Root Tile

Lellan DigitalCanvas
Installation Guide

Revision 0.9.2

Table of Contents

1   This Manual

This manual describes the steps necessary to plan and execute the installation of a Lellan DigitalCanvas.

For installations where the DigitalCanvas is to be mounted on a ceiling (or any surface greater than 30° from vertical), additional installation instructions can be found in the *Lellan SmartTile Ceiling Kit Installation Guide.*

Information on configuring, operating, maintaining the DigitalCanvas, once installed, can be found in the *Lellan DigitalCanvas User Manual.*

In addition, procedures for creating content for the DigitalCanvas is covered in the separate *Lellan Makeflix User Manual*.

2   Warnings

Important: Consult local codes and regulations before installation.

3   Introduction to Lellan DigitalCanvas™

The Lellan DigitalCanvas™ is a modular system composed from 5 major 'components': SmartTiles, PowerBoxes, SmartCables, a SmartHub, and the DigitalCanvas Controller App. *Figure 3-1* illustrates a typical DigitalCanvas containing 56 SmartTiles, 2 PowerBoxes and 1 SmartHub.

This section reviews each of these components and their roles in operating the DigitalCanvas.
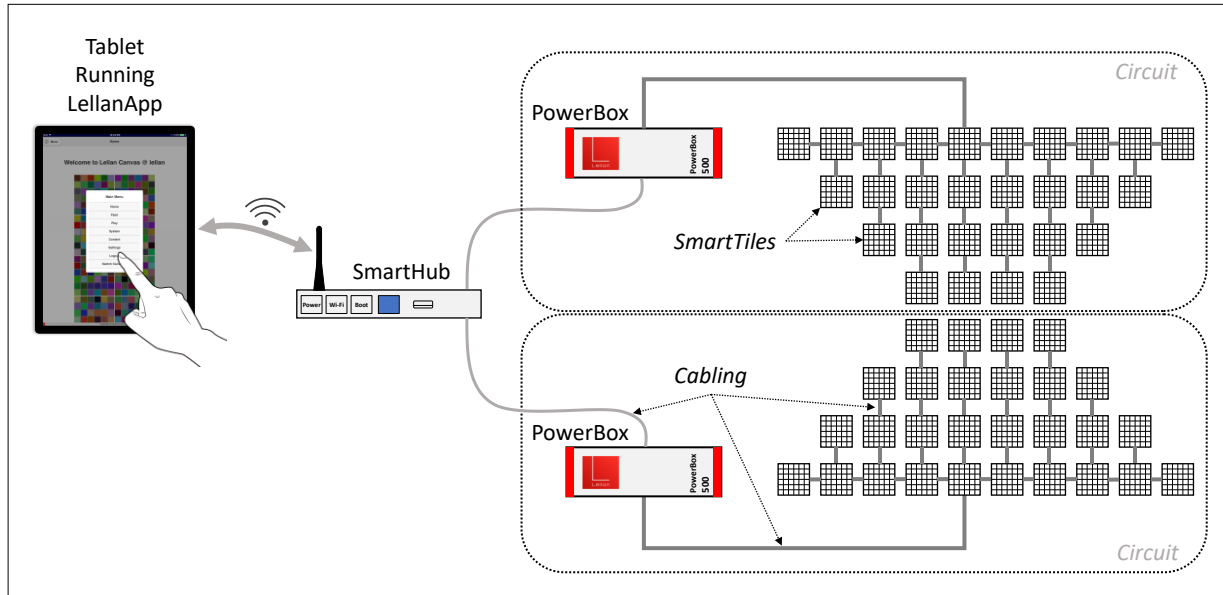
Figure 3-1: DigitalCanvas Containing 56 SmartTiles in Two Circuits

3.1   SmartTiles and their Frames

The *SmartTile* is the primary building block for a DigitalCanvas. It is the 'light engine' responsible for showing the patterns of color, light and motion that are the key feature of a DigitalCanvas.

The SmartTile consists of two major pieces - the *Frame* and the Tile itself – which are held together using magnets in the 4 corners. During installation, the Frame is first mounted onto the wall (or other surface). Cables are then attached to the Frame. Finally, the Tile is mated onto the Frame and held in place by the magnets.

Figure 3-2 shows a SmartTile and its mounting Frame, both assembled and separately.
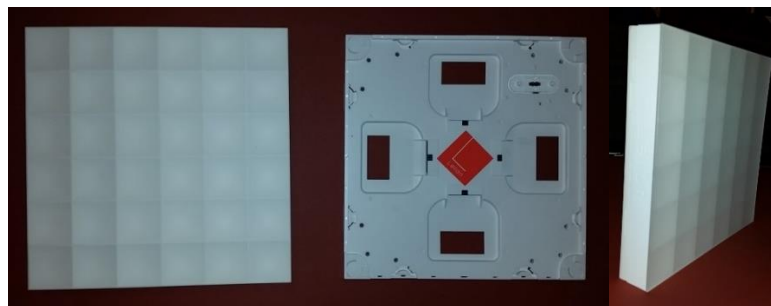
Figure 3-2: SmartTile and Frame

3

A single DigitalCanvas can include up to 240 SmartTiles.

Each SmartTile contains 36 individually controllable RGB light _Cells_ arranged in a 6x6 grid.

The collection of SmartTiles in a DigitalCanvas can be laid out on a surface (e.g., a wall) in any pattern whatsoever. The DigitalCanvas in Figure 3-1 includes 56 SmartTiles laid out in a "rotated bow-tie" pattern.

3.2   PowerBoxes and Circuits

Figure 3-3 shows a PowerBox.

Figure 3-3: PowerBox

Each _PowerBox_ provides power to up to 40 SmartTiles. A PowerBox together with the 1 to 40 SmartTiles that it powers is known a _Circuit_. The DigitalCanvas in Figure 3-1 contains 56 SmartTiles, divided into two Circuits of 28 Tiles each.

Most DigitalCanvases will have fewer than the maximum six Circuits _active_, i.e., actually connected to a PowerBox and some SmartTiles

3.3   The SmartHub

The _SmartHub_ is the 'brains' of the DigitalCanvas and, together with the DigitalCanvas Controller App, provides the user full control over the operation of the DigitalCanvas including the moving patterns of colored light displayed on its collection of SmartTiles.

Figure 3-4 shows a SmartHub.

Figure 3-4: SmartHub

Each DigitalCanvas has a single SmartHub. Each SmartHub can control up to 240 SmartTiles (configured as 6 Circuits of 40 SmartTiles each).

The SmartHub must be connected to a network either via Wi-Fi or via a wired Ethernet connection.

3.4   SmartCables and other cables

SmartCables are used to carry power and data between SmartTiles as well as from the PowerBoxes to SmartTiles.

Figure 3-5 shows several SmartCables.

Figure 3-5: SmartCables

SmartCables come in 4 lengths (see Table 3-1) to accommodate a variety of SmartTile layouts.

	22 centimeters (8.6 inches)
SmartCable Lengths	33 centimeters (13 inches)
	1 meter (3.3 feet)
	3 meters (9.85 feet)

Table 3-1

In addition to SmartCables, the DigitalCanvas utilizes Cat5 Ethernet cables to connect the PowerBoxes to the SmartHub.

3.5   LellanApp: The DigitalCanvas Controller App

The *DigitalCanvas Controller App*, more commonly referred to a simply as the *LellanApp*, is a software application that runs on an iPad, an Android tablet, a Mac or a PC. It provides the user interface for operating the DigitalCanvas. In this *Guide*, instructions involving the LellanApp assume that it will run on an iPad or 10" Android tablet. See the *DigitalCanvas User Manual* for instructions on using with a Mac or PC.

4   Planning the Installation

The following sections cover decisions and/or plans that need to be made before the DigitalCanvas installation can proceed.   The topics covered are:

1. The Network Configuration
2. Site Planning
3. SmartTile Layout
4. Cabling Plan

4.1   The Network Configuration

The DigitalCanvas requires a network connection between the SmartHub and the device (i.e., iPad, Android tablet, Mac or PC) on which the LellanApp is running (i.e., the *app device*). There are three distinct ways in which this network connection can be configured: *AP mode, Wi-Fi mode* and *Wired mode.*

As part of the installation planning, you will need to choose which of these configurations will be used with your DigitalCanvas. The choice of network configuration will place constraints on the DigitalCanvas installation, most importantly on the location of the SmartHub.

The three possible network configurations are as follows:

1. *AP mode*: The SmartHub sets up its own standalone Wi-Fi network that the app device joins as illustrated in Figure 4-1. This standalone Wi-Fi network is separate from any existing Wi-Fi (or wired) networks that may exist in the same location. In this mode, you will need to select a unique SSID and passphrase for the 'new' Wi-Fi network.
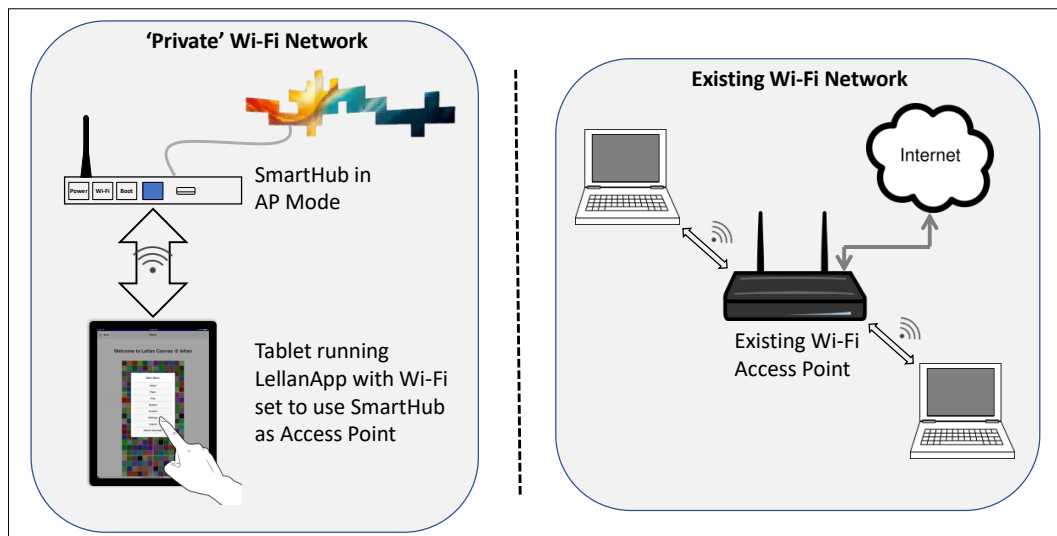
Figure 4-1: AP Mode Illustrated

2. *Wi-Fi mode*: The SmartHub joins an existing local area network (LAN) via Wi-Fi. The app device joins the same network via either Wi-Fi or a hardwired Ethernet connection. Wi-Fi mode is illustrated in Figure 4-2.
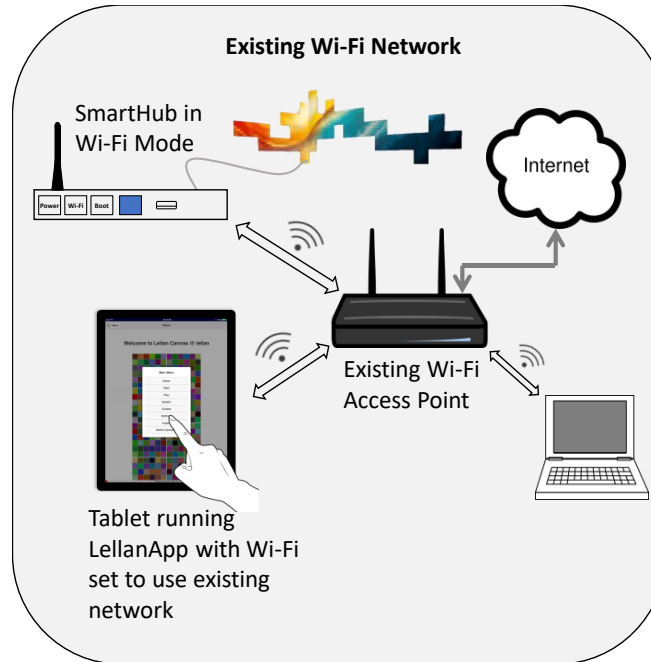

Figure 4-2: Wi-Fi Mode Illustrated

3. *Wired mode*: The SmartHub joins an existing local area network (LAN) via a hardwired Ethernet connection (see Figure 4-3). The app device joins the same network via either Wi-Fi or a hardwired Ethernet connection.
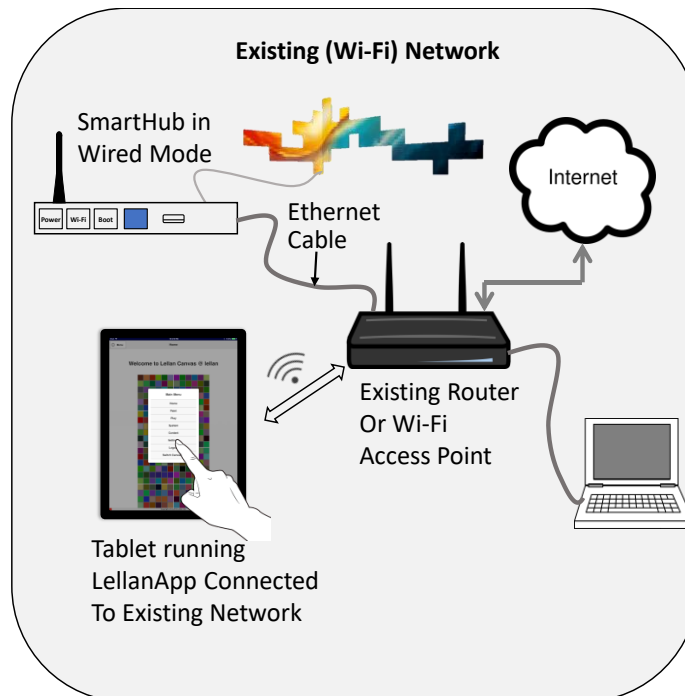

Figure 4-3: Wired Mode Illustrated

Note that in AP mode, the DigitalCanvas will not be connected to the Internet and Internet-based resources (such as automatic time setting) will not be available. In Wi-Fi and Wired modes, the DigitalCanvas will be connected to the Internet if and only if the existing local area network that the SmartHub joins is connected to the Internet.

Whenever DigitalCanvas is powered up or rebooted, it will automatically connect to the network using the most recently configured mode and parameters (Wi-Fi SSID, etc.).

In addition to configuring the mode, you will need to select a *network name* for your DigitalCanvas. This name will be used to refer to the DigitalCanvas from other devices on the network. It should be between 4 and 15 characters in length and unique among devices on your chosen network.

4.2   Site Planning

The following sections cover issues that arise in choosing and/or designing the physical locations for the SmartTiles, the PowerBoxes and the SmartHub.

4.2.1   Mounting Surface for SmartTiles

SmartTiles are designed to be mounted on a flat or nearly flat 'surface'. The mounting surface is commonly a flat wall or a piece of plywood that will then be mounted to a wall. But the mounting surface need not be physically continuous. For example, SmartTiles can be bolted to a grid of struts spaced to align with the SmartTile mounting holes (see Section 6.1.3: Location of Mounting Holes on SmartTile Frame) that form a virtual flat mounting surface.

The layout of the SmartTiles on a surface is covered in detail in Section 4.2.2 below. This section covers the basic nature of the mounting surface.

The mounting surface can be vertical (e.g. a wall) or horizontal with the SmartTiles facing up (e.g., a table or shelf) . SmartTiles can also be installed on a horizontal surface facing down (e.g., on a ceiling) with the addition of the *Lellan SmartTile Ceiling Kit* or some other additional mechanical support to keep the Tiles and Frames from unexpectedly separating and falling down. The maximum safe tilt off vertical with the Tiles facing downward (without the Ceiling Kit and without additional mechanical support) is 30°.

Although the SmartTiles are designed to be mounted directly onto any wall (or other existing surface) that accepts screws, many installations may find it advantageous to first mount the SmartTiles on a special installation surface (e.g., a sheet of plywood or a grid of struts) and then mount this installation surface onto the existing wall, table or ceiling. This is especially advantageous when routing the cables behind the mounting surface (see Section 4.4.4) since this may avoid having to cut holes into the existing wall.

The flatness of the mounting surface is key to the DigitalCanvas appearance, especially in continuous layouts (see Figure 4-6). Any unevenness in the surface behind a Tile or between adjacent Tiles may result in noticeable gaps or seams between Tiles and/or unevenness in the front surface of the DigitalCanvas.

Behind a single SmartTile, the surface variance can be up to 3mm (⅛ inch). Any greater unevenness may result in failure of the floating data/power connector between the SmartTile and its Frame.

Behind adjacent SmartTiles in a continuous layout, the total surface variation should also be kept to less than 3mm (⅛ inch). Any greater unevenness will result in unsightly gaps between the Tiles.

