done in the *Green Level* and *Yellow Level* controls in the *Communication Test* panel.

![Communication Test Panel](image)

The settings in the above picture work like this:
- If the communication level is greater than 20, then communication is good and the icon colors green.
- If the level is greater than 10 but less than 20, then the communication is low and the icon colors orange.
- If the level is less than 10 but the fixture does respond, then the communication is poor and the icon colors red.
- If the fixture doesn’t respond at all then the fixture icon colors black to show it has not responded.

What are these values and what units are they expressed in? Unfortunately that is beyond the scope of this user guide. While the values depend upon each installation, in general, the GreenWorx software default values selected are a good starting point.

Unlike other places in GreenWorx where a popup dialog is used to show progress for a task, in this case a panel appears in the end of the ribbon showing the progress and containing a button to stop the test.

![Progress Panel](image)

**Tip:** When a panel like this is used to track the action of an operation, you are free to change tabs or scroll around in a tab. This can be very useful! As the test progresses, the state of icons change as they are tested which makes it easier to monitor the test.
Selecting fixtures to test

In the Communication Test panel are three buttons which start the test process on possibly different numbers of fixtures. The first button, labeled Selected fixtures, tests only those fixtures you have selected in the tab. The second button, labeled Tab fixtures, tests all the fixtures on this tab. The last button, labeled All Fixtures, test all fixtures in the design.

You can also test a single fixture by right-clicking on it and selecting Comm Test from the popup menu.

Communication Testing Input Devices

Like fixtures, Input Devices can also be tested for communication. Select the icon for the input device on the Inputs tab, right-click and select Comm Test from the popup menu. The test dialog is the same as shown above when testing a single fixture.

The Response Test: A quick minimal test for fixtures

The communication tests can take a while to run. A very quick test is what is called the Response Test. In this test each fixture is asked to respond to a message sent. The advantage of this test is that only one message is sent from the System Controller and each fixture responds very quickly. Unfortunately, the quality of the communications can’t be evaluated by this test – only the presence or absence of a fixture can be detected.

To start this test, choose one of the usual Selected, Tab, or All buttons in the Response Test panel. When this test completes the tab icons are colored green if they respond and black otherwise.

Function Testing Fixtures

In addition to testing the communication between the System Controller and a fixture, you can also test if the fixture is operating as expected. This test requires someone at the GreenWorx software and someone to actually look at the fixture to see if it responds.

To begin a function test, right-click on the fixture and select Test from the popup menu. The Test tab of the fixture properties opens.
Four buttons can be used to control the fixture On – or “High” - Off, or to any of the levels that are used in its Lighting Control Table – see the Templates chapter for a description of the Lighting Control Table. The device can also be started blinking at a rate specified. Use the Off button to stop it blinking.

Why is this different than controlling a zone to High or off or to any scene that includes this fixture? This type of functional test controls only a single fixture.

You can also control a single fixture or selection of fixtures by selecting then in the right pane when in the Program, Verify, Test, or Control categories. Right click on one of the fixtures in the selection and select Fixture Control and the level desired.
Function Testing Input Devices

There are no specific features in the GreenWorx software for function testing an input device. However you can use the Send/Receive Log – described in the Monitoring Tools chapter – to watch as commands are sent from the input device and received by the System Controller. Again, it may be necessary to have two people to do this: One to watch the log and the other to press keypad buttons or to trigger sensors.

Network Checkup

The Network Checkup tool is like “One Stop Shopping” for testing an installation. Any number of fixtures, from a single fixture to all fixtures, can be tested for communications, ballast/bulb problems, and to see if they are verified with the design file. A complete, easy to read report is produced that shows the results with the problem fixtures highlighted.

If this tool is used periodically and the results given to the facilities maintenance staff, they can use it locate and replace failed fixtures, and burned out bulbs, without having to manually check each fixture.

To begin a Network Checkup, press the Start Checkup button from the Network Checkup panel:

The Network Checkup dialog opens:
Select in the *Check-up Configuration* box the test options wanted.

You can test all fixtures, fixtures only on a selected tab or a set of fixtures from a named selection. To create a named selection, review the Advanced Selection dialog in the Fixtures chapter.

Depending upon how configured, a network checkup performs these tests:

- The same verification as described in the previous chapter.

- If the FCM has the requisite hardware, a test is made for the working ballasts – in fluorescent fixtures – and bulbs. This determination is based upon the amount of current being used by each ballast in the fixture.

- A communications test that checks the quality of communications of messages sent to the fixture from the System Controller and for messages sent from the fixture and received by the System Controller. The quality of the communications is determined in the same manner as described above for the communications test.

Once the test is configured, press the *Start* button. The test begins and an estimated time to completion displays. If you want to stop the test press the *Stop* button.

When the test completes press the *Save Report File* button. This report contains information on all fixtures tested unless you tick the *Report only failed fixtures* box.
What’s Next?

Now that all fixtures and input devices are programmed, verified, and tested, the next step is actually controlling the installation from GreenWorx – controlling fixtures and zones.

Your installation

As part of installing a GreenWorx system the communication test tools should always be used to identify any problem areas. Periodically using the Network Checkup tool to check not only if any fixture has ballast or bulb problems, but also the communications between each fixture and the System Controller, is an excellent idea. The power to an installation and what in the installation consumes power may change and those changes could introduce noise that may affect communications. Periodic testing ensures correct operation and finds problems before they become a crisis.
Chapter 13: Controlling

In the previous chapters, devices were programmed, verified, and tested. In this chapter devices are finally controlled. The various methods to control zones and individual fixtures are described. Also in this chapter the methods to request fixture light levels, sensor status, and the health status of fixtures are described.

Fixture Control Modules contain optional hardware that, in conjunction with the FCM firmware, detects when a ballast or bulb has failed or when the fixture temperature has gone over a set limit. Checking the fixture to see if this system has detected these problems, over the course of the last several hours, is referred to as the *Health Check* of a fixture.

