



DarkSpot

User Reference Manual

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# System Requirements

## Hardware Requirements

- Dedicated PC with 1 GHz processor (32 or 64-bit), 2 GB of RAM, and 1 GB available hard drive space (Should be separate from your WATCHOUT computers)
- 100mbps Ethernet Interface for LAN
- Broadcom-enabled embedded or USB plug-in Bluetooth 2.0 wireless adapter
- Internet connection for Windows activation and Bluetooth driver installation
- 1 to 4 Nintendo Wii Remotes (Model RVL-003)
  - Number of Wii Remotes is dependent on the number of reverse follow spots desired for your production.
  - Newer revisions of the Wii Remote (Model RVL-CNT-01-TR) should not be considered compatible with DarkSpot.
- 1 to 4 Nintendo Wii Nunchuks (Model RVL-004)
- Batteries for each Nintendo Wii Remote (2 batteries per device)

## Software Requirements

- Microsoft Windows 7
- Broadcom WIDCOMM Bluetooth Software for Windows
  - Installing these drivers requires both an internet connection and that you restart your computer while holding F8 and selecting Disable Driver Signature Enforcement. Restart your computer normally after installing this driver.
- Java SE Runtime 8u25 or compatible
- WATCHOUT 5
  - WATCHOUT should be installed on a different computer in order to ensure maximum performance. The WATCHOUT production computer and the DarkSpot computer need to be connected together using a 100mbps LAN connection.

# Configuring WATCHOUT

Before getting started with configuring DarkSpot, set up your show file with all of the screens you will need and import an image that is black and alpha that represents the reverse follow spot on stage. These steps to set up your show are important because the screens on your stage as well as the pixel size of your black and alpha image are important for the next steps. Be sure the image resource for your black and alpha reverse follow spot is set to be optimized for 'More Effects and Capabilities'.

## Enabling Production Computer Control

In WATCHOUT, go to File → Preferences and click on the 'Control' tab. Check either/both 'TCP/IP' and/or 'UDP'. You must at least enable the protocol you wish to use to communicate between DarkSpot and WATCHOUT.

---

### Which protocol should I use?

**TCP/IP:** Communicates using a set connection between the DarkSpot computer and the WATCHOUT production computer. This type of connection is generally considered more robust, but uses larger packets. On congested networks, or in settings where more than just the projection systems are on your network, this may be the best protocol.

**UDP:** Communicates using datagrams one way from the DarkSpot computer to the WATCHOUT production computer. This protocol does not allow DarkSpot to know if information is making it to the WATCHOUT production computer, but has less overhead. If you only have the projection system on your network and you are utilizing all four reverse follow spots, this may be the best protocol.

---

## Creating Inputs

In WATCHOUT, go to Window → Input and add the following inputs as Generic Inputs with Maximum Values of '1':

DarkSpot_1_A	DarkSpot_2_A	DarkSpot_3_A	DarkSpot_4_A
DarkSpot_1_X	DarkSpot_2_X	DarkSpot_3_X	DarkSpot_4_X
DarkSpot_1_Y	DarkSpot_2_Y	DarkSpot_3_Y	DarkSpot_4_Y
DarkSpot_1_Z	DarkSpot_2_Z	DarkSpot_3_Z	DarkSpot_4_Z

Only add the inputs for the number of reverse follow spots your show needs, so a show with 3 spots would only use inputs with the numbers 1, 2, or 3. These variables form the basis of control for DarkSpot in WATCHOUT. In addition to those variables, the following variables need

to be created, with their values set to the described values. This is often most easily achieved by setting their maximum to the desired value, and then running the value to their maximum by clicking and dragging to the far left in the value field.

DarkSpot_Space_W	Combined widths (in pixels) of all display surfaces across the stage, minus the blended space between projectors.
DarkSpot_Space_H	Combined heights (in pixels) of all display surfaces on stage minus the blended space between projectors.
DarkSpot_Space_X	X Position of the farthest-left screen.
DarkSpot_Space_Y	Y Position of the highest screen.
DarkSpot_Spot_W	Width of the asset provided to use as the dark spot.
DarkSpot_Spot_H	Height of the asset provided to use as the dark spot.
DarkSpot_Spot_ZMax	Value between 0.000 and 1.000 that scales the dark spot down by the given amount, meaning the dark spot can only ever be the this percentage of the original asset. This variable will have its maximum value set to 1.000, and you will have to set it by dragging the value until it matches the desired setting.

## Placing Spots on Stage

In WATCHOUT, go to Window → Task and add a new Auxiliary Timeline. Double click on the new Auxiliary Timeline and go to Timeline → Timeline Settings. Configure the timeline as such:

Name	DarkSpot
Time Position	0.0
Duration	15.0
Stacking Order	Always On Top

Next, add your reverse followspot image to a layer for every reverse follow spot you wish to have on stage to the new auxiliary timeline, and configure each media item as such:

Time	0.0
Duration	15.0
Stage Preview	Reduced (User preference, selection does not change output)
Anchor Position	Click on the Center button once to set the anchor position
Image Stacking Order	Default
Image Blend Mode	Normal
Masked by Layer Above	Off
Suppress Rendering	Unchecked
Auto-orient [...] path	Unchecked
Use Anchor [...] Point	Unchecked
External Control [...]	Checked

Next, turn on the tween tracks for 'Position', 'Scale', and 'Opacity' for each media item. Set their formulas as such, substituting # (pound sign) for the dark spot number 1 thru 4. We recommend that the spot number match the layer number, although this is not required.