SmartTiles can be recessed into the surface. To recess flush, the recess should be 46.3mm deep (1.82 inches). The rough opening of the recess should allow ~7mm (¼ inch) from the edges of the collection of SmartTiles to account for tolerances in Tile size and mounting precision. The finished opening does not require clearance.

SmartTiles can be used as the top surface of a table, counter or shelf provided static loads do not exceed 10 kilograms (22 pounds). In cases where loads exceed this limit (e.g., when used in flooring), the SmartTiles should be placed underneath an additional covering (e.g., a sheet of plexiglass) that bears all the expected load.

4.2.2   PowerBox Location

Each PowerBox needs to be located within 3ft of a standard 120V, 15A outlet *AND* within approximately 2.5 meters (8 feet) of the closest SmartTile in its Circuit. This distance is determined by the 'effective length' of the longest available SmartTile cable (which is 3 meters or 9.85 feet). This distance will need to be adjusted to account for changes in effective length based on the physical routing of the cable.

Figure 4-4 shows the dimensions of the PowerBox and the required clearances for airflow and cable routing.
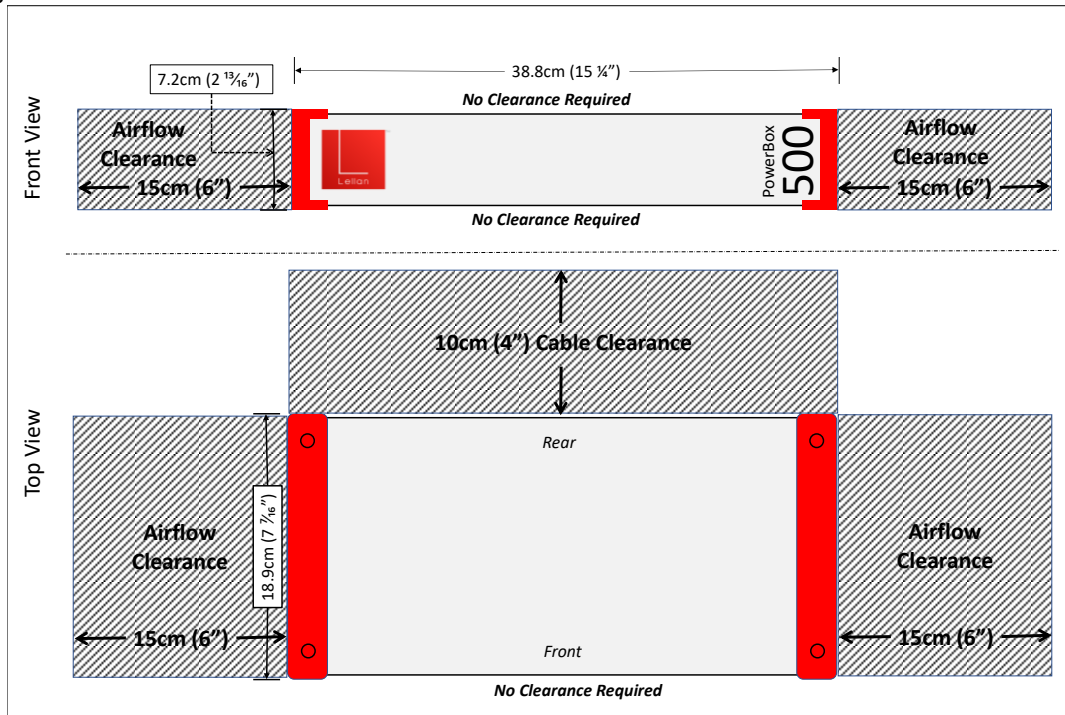
Figure 4-4: PowerBox Dimensions and Required Clearances

PowerBoxes should be installed 'right side up', i.e., as shown in the *Front View* in Figure 4-4. Any other orientation may interfere with airflow and result in thermal shutdown of the PowerBox.

PowerBoxes may be stacked.

For noise control as well as visual 'cleanliness', you may want to place the PowerBox in a cabinet or enclosure or behind the mounting surface. Any such enclosure must allow for at least 0.3m^3/min (11.3 CFM) of unrestricted airflow for each PowerBox.

The PowerBox location needs to be accessible, but not on an everyday basis. The PowerBox has a single user control – an input power switch – that is designed to be left in the on position except during maintenance or long-periods of inactivity. Output power to the DigitalCanvas is switched remotely from the SmartHub.

4.2.3   SmartHub Location

The SmartHub must be located within 4ft of a standard 120V, 15A power outlet *AND* close enough to each of the PowerBoxes so that it can be reached by a 100ft Cat5 Ethernet cable. The exact maximum distances will depend on how the cables can be physically routed from the SmartHub to the PowerBoxes.

Figure 4-5 shows the SmartHub dimensions and required clearances for airflow and cable routing.
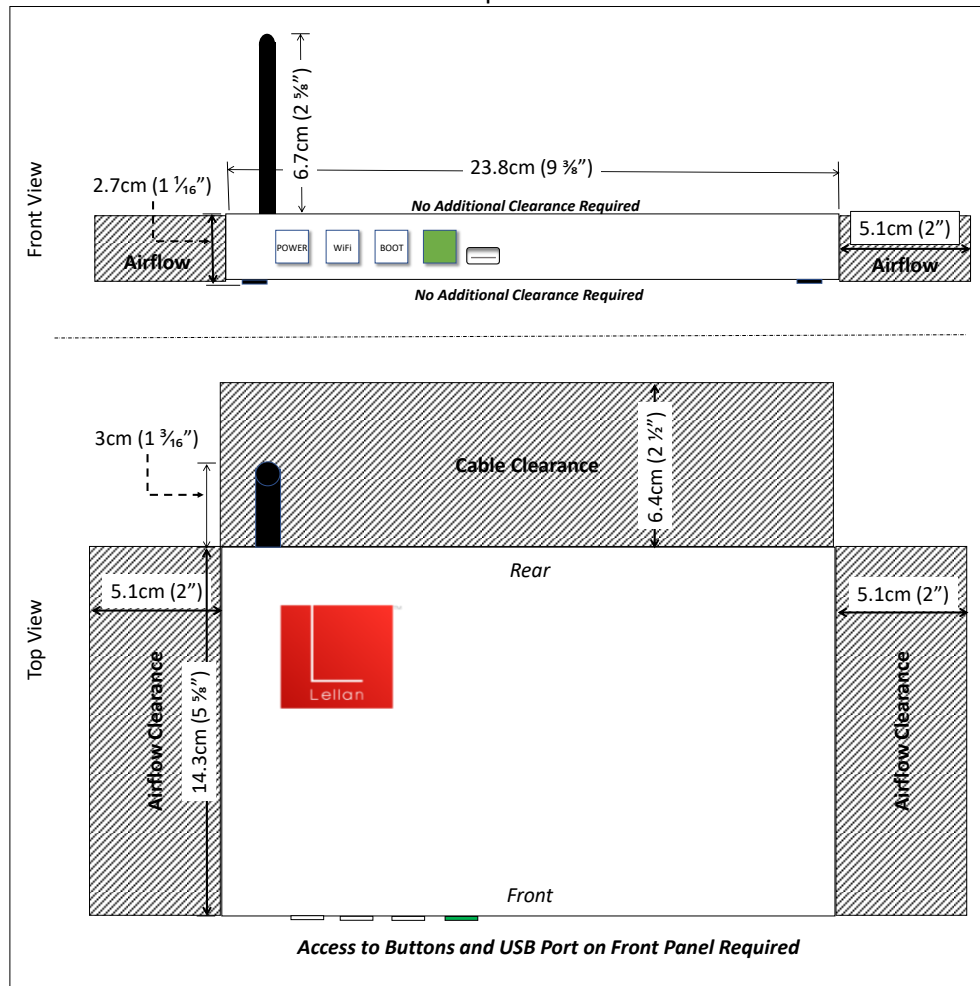
Figure 4-5: SmartHub Dimensions and Required Clearances

Although there are no specific clearances for the front panel of the SmartHub, the buttons and USB port must be accessible for occasional maintenance and emergency reset operations. In addition, the front panel includes an Indicator LED that gives useful information about the state of the DigitalCanvas, especially during startup operations. It can be handy to be able to see both this LED and the DigitalCanvas simultaneously during startup

An important consideration in placing the SmartHub is maximizing the reliability of its Wi-Fi communication. This will depend on how the DigitalCanvas network is to be configured (see Section 4.1).

If the DigitalCanvas will run in AP mode, then the SmartHub should be located within 100ft of and, if possible, with an open line-of-sight to the location(s) where the user will be positioned while using the LellanApp (on an iPad, tablet or PC) to operate the DigitalCanvas. Any walls or other obstructions between the SmartHub and the LellanApp device(s) will weaken the Wi-Fi connection and could interfere with the operation of the DigitalCanvas.

If the DigitalCanvas will run in Wi-Fi mode, then the SmartHub should be located within 100ft of and, if possible, with an open line-of-sight to the Access Point for the Wi-Fi network. Any walls or other obstructions between the SmartHub and Access Point will weaken the Wi-Fi connection and could interfere with the operation of the DigitalCanvas.

If the DigitalCanvas will run in Wired mode, then the SmartHub only needs access to a Cat5 or better Ethernet cable back to the hub or router.

4.3   Specifying the Layout

The true power of the DigitalCanvas is in the modular design of the SmartTiles. A DigitalCanvas can take on an almost infinite variety of shapes simply by laying out the SmartTiles in unique physical arrangements. The layout of SmartTiles in a DigitalCanvas is a primarily an issue of artistic design. This section, however, covers a few constraints and guidelines that need to be followed when planning the physical layout and installation of the SmartTiles.

4.3.1   Layout Types

Figure 4-6 illustrates 3 types of layouts for a DigitalCanvas. The three layout types differ a bit in the issues that crop up during installation.

The goal for the *continuous* layouts is a seamless integration of the SmartTiles into a single contiguous shape with a single 'flat' front surface.   It's quite the opposite for a discontinuous layout, where 'seams' between the SmartTiles are an inherent part of the design.
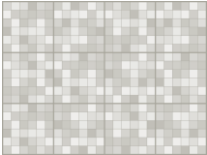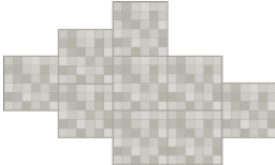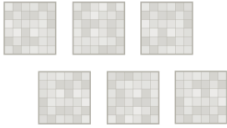
Rectangular/Continuous	Irregular/Continuous	Discontinuous

Figure 4-6: Types of DigitalCanvas Layouts

4.3.2   3-Dimensional Layouts

In most cases, a DigitalCanvas will be laid out on a single 2-dimensional surface (e.g., a wall). But it is possible to layout a DigitalCanvas in 3 dimensions. For example, the SmartTiles could wrap around or into a corner between two walls or the SmartTiles could wrap around a column.

The DigitalCanvas software (e.g., the LellanApp user interface, the content creation tools, etc.) assumes that every Canvas is laid out on a single 2-dimensional surface. For 3-dimensional DigitalCanvases, you will have to 'project' the 3d layout into a 2d layout during the Map Canvas procedure (see Section 5.13).

The content creation tools will then use this 2d Map to create '2d content' that gets played on the 3d Canvas. The software will not provide any assistance in creating and/or playing content that takes advantage of the 3d nature of the Canvas.

4.3.3   SmartTile Orientation (Rotation)

In most cases, all SmartTiles in a DigitalCanvas will be laid out in the same orientation relative to a (somewhat arbitrary) vertical axis. But it is possible to lay out SmartTiles that are arbitrarily rotated relative to the other SmartTiles in the Canvas. See the Canvas on the right in Figure 4-7 for an example.

The DigitalCanvas software, however assumes that the SmartTiles in a DigitalCanvas either all have the same orientation or are at least rotated relative to their peers by some multiple of 90°. For any Tile that has a non-90° rotation, you will need to regularize its rotation (i.e., to specify some rotation that is a multiple of 90°) during the Map Canvas procedure (see Section 5.13). The content creation tools will then use this regularized Map to create regularized content that gets played on the 'non-regular' Canvas (see Figure 4-7). The software will not provide any assistance in creating and/or playing content such that it is properly adjusted for the 'rotated' SmartTile(s).
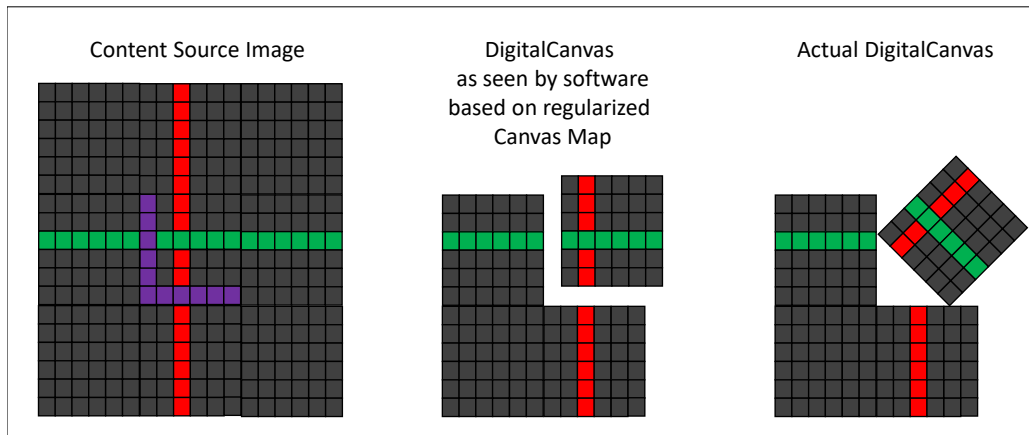

Figure 4-7: Rotated SmartTile as seen by the DigitalCanvas software

4.3.4   DigitalCanvas Orientation (Rotation)

Most DigitalCanvases will be laid out with all the SmartTiles oriented to so that one edge is parallel to a (somewhat arbitrary) vertical axis. But it is possible to rotate the entire Canvas relative to the vertical axis. See the Canvas on the right in Figure 4-8 for an example.

The DigitalCanvas software, however, assumes that every Canvas is oriented parallel to the vertical axis. If this is not the case, you will need to adjust the data you enter during the Map Canvas procedure (see Section 5.13) so that it appears to the software *as if* the Canvas were oriented parallel to vertical. The content creation tools will then use this adjusted Map to create 'unrotated' content that gets played on the rotated Canvas (see Figure 4-8). The software will not provide any assistance in creating and/or playing content such that it is adjusted to display 'correctly' on a rotated Canvas.
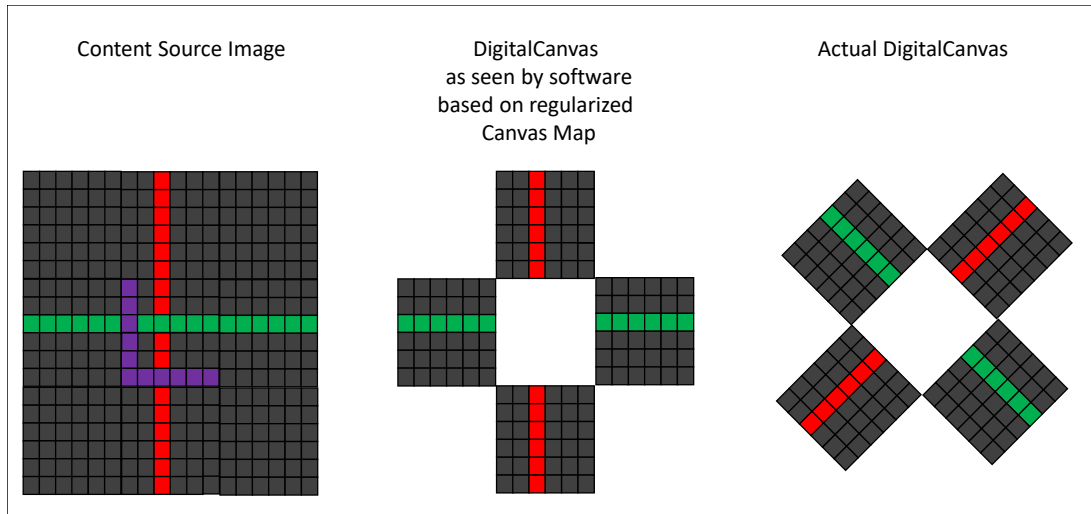
Figure 4-8: Rotated DigitalCanvas as seen by the DigitalCanvas software

4.3.5 Other Layout Considerations

The issues that must be considered when planning a layout are:

5. For irregular and discontinuous layouts, it is best to position the SmartTiles on the lines of a 5cm grid. This will ensure that every Tile is offset from every other SmartTile by some multiple of one cell. This will help avoid visual artifacts that can occur when creating content for the DigitalCanvas.