The Control category

The Control category in the GreenWorx software appears as:

![GreenWorx Control Category](image)

The View panel controls how the icons on tabs appear. When the *Control* category is the current category, you can see two different views of each icon showing:

- The current light level of the fixture
- The results of the last fixture health check

How are these two different views seen? Select which view to see by ticking one of the two checkboxes in the View panel. Ticking one automatically clears the other – you can’t see both at once.

When viewing *Light Levels*, fixture icons are colored according to their current light light level. For example,
In the picture most of the icons are on High and are shown in yellow. Two of the four icons on the right are off – shown in gray - and two are set to medium – shown in orange.

How does GreenWorx know the state of any fixture? As long as GreenWorx is connected to the System Controller it receives all Zone control commands sent by the System Controller to the installation. Using the information in the design file and the command information, the status of effected fixtures can be tracked.

However when you first connect to the System Controller, GreenWorx does not know the status of any fixtures. You can leave the software connected and over time, as Zone control commands are sent by the System Controller in respond to schedules and Input Devices, the status of all fixtures become determined. Another method to determine the status of all or a selected set of fixtures is to use the Get Light Levels operation.

When viewing Ballast/Bulb status, fixture icons are colored green if there was no problem noted during the health check, and orange if there may be a ballast/bulb problem. In the picture below there is one fixture that shows a possible problem.

Also in the View panel is a Clear View button. This clears the status kept for the last get light levels or health check. Once the status is cleared all icons are shown in white since their status is unknown. The View panel legend helps if you forget these color choices.
Input devices don’t have status nor do they have the health check facilities. In the *Control* category when the *Inputs* tab is selected no colored bars are shown under Input Device icons as in the other categories.

**Controlling zones and fixtures**

There are several ways to control a zone. The method that is always available is to expand a zone name in the left pane, then right-click on a scene name, and then select *Activate* from the popup menu.
A zone activation command is sent from the System Controller to the selected zone to set it to the selected scene. A popup shows the message being sent. This popup automatically closes when the command transmission is completed.

The other method to control zones relies upon assigning a color to a zone. Once a color is assigned to a zone then the background around an icon shows that color. A right-click on that color shows a popup menu that lets you activate the zone. In this example, a right click was made on the yellow around the icon – yellow was selected as the zone color for this zone.

If you don’t assign a color to a zone then this method can’t be used.

Individual fixtures can also be controlled. Select one or more fixtures then right click on one and select the level desired.
When controlling fixtures in this manner, unlike zone activation, a separate command must be sent to each fixture in the selection and this can take some time. A popup progress dialog shows the action and gives you a chance to stop the operation.

Get Light Levels

As described at the start of this chapter, unless GreenWorx is connected to the System Controller when zone activation commands are sent by the System Controller, the state of the fixtures that are part of that zone is not known.

To have GreenWorx determine the light levels of one or more fixtures, the buttons in the *Get Light Levels* panel are used. As usual, you can carry out the operation on *selected* fixtures, all fixtures on the *tab*, or *all* fixtures in the installation.

GreenWorx may use a method, depending upon the number and type of fixtures to be interrogated, that doesn’t require that a separate command be sent to each fixture.

If during the operation to get light levels, any fixture that doesn’t respond is colored red to show it is missing.

**Note:** In other categories black is usually used to show fixtures that don’t respond. Red is used in this category because a fixture that is OFF shows in a gray color and that is too close to black to be visually distinguished.

Health Check

As described at the start of this chapter a health check can be performed on a selected set of fixtures. Those fixtures that are experiencing possible problems are shown in orange and fixtures that pass the health check are in green.

Not all FCMs have this additional hardware and firmware and even if they do, then this feature must be first configured before it works. That configuration is made as part of the FCM settings in the Template as described in the *Templates* chapter.

**Note:** The health check when looking for bad ballasts and bulbs is performed by monitoring the usual or expected current used by the fixture. If that current is less than expected then there is a *possible* ballast or bulb problem. It takes several hours after the fixture has been powered on and at a High level before the firmware can make a determination of what is normal.
Input Device State

In the Input Devices chapter the configuration of inputs to the Zone Lighting Controller, the Input Sense Module, or the Voltage Sense module was discussed. Similarly to fixtures it is possible to request the state of an Input Device’s inputs. That is, what state are the inputs at? Are they Set or Clear (open or closed, on or off)?

To request the state of an Input Device right click on the Input Device icon in the Inputs tab and select Get Status from the popup menu.

A popup dialog shows the decoded status reply:
Enabling and Disabling Input Device’s inputs

In the System Controller chapter in this user guide, various methods of enabling and disabling Input Devices were presented. All of those options effect either all input Devices or all Input Devices whose inputs are connected to a specific type – open/close, photo, or occupancy - of sensor. You can also disable a single Input Device input. Right click on an Input Device and select Sensor Enable or Sensor Disable and then the kind of sensor.

When retrieving the status of an Input Device, the enabled / disabled state of an input is also shown along with the open / close status of the input itself. In the decoded status reply pictured above, the state of the four inputs on the Zone Lighting Control are shown. Each is also shown as Enabled. The text would show Disabled otherwise.

Note: It isn’t possible to disable a specific input, say input #1 or #2. All that can be done is to disable all inputs that are configured for a specific sensor type.

Occupancy Sensor State

In GreenWorx there are additional facilities for Occupancy Sensors attached to Input Devices. In the Input Devices user guide chapter the facilities for adding occupancy sensor icons to fixture tabs – that is to tabs other than the Inputs tab – was discussed. If you have placed icons for occupancy sensors on those tabs then these facilities can be used. The three buttons in the Get Sensor State panel begin this process.
A message is sent to each Input Device that is connected to one of the selected Occupancy Sensors and its state is determined. The Occupancy Sensor icon shows the state of the Occupancy Sensor.

In the above picture, three Occupancy Sensors are in the closed state and one in the open state.

What’s Next?

The next chapter of the user guide discusses the method for updating the firmware in devices and Input Devices.