Position

$$X = \text{DarkSpot\_}\#\_X * (\text{DarkSpot\_Space\_W} + (\text{DarkSpot\_Spot\_W} * \text{DarkSpot\_Spot\_ZMax})) - (\text{DarkSpot\_Spot\_W} / 4) + \text{DarkSpot\_Space\_X}$$
$$Y = (1 - \text{DarkSpot\_}\#\_Y) * (\text{DarkSpot\_Space\_H} + (\text{DarkSpot\_Spot\_H} * \text{DarkSpot\_Spot\_ZMax})) - (\text{DarkSpot\_Spot\_H} / 4) + \text{DarkSpot\_Space\_Y}$$
$$Z = 0$$

Scale

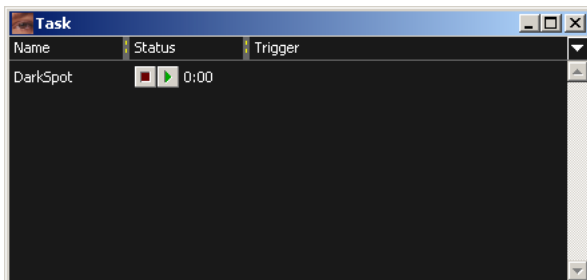
$$X = \text{DarkSpot\_}\#\_Z * \text{DarkSpot\_Spot\_ZMax}$$
$$Y = \text{DarkSpot\_}\#\_Z * \text{DarkSpot\_Spot\_ZMax}$$

Opacity

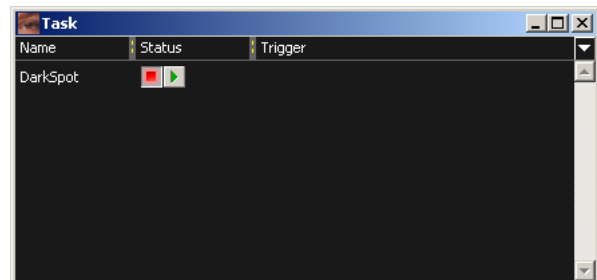
$$\text{Opacity} = \text{DarkSpot\_}\#\_A$$

## Enabling and Disabling Spot Display

Pressing the Stop button for the DarkSpot auxiliary timeline will switch between the spots being on and off. The state of the button and the state of the spot visibility are illustrated here:



Dark Red Stop Button = Spots On



Bright Red Stop Button = Spots Off

# Configuring DarkSpot

Now that we have set up WATCHOUT to accept input from DarkSpot, we need to teach DarkSpot a bit about your show. The primary way of doing this is with a 'launch.properties' file that is placed in the DarkSpot program directory. This section discusses the values you can include in that document, and the values that are assumed if they are not present.

## Application Settings

There are two application-wide settings in DarkSpot. These settings affect the overall interface of DarkSpot, and can not be changed after launch without quitting DarkSpot and changing these values.

Property	Default	Description
app.Fullscreen	NO	YES or NO. Determines if the app runs in fullscreen mode.
app.LicenseeName	User	Your name or organization's name.

## Network Settings

These settings determine what production computer DarkSpot will send information to, and allows DarkSpot to connect to that computer at launch. The IP Address and Port can be changed while running DarkSpot, but protocol type can not be changed.

Property	Default	Description
net.WatchoutIP	localhost	IPv4 address of your WATCHOUT production computer. (xxx.xxx.xxx.xxx)
net.WatchoutPort	3040	Port # of WATCHOUT.
net.WatchoutProtocol	TCP	TCP or UDP. See Configuring WATCHOUT for more information on this setting.