6. For irregular, continuous layouts, it is best to either line up adjacent SmartTiles exactly or to offset them by half the width of a Tile (15cm). This will enable you to use the O-Clamps (see Section 5.5.1) to pull the Tiles together to avoid seams in the surface. If the Tiles are offset in other than half-Tile increments, the O-Clamps cannot be used and it will be much harder to achieve a continuous surface.

7. For discontinuous layouts, the distance between every SmartTile and its nearest neighbor (measured center-to-center) must be less than the 'effective length' of the longest available SmartTile cable. The longest cable is currently 3 meters (9.85 feet). But the effective length of this cable must be adjusted downward depending on how the cable is physically routed. For example, if the cable is routed behind the wall its effective length will be a few inches shorter.

8. For discontinuous layouts where the cables are not routed behind the wall, its best to ensure that the distances between a SmartTile and the other Tiles it is connected to (see Section 4.4 below) match the effective length of one of the available cables (see Section 3.4). There is no way to "stuff" any excess length into the SmartTiles in order to prevent sagging or otherwise unruly cables

4.4 Developing a Cabling Plan

4.4.1 Cabling Plan 'Rules'

Before installing the cables, you will need to decide on a cabling plan for the DigitalCanvas that specifies how the SmartTiles and PowerBoxes are to be logically interconnected via cables. There is a great deal

of flexibility in formulating this plan, but there are rules that must followed for the DigitalCanvas to function and to function well.

See the figures in Sections 8 and 4.4.3 below for examples of well-formed and flawed cabling plans, respectively.

Note that the following sections frequently talk about connecting *SmartTiles* via cables. This is a short-hand. In fact, it is the SmartTile *Frames* that are being connected via cables*.

The cabling plan rules are as follows:

1. Cabling is done on a Circuit-by-Circuit basis. All cable connections must be within one Circuit and under no circumstances can a cable cross between Circuits. (See Figure 4-10 and Figure 4-11)

   This is a very important rule. The DigitalCanvas has no way to detecting such cross-Circuit connections and such connections will almost always short out the two PowerBoxes involved.

2. Every SmartTile has 4 cable ports. It does *not* matter into which port any given cable is plugged. Chose the port to minimize cable length or to maximize the ease of physical installation of the cable.

3. All cables are symmetric and can be installed arbitrarily "left-to-right" or "right-to-left".

However, from a *logical* point of view when creating a cabling plan, we think of each cable as having a direction, carrying messages *from* one SmartTile (or PowerBox) *to* another SmartTile. From a SmartTile's perspective, each cable is therefore either *incoming* or *outgoing*. (See, for example, Figure 4-9.).

4. Every PowerBox must be connected to one SmartTile. This SmartTile is referred to as the <u>Root Tile</u>. The cable from the PowerBox is always *incoming* into the Root Tile.

5. Every SmartTile must have one *incoming* connection.

SmartTiles can have more than one incoming connection (see Figure 4-13), but there is no benefit to this. Only one of the connections will be used. And the DigitalCanvas performance can be negatively affected by any unused connections.

6. Each SmartTile can have from zero to three *outgoing* connections.

7. For any SmartTile there will be a <u>connection path</u> from the Root Tile, i.e., a sequence of directional connections starting at the Root Tile and passing thru intermediate Tiles to reach that SmartTile. The length of a connection path is the *number* of cable connections required between the Root and the target Tile, without regard to the physical length of these cables.

For best performance, minimize the lengths of the connection path from the Root Tile to each of the other SmartTiles. The longest connection path is the most important in determining the DigitalCanvas performance. (See Figure 4-12)

8. Use the shortest physical length cables possible. Shorter cables, result in better overall DigitalCanvas performance.

Physical length is slightly more important to performance than length of connection path (Rule #7). For example, if there is a trade-off between using two cable connections versus one cable that is physically twice as long, choose the two cable connection option (see).

4.4.2 Examples of Well-Formed Cabling Plans

Figure 4-9 shows a well-formed cabling plan for a discontinuous, irregularly shaped DigitalCanvas with 7 SmartTiles on a single Circuit.
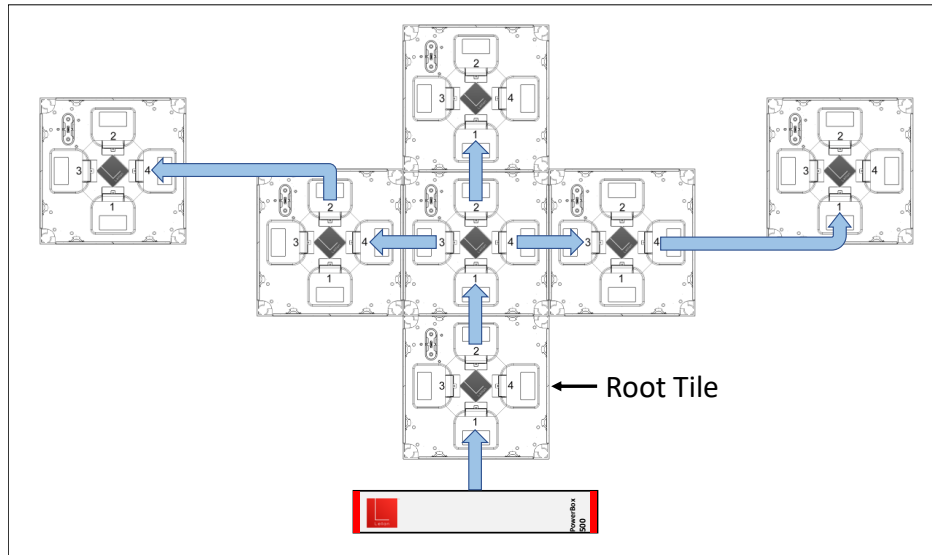

← Root Tile

Figure 4-9: Example Cabling Plan – Discontinuous, Irregularly Shaped DigitalCanvas

Figure 4-10 shows a well-formed cabling plan for a continuous, rectangular DigitalCanvas with 2 Circuits of 9 Tiles each. Note that this Canvas does not really require 2 Circuits since there are only 18 Tiles total. But there is no issue (except for cost, of course) with under-populating Circuits.
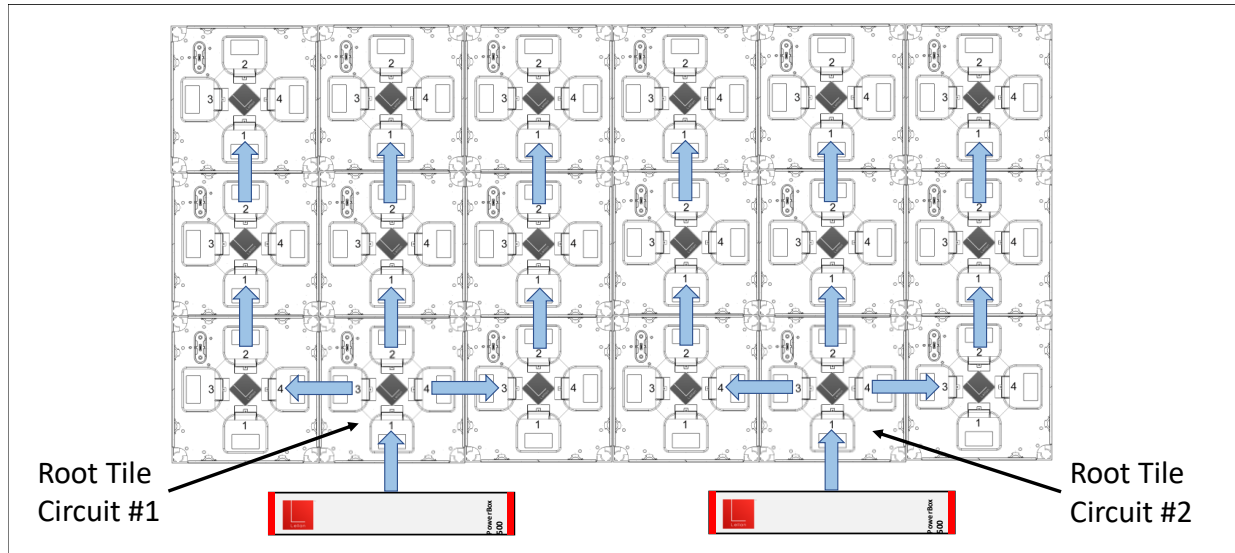

Root Tile
Circuit #1

Root Tile
Circuit #2

Figure 4-10: Example Cabling Plan: Continuous, Rectangular Shaped Digital Canvas with 2 Circuits

4.4.3 Examples of Flawed Cabling Plans

Figure 4-11 shows the same DigitalCanvas as Figure 4-10, except for a single cable added between the two middle Tiles in the top row. This cable creates a connection between the two Circuits – which violates the first rule in Section 0. In a DigitalCanvas cabled as in this figure, one or both PowerBoxes will fail almost immediately.
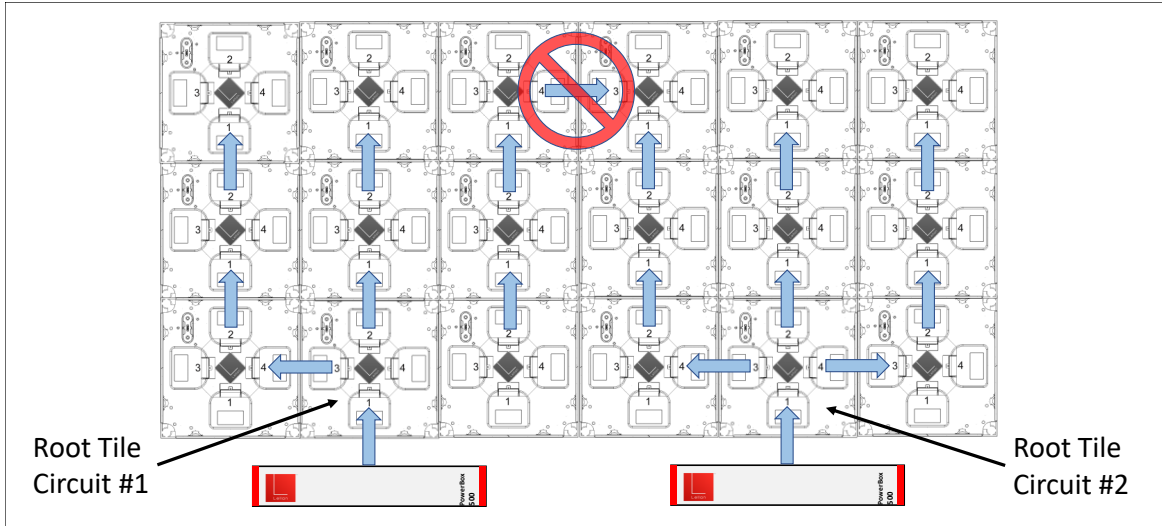
Figure 4-11: Erroneous Cable Plan, Cable Connection Across Circuits

Figure 4-12 shows a DigitalCanvas that has the same layout as one of the Circuits from Figure 4-10, but has a very different cabling plan. This cabling plan violates Rule #7 from Section 0. Its longest connection path (from the Root to the Tile in the lower right corner) is 7 cables in length. In contrast, the longest connection path (from the Root to the Tiles on the upper corners of each Circuit) in Figure 4-10 is 3 cables.

Although the DigitalCanvas in Figure 4-12 will function fine, its performance will be significantly less than if it were cabled using the plan from Figure 4-10.
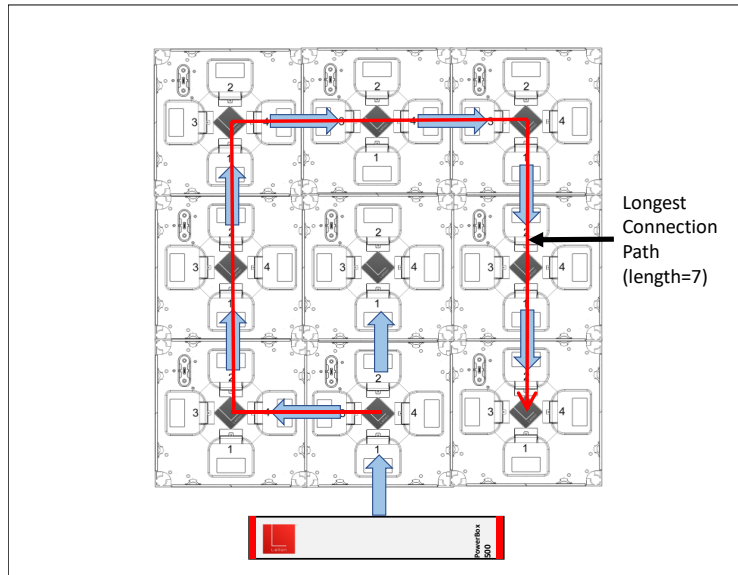

Figure 4-12: 'Incorrect' Cabling Plan, Unnecessarily Long Connection Path

Figure 4-13 shows a DigitalCanvas with the same layout and cabling plan as one of the Circuits in Figure 4-10, but with two additional cables added in the top row. These two added cables violate Rule #5 in Section 0 since the two upper-corner Tiles now have two incoming connections.

The DigitalCanvas shown in Figure 4-13 will function as expected but its overall performance will be less than if the two added cables were left out. (Alternatively, the two cables leading into the two upper-

corner Tiles from below could be left out. This alternative, however, leads to longer connection paths from these upper-corner Tiles.)
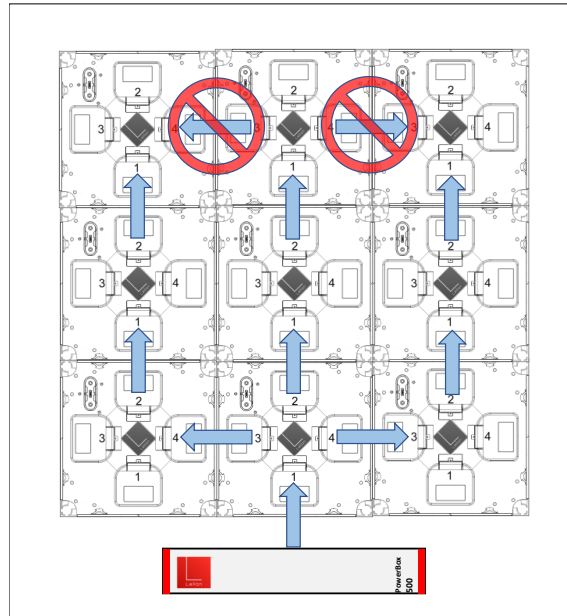

Figure 4-13: 'Incorrect' Cabling Plan, Two Tiles with More than One Incoming

Figure 4-14 illustrates two alternative cabling plans for the same layout. Both cabling plans will function. But, as per Rule #8, cabling plan A is preferred to cabling plan B because of the physically long cable used in plan B, even though the longest connection path is longer in A than in B.
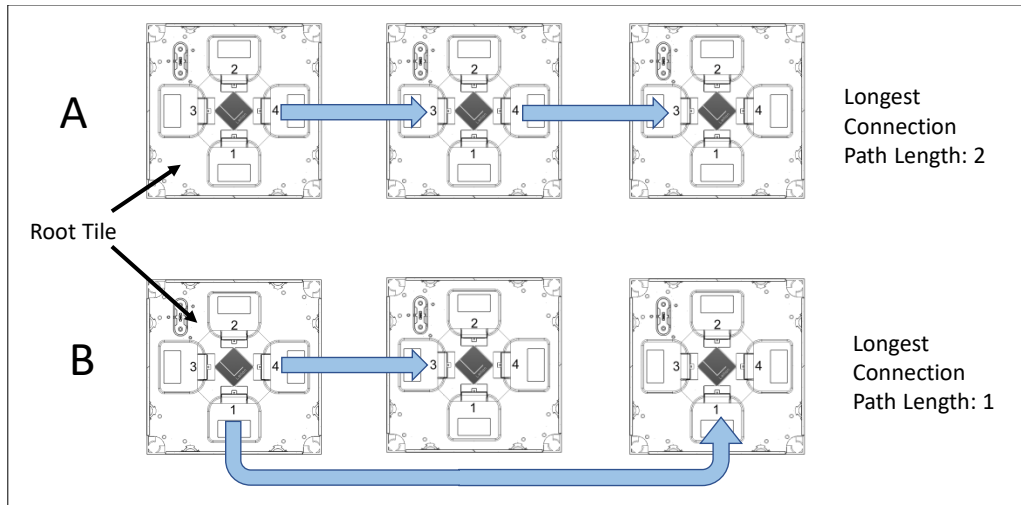

Figure 4-14: Cabling Plan A is Preferred to Cable Plan B Due to Cable Length

4.4.4   Physical Cable Routing

There are two ways in which cables can be physically routed into a SmartTile – through the side of the Frame (see Figure 4-15) *or* through the back of the Frame (see Figure 4-16). When connecting through the side of the Frame, the cable will run in front of the mounting surface to the next SmartTile. When connecting through the back of the Frame, the cable will generally run through a hole or gap in the mounting surface and behind the mounting surface to the next SmartTile.
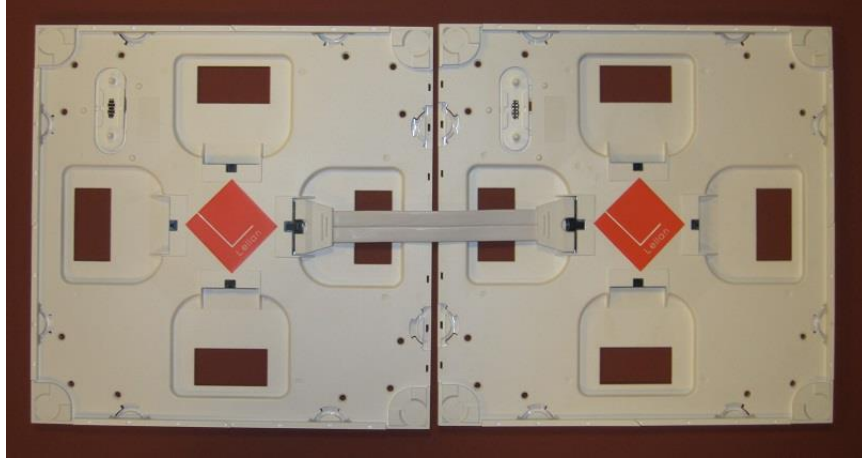
Figure 4-15: Cable Routed Through Side of Frame and In Front of Mounting Surface

Figure 4-16: Cable Routed Through Back of Frame and Behind Mounting Surface

For DigitalCanvas layouts that are Continuous (see Figure 4-6) the cables will generally be run through the side of the Frames from Tile to Tile.