Your installation

While the bulk of this user guide is devoted to creating a design, the majority of time you will spend with the GreenWorx software is to use it to control and monitor an existing installation. Once schedules and zones have been created and tweaked to get the exact function needed in your installation, what remains is to use GreenWorx to periodically monitor the installation.
Chapter 14: Remote Firmware Update

This chapter describes the facilities, called Remote Firmware Update or “RFU”, used to update the firmware in FCMs and Input Devices. This is an Advanced Topic and should only be performed by experienced users. It is only available at the Installer privilege level.

Don’t confuse RFU with programming as covered in a previous user guide chapter. Programming is the process by which the configuration of a device – zones and scenes - is written to its memory. RFU updates the firmware storage memory of a device. The term Remote is used because the firmware, like programming, is done from the GreenWorx software by sending messages to the device using the System Controller. Firmware is not updated by having to open the physical device and replace memory chips.

What is firmware?

Stored in permanent memory in each fixture and Input Device is a program that defines how the device operates. This stored program allows the device to send and receive messages and to carry out the actions of those messages. This program is saved in a type of memory that can be read and written but also retains its contents even if the power to the device is lost and restored.

Why update Firmware?

Like any program, periodically new features are added and issues resolved. If the firmware in devices is updated then those new features are available for use and problems you may have been experiencing are resolved.

Firmware is only one part of the operation of a device as the hardware is, obviously, also very important. If a new feature is added to the firmware in support of a new hardware feature, then upgrading the firmware in a device that lacks that additional hardware has, at best, no effect, and at worst prevents the device from operating at all. During the first phase of firmware update, a check is made to ensure that the new firmware should be installed in the existing hardware.

The Firmware Update category

The Firmware Update category in the GreenWorx software appears as:
The View panel controls how the icons on tabs appear. When the Firmware Update category is the current category, you can see three different views of each icon showing:

- If there is a later version of the firmware in a device is available.
- If firmware update completed correctly or incorrectly when it was last attempted.
- In the device’s stored firmware matches the expected contents for its version.

How does GreenWorx know that more recent firmware is available for a device? Included in each GreenWorx software installation are firmware files for all GreenWorx products – fixtures and Input Devices. The firmware files are periodically updated from the GreenWorx manufacturers support website. Each firmware file is tagged with a version number. Stored in each device is the version number of the firmware it is running - you can see this version number on the Id tab of the device’s properties dialog. A simple version comparison is done to see if later firmware is available for a device.

How does GreenWorx know the results of the last update or verify operation? During these operations, GreenWorx determines if the update or verification of a device was successful or not. That information is saved in the design file.

How are these three different views seen? Select which view to see by ticking one of the three checkboxes in the View panel. Ticking one automatically clears the others – you can’t see more than one at once.

When viewing Needs Update, fixture icons are colored orange if they need updating and green otherwise. For example,

The two icons at the right side do not contain the latest firmware.
When viewing *Update Results*, fixture icons are colored red if there was a problem with updating and green otherwise. The two fixtures at the right side didn’t update correctly.

When viewing *Update Results*, fixture icons are colored red if the didn’t pass firmware verification and green otherwise.

Input Devices can also have their firmware updated and, as with other categories, the status is shown by a colored bar below the Input Device icon.

Also in the View panel is a *Clear View* button. This clears the status kept for the last update and verify operations. Once the status is cleared all the icons that were colored green or red are shown in white since their status is unknown. The View panel legend helps if you forget these color choices.
Important considerations before beginning a firmware update

When you begin a firmware update a warning dialog is shown.

As the text in the dialog says, RFU takes time and during the time it is happening the installation does not behave as normal. Read and close this dialog and then the RFU setup dialog opens.
RFU can be performed on a single device or a selection of devices. Given the time it takes to complete, updating many devices simultaneously is a good idea. RFU is started by using one of the two buttons in the Firmware Update panel in the ribbon. You can either perform RFU on a section or on the tab fixtures. The third option seen in other categories – the All Fixtures option – is not available in RFU.

If you are updating more than one device then they must all be of the same type as the firmware is different for each GreenWorx product.

The first step is to press the Check button. This checks to see if all the devices in the selection are of the same type and if all can be updated to the same firmware version. As an example, after the Check button was pressed the dialog updated to show this:

![Check dialog showing device selection and firmware versions](image)

This tells you that the devices in the selection – there were 6 – are all Fixture Dimmer Quad devices and their existing firmware version was 1.85 and they all can be updated to firmware version 1.91.

The settings in the Update Options box in the dialog control how RFU proceeds. The default values are correct for most installations.

As soon as firmware update starts, if the selected devices are fixtures they are controlled to High and then the RFU process begins.

During the time that RFU is running you can follow its progress by putting the tab into List View. There are additional columns in the list that show the status each section of the firmware as it is being updated.

When firmware update completes the normal function of each device is restored.

**Firmware Verify**

RFU is very careful to make sure that the firmware is written correctly to each device. But as discussed in the Verify user guide chapter, sometimes things can go wrong. Firmware Verify provides a means to checks that the firmware in the device matches the firmware file available from the GreenWorx manufacturer.
To begin firmware verify either select fixtures and use the *Selected Fixtures* button in the *Firmware* Panel or use the *Tab fixtures* button to check all the fixtures in the tab. When the firmware verify operation completes, the tab icons color to show the results as described above.

**What’s Next?**

This chapter completes the chapter set that began with *Programming*. All of these chapters focused on fixtures and Input Devices and their configuring and control.

In the remaining chapters of this user guide various additional topics are covered discussing different aspects of deploying and monitoring an installation, working with the System Controller, and other specific topics related to the GreenWorx software.