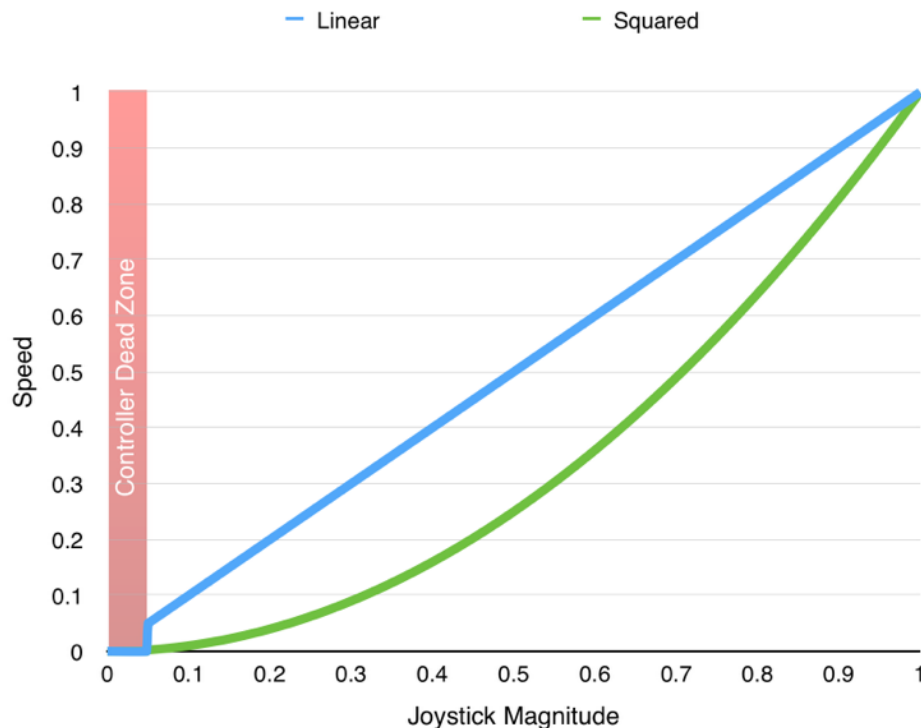
## Screen Settings

These settings allow DarkSpot to provide a somewhat accurate display of spot location to spot operators. The number of screens determines how many screen settings you need. If you have 4 screens, you will need a Screen1, Screen2, Screen3, and Screen4 property set.

Property	Default	Description
screens.NumberOfScreens	3	Number of screens on stage
screens.Screen1	0,0,1920,1080	X offset, Y offset, Width, Height of the screen. Y offset is distance from stage floor in pixels, X offset is distance from previous screen in pixels. X offset can be negative.
screens.Screen?	0,0,1920,1080	Replace ? with screen number, one for each screen on stage.

## Controller Settings

There is only one controller setting available in DarkSpot. DarkSpot supports two different styles of controller math. The default style is Linear Magnitude, meaning that however far the operator pushes on the joystick, that is the speed the spot will move. Some users may prefer to use Squared Magnitude, which squares the magnitude of their input to determine speed, allowing for more control at the slower speed. On larger stages, this may prove very useful. The chart below shows how these two choices work. Note that the lower 5% of the joystick is the dead-zone, meaning no input will be read in order to avoid accidental movement.



Property	Default	Description
controllers.useSquaredMagnitude	NO	See information of previous page.

## Example 'launch.properties' File

```
# DarkSpot 0.1 Launch File

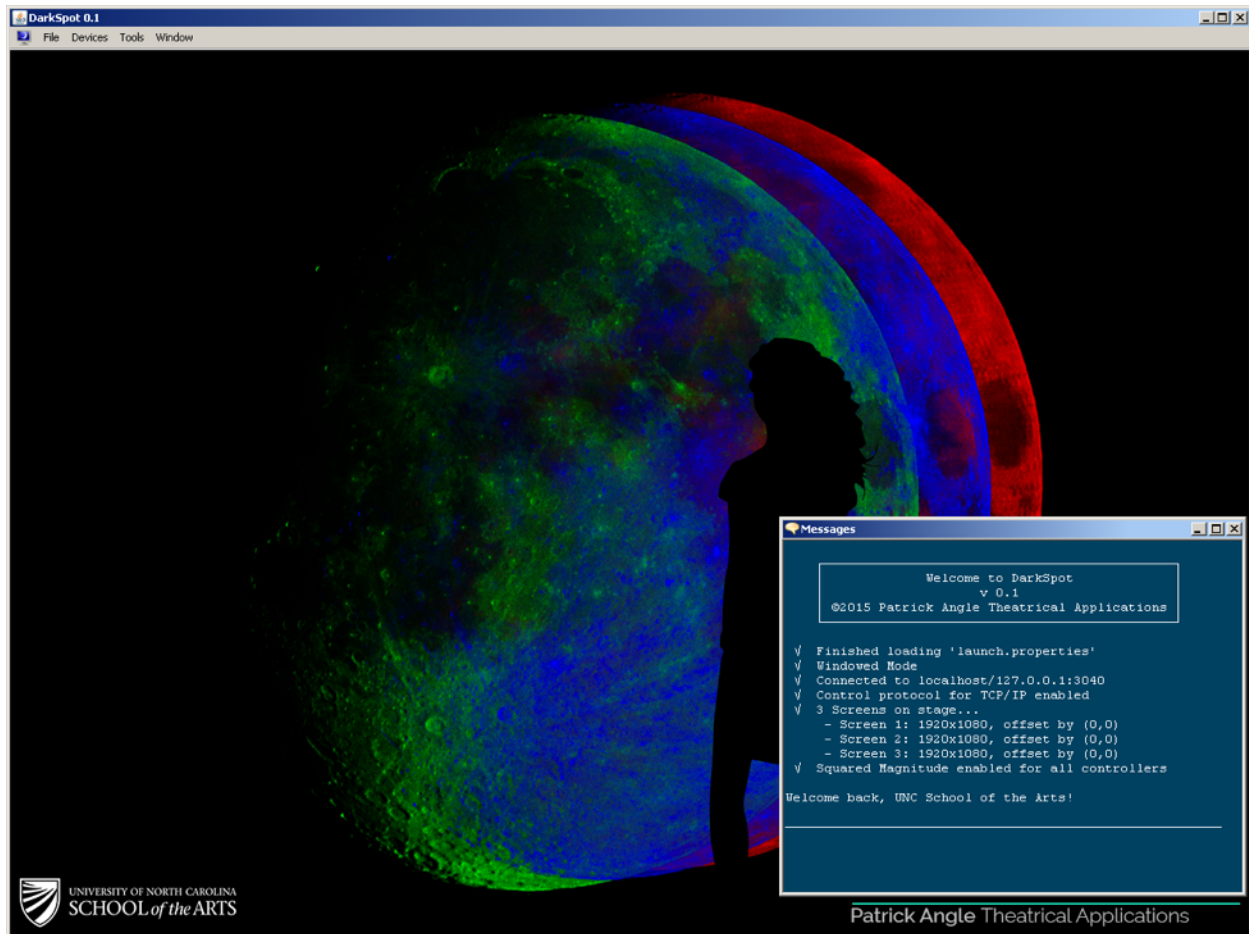
# Application Settings
app.Fullscreen=YES
app.LicenseName=UNC School of the Arts

# Network Settings
net.WatchoutIP=10.10.10.1
net.WatchoutPort=3040
net.WatchoutProtocol=TCP

# Screen Settings
screens.NumberOfScreens=3
screens.Screen1=0,0,1920,1080
screens.Screen2=0,0,1920,1080
screens.Screen3=0,0,1920,1080

# Controller Settings
controllers.useSquaredMagnitude=YES
```