For Discontinuous layouts and for the cables that run from the PowerBox to the Root Tile (see, Figure 4-9), you will need to make a choice whether the cables will run through the side of the Tiles and in front of the mounting surface *or* will run through the back of the Tiles and behind the mounting surface.

If you will be running cables behind the mounting surface, you may need to cut holes in the mounting surface to match the holes in the back of the Frames adjacent to every port that has a cable in the Cabling Plan. These holes need to be a minimum of 4.5cm x 1.3cm (1¾" x ½") and oriented with the long side parallel to the port connector.

You will also need to ensure that the cables have unobstructed routes from Tile to Tile behind the mounting surface.

Finally, you will need to consult your local Electric Codes to insure in-wall installation is permissible in your location. Each cable carries up to 20A at 24V.

5 Installing the DigitalCanvas

5.1 What Has Been Shipped to You

For a DigitalCanvas consisting of **N** SmartTiles, your shipment should contain the following items:

Item	Quantity
SmartTile including mounting Frame	N
22cm SmartCable	N (1 per SmartTile)
O-Clamp	Nx3 (3 per SmartTile)
Edge Extender (see Figure 5-2)	Nx8 (8 per SmartTile)
PowerBox	M [= ((N + 39) ÷ 40) truncated to an integer]
1-Meter SmartCable	M (1 per PowerBox)
1.5-Meter Cat5 Ethernet Cable	M (1 per PowerBox)
Power cord for the PowerBox	M (1 per PowerBox)
SmartHub	1
Power Adapter for SmartHub	1

In addition, your shipment may include specially ordered 3-meter SmartCables.

5.2 Additional Things You Will Need

iPad or 10" Android tablet

Level

Pencil

At least 4 per SmartTile screws or other fasteners suitable for your mounting surface (see Section 5.5.2)

Screwdriver suitable for these fasteners

Drill (if necessary for use with fasteners)

Saw or other tool to cut through mounting surface (if necessary for cable routing)

5.3 Installation Steps

Once planning is complete, installing the DigitalCanvas involves the following steps:

1. Prepare the mounting surface including cutting any holes necessary for cable routing.
2. Mount the SmartTile Frames.
3. Install the cabling for the SmartTiles
4. Install the PowerBoxes and the SmartHub.
5. Install the SmartTiles onto the Frames.

6. Install the LellanApp and Connect to the DigitalCanvas

7. Set the Network Name.

8. Mark the Active Circuits

9. Test the Connections.

10. Create the Canvas Map.

11. Configure the Network.

12. Have fun!

The following sections cover each of these steps in detail.

5.4   Step 1: Prepare the mounting surface

Based on the DigitalCanvas layout, place guide marks on the mounting surface showing the location and orientation of each of the SmartTiles.

If the layout is rectangular and continuous (see Figure 4-6), you may need only provide guide marks for the top row of SmartTiles. Placement and orientation of the subsequent rows will be constrained by the O-Clamps that connect adjacent Tiles (see Section 5.5.1).

If the Cabling Plan involves routing cables out the back of the Frames (see Section 4.4.4), use a Frame as a template to mark the exact locations and dimensions where holes will need to be cut thru the mounting surface.

It is best to make *all* of the cabling hole cuts before mounting any Frames. This will avoid dust or other particles created by the cutting from contaminating the floating contact connectors on the Frames.

5.5   Step 2: Mount the Frames

The SmartTiles will arrive with their Frames magnetically attached. Separate the Frames from the Tiles. This is most easily done by grabbing hold of the Frame using one of the holes in its back and gently pushing against the Tile through the hole.

Put aside the Tiles. There is no need to track which Tile came with which Frame – any Tile can be mated with any Frame.

Mount the Frames as follows.

5.5.1   Installing the O-Clamps (Continuous layouts only)

In a continuous layout, before fastening the Frame to the surface use one or more O-Clamps to attach the Frame to previously installed adjacent Frames. The O-Clamps serve to force the adjacent Frames (and hence Tiles) as closely together as possible in order to create a seamless DigitalCanvas surface.

See Figure 5-1 for a photo of the O-Clamps and how they are used.
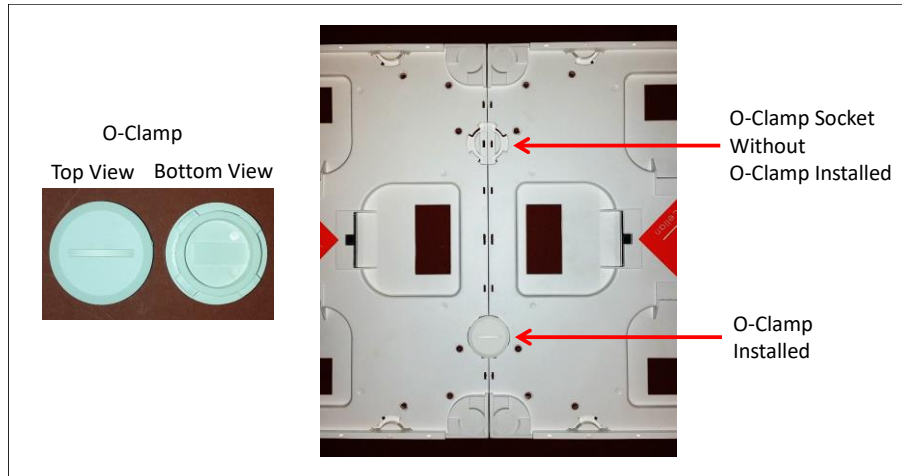
Figure 5-1: O-Clamps

Two O-Clamps are included with each SmartTile. They are shipped in the box that contains the cable.

O-Clamps can only be used where two Frames are fully adjacent to each other or are offset by exactly one-half of the Tile/Frame size. In all other cases, the sockets for the O-Clamps from the two Frames will not line up with each other.

Before installing the O-Clamps, you will need to remove the Edge Extenders along the side of the Frame where the O-Clamps will be installed. For each side, there are two Edge Extenders. To remove, just grab the Extender between thumb and forefinger and pull out. See Figure 5-2 for examples of the Edge Extenders installed, being removed, and removed.
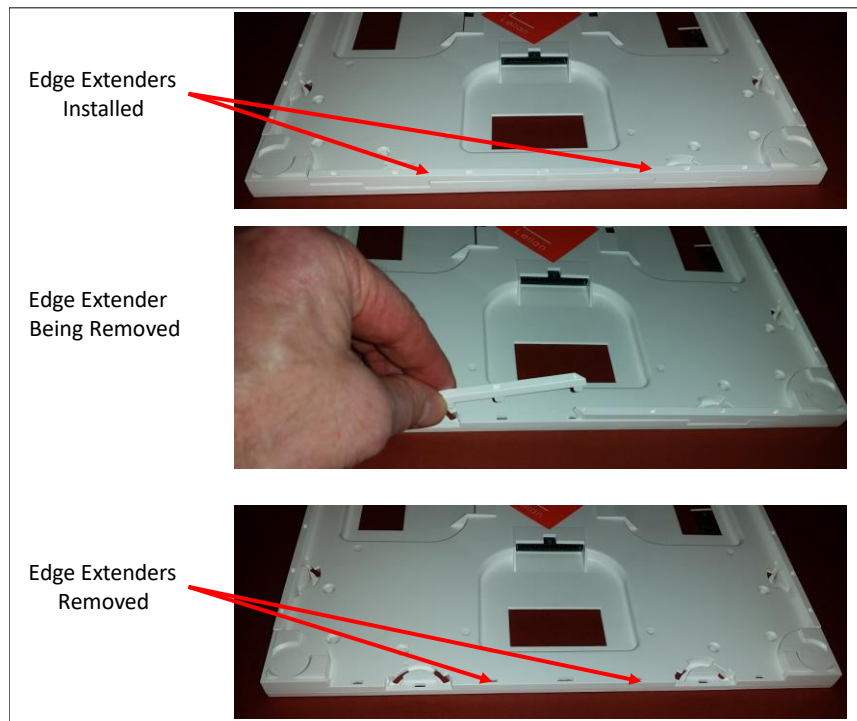
*Figure 5-2: Edge Extenders Installed, Being Removed and Removed.*

To install the O-Clamps, line up the O-Clamp half-sockets from the two adjacent Frames (see Figure 5-1). In each socket, insert an O-Clamp with the slot on the front of the O-Clamp at a 45° angle relative to the edge between the Frames. Push the O-Clamp in and using a large coin or the edge of a spare O-Clamp turn it ⅛-turn clockwise to lock in place. (A ⅛-turn counter-clockwise will unlock.) Figure 5-3 shows the insert and locked positions for an O-Clamp.
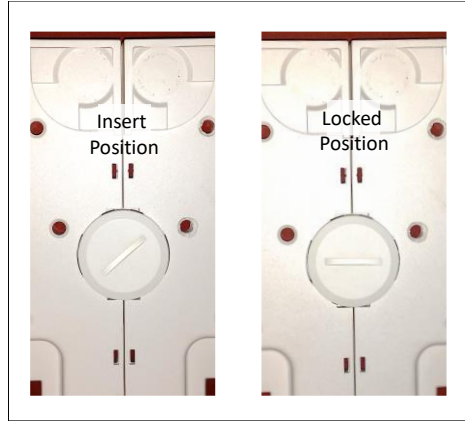
Figure 5-3: O-Clamp in Insert and Locked Position

Since only two O-Clamps are shipped with every SmartTile, there may not be enough O-Clamps to use 2 on every junction where Frames meet in your layout. To allocate the available Clamps, use two O-Clamps on every junction between two Frames that are both on the outside perimeter of the layout. Spread the remaining O-Clamps as evenly as possible across all of the other junctions in the layout. Figure 5-4 gives an example using 9 SmartTiles and, hence, 18 O-Clamps.
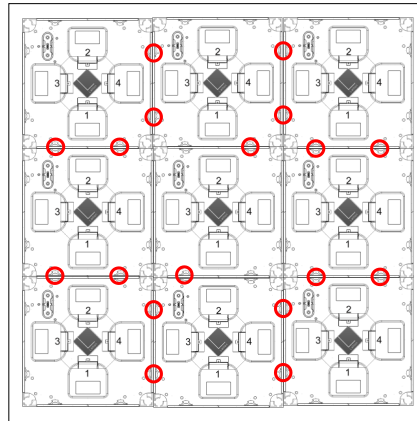

Figure 5-4: Distribution of 18 O-Clamps to Continuous Square Layout of 9 Tiles

5.5.2   Fastening the Frame to the Surface

Mount the Frames to the surface using appropriate fasteners for the surface material.

The rotation of the Frame (in 90° increments) does not matter (see Section 4.3.3). However, in the long run some of the maintenance operations on the DigitalCanvas will be a bit easier if all of the Frames in the DigitalCanvas are rotated the same way.

Each Frame hosts 12 fastener locations (see Figure 5-5). The exact location of these mounting holes is given in Section 6.1.3: *Location of Mounting Holes on SmartTile Frame*. It is recommended to use four fasteners per Frame (one in each corner).
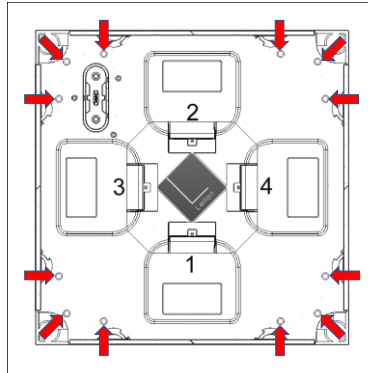
Figure 5-5: Twelve fastener locations on Frame

The depth of all molded fastener locations on the Frame is 8.4 mm (0.33 inches) and the diameter is 5mm (3/16 inch). The fastener location has a 45° beveled top and is most appropriate for a beveled flat head screw. See Figure 5-6.
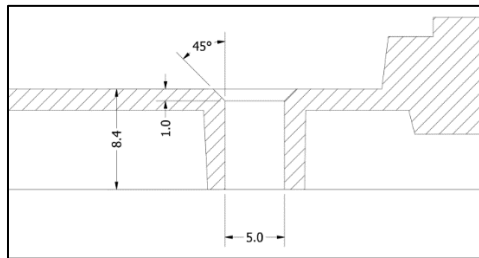

Figure 5-6: Cross-section of a single fastener location on Frame. Dimensions in mm.

The top of the screw must not extend above the top of the fastener location more than 5mm (3/16 inch) or it will interfere with the proper mating of the SmartTile to the Frame.

5.6   Step 3: Install the Cabling for the SmartTiles

After all the Frames are mounted, you can install the SmartCables between Frames as per the Cabling Plan (see Section 4.4). Figure 5-7shows Frames from a small DigitalCanvas with the SmartCables installed.
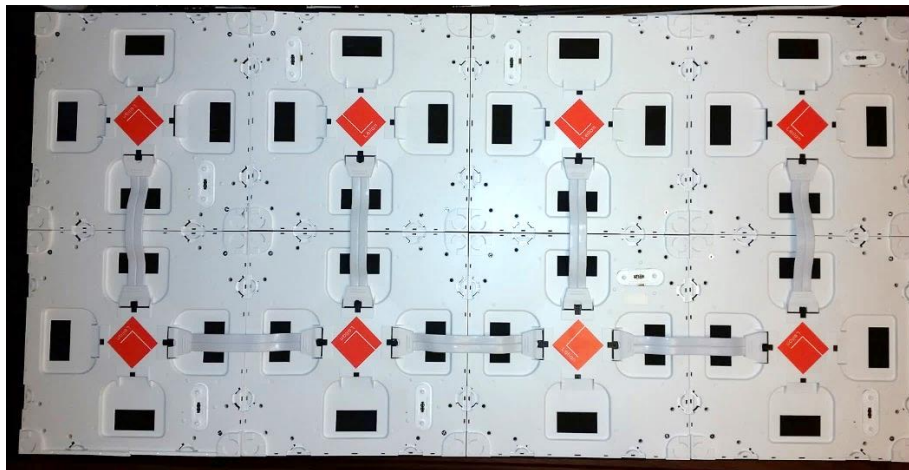

Figure 5-7: DigitalCanvas Frames with SmartCables Installed

Before installing a SmartCable, remove any Edge Extenders along its path. See Section 5.5.1 and Figure 5-2 for how to do this. This step is *very* important. If the Edge Extenders are not removed, the SmartCable will be routed over the Edge Extenders preventing proper mating of the Tile to its Frame. The result will be intermittent and hard to diagnose failure of the SmartTiles.

Edge Extenders do not have to be removed for any SmartCables routed out the back of the Frames.

SmartCables are symmetric and can be plugged into any of the 4 sockets on the Frame.