**Your installation**

When should firmware be updated in an installation? As with all questions of this type: It depends. If everything is working correctly then the maxim of “if it is not broken then don’t fix it” is always a good policy. However, by continuing a relationship with the installation commissioning team and the GreenWorx manufacturer, you will know when firmware updates are available and if they are appropriate to your installation.
Chapter 15: Monitoring Tools

This chapter describes tools that you can use to monitor the operation of the installation. These are:

- The Send and Receive log
- The Zone log
- The Power meter graph and list

Send and Receive Log

Communications between the System Controller and the FCMs and Input devices in an installation are through messages. Each of these messages contains several parts: They describe where the message came from and where the message goes to, the action that initiated the message or what action the message should carry out, and any additional information necessary.

For example, when the System Controller sends a command to the installation to activate a zone to High, that message comes from the System Controller and goes to all FCMs. Included are the zone number and the level. Those FCMs that are part of the zone respond by being set to High. When a button is pressed on a Zone Lighting Controller keypad, a message is sent from the ZLC to the System Controller. The System Controller carries out the action associated with that button.

All these messages represent the dynamic activity of the installation. If you could watch that activity over time you would have an excellent window into how the installation behaves. You also have an excellent tool to ensure correct operation. For example, at 10pm a certain zone should be set to Low. Is it? When an occupancy sensor is triggered, two zones should come on. Do they?

The Send and Receive log is there to answer those questions. The GreenWorx software “listens in” on all the messages sent and received by the System Controller and records them in a file. To configure the location of that file, select from the Application Menu, GreenWorx Options, and look on the Log tab.

**Note:** If you are using a connection catalog to access multiple installations, the GreenWorx software adjusts the log path to place the log file in the Project Folder so the log entries from one installation are not mixed with others.

To open the Send and Receive log, Press the Log Viewer button in the System Controller category and the log viewer dialog opens.
The Send and Receive log shows each message sent in an installation over time. The columns shown are:

- **The time the message was received.** If you are connecting to an installation in a different time zone than the computer that is running the GreenWorx software resides in, note that the times shown are the *installation time* and not the *local time* where the computer resides. For example, if a zone is scheduled to be activated at 10am, the log shows that happening at 10am but – assuming the installation is in Michigan and the computer is in California - the entry appears in the viewer at 8am local California time.

- **The message source.** If nothing is listed then the source of that message is the System Controller.

- **The command.** In the above example several Heartbeat messages are shown as well as several Zone Activate commands. The command is decoded as much as possible into the terms and names that the installation design uses.

There are several buttons at the bottom of the dialog.

- **Clear Log.** All log entries are cleared. There is no undo action for this.

- **Export Log Contents.** This provides a method to capture the log into a format that could be saved or imported into spreadsheet or database programs.

<table>
<thead>
<tr>
<th>Time</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/30/2013 8:06:31 AM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 8:07:32 AM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 8:10:32 AM</td>
<td>Main Gym to High</td>
</tr>
<tr>
<td>10/30/2013 9:00:31 AM</td>
<td>Main Gym to Medium</td>
</tr>
<tr>
<td>10/30/2013 9:07:32 AM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 9:30:31 AM</td>
<td>Practice Gym to High</td>
</tr>
<tr>
<td>10/30/2013 9:30:32 AM</td>
<td>Practice Gym to Off</td>
</tr>
<tr>
<td>10/30/2013 10:07:32 AM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 11:07:31 AM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 12:07:31 PM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 12:54:51 PM</td>
<td>Soland 2LC [3501]</td>
</tr>
<tr>
<td>10/30/2013 12:54:52 PM</td>
<td>MEDIUM button Zone 2</td>
</tr>
<tr>
<td>10/30/2013 12:59:46 PM</td>
<td>Practice Gym to Medium</td>
</tr>
<tr>
<td>10/30/2013 12:59:46 PM</td>
<td>OFF button Zone 2</td>
</tr>
<tr>
<td>10/30/2013 1:07:31 PM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 1:07:31 PM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 3:07:31 PM</td>
<td>Heartbeat</td>
</tr>
<tr>
<td>10/30/2013 4:07:31 PM</td>
<td>Heartbeat</td>
</tr>
</tbody>
</table>
The *Set Time Range* button gives you the ability to limit the number of log entries shown by limiting what is seen to entries made during a specified time.

![Image of Set Time Range button](image)

**Big Important Note:** The Send and Receive log, and the Zone Log discussed in the next section, are only a facility provided by the GreenWorx software. If the software is not running and connected to the System Controller then new entries are not being added to the log file. During the time that the software is not connected to the System Controller any messages sent are not logged.

The Log doesn’t record all messages. It doesn’t, for example, record any of the messages used by GreenWorx to program or verify fixtures and Input Devices.

**Zone Log: An alternative log view**

The *Send and Receive log* described in the preceding section shows each zone control message and the time it was sent by the system controller. But even with the log, visualizing how the zones in an installation are controlled over time can still be challenging. The Zone Log provides an alternative view of the *Send and Receive log*. Taking the same data, the Zone log shows in 15 minute time blocks the state of each zone in an installation.

To open the Zone Log, press the *Zone Log* button in the System Controller category.
The columns of the zone log are:

- The installation time. The state of the zone is shown every 15 minutes starting when the Send and Receive log starts and ends at the current time.
- The power used by the installation at that time considering all fixtures
- A column for each zone and the state of that zone at the time. In this example, there are three zones. The zone state is given in text and also in the same color scheme as used by fixture icons to show their state.

A similar set of buttons is at the bottom of the zone log viewer to set a display time range and to export the log to an external file.

The zone log viewer isn’t magic! It is subject to the limitation of what is in the log file. If you have not had GreenWorx connected to the System Controller for a useful period of time, the Zone Log Viewer shows nothing useful as well.

**Tip:** Back in the *Schedules* chapter the simulation tools in GreenWorx were covered. These tools are used to simulate how a schedule controls an installation over time. The *Zone log viewer* is the real world companion to that simulation. While the simulation shows the *expected* results of a schedule, the zone log viewer shows the *actual* effects of a schedule and any Input Device actions over time.
Power Meter

The Power Meter is a set of tools in GreenWorx to see current and expected power usage in an installation. All these tools are available from the Power Meter ribbon category.