# Getting to Know DarkSpot



The DarkSpot User Interface, shown with Messages window.

DarkSpot is a single window application that contains other windows to manage tasks and display information. The Messages window is present at startup, and will display the results of the launch.properties settings being loaded. Actions are generally driven by using the menu bar at the top of the window (or screen if you are using Fullscreen Mode). The following functions are present in the menu bar...

## The Moon Menu

### About

Shows the About DarkSpot dialog. This dialog contains information regarding the current version of DarkSpot that is running, along with relevant copyright information.

### **Jump to Windows**

When in Fullscreen Mode, this function allows you to return to Windows without quitting DarkSpot and stopping output.

### **Quit**

Quit will completely stop all output, as well as input. You will be asked to confirm this choice every time; there is no way to suppress the confirmation dialog.

## **The File Menu**

### **Save Session**

Save information regarding the current state of DarkSpot, including Production Computer information, screens, controller settings, etc. This will produce a file that can be used as a launch.properties file, or be opened later using...

### **Open Session**

Open an old session from disk that was saved using the Save Session function.

## **The Devices Menu**

### **Connect Bluetooth Device to Windows**

Presents the Windows 'Add a Device' dialog to connect Bluetooth controllers. Only one controller can be connected for each 'Add a Device' wizard. Use this function multiple times to add multiple devices.

### **Manage Bluetooth Devices in Windows**

Presents the Windows 'Devices' window, allowing you to remove connecting devices, in compliance with our recommended practice discussed later.

### **Connect Controller #1**

Registers only the first available controller that has already been connected to Windows with DarkSpot. This is useful for testing with a single controller, but should generally be ignored in favor of...

### **Connect All Available Controllers**

Registers up to four available controllers that have already been connected to Windows via the 'Connect Bluetooth Device to Windows' function.

### **Disconnect All Controllers**

This function is should only be used at the end of every day to ensure that DarkSpot has fully released all controllers. Only use this function when all Controller windows have already been closed, and you intend on next disconnecting controllers from Windows.

## The Tools Menu

### **Network**

Shows the Network window, allowing you to enter an IP address and port number for the Production Computer in order to connect, refresh the current connection in cases where DarkSpot failed to do so, or send raw test data over the network to your production computer to ensure it is functioning.

### **Messages**

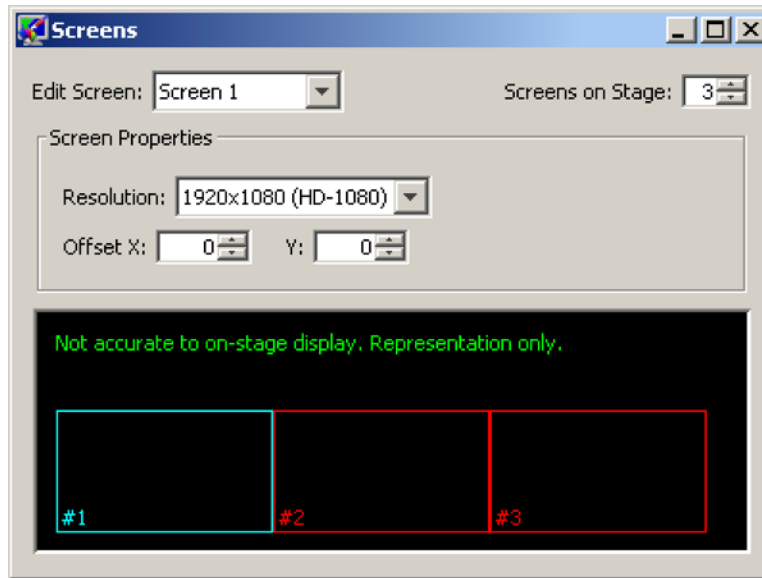
Shows the Messages window, which was visible on launch, but can be closed at any time. All important communications that do not require user input are placed here, so it is recommended that this window stay open.