SmartCables are designed to fit snuggly and securely into the sockets. Push the SmartCable connector into the socket with sufficient force until a mechanical 'click' is heard as the tab on the connector snaps over the corresponding piece on the socket (see Figure 5-8). Push the connector in 'straight' without tipping or rocking. Tipping and rocking can bend and damage the connection pins inside the connectors and sockets.
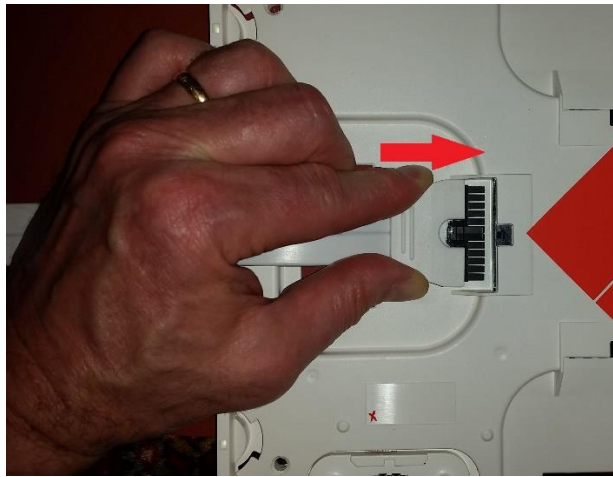

Figure 5-8: Inserting SmartCable plug into Frame Socket

To disconnect a SmartCable, press down on the tab in the center of the plug while simultaneously pulling the plug from the socket.

Once a SmartCable is connected at both ends, it may tend to bow out and away from the back of the Frame. If this happens, push the cable back into the Frame so that it bows 'in' rather 'out'. This will help avoid problems when mating the SmartTile to its Frame.

SmartCables may be painted if needed to minimize the impact on the installation.

5.7   Step 4: Install the PowerBoxes and the SmartHub.
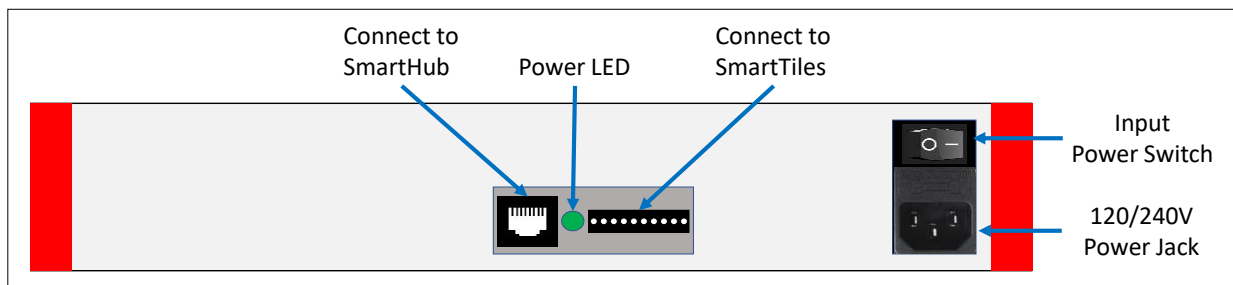
Figure 5-9: PowerBox Rear Panel - Sockets and Controls
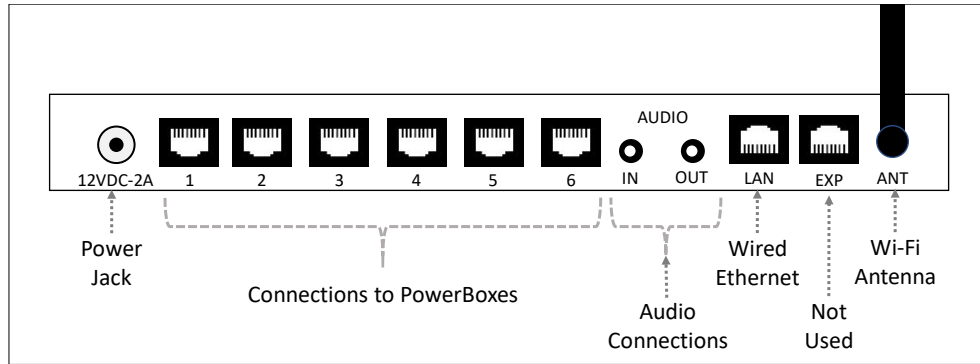
Figure 5-10: SmartHub Rear Panel - Ports

Place the PowerBoxes and the SmartHub in their intended locations (see Sections 4.2.2 and 4.2.3).

Install the cables between the PowerBoxes, the Frames and the SmartHub as follows:

1. For each PowerBox, use a 1-meter or 3-meter SmartCable to connect from the SmartCable socket on the PowerBox (see Figure 5-9) to the Frame for the Root Tile of its Circuit. The SmartCable socket on the PowerBox is identical to the sockets on the Frame so the SmartCable can be installed in either 'direction'.

2. For each PowerBox, use an appropriate length Cat5 Ethernet cable to connect from the SmartHub port on the PowerBox (see Figure 5-9) to one of the PowerBox ports on the rear of the SmartHub (see Figure 5-10).

You can connect to any of the six PowerBox ports on the SmartHub. However, as a rule you should use the lower numbered ports first (and leave open the higher numbered ports if there are less than six Circuits). In addition, if you can order the physical locations of the Circuits (left to right or up to down), you should follow the same order in assigning the ports (lower numbered to higher numbered).

Be aware that there are two additional ports on the rear of the SmartHub (labelled LAN and EXP) that use the same RJ45 connectors as the SmartHub ports. Do NOT connect the cables from the PowerBoxes into these two ports.

3. If you will be using Wired mode for networking the DigitalCanvas, plug the Cat5 or better Ethernet cable coming from you network hub or router into the LAN port on the rear of the SmartHub.

4. Make sure that the power switch on all of the PowerBoxes is in the 'Off' position. Then for each PowerBox, plug the power cord into the IEC jack on the rear panel and then into the 120V/240V wall socket.

5. Plug the cord from the SmartHub power adapter into the power jack on the SmartHub and then plug the power adapter into the 120V/240V wall socket.   This will start the SmartHub boot process as evidenced by the flashing Indicator LED.

## 5.8   Step 5: Install the SmartTiles onto the Frames

SmartTiles are 'fastened' to their Frame using magnets located in the four corners of both the Tile and the Frame (see Figure 5-11).
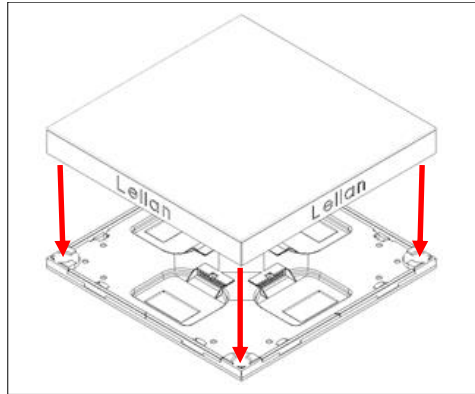
Figure 5-11: Magnetic Mating of Tile to Frame

There is no cable connecting the Tile and its Frame. Instead there is a special floating connector on the Frame that magnetically mates with a corresponding connection pad on the back of the Tile (see Figure 5-12).

The SmartTile can be inserted in only one orientation relative to its Frame – the floating connector on the Frame must line up with the connector pad on the back of the Tile.

Front of Frame   Back of Tile
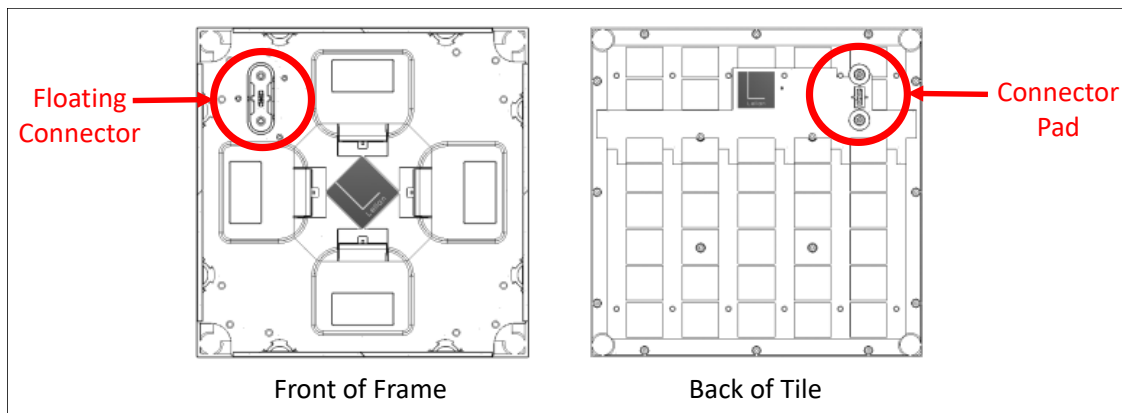
Figure 5-12: Floating Connector on Frame Aligns To Connector Pad on Tile

To install the Tile bring it close to the Frame in the correct orientation. When the distance between Frame and Tile is about 2.5cm (1"), the magnets will pull the two pieces together and properly align them.

If the Tile oriented incorrectly relative to the Frame (i.e., the floating connector and connector pads do not line up), then magnetic forces will tend to push the two pieces apart.

After the Frame and Tile mate, check to make sure that the Tile sits squarely and firmly in the Frame. If not, pull the Tile out and reinstall as above.

The Tile can be removed from the Frame by lighting prying from one side or by using a standard glass movers suction cup to gently pull the Tile away from the Frame. Suction cups are particularly useful when the Tile is in an 'interior' position and no edges are easily grasped.

Even when the Tiles are properly installed onto the Frame there will be a small amount play in the Tile's location. You may find that you will need to slightly nudge one or more adjacent Tiles in order to fit a Tile into its place in the layout.

Once all the SmartTiles are installed, switch on all of the PowerBoxes by turning the power switch to the 'On' position.   You should see a heartbeat (two blue cells alternating on-off) on all Tiles in the DigitalCanvas. If the heartbeat doesn't show or only shows on some of the Tiles, use the following troubleshooting chart:

No heartbeat all	Make sure that the SmartHub is powered on and has fully booted (Indicator LED on solid green).
	Make sure that the PowerBoxes are plugged in and switched on.
	Make sure that the cables from the SmartHub to the PowerBoxes and from the PowerBoxes to the Root Tiles are installed correctly.
	Try cycling the power on the SmartHub (and waiting for it to fully boot – about 30 seconds).
One Circuit has no heartbeat on any of its Tiles	Make sure that the PowerBox for the Circuit is plugged in and switched on.
	Make sure that the cables from the SmartHub to the PowerBox and from the PowerBox to the Root Tile are installed correctly.
	Turn off the PowerBox. Remove and then reseat the Root Tile. Turn the PowerBox back on.
One or more individual Tiles do not have a heartbeat	Turn off the relevant PowerBox. Remove and then reseat the affected Tile(s). Turn the relevant PowerBox back on.

If the above troubleshooting actions do not solve the problem, it is always possible that the heartbeat feature has been turned off in one or more Tiles. If this is the case, go on to the next step (Connectivity Test) to further test the operation of the Tiles (and see the Heartbeat sections in the *DigitalCanvas User Manual).*

5.9   Step 6: Install the LellanApp and Connect to the DigitalCanvas

The remainder of the installation procedures utilize the LellanApp, the DigitalCanvas controller software running on an iPad or an Android tablet. The following sections will step you through using the LellanApp for the specific tasks needed to complete the installation. More detailed information on these procedures (including how to run them on a Mac or PC) can be found in the *Lellan DigitalCanvas User Manual.*

To use the LellanApp to connect to the DigitalCanvas you must:

1. Install the LellanApp on your device (iPad or 10" Android tablet) from the Apple AppStore or Google Play using the device's standard procedures for app installation.

2. Ensure that the SmartHub is powered on and fully booted. The Indicator LED should be on solid green.

3. Connect your device to Wi-Fi network created by the DigitalCanvas. How you do this will vary significantly depending on the type and version of your app device.

By way of example, the process on an iPad Air running iOS 10.1 is as follows:

- In the iOS Settings App, tap the Wi-Fi settings entry in the left-hand column on the screen. This will fill the right-hand column with a list of SSIDs for Wi-Fi networks visible to the iPad (Figure 5-13). One of these should be *Lellan_Canvas.*
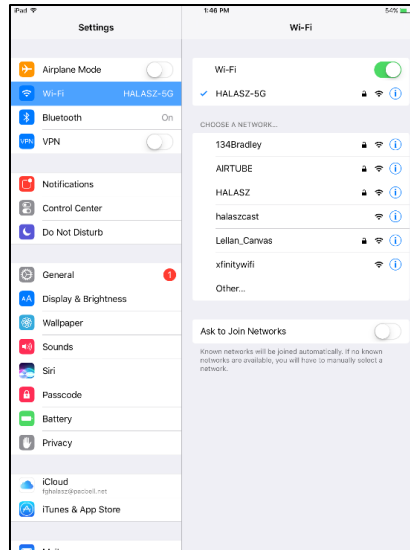

Figure 5-13: The iOS Wi-Fi Settings App

- Tap the Lellan_Canvas entry. This will bring up a dialog asking for the password for Lellan_Canvas (Figure 5-14). Enter *LEDLIGHTS* then tap the Join button.
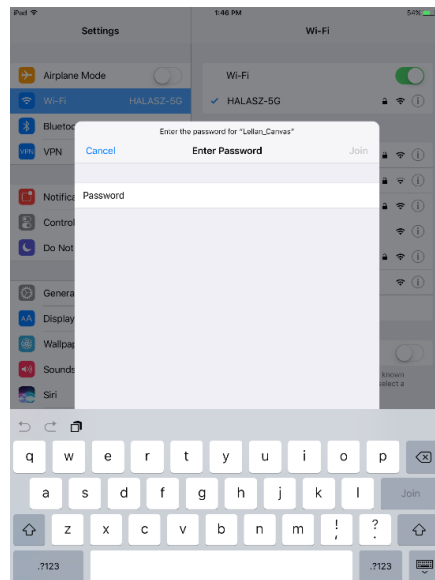

Figure 5-14: Entering password for Lellan_Canvas

- After the iPad successfully connects to the Lellan_Canvas network, a checkmark will appear to the left of the Lellan_Canvas entry, which has moved to the top of the column, and Lellan_Canvas will appear next to the Wi-Fi entry in the left-hand column. (See Figure 5-15)

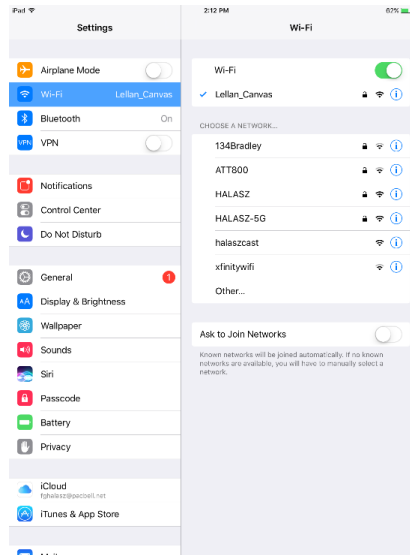

Figure 5-15: Successful connection to Lellan_Canvas

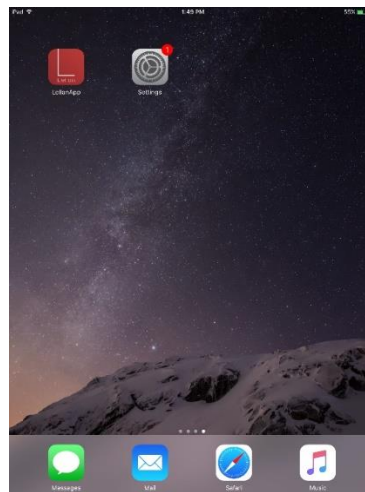- Press the Home button to return to the iOS Home Page (Figure 5-16).

Figure 5-16: iOS Home Screen

4. Start the LellanApp by finding and then tapping on its icon on the Home screen(s).

5. The LellanApp will launch into the *Discovery* page. The *Discovery* page will immediately begin to search for and list all the DigitalCanvases on the local area network as shown in Figure 5-17. Note that for most installations, this 'list" will consist of a single DigitalCanvas.

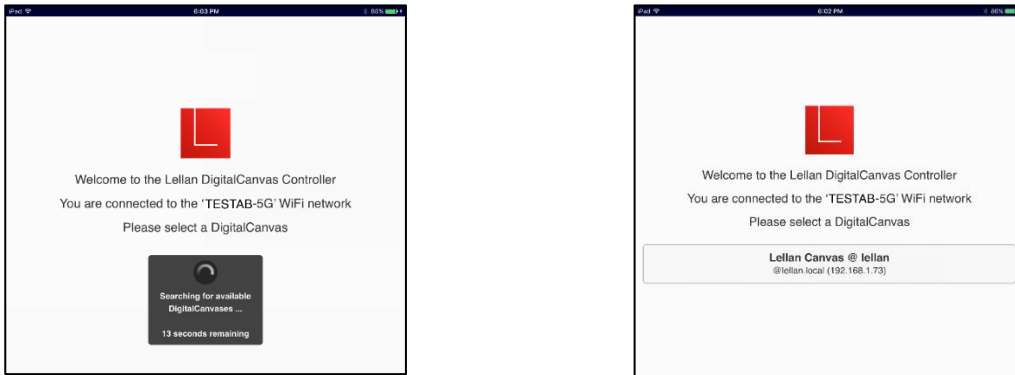*Figure 5-17: The LellanApp Discovery Page*

6. To enter the LellanApp, tap on the list item for the desired DigitalCanvas. This will take you to the *Login* Page for that DigitalCanvas (see Figure 5-18).