The first step to using the Power Meter is to configure the power graph. Press the Power Meter Setup button in the ribbon. The setup dialog opens.

The Power Meter displays information about the power usage of fixtures grouped into zones, or the fixtures on a tab, or both.

Select the zones or tabs that you want to see in the power meter. Move them from the left list to the right list using the arrow buttons. The bars in the power meter are in the order – left to right – as the zones or tabs appear in the right list – top to bottom. You can arrange the bar order by using the Move Up and Move Down buttons.
Also select if GreenWorx should attempt to scale the graph and display graph rule lines or if you want to make these choices yourself. When all your selections are made, close the dialog with OK.

**Tip:** If you are using overlapping zones then showing power usage by tabs might be a better way than by zones. With overlapping zones, the sum of the power shown by all power graph bars is larger than the installation power usage since fixtures in overlapping zones contribute to the power totals more than once.

With the specification set, the Power Meter graph displays in the right pane.

![Power Meter Graph Example](image)

One important property of the Power Meter is that it takes into account the power usage of any non-controllable fixtures. These fixtures are assumed to be on 24/7. The height of each bar is determined by the maximum power usage of the zone or tab. This is computed as the power usage with every fixture on High.

In the above example, the 1st floor contains many non-controllable fixtures and even though no zone controllable fixtures are on, the power usage is still approximately 4.5 kw.

You can also view this same information in a tabular form. Press the *Show List* button in the ribbon. The right pane changes to a list form.
The tabular form shows several additional pieces of information: The current power usage, as the graph shows, and also the power usage in each of the system scenes and user defined scenes.

In the Power Meter ribbon category, in the Lighting system power usage: Current panel is a horizontal single bar graph that shows the current power usage of the installation as a whole.

Both the graph and the tabular list show the instantaneous power usage (kilowatts). To show power usage over time (kilowatt hours), another feature of the power meter can be used.

**Power Usage Over Time**

In the power meter category is a panel labeled Lighting System power usage: Over Time. In that panel are a number of tools who’s use is best shown by an example: To determine the power usage over the course of the next seven days, select from the Time Period dropdown Next 7 days then press the Update button. The right pane shows the results:

The zone and/or tabs the power meter is configured for are listed in the 1st column. The total power usage in the time range is listed in the 2nd column. If the Compare to ON 24/7 option in the ribbon is ticked then additional data displays in a 3rd and 4th column. These show what the power usage would have been during the time period if all fixtures were On. The percentage reduction is shown in the 4th column.

**Tip:** Using the Power Meter is an excellent way to see, during installation design, the effectiveness of the zones and scenes you design in power savings.
Graph Options

When the power meter graph is displayed there are two additional options.

- Set Graph Tile. You can supply a text title that displays above the graph
- Save Graph image to file. This option creates a JPOG file of the current displayed graph. This can be useful in documenting power usages.

What’s Next?

The next chapter continues with some additional tools designed to help you deploy the design into an actual installation.

Your installation

GreenWorx is all about two things: Control and Power Management. The Power Meter tools show the effects of zone and control choices made during design. It answers the big questions: What are the power savings now and, if the design is modified, what would the power saves be in the future?
Chapter 16: Deploying

This chapter describes two tools used as part of the commissioning process.

The User Manager is a tool to update the System Controller table that lists individuals authorized to connect to the System Controller and their privilege level.

The Site Info dialog is a location to configure what the expected conditions should be when making a connection to the System Controller.

Users and Privilege levels

A GreenWorx installation is a complex system. Using the tools in the GreenWorx software incorrectly or inadvertently can yield unpredictable results. To prevent both unauthorized control and change of the installation, a login system is implemented by the System Controller. Before anyone can access the System Controller they must first log in with a user and a password. Besides granting them access they also are assigned a privilege level that controls both what they can do and what they see. The four GreenWorx privilege levels are:

- **User.** A user can control the installation zones and fixtures. They can view but not update schedules and Input Device configuration, and the System Controller settings.

- **Facilities Manager.** A facilities manager can perform all acts a User can plus additionally modify schedules, masks, and Input Device configuration.

- **Installer.** An Installer can do all that a Facilities Manager can and in addition configure all aspects of the design including, but not limited to, changing the GSC settings, creating and modifying zones, etc. Basically, everything documented in this user guide is available to the installer.

- **Engineer.** An Engineer can perform all that an Installer can do with additional access to diagnostics and tests. Those diagnostics are not described in this user guide.

Each level user is allowed to add or modify users at privilege levels below their level. For example, an Installer can create Facilities Managers and Users but not other Installers. In the same way, Facilities Managers can create Users but not Installers.

During connection to the System Controller the login dialog opens:
This dialog doesn’t appear until communications have been established with the System Controller. The current time on the System Controller as well as the installation sunrise and sunset are shown.

Enter a User name and password and press Login to access the System Controller. If the user name and password are found in the user table, then connection continues.

**Facilities Manager and User**

Up until this point, every picture in this user guide of the GreenWorx ribbon showed what an Installer or Engineer sees. When logged in as a Facilities Manager or User, the ribbon appears as:
Note that only the System Controller, Power Meter, Schedules, and Control categories are seen. The other categories are not present since they contain functions that a User or Facilities Manager can’t perform.

Even though some buttons appear when logged in as a User, attempting to use them is blocked at the User privilege level. For example, if a User attempts to change the time on the System Controller, this dialog appears,

![Update User Table dialog](image)

### Updating the User Table

Updating the User Table is done by using the *User Manager* tool. The button for this tool is in the System Controller category. When pressed, the User Manager dialog opens:

![User Manager dialog](image)
Information on the currently logged in user is shown in the My Account box at the top of the dialog. A user can change their own password but not their user name.

In the Account Management box is a list of all users at lower privilege levels then the currently logged in user. In this example the current user is an Installer so the list contains Users and Facilities Managers. The three buttons at the bottom of the dialog – Add, Edit, and Delete – are used to create a new user, modify an existing user, or delete a user.