### **Screens**

Shows the Screens editor, allowing you to lay out screens visually to match WATCHOUT's screens.

# Screens

DarkSpot includes a screen editor to allow you to lay out screens in DarkSpot to resemble their actual on stage positions, including overlap, offsets, and screen size. The screen editor can be opened by going to Tools → Screens in the menu bar.



Screens have several properties that can be accessed by selecting the screen you want to edit from the Edit Screen dropdown list. The screen you are currently editing is displayed in cyan in the screen representation display, while other screens are displayed in red. Each screen also has a number in the lower-left hand corner that correlates to the number in the Edit Screen dropdown list. The number of screens can be adjusted anywhere from 1 to 9 using the Screens on Stage field in the top-right of the Screens window.

## Properties

Each screen has a resolution, an X offset, and a Y offset. Resolution is the pixel dimensions of the screen, which can be selected from the dropdown list of screens. The following resolutions are available for screens:

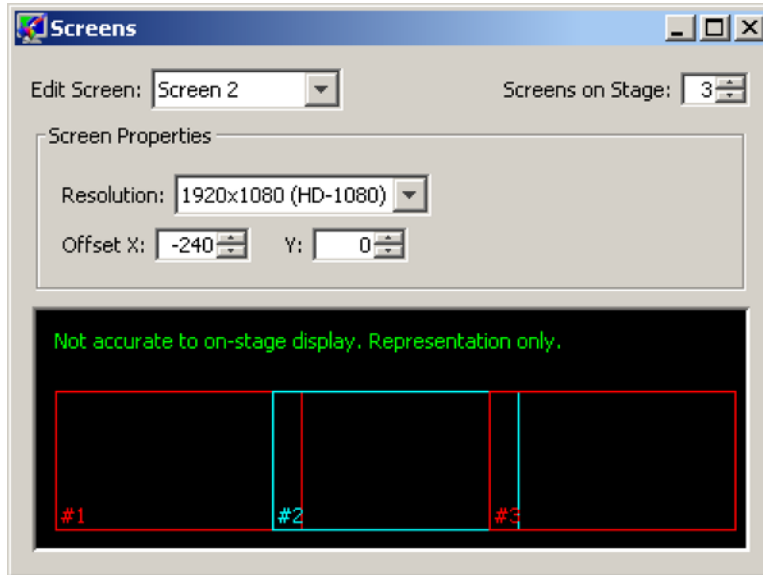
1024x768 (XGA)	1600x1200 (UXGA)
1280x960 (QVGA)	2048x1536 (QXGA)
1280x1024 (SXGA)	1280x720 (HD-720)
1400x1050 (SXGA+)	1920x1080 (HD-1080)

These are the only resolutions available in DarkSpot itself. If launch.properties defines any other resolution, the screen will honor that resolution, but will only allow the resolution to be changed to one of the eight supported resolutions if you wish to change it.

X offset and Y offset are both defined in pixels, and can be used for creative screen layout, edge blending, or spacing out screens. X offset is relative to where the previous screen number

would be if there was no offset set for it. Positive X offset will move the screen stage left, and negative X offset will move the screen stage right. Y offset is relative to the stage floor at 0 pixels away from the ground. Positive numbers move towards the ceiling of the space, and negative numbers go into the floor.

An example of using offsets to emulate on stage edge blending can be seen here:



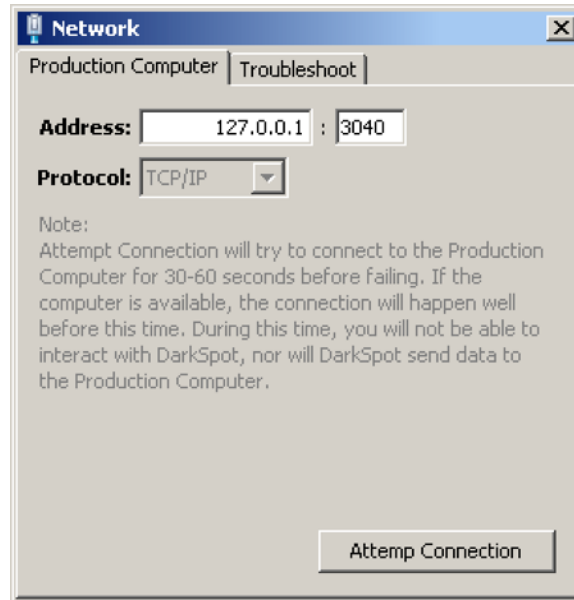
In this example, the screens are laid out as such:

	<b>Resolution</b>	<b>X Offset</b>	<b>Y Offset</b>
<b>Screen 1</b>	1920x1080	0	0
<b>Screen 2</b>	1920x1080	-240	0
<b>Screen 3</b>	1920x1080	-480	0

Lastly, remember that your screen arrangement here need only be representative of your stage.