7. On the *Login* Page, select **admin** as the user (if it's not already selected) and enter **1221** as the passcode using the numeric keypad. Tap the *Login* button.
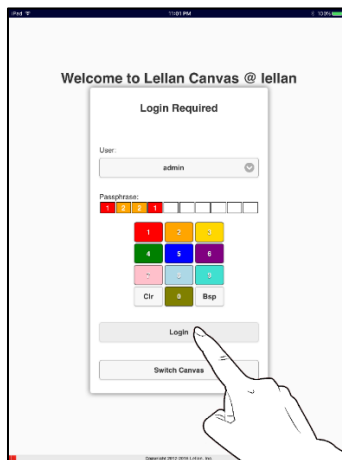

Figure 5-18: The Login Page

8. This will take you to the *Home* Page and bring up the *Main Menu* (see Figure 5-19)*.* If the *Main Menu* does not appear, tap the *Menu* button in the upper-left corner of the page.
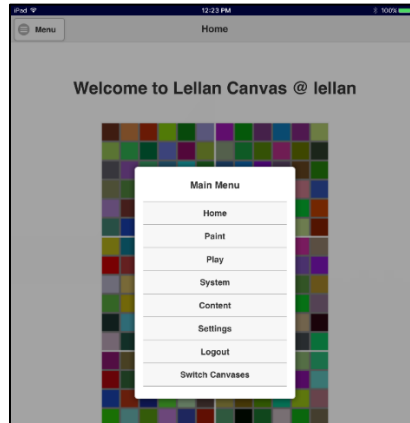

Figure 5-19: The Home Page and the Main Menu

9. The LellanApp is now ready to proceed.

5.10   Step 7: Set the Network Name

The DigitalCanvas comes configured with *"lellan"* as its network name, i.e., the name used to refer to it by other devices on its network. Changing this name is recommended to avoid a name collision should another DigitalCanvas be added to the same network. The new network name should be between 4 and 15 characters long, start with an alphabetic character, contain only alphabetic and numeric characters or one of the characters ["-", "_", "+", "=", "^"].   It must be unique among devices on the network.

To change the network name:

1. From the *Main Menu*, tap *Settings.*

2. From the *Settings* Page, tap *Names.*

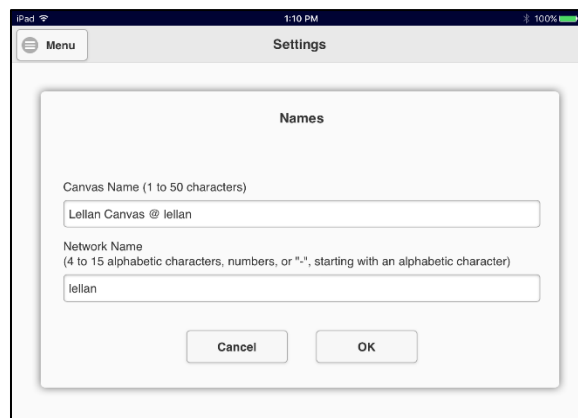3. This will bring up the *Names Settings* Page (Figure 5-20).

Figure 5-20: The Names Settings Page

4. Tap in the *Network Name* edit box and use the soft keyboard to enter the new network name.

5. If you like, you can also change the *canvas name,* which is used to refer to the DigitalCanvas in various labels within the LellanApp.

6. Tapping the *OK* button will 'set' the new name(s) and return to the main *Settings* page via a "success" message box. Tapping the *Cancel* button will discard any edits made to the names and simply return to the main *Settings* page.

7. Return to the *Main Menu* by tapping the *Menu* button in the upper-left corner of the screen.

8. Wait for 30 seconds

9. On the *Main Menu*, tap *Switch Canvases.*

10. This will bring you back to the *Discovery* page as shown in Figure 5-17, except that the listed DigitalCanvas will have the new network (and canvas) names.

11. Proceed to log back into the LellanApp as shown in steps following Figure 5-17.

5.11   Step 8: Mark the Active Circuits

The Mark Circuits Active procedure informs the DigitalCanvas which of the 6 possible Circuits are in fact connected to a PowerBox and SmartTiles (i.e., *active*).

The procedure is as follows:

1. From the *Main Menu*, tap *Settings.*

2. From the *Settings* Page, tap *Map Canvas.*

3. From the *Actions?* Menu, tap *Set Active Circuits.*

4. This will bring up a panel listing the six circuits with a checkbox beside each one (Figure 5-21). Tapping the relevant checkbox, to mark each circuit active (checked) or inactive (not checked).
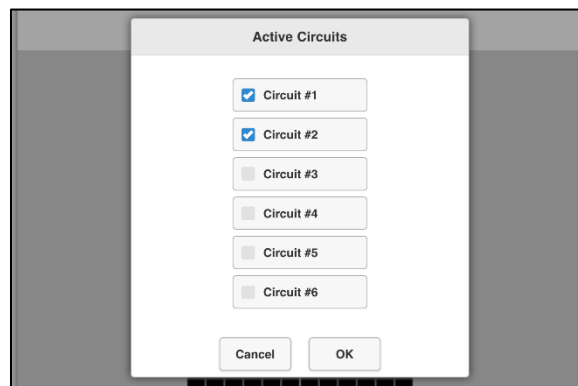

Figure 5-21: Mark Circuits Active

5. When you are done, tap the *OK* button to set the new active Circuits list and return to the *Map Canvas* Actions menu. Alternatively, you can also tap the *Cancel* button to return to the *Map Canvas* Actions menu discarding any changes that you have made to the active Circuits list.

5.12   Step 9: Test the Connections

The next step is to test whether the connections between SmartTiles and between the Tiles and their Frames are all working.

From the *Main Menu,* tap *Settings.* On *Settings* Page, tap *System Maintenance.*

This will bring up the *Connections Test* Page (see Figure 5-22).
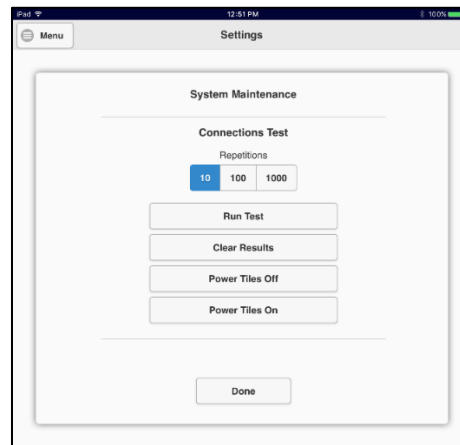

Figure 5-22: The Connections Test Page

To run the connections test:

1. Select **10** on the *Repetitions* radio buttons.

2. Tap the *Run Test* button.

The connections test will begin to test each of the 4 ports on each of the SmartTiles in the DigitalCanvas. While the test is in progress for a Tile, that Tile will show several rapidly flashing blue cells. As each port is tested, the results will be displayed in the cells along the 4 edges of the SmartTile (corresponding to the 4 ports of that Tile). The test is complete when there are no more Tiles in the Canvas showing the flashing blue cells.

When the test is complete, examine the results. For the present purposes, just make sure that all SmartTiles should have some color-coded results. (For a detailed analysis of results, see the *Digital Canvas User Manual.*)

If all the Tiles show color-coded results, clear the DigitalCanvas by tapping the *Clear Results* button and move on to Section 5.13.

For any Tile that does not show color-coded results, you will need to examine that Tile, the Tile that immediately precedes it in the path of cabling from the Root Tile (see Section 4.4), and the cables that connect these two Tiles. If there are multiple Tiles with no results, start with the Tile that is closest to the Root Tile along the cabling path.

To troubleshoot a problematic Tile, do the following:

1. Turn off power to all the SmartTiles in the DigitalCanvas by tapping the *Power Off Tiles* button.

2. Remove the problematic Tile from its Frame.

3. Remove the Tile that precedes the problematic Tile in the cabling path from its Frame.

4. Remove and then reinstall the cable between these two Tiles making sure that the cable is firmly snapped into place on both ends.

5. Clean any debris or contamination (if any) from the floating connectors on the Frames and from the connector pads on the back of the Tiles.

6. Reinstall the two Tiles into their Frames, making sure that they are squarely and firmly seated.

7. Repeat the connection test

If after following this troubleshooting procedure, the problematic Tile still fails to show results from the connection test you should try replacing the components one-by-one in the following order. Rerun the connections test after each replacement until the problematic Tile passes the test.

1. The cable between the problematic Tile and its predecessor in the cabling path.

2. The problematic Tile

3. The Tile preceding the problematic Tile in the cabling path

4. The Frame from the problematic Tile

5. The Frame from the Tile preceding the problematic Tile in the cabling path.

Once all problematic Tiles have been fixed, move on to Section 5.13.

5.13   Step 10: Create the Canvas Map

The next step is to create a Map that tells the DigitalCanvas exactly how it's SmartTiles are laid out in space. The DigitalCanvas can automatically detect it's cabling plan, but it has no way of detecting exactly where the SmartTiles are located on the mounting surface. The Canvas Map provides this information to the DigitalCanvas.

To create a Canvas Map:

1. From the *Main Menu*, tap *Settings*.

2. On the *Settings* Page, tap *Map Canvas*.

3. On the *Actions?* menu, tap *Create/Recreate Map*.

This will begin a two-step process to create a Canvas Map as follows:

1. **Search and Address:** The DigitalCanvas will begin an automatic search of all Active Circuits looking for SmartTiles and the interconnections between these Tiles. In addition, this search process will assign a (new) Address to each Tile based on the discovered interconnections.

2. **Map the Layout:** In a mapping editor, you will be presented with each discovered SmartTile in turn and asked to place it at its correct location relative to the other SmartTiles on a mockup of the mounting surface.

5.13.1 Map Canvas: Search and Address Phase

The Search and Address phase begins immediately after you tap *Create/Recreate Map.* While the Search and Address phase is in progress, there will be a "spinning wheel" message box displayed over the page (Figure 5-23).

Figure 5-23: Gathering Data Message Box

The Search and Address process will progress through each of the active Circuits in turn. You can see the progress of the process as it lights up the various Tiles in the circuit in much the same manner as seen in the connection test described in Section 5.12.

This phase make take up to 5 minutes per active Circuit. When it is complete, the "spinning wheel" message box will disappear and you will be taken to the *Create Canvas Map* page.

5.13.2 Map Canvas: The Mapping Phase

The Mapping Phase involves three intertwined operations that you carry out on the *Create Canvas Map* page:

1. Adding tokens for unmapped Tiles into the Canvas Map (see Section 5.13.2.4: *Next Unmapped: Adding SmartTile Tokens to the Map*).

2. Moving all tokens so that they match their SmartTile's location in the actual DigitalCanvas (see Section 5.13.2.5: *Moving SmartTile Tokens*).

3. Rotating all tokens to match their SmartTile's rotation in the actual DigitalCanvas (see Section 5.13.2.6: *Rotating SmartTile Tokens*).

When these three operations have been completed for all SmartTiles, you can install the new Canvas Map into the DigitalCanvas by tapping the *Save* button (see Section 5.13.2.10: *Saving (Installing) the Canvas Map*) and exiting *Create / Recreate Map* using the *Done* button.

The *Create Canvas Map* page contains the editing controls in the top third of the page with the mapping area taking up the rest of the page (see Figure 5-24).
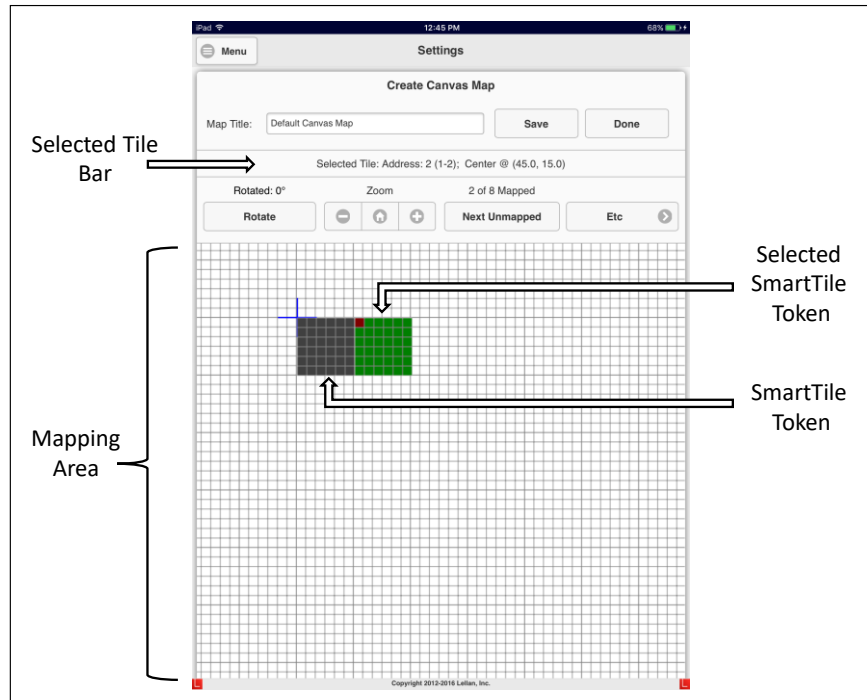

Figure 5-24: The Create Canvas Map Page

5.13.2.1 The Mapping Area

The mapping area is used to create a map of the DigitalCanvas by dragging and dropping SmartTile tokens to form a scaled replica of the 'real' DigitalCanvas (see Figure 5-24)

The mapping area represents an arbitrarily large surface with each gridline representing 5cm (i.e., the size of a single cell in an actual SmartTile). As a placement aid, every sixth gridline (i.e., every 30cm or the size of a SmartTile) is slightly enhanced.

The origin is marked by the center point of a large blue "+". The origin represents the upper-left corner of the bounding rectangle of the SmartTiles within the DigitalCanvas.

Distances in the Map are measured down and to the right of the origin. For the Map to be well-formed (which it must be before it can be saved), no SmartTile can extend above or to the left of the origin.

5.13.2.2 SmartTile Tokens

Each SmartTile token in the Map represents one real SmartTile in the DigitalCanvas.

When not selected, the tokens will be colored black. You can select a SmartTile by tapping anywhere on the token. This will change the token to be green in all its cells except for one corner, which will be colored red. In addition, the corresponding SmartTile in the actual DigitalCanvas will turn on all green except for a single corner red cell (and all other SmartTiles will be turned "off"). Note that the corner that is red in the token and the actual SmartTile may not match (see Section 5.13.2.6: *Rotating SmartTile Tokens*).

When you select a token, the Address and the mapped location of the SmartTile is shown in the *Selected Tile Bar* (see Figure 5-24). The location represents the center of the SmartTile.

5.13.2.3 Getting Started

The *Create Canvas Map* page will begin with the mapping area empty of tokens. Above the *Next Unmapped* button will be the label "N of N unmapped", where N is the number of SmartTiles discovered in the search phase.

Map the Canvas as follows:

4. Tap the *Next Unmapped* button. Place and rotate the new SmartTile token as described in the following sections.

5. Repeat Step 1 until all the SmartTiles have been mapped (label will read "0 of N unmapped").

6. Tap the *Save* button to save/install the new Canvas Map.

7. Tap the *Done* button to exit.

5.13.2.4 Next Unmapped: Adding SmartTile Tokens to the Map

To add an unmapped Tile into the Canvas Map, tap the *Next Unmapped* button. This will add a token for the next unmapped SmartTile into the Map.

The added token will be placed directly on top of the most recently selected token (resulting in a red Ø warning as described in Section 5.13.2.5: *Moving SmartTile Tokens*).

If there is no most recently selected token (e.g., if this is the first token added to the Map), then the token will be placed to the upper-left of the origin point (resulting in a yellow Ø warning as also described in Section 5.13.2.5: *Moving SmartTile Tokens*).

5.13.2.5 Moving SmartTile Tokens

To move a SmartTile within the map, tap down on and then drag the token to the desired location in the map as shown in Figure 5-25. The location information in the *Selected Tile* bar will update instantaneously as you drag.

By default, when you drop the token (i.e., when you lift up your finger from the surface or from the right mouse button after the drag), its location will be adjusted so it falls on the nearest grid intersection (i.e., on a multiple of 5cm both vertically and horizontally). This default snap to grid functionality can be turned on/off via the *Etc* button (see Section 5.13.2.9: *The Etc Button*).