When adding a new user, their user name and password are entered and their privilege level specified.

![User Properties](image)

The Engineer level has a pre-defined password and user name that can’t be changed.

**Site Information**

Site Information is used during System Controller connection to verify that the installation is as expected. This comprises these three optional tests:

- The version levels of the System Controller and System Extenders are as specified.
- Which system extenders should be present?
- What level of power line noise is acceptable?

Why are these tests important? A GreenWorx installation is long-lived. Because of the robust nature of the hardware and firmware and the 20 year calendar, an installation can operate autonomously for long periods of time. When connecting it is always a good idea to at least minimally see if conditions are as expected.

The Site Information dialog is opened from the System Controller category and is a multi tabbed dialog containing configuration for the tests described above and also gives some overall information about the installation.
Site Info: Setup

The site info tab is:

The expected GreenWorx versions are given in the 1\textsuperscript{st} part of the dialog. The expected system extenders are given in the next part of the dialog.

**Tip:** GreenWorx communication is often so good that if an extender goes offline you may not notice as messages still make it from the System Controller to the fixtures. But there is no guarantee of this! You should definitely use the site info to establish which extenders should be preset in the system so this can be checked.

The noise levels are in the same units as described in the user guide chapter on *Testing*, in the section on communication tests.

As stated above, these startup tests for versions, extenders, and noise are optional and are enabled or disabled by the three checkboxes at the bottom of the dialog.
Site Info: Network

The first tab of the Site Info dialog contains the System Identification and Network Summary.

Listed in the *Network Identification* box is the same information as was supplied when the design was created. It is possible to change the system name, ID, and/or password but it is not an action that should be taken lightly! A change to the ID or password requires re-programming of *every* fixture and Input Device in the installation.

The *Network Summary* box contains a summary listing of all the fixtures and Input Devices in the installation grouped according to their type. Each type is broken down to show the number working, not controllable, not installed, and needing replacement. These four properties are set for a fixture or Input Device by opening their properties dialog and modifying these settings.

Site Info: Location and Installer

The final two tabs of the Site Info dialog provide a place to record the installation location, installer and contact information for both. This can be useful for installers who commission and maintain several installations.
What’s Next?

The next chapter of the User Guide examines a topic that no one likes – documenting the installation. Of all aspects of creating and maintaining an installation, this is in many ways the most important and also the least done. GreenWorx has several tools that may make this job, if not painless, at least palatable.

Your installation

As part of the commissioning process, both the site info and the user manager tools must be used or the staff charged with managing the installation will be unable to gain access to the System Controller. It is NOT a good idea to setup one installer account and leave that user name and password with the management team.
Chapter 17: Documenting an installation

This chapter describes the GreenWorx software tools for documenting an installation and keeping track of changes. There are three tools described in this chapter.

- Printing
- Capturing tab images
- Change Log

A GreenWorx installation is comprised of many parts potentially distributed over a physically large area. Also, it can run autonomously for a very long period of time. Because of these two factors, you may find that knowledge of the installation can get lost. The tools in this chapter can, if used, help you document the installation in a way that can be referred to at a later date to refresh your memory or transfer knowledge of the installation to others.

The most important documentation of an installation is, of course, the design file. In the Online Operations chapter the facilities to store the design file in the System Control memory are discussed. This is an excellent way to prevent loss of the design file.

Printing

As with most Windows programs, you can create a printout of the loaded file. Select from the application menu Print, or hover the mouse over Print and a sub-menu opens that gives you access to other printing options.

Note: if you chose Print Preview, a special preview ribbon replaces the GreenWorx ribbon. It remains open until you are done with print preview and close it.

The printout from GreenWorx contains these sections:

- The System identification including this network id and password
The same system summary available from the Site Info dialog. This shows the number and type of each device in the installation and which need replacement, not installed, etc.

- The name and number of each zone.
- A listing of all fixtures showing their unit id, the three text fields in the id – the panel name, circuit name, and description - the firmware version, the template assigned to the fixture and the zones – by number – the fixture is part of.
- A text representation of all schedules and their schedule entries.
- The configuration of all masks.
- The configuration of all input devices.
- The change log.

**Tip:** Rather than actually print to paper, there are a number of low-cost print drivers that create PDF files. Once a PDF “printer” is installed you can print to a PDF file rather than to a stack of paper.

**Capturing tab images**

As part of the document for an installation, you can select from the Tab menu Save Tab Image as File. This can be done from any category that shows tabs. A JPG file is created showing the tab with all icons and drawing elements on it. The icons appear in the same colors as they are in the tab at the time you created this image file. A File-Save dialog is used so you can name the file.

**Tip:** One possible use for this would be to create images of the design’s floors - or areas or building or however you have organized the installation into tabs – showing the zones and scenes.

**The Change Log**

The change log is a tool that can be used to make notes that are stored in the design file. The intent of those notes is to capture any details about changes or operation, but there are no specific requirements of the note. The name of the user – from the login – and the date and time are automatically added to the note.

To open the Change Log, press the Change Log button in the System Controller category. The change log dialog opens.
In the left pane of this dialog shows a list of the notes in the file with their date time of when they were created and user who made the note. Select a note in that list and the text for that note shows in the right pane of the dialog.

To create a new note, press the New button. To delete a note, select it and press the Delete Button.

The change log can be exported to a text file for whatever reason – perhaps to print or email – using the Export to text file button.

*What’s Next?*

The next user guide chapter discusses the System Controller configuration and tools to view and modify those settings.

*Your installation*

Periodically using the tools in the chapter provides one part of the documentation necessary for efficient maintenance of the installation. These tools only work if you use them.
Chapter 18: The System Controller

This chapter describes the System Controller settings that can be adjusted, the tools to view the current state of the System Controller, and the procedure to update the firmware in the System Controller. All of this chapter should be considered an Advanced Topic.