# Network

DarkSpot's current network configuration can be altered using the Network tool, which can be accessed by going to Tools → Network in the menu bar.



## Production Computer

Under the Production Computer tab, you can configure the connection DarkSpot is using to your WATCHOUT production machine. In this tab you can enter the IP address and port of WATCHOUT. The Address field can also contain a fully-qualified domain name if DNS is available on your network. The third option for this field is to use 'localhost', to connect to the current computer. The port number will always be 3040 for a standard WATCHOUT installation.

The protocol dropdown will either have TCP/IP or UDP selected. This setting can not be changed while DarkSpot is running. This setting is loaded from launch.properties at startup.

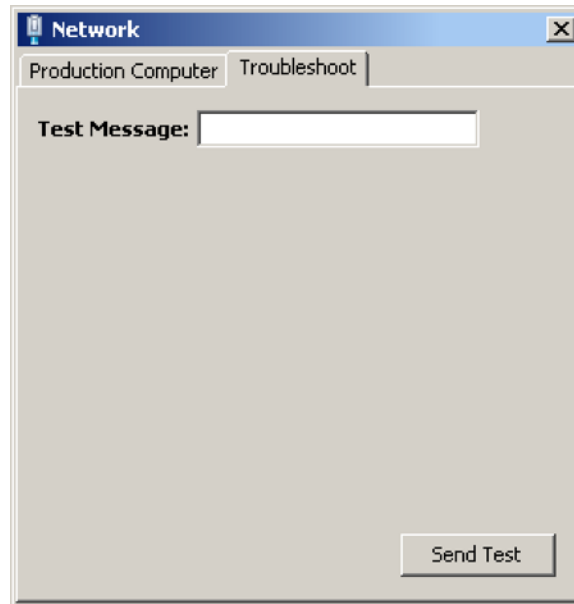
After you have changed network settings, you must click the Attempt Connection button. This will attempt to reach WATCHOUT using these new settings, and log the results of the attempt to the Messages window.

Attempting a connection can take up to 30 seconds, during which DarkSpot will appear to have frozen. This is normal. Wait until either a success for failure is logged to the Messages window to continue using DarkSpot.



## Troubleshooting

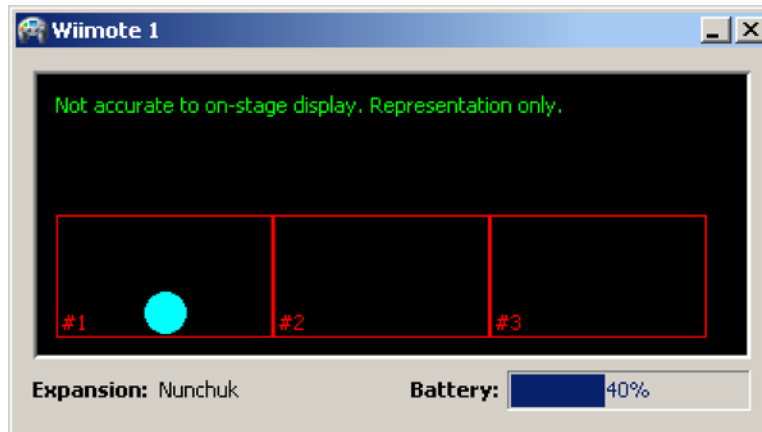
The Troubleshooting tab in Networking has a single function. Entering a WATCHOUT Production computer message into the Test Message field and clicking Send Test will send the entered message straight to the WATCHOUT Production computer. This is useful for diagnostic purposes.



# Controllers

## Controller Window

Each controller that you connect to DarkSpot will get its own Controller Window that provides information about each controller's state as well as a few functions for managing that controller.



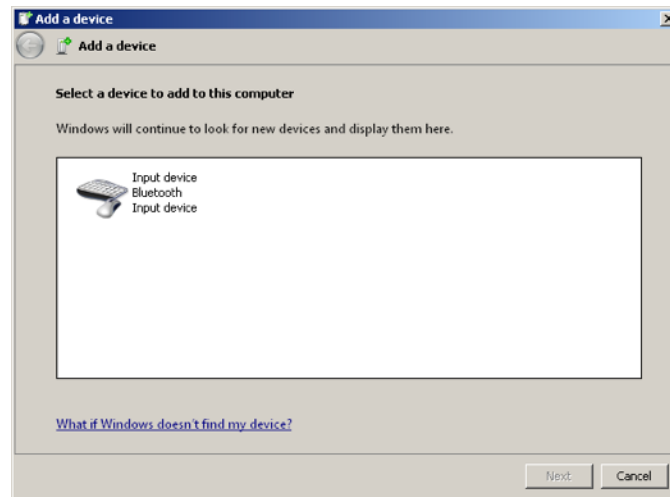
The Blue Circle represents the current position of that operators follow spot on stage. Keep in mind that this position is an estimation, and that spot operators should always have a full view of the stage. When the circle is solid blue, the dark spot is at full intensity, that is to say that it is full black in that area. As you fade your spot out, it will become less and less blue, until there is only the outline of the spot visible. For a complete outline of how to control each reverse follow spot, see the section Operator Controls.