Figure 5-25: Moving a SmartTile Token

You can also move a selected token numerically by tapping the *Etc* button and then tapping *Move Selected Tile* on the *Etc* menu. A panel will pop up with two numeric keypads that can be used to set the exact X and Y of the new location (Figure 5-26). Tap *Move* to complete the move or *Cancel* to cancel the move operation.
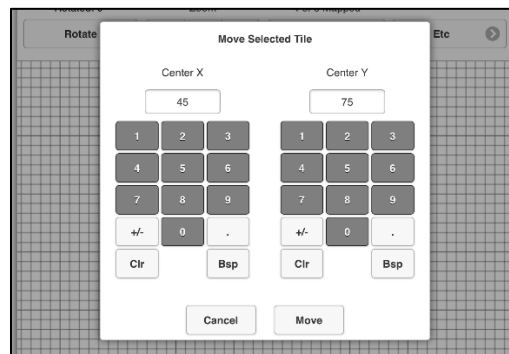

Figure 5-26: Move a SmartTile Numerically

Whenever you drag (or drop) a token so that it overlaps with another token, a large red Ø symbol will appear in both overlapped tokens (see Figure 5-27). This indicates that the Map is not well-formed since SmartTiles cannot overlap in the real DigitalCanvas.
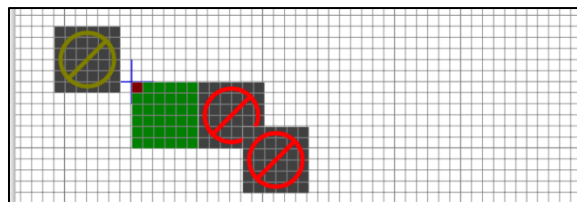

Figure 5-27: Marking Overlapping and Out-of-bounds SmartTiles

Similarly, whenever you drag (or drop) a token so that it extends above or to the left of the origin, a large yellow Ø symbol will appear in the token (see Figure 5-27). This also indicates an ill-formed Map since a SmartTile, by definition, cannot be located outside of the bounding box of the DigitalCanvas.

5.13.2.6 Rotating SmartTile Tokens

In addition to its location, every SmartTile can also be rotated around it center (in 90° increments). The Canvas Map includes information about this rotation.

To map a SmartTile's rotation, select its token in the Map. Then tap the *Rotate* button until the red corner cell on the token matches the red corner cell of the actual SmartTile. Every time you tap *Rotate*, the red corner on the selected token will advance clockwise to the next corner; the red corner on the SmartTile will stay fixed. Figure 5-28 illustrates this procedure.
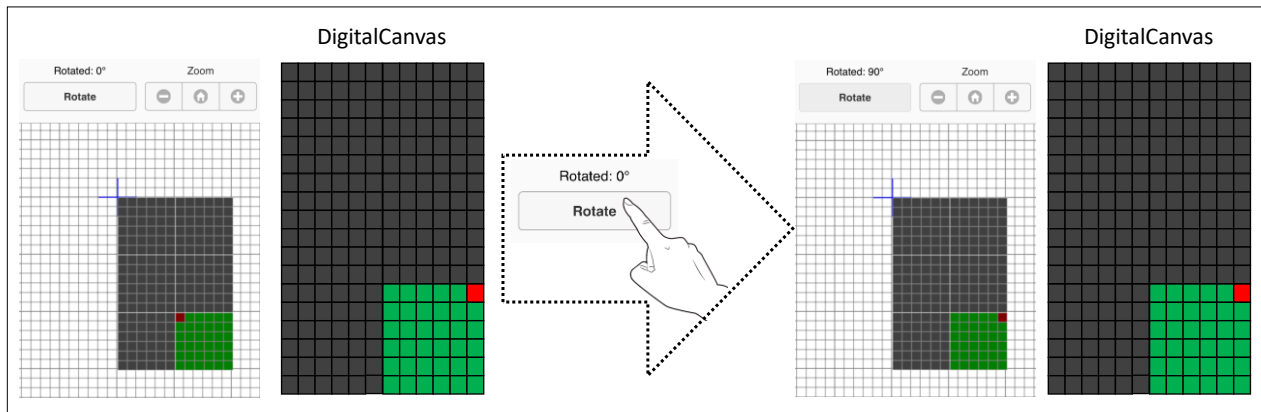

Figure 5-28: Rotating SmartTile Tokens

To ensure a correct Canvas Map, you must manually ensure that the red corners match for every SmartTile in the DigitalCanvas. The system has no way of automatically detecting if the Map rotations are incorrect. However, if they are incorrect, you will see errors in the patterns shown on the DigitalCanvas.

5.13.2.7 Scrolling and Zooming the Canvas Map

The Canvas Map in the mapping area can be scrolled and zoomed to make placing the tokens easier.

To zoom, tap the *"−"* (zoom out) or *"+"* (zoom in) buttons on the *Zoom* button panel. This will decrease/increase the scale used in the mapping area (and hence the size of the SmartTile tokens) while keeping the location at the center of the viewport constant. Figure 5-29 shows an example of Zooming Out.
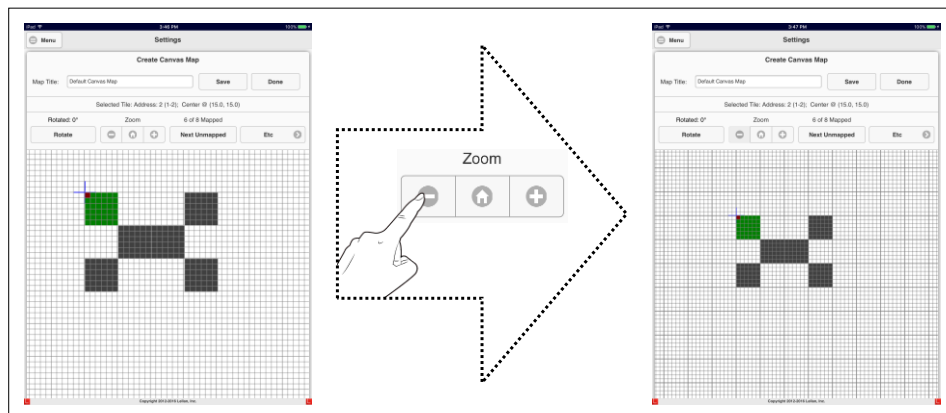

Figure 5-29: Zooming Out

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To scroll, tap down on any place in the mapping area that is not covered by a SmartTile token and then drag. The mapping area (including the tokens and the origin marker) will scroll relative to its viewport in concert with the drag. Figure 5-30 illustrates Scrolling.
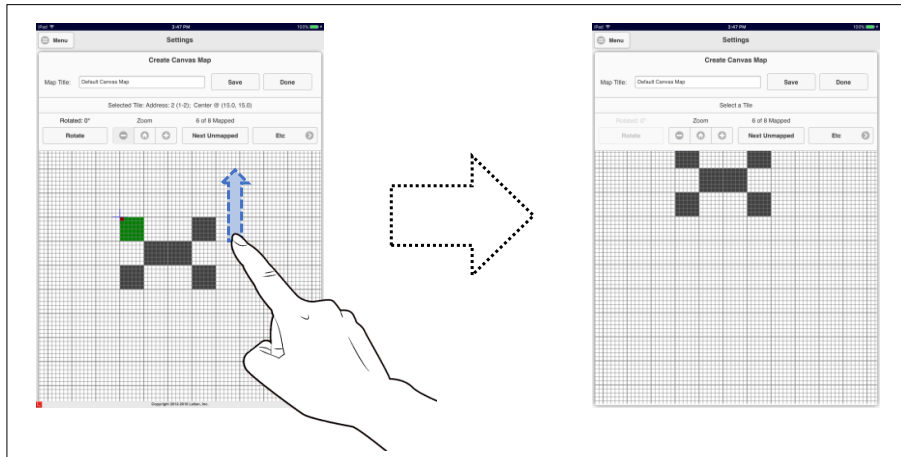

Figure 5-30: Scrolling

Tap the *"Home"* icon ( ) on the *Zoom* button panel to return both the zoom and the scroll of the Map to their default values. This will show the entire DigitalCanvas centered within the viewport. Figure 5-31 illustrates the process.
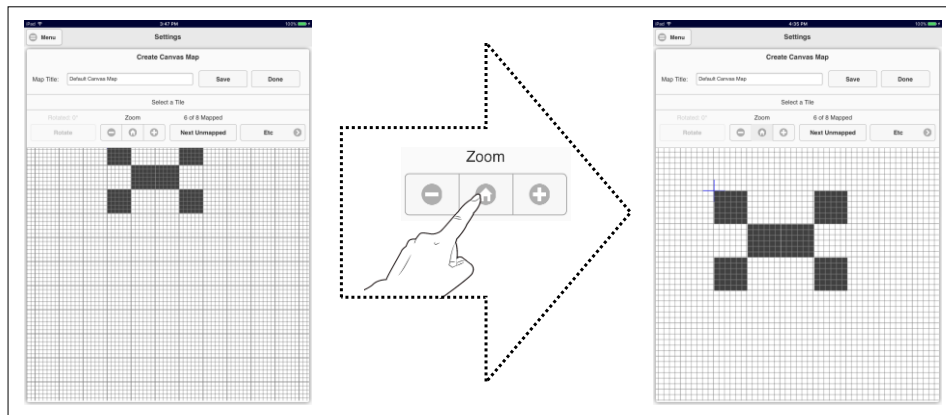

Figure 5-31: Home Centers and Zooms to Default Level

While editing a Map, you may run into a situation where the proper placement of a token relative to the other tokens results in that token extending above or to the left of the origin. To correct this situation, you could move all the other tokens down or to the right to make sufficient room for the problem token. This can be quite tedious. As an alternative, place the token in its proper relative position ignoring the origin violations. Then tap the *Etc* button followed by *Reset Canvas Origin.* This will move all tokens in the Map sufficiently down and/or right so that the Map no longer extends beyond the origin. Figure 5-32 illustrates the process.
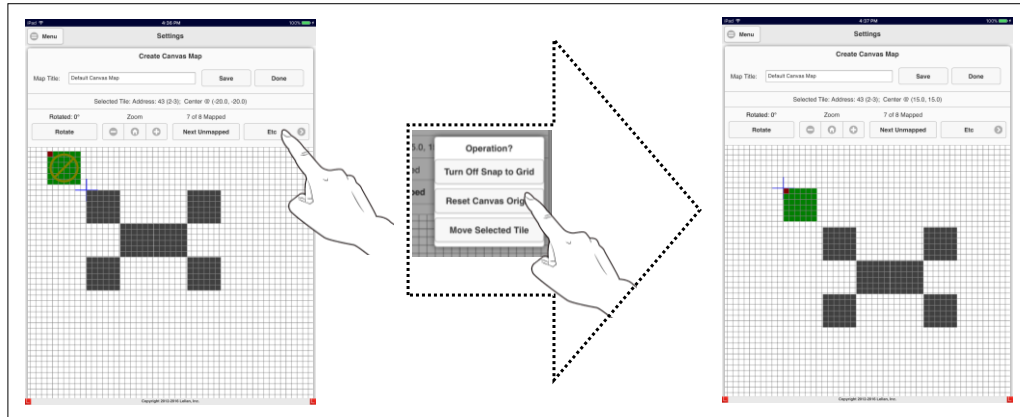
Figure 5-32: Reset Canvas Origin

5.13.2.8 The Map Title

Every Canvas Map has a title that is used in various places in the LellanApp. Tap in the *Map Title* text box to change the Map Title.

5.13.2.9 The Etc Button

Tapping the *Etc* button will bring up a menu of three items. The first and third items (*Turn On/Off Snap to Grid* and *Move Selected Tile*) are described in Section 5.13.2.5: *Moving SmartTile Tokens.* The second item (*Reset Canvas Origin*) is described in Section 5.13.2.7: *Scrolling and Zooming the Canvas Map.*

5.13.2.10 Saving (Installing) the Canvas Map

Tap the *Save* button to install the current state of the Map being edited as *the* Canvas Map for this DigitalCanvas. You can save at any time, providing the Map is well-formed (i.e., there are no overlapping tokens and no token extends beyond the origin).

5.13.2.11 Done to Exit

Tap the *Done* button to exit the Map Editor page and return to the main *Map Canvas* menu. If there are unsaved edits to the Map, you will be asked to reconfirm your choice to exit. If you continue to exit, any unsaved edits will be discarded. If you exit with one or more Tiles still unmapped, then these unmapped Tiles will not work correctly in many of the DigitalCanvas operation.

5.14   Step 11: Configure the Network

The final step in installing the DigitalCanvas is to configure the network into one of the modes described in Section 4.1.

The DigitalCanvas arrives configured in AP mode with the SSID ***Lellan_Canvas*** and the passphrase ***LEDLIGHTS***. Even if you will be using an AP mode configuration, you should change the SSID and passphrase during installation for security reasons as well as to prevent any SSID collisions in case another DigitalCanvas is installed in the same location (SSIDs must be unique within a location).

Detailed information on configuring and using network can be found in the *DigitalCanvas User Manual.*

To set the DigitalCanvas network configuration:

> 1. From the *Main Menu, tap Settings.*

2. From the *Settings* Page, tap *Network.*

3. The *Network Settings* Page will appear, showing the current network configuration as well as two or three choices for changing the network configuration (Figure 5-33).
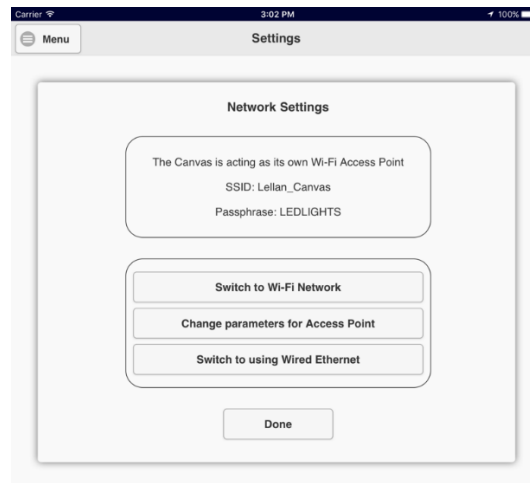

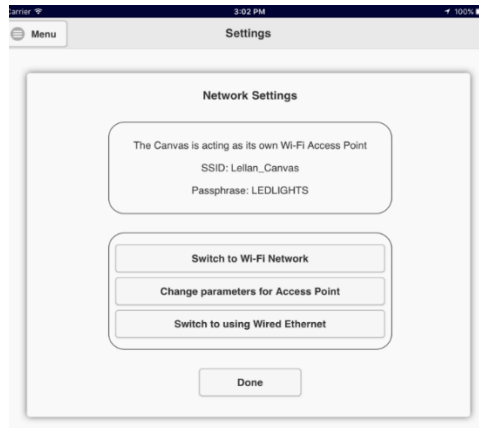*Figure 5-33: The Network Settings Page*

4. Tap the button representing the desired change (e.g., *Switch to Wi-Fi Network*).

5. In general, the network reconfiguration will happen in 4 steps as follows:

   a) The LellanApp will ask for the parameters of the desired network configuration. For example, the SSID and the security Passphrase.

   b) The DigitalCanvas will then switch its network configuration as requested.

   c) At this point, you must go to the Wi-Fi Settings page/app on your app device and switch the app device's network settings to match the network just configured on the DigitalCanvas.

   d) Once you have made the app device switch, the app will attempt to reconnect to the DigitalCanvas using the new network configuration.

   The LellanApp will guide you thru these 4 steps.

The following is an example of switching the network configuration from the factory default AP mode to Wi-Fi mode for a network with the SSID of **TestNet** and a passphrase of **EXAMPLE1234**.

1. From the *Main Menu*, go to the *Main Menu->Settings->Network* page (Figure 5-34)

Figure 5-34: Network Settings Page - Factory Default Network

2. On the *Network Settings* page, tap the *Switch to Wi-Fi Network* menu item. This will bring up a list of the Wi-Fi networks that are currently available to the DigitalCanvas (Figure 5-35). The networks are listed by their SSID, ordered by the strength of their signal.
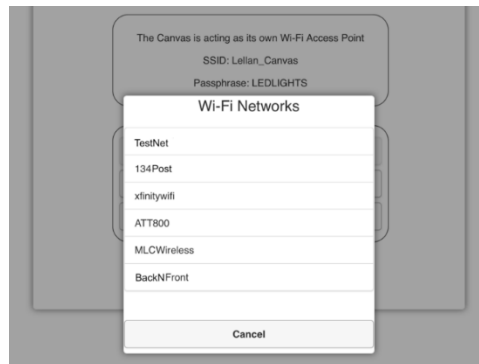
Figure 5-35: List of Available Wi-Fi Networks

3. Select the *TestNet* item from the menu of Wi-Fi networks. This will bring up a dialog box asking for the passphrase for the network (Figure 5-36).
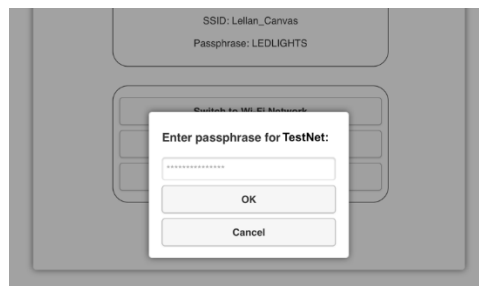
Figure 5-36: Wi-Fi Passphrase Dialog

4. Type in the passphrase for the network and tap *OK.* The DigitalCanvas will then attempt to connect to the TestNet Wi-Fi network. If it is successful, it will bring up a dialog box asking you to switch the network connection of the "this device" (i.e., the iPad, tablet, or PC that the LellanApp is runnng on) to the same TestNet network (Figure 5-37).
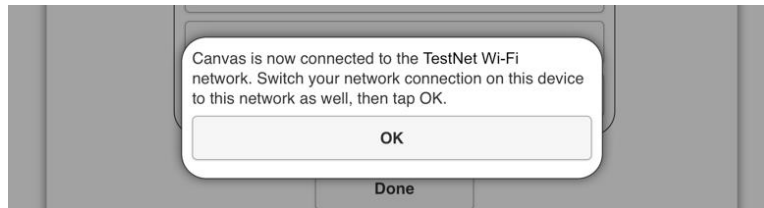
Figure 5-37: Switch Network Request

5. At this point, you will need to use the Network Settings page or app on your device to connect your device to the *TestNet* network. On most devices, this will require suspending the LellanApp and entering the Settings app. Figure 5-38 is an example from the iPad.