The System Controller ribbon category shows the tools described in this chapter.

Event Enables

In the user guide Masks chapter, masks, used to control the action of Input Devices was discussed. In addition to that there is a mechanism to manually control if the System Controller responds to inputs and executes the schedule. These are called event enables and are on shown in the ribbon in a panel of the same name.

Four buttons – shown as round green or red disks - show if the named class of events is enabled or not. When enabled they show in green and when disabled they show in red.

In this case General, Photo and Timed events (the schedule) are enabled but any occupancy sensors are disabled. These are not only indicators but also buttons you can click on. When clicked they toggle from enabled to disabled and from disabled to enabled.

Note: This is a manual process and events disabled in this way can only be re-enabled manually. Disabling and enabling events in this manner can’t be done without the GreenWorx software.

Why would you want to do this? Perhaps during installation testing you may want to disable some kind of events so as to make installation testing easier.
Setting the GSC Time

You can set the GSC time and location – the location is used to determine the time of dawn and dusk – by opening the Time dialog. Press on the button with the clock image and this dialog opens.

When this dialog opens the time from the System Controller is read and displayed in the top box. The current time on the computer is also read and displayed. You can set the System Controller clock to the current computer time or to a time selected.

**Note:** If you have connected over the network to an installation outside of the time zone you are in, be careful setting the time. You should set the time to at the installation not to your local time! For locations outside of the United States, contact Technical Support.

From this dialog you can also set or modify the installation location. Enter a zip code and press the *Lookup* button. The location information is displayed. If you make a change to the location then a warning pops up to remind you that the System Controller must be programmed before the change is in effect.

**Masks**

Also in the System Controller category is a button to open the Masks dialog. This dialog is used to configure the Masks in an installation and also to view and modify their current values. This dialog is described in the user guide *Masks* chapter.
GNX Phase connections

GreenWorx is designed for three phase power systems. Each of the three System Extenders is connected to the three power line phases.

It is very important that the phase connections are made and remain the same. The System Controller contains a table that reflects the current connections and the expected connections. Each design file also has a table of the expected connections. To view these three tables, select the GNX-Phase button in the ribbon. The Network Configuration dialog opens.

![Network Configuration dialog](image)

The three columns show the current phase connection to each System Extender, the expected connection, and the connection as saved in the design file.

When connection to the System Controller is made if any disagreements occur between these tables then this dialog shows to alert you to this fact. You can make the current phase connections the new expected phase connections by closing the dialog with the Accept as connected button.
GSC Settings

To modify the GSC settings press the GSC-GSX Setup ribbon button. A multi-tabbed dialog opens.

The first tab of this dialog is for System Controller settings and the second tab for System Extender settings.

Most of these values shouldn’t be changed from their default values unless there is a compelling reason to do so. But there are three settings in this dialog that you may want to configure.

GSC Setup: Heartbeat message

The Heartbeat message is a periodic message broadcast by the System Controller. It is received by all GreenWorx devices and tells them that the System Controller is working. Why is this message used? In the very unlikely event that the System Controller stops functioning, then the fixtures, after missing several heartbeat messages, control themselves to High. This prevents the installation lighting from being in an off state unexpectedly. For example, if during the night when the facility is unoccupied the System Controller fails, the scheduled event to turn on fixtures would not happen. The missed heartbeat messages cause the fixtures to turn on anyway.

In this tab of the dialog the heartbeat option can be enabled and the time period of the messages set.
GSC Setup: Power Outage

When FCMs first power on, they set the level of the fixture they control to High. After power is restored after an outage then all fixtures are set to High. Depending upon the length of the power outage they can be configured to return to the level they were at before the power failed.

While this sounds like a good idea to always do this, it may not be for extended power outages. Suppose that under normal circumstances fixtures are scheduled to be on at 6am. Suppose that the power fails at 5am and is restored at 10pm. At 5am the fixtures were off. At 10am they should be on. If they are set to their last level, then they would go off and that is probably not what you want.

It is usually best just to have fixtures restore to on and then remain on until the next schedule entry is able to control them. It is always better to have more lighting then is needed rather than less.

GSC Setup: Transmission count

A feature of the GreenWorx system is that messages can be sent once, twice, three times, or four times. The intent of this feature is to ensure that messages are received by their targets. Under normal circumstances a single message transmission is sufficient. The setting in this tab controls how the system controller sends messages for schedules and for responding to input devices.

Note: There is a different, but similar option that you can set for the GreenWorx software in the GreenWorx Options dialog. The option in the GSC Setup dialog controls only those transmissions initiated by the System Controller and not by the GreenWorx software.
GSX Settings

The GSX Setup tab of this dialog contains information about the System Extenders.

Again, most of the settings in this dialog should not be modified. The dialog shows, for each extender, the firmware versions of the extenders and of the phase connection chips inside the extender. Also in this dialog is a method to set the receive sensitivity of each extender phase and to write those modifications out to the System Extenders.

One group of settings you may want to modify in this dialog is to change the name of each extender. The default names “Extender 0”, “Extender 1” are, while accurate, much less than descriptive. You may want to use better names so if you have to track down – physically – “Extender 3” a more descriptive name like “3rd floor wiring room” may help you locate it.
GSC Status

The GSC Status dialog shows all aspects of the System Controller and System Extender status. Click on the GSC-GSX Status button in the ribbon and a multi-tabbed dialog opens. This dialog contains tabs for:

- System Extender ("GSX") statistics
- System Controller ("GSC") history
- Signal and Noise meters
- Noise data metrics
- Event enables and disables

GSC-GSX Status: GSC Statistics tab

The statistics tab shows metrics for the last message received by a System Extender on any of the System Extender phases. Select the extender – by number – and press the read button. The display updates to show the statistics. The interpretation of these statistics are beyond the scope of this user guide.
GSC-GSX Status: GSC History tab

The history tab show internal counters in the System Controller and their values. The Read button reads the current counter values and the Clear button sets them to zero. Also show on this tab is the length of time that the System Controller has been powered on and operational.
GSC-GSX Status: Signal / Noise Meters tab

The signal and noise meters tab shows, in a graphical format, similar data as that shown by the Statistics tab. A vertical bar is shown for each System Extender and each phase connected to that extender. There is no Read button on this tab. When selected, this tab is live and shows signal and noise as data arrives from the System Controller.