Additional diagnostic utilities are available by right-clicking on the black screen area. Here you can identify each controller, or force a reinitialization of the controller on DarkSpot's side. These features should not be used during regular operation of DarkSpot.

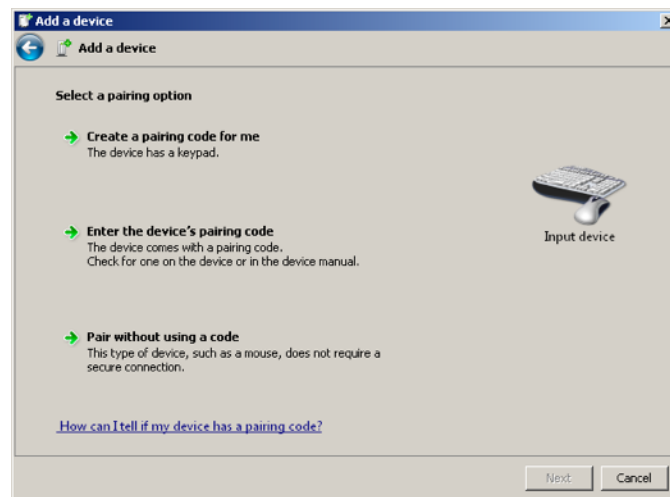
# Connecting Controllers

## Step 1: Connecting Controllers to Windows via Bluetooth

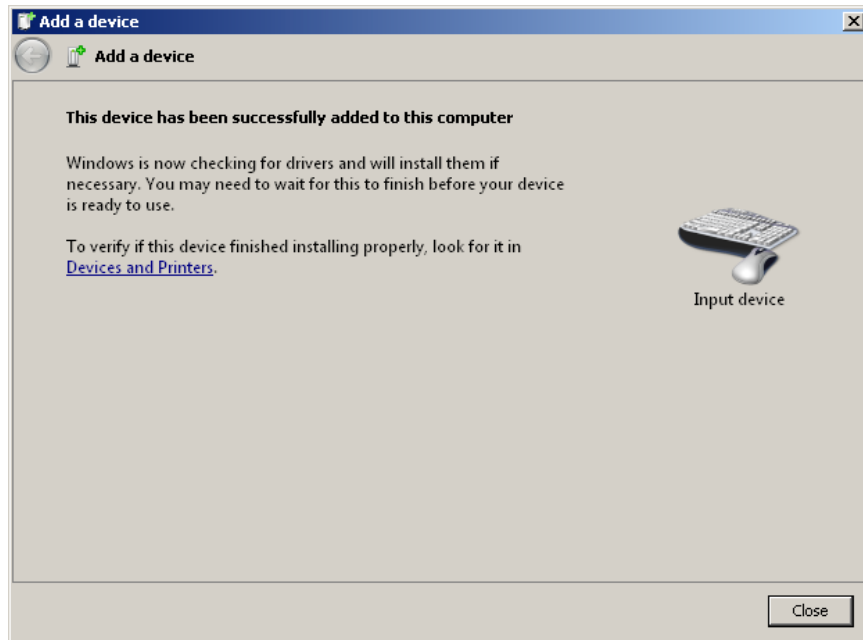
To start connecting the first controller to Windows via Bluetooth, go to Devices → Connect Bluetooth Device to Windows. You will be presented with the Windows Add Device wizard. Press the ① and ② buttons on the Wii Remote Control to enter sync mode. The LEDs at the bottom of the controller will start flashing if the device is in sync mode. The device should appear in the devices list, as shown here:



Click on the new device you want to connect, and click Next.



Select 'Pair without using a code' and click Next. Windows will now connect to the device. When the connection has succeeded, you will see this window:



Repeat the instructions in step one to connect each of the controllers you need to control your reverse follow spots. (One for each reverse follow spot you wish to have on stage.)

### Step 2: Connecting Controllers to DarkSpot

After each of your controllers are connected to your computer using the instructions in step one, you can connect all of your controllers to DarkSpot and begin sending data over the network, assuming DarkSpot is connected to your WATCHOUT Production computer.

---

### Before you continue...

Before continuing, ensure that none of the Nunchuks are connected to their Wii Remote. Only after the following actions are completed can you plug in the Nunchuk. Failure to follow this instruction will result in DarkSpot not being able to recognize the Nunchuck hardware.

---


In DarkSpot, go to Devices → Connect All Available Controllers. This will display a window for each controller that is available.

Only now is it safe to plug in the Nunchuk accessory for each controller. Test each controller by moving the joystick around, and ensure that the input is mirrored in that controller's window.

# Appendices

## End of Day Procedures

At the end of the day, a few steps are necessary to cleanly disconnect controllers from DarkSpot, and ensure a problem-free launch the next day.

1. Disconnect each controller from DarkSpot by clicking the X in the upper-right hand corner of each Controller Window.
2. In the menu bar, select Devices → Disconnect All Controllers.
3. In the menu bar, select Devices → Manage Bluetooth Devices in Windows
4. You will now be presented with the Windows Device List. Select each Wii Remote Control, and select Remove Device for each one.
5. Finally, go to  → Quit in the menu bar. Confirm you wish to quit DarkSpot.
6. It is now safe to turn off the DarkSpot computer, as well as quit WATCHOUT on your production computer.