Signal is shown in green and noise in red. The portion of the bar that is colored shows the strength of the signal and noise.

Note: To implement these meters a large amount of data must flow between the System Controller and the GreenWorx software. If you are connected to a System Controller over a slow internet connection there may be issues of having these meters work reliably.
GSC-GSX Status: Noise Data tab

The *Noise Data* tab shows a breakdown of any recorded from the last message received from the System Controller. Interpreting this data is beyond the scope of this User Guide.
GSC-GSX Status: Events tab

The Evens tab shows data similar to the Event enables shown in the System Control ribbon Event Enable Status panel. From this tab you can enable and disable any of the four events types.

What does it mean to disable General events, Occupancy events, and Photo events? Even with the events disabled, Input Devices continue to send messages to the System Controller. When those messages are received, and if the event is disabled, then the message is ignored.

In this dialog tab are two other buttons in the Inputs box. These buttons send commands to all Input Devices to tell them to enable or disable sending messages to the System Controller. Like the event disables, this is a manual operation and if Input Devices are disabled in this manner, the only way to enable them is to use the GreenWorx software.

To recap these different mechanisms to disable events:

- An event disable prevents messages from Input Devices when received by the System Controller from being processed. It doesn’t prevent the Input Devices from sending messages.

- An Input disable prevents Input Devices from sending messages to the System Controller.
Unlike the event disables where you can choose to disable only a selected set of inputs – occupancy sensors, photo sensors, or keypads – Input disabled effect all Input Devices.

GSC Reset

Under normal circumstances, you should never need to reset the System Controller. But if you do, then the Reset button in the System Controller panel does that. Before it performs a reset a warning displays.

A reset of the system controller does not affect its programming. But any events that were disabled will become enabled.

GSC Update

The GSC, like fixtures and Input devices, contains firmware that works with the GSC hardware to carry out its function. That firmware can be updated. To begin the process, press the Update button in the System Controller panel. The update dialog opens:
The first step is to select the serial port for connection to the System Controller. At this time internet connections to the System Controller are not supported when performing GSC Firmware update. The second step is to load the new firmware file using the browse button to locate it. Press the *Begin Firmware Update* button to start the process.

Unlike firmware update for fixtures and input devices which can take about an hour, GSC firmware update takes only a few minutes.

**What's Next?**

The next chapter in this user guide, the final chapter, covers the settings and configuration of the GreenWorx software itself.

**Your installation**

All of these settings in the System Controller and the tools covered in this chapter are aspects of the GreenWorx system that are completely in the control of the Installation Team. How they should be set, monitored, and changes as necessary is beyond the scope of this user guide.
Chapter 19: GreenWorx Options

There are a number of options that you can use to configure the GreenWorx software itself.

To view and modify GreenWorx options, press the GreenWorx Options button in the application menu.

A multi-tabbed dialog opens that contains GreenWorx options organized into functional groups.
Options – Operations

The operations tab contains settings that control the general option of GreenWorx. These options are:

- As described in several places in this user guide, the ribbon is configured based upon the user login information. Login happens upon connection to the System Controller. This option determines how the User Interface is configured when GreenWorx starts before connection is made to the System Controller. Once connected, the User Interface reconfigures based upon the login regardless of this setting.

- Usually zones and scenes are shown by name. The *Show zone/scene numbers* option is a way to suffix those names with the zone/scene number should you want to see the numbers for some reason.

- The Command Steps dialog – described in the Getting Started chapter – normally closes when the operation it was used for completes successfully. Using this option you can configure GreenWorx not to automatically close the dialog even if the operation completes successfully.

- The Power Meter facilities display information in Kilowatts and Kilowatt Hours. This option changes that to use Watts. This may be appropriate in very small installations.
- As described in other GreenWorx documentation, the basic messaging structure of GreenWorx allows messages be transmitted from 1 to 4 times to ensure message delivery. This option sets the transmission (or “echo”) count for messages sent by GreenWorx.

- In the *Online Operation* user guide chapter, the concept of the *Project Folder* is discussed. This option sets the root folder for all projects created.

- In the *Online Operations* chapter of this user guide, connections to the System Controller can be made through a connection catalog. This option supplies the path to the catalog file and a checkbox enables/disabled use of it.

### Options – Connection

This connection information in this tab is described in the *Online Operations* user guide chapter. Also in this dialog are four options that configure the connection process and determine if the listed checks are performed or not during connection.
Options – Log

The Log settings are described in the *Monitoring Tools* user guide chapter.
Options – Timeout and retry

Communications between any transmitter and receiver in any medium has to handle the possibility that if expecting a reply to a request, the request may not be received by the intended recipient or the reply returned may be lost. In order to not have communications “grind to a halt” GreenWorx always has a timeout for any message sent that expects a reply and if a reply doesn’t arrive within the specified time – the timeout expires - GreenWorx resends the request.

Different timeout values are used when communicating with the System Controller and when communicating with fixtures.

Timeouts should be set long enough for a reply given the transport mechanism of the request – serial connection to the GCS, network connection to the GSC, or communication with remote fixtures – but not so long as to excessively wait should the target of the message not exist or be non-functional.
Options – Extra Features

There are a number of special features in GreenWorx that are normally only useful to GreenWorx Technical Support. Special codes are added to enable those features.

Options – Advanced

The Advanced options tab contains very specialized options, the use of which is beyond the scope of this User Guide. The best advice is to not change any settings on this tab.
What’s Next?

This is the last chapter in this User Guide. There is nothing next but to use all that you leaned in working with your GreenWorx installation. And if you have read though to here, then congratulations! Who says no one reads anymore?