## Operator Controls



---

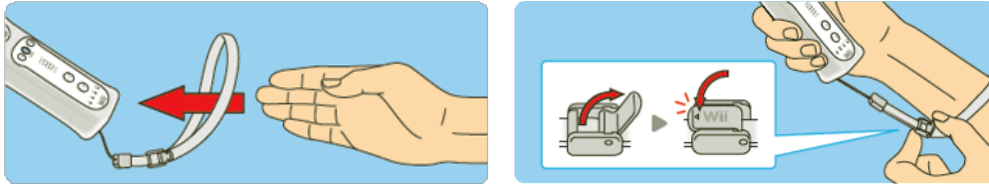
### Regarding 'Intensity'

Because DarkSpot is a reverse followspot solution, intensity refers to the amount of black in a given spot. Full intensity means no projection content shows in that area and zero intensity means all projection content is shown in the spot's area.

---

## Operator Safety Information

1. Wear the wrist strap. Make sure that all operators using the Wii Remote are wearing the wrist strap and that it has been tightened using the strap lock. When sharing the Wii Remote between multiple operators, please be sure each person using the Wii Remote takes the time to properly put on the wrist strap. Wearing the wrist strap will help prevent the Wii Remote from flying across the room if you accidentally let go of it during operation.



2. Hold the Wii Remote firmly and do not let go. Even while wearing the wrist strap, make sure you don't let go of the Wii Remote during operation and do not use excessive motion. For example, in Wii Sports bowling, the proper way to let go of the ball while bowling is to release the "B" button on the Wii Remote—DO NOT LET GO OF THE Wii REMOTE ITSELF. If you are having so much fun that you start perspiring, take a moment to dry your hands. If you use excessive motion and let go of the Wii Remote, the wrist strap may break and you could lose control of the Wii Remote. This could injure people nearby or cause damage to other objects.
3. Give yourself plenty of room. You will probably move around while using the Wii Remote, so be careful that all areas that you might move into are clear. Make sure that furniture, objects and people are out of the operation area so you don't accidentally bump into them while operating. Also, as indicated in the Wii Operations Manual, it is recommended to stay at least three (3) feet from other objects.

Note that some of these precautions may not be applicable in DarkSpot 0.1, but may become applicable in future releases where motion controls may be used.

To ensure operator safety and continual operation of the DarkSpot system, ensure that each Nunchuck controller is properly secured following these instructions:

1. Feed the cord on the wrist strap through the connector hook.
2. Insert the Nunchuk plug into the External Extension Connector on the bottom of the remote until it "clicks" into place.
3. Make sure the wrist strap cord runs through the connector hook.

### **WARNING - Repetitive Motion Injuries & Eyestrain**

Using computers for an extended period of time can make your muscles, joints, skin or eyes hurt. Follow these instructions to avoid problems such as tendinitis, carpal tunnel syndrome, skin irritation or eyestrain:

- Avoid excessive use.
- Take a 10 to 15 minute break every couple of hours, even if you don't think you need it.
- If your hands, wrists, arms or eyes become tired or sore while operating, or if you feel symptoms such as tingling, numbness, burning or stiffness, stop and rest for several hours before operating again.

- If you continue to have any of the above symptoms or other discomfort during or after operation, stop operating and see a doctor.

 **WARNING - Battery Leakage**

Leakage of battery fluid can cause personal injury as well as damage to your remote. If battery leakage occurs, thoroughly wash the affected skin and clothes. Keep battery fluid away from your eyes and mouth. Leaking batteries may make popping sounds. To avoid battery leakage:

- Do not mix used and new batteries (replace all batteries at the same time).
- Do not mix different brands of batteries.
- Nintendo recommends alkaline batteries. Do not use Lithium ion, nickel cadmium (nicad), or carbon zinc batteries.
- Do not leave batteries in the remote for long periods of non-use.
- Do not recharge alkaline or non-rechargeable batteries.
- Do not put the batteries in backwards. Make sure that the positive (+) and negative (-) ends are facing in the correct directions. Insert the negative end first. When removing batteries, remove the positive end first.
- Do not use damaged, deformed or leaking batteries.
- Do not dispose of batteries in a fire.



## Revision Notes

### 0.1b

DarkSpot 0.1b resolves the following issues and includes the following new features:

- Squared magnitude for controllers now applies correctly when set in the launch.properties file.
- A new launch property, `experimental.outputFramesPerSecond`, is available that will adjust how many times a second DarkSpot gives Watchout an update for each spot. The default without this property is 30.
- DarkSpot will now automatically attempt to reconnect to the Watchout production computer automatically when the connection is interrupted.

Known issues include:

- As part of the automatic reconnection system, DarkSpot will appear to be frozen until it reconnects to WATCHOUT. While not desirable, the first priority is to reconnect, resulting in the freeze. Use the Windows Task Manager to quit DarkSpot if you get stuck in a reconnection loop.