    After your device successfully connects to the *TestNet* network, you must return to the LellanApp. On an iPad, for example, this would involve double tapping the Home button and then selecting the LellanApp from the "list" of active apps.
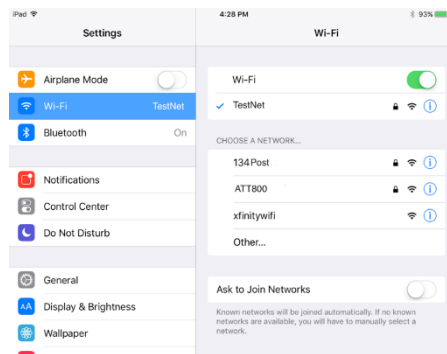

Figure 5-38: Connecting an iPad to the TestNet Wi-Fi Network

6. Once you return to the DigitalCanvas controller app, tap "OK" to dialog box asking you to switch networks (Figure 5-37). This should finalize the network switch and return you to the *Network Settings* page, with the status box showing that the DigitalCanvas is now connected to the TestNet Wi-Fi network (see Figure 5-39).
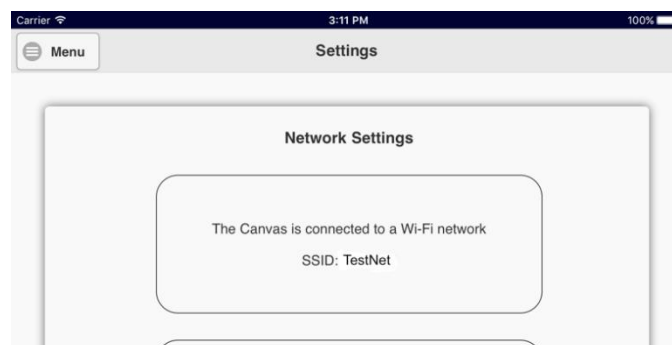

Figure 5-39: Network Settings Page after Successful Network Change

5.15   Step 12: Have fun!

Congratulations, your DigitalCanvas is now installed. Refer to the *DigitalCanvas User Manual* for information on how to further configure and operate it.

And most importantly, have fun and enjoy your Lellan DigitalCanvas.

6 Specifications and Dimensions

6.1 SmartTile

6.1.1 SmartTile Specifications

Specification	Details
Light Source	36 individually controllable light cells / SmartTile
Light Cell	Red / Green / Blue LEDs with 5 x 5cm cell dimensions
Lumen Maintenance	50,000+ hours L_{70}
Luminance (nits)	Maximum 545 nits
Color Range	16.7 million additive RGB colors
Color Resolution	24 bit
Operating Voltage	24V DC
Power Consumption	10W maximum at full output
Weight	4lbs / 1.8kg
Housing	Polycarbonate (PC) and Acrylonitrile butadiene styrene (ABS)
Connector	SmartCable maximum 50 connection cycles
Dimensions	11.8 x 11.8 x 1.82 in / 300 x 300 x 46.3mm
Operating Temperature	32° F to +104° F / 0° C to +40° C
Storage Temperature	-4° F to +158° F / -20° C to +70° C
Humidity	0-95% non-condensing
Environment	Indoor, dry location, IP20
Certification	UL, FCC

6.1.2   SmartTile Dimensions

1.8" / 46.3 mm

11.8" / 300.0 mm
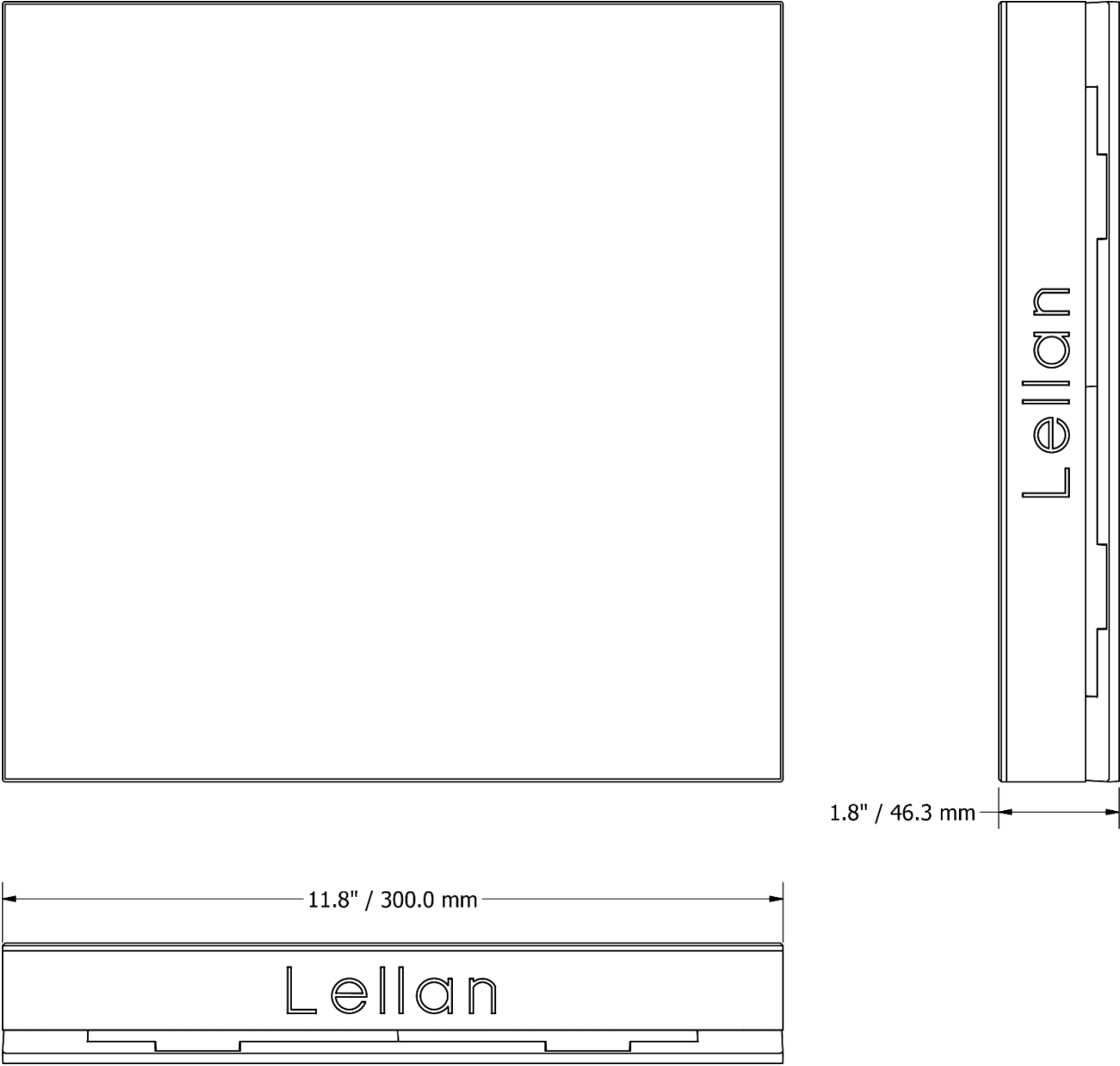
6.1.3 Location of Mounting Holes on SmartTile Frame
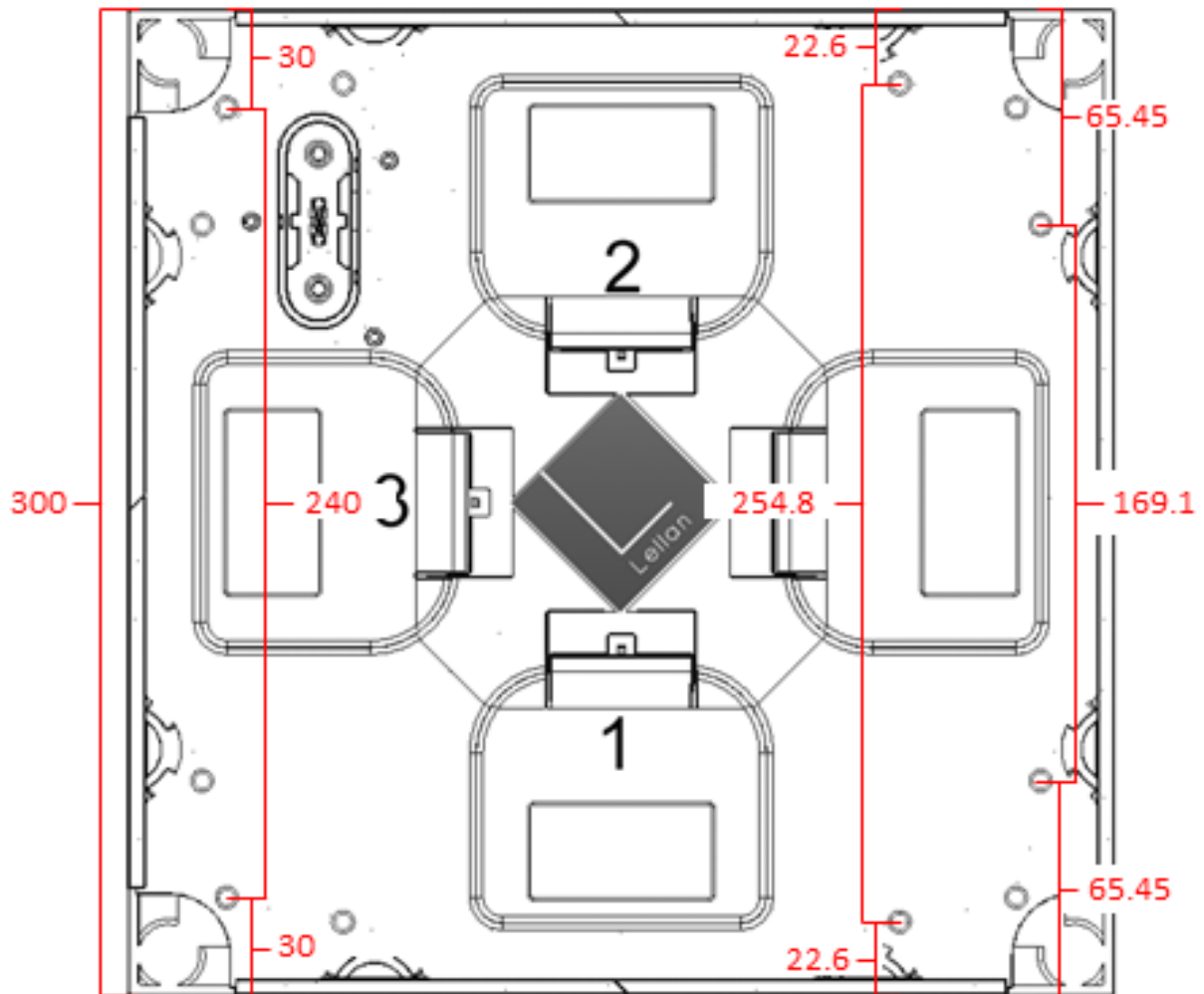
- All measurements in millimeters

- Frames are 90° rotationally symmetric with respect to the mounting holes

- Measurements to an edge are to widest point of frame

  Foot of frame (where it touches mounting surface) is inset ~0.2mm from widest point on frame on all sides

6.2 SmartHub

6.2.1 SmartHub Specifications

Specification	Details
Control	Ethernet, WiFi
Speed	Minimum 20 Frames per Second
Input Voltage	12V DC / 2A
Maximum Size	SmartHub max capability 240 SmartTiles
Dimensions	5.7x9.4x1.2 in / 143.8x239x30 mm
Weight	1.1lbs / 0.5kg
Housing	Acrylonitrile butadiene styrene (ABS)
Operating Temperature	32° F to +104° F / 0° C to +40° C
Storage Temperature	-4° F to +158° F / -20° C to +70° C
Humidity	0-95% non-condensing
Environment	Indoor, dry location, IP20
Certification	UL, FCC

6.2.2   SmartHub Dimensions

1.2" / 30.0 mm

9.4" / 239.0 mm

5.7" / 143.8 mm
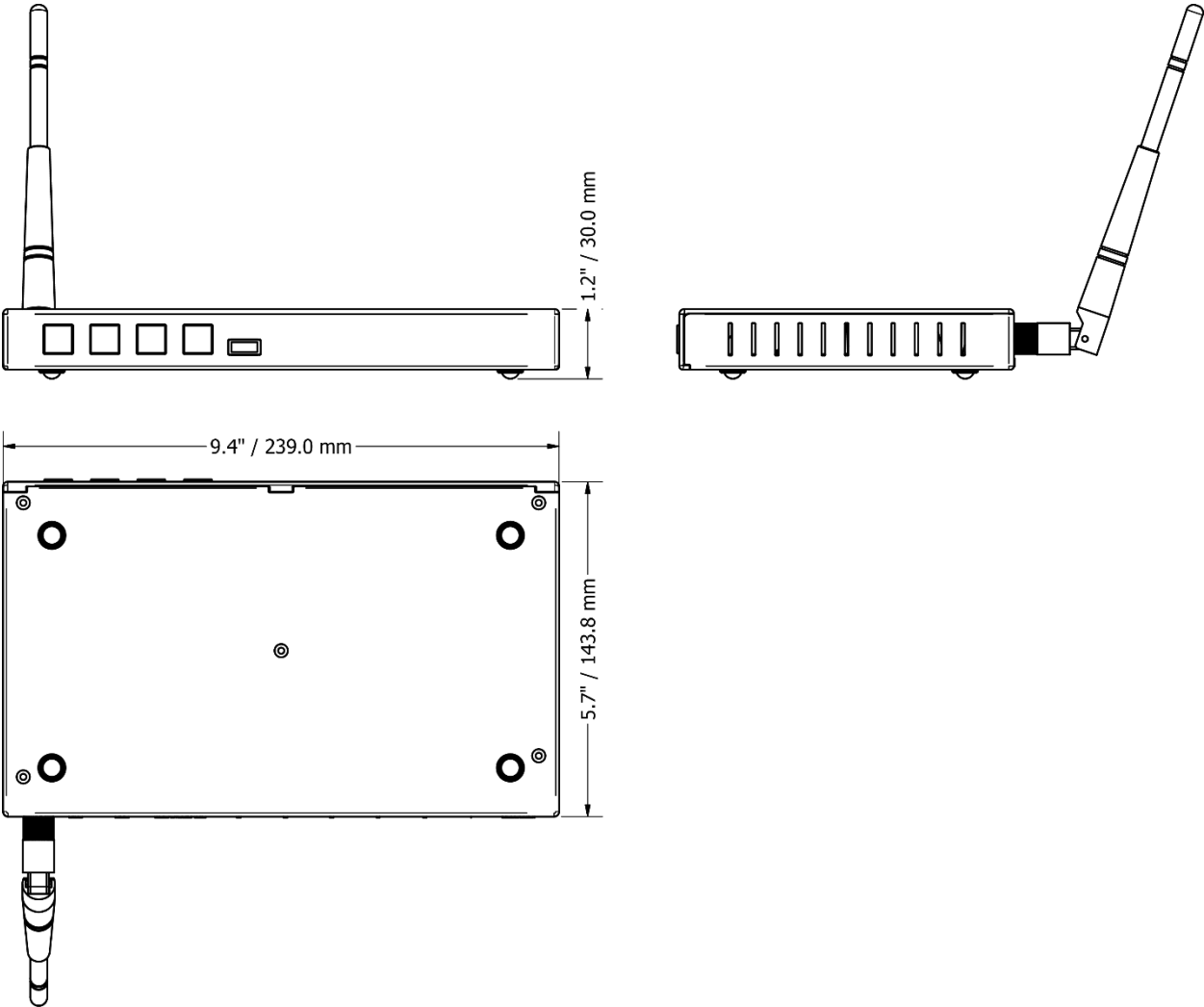
6.3   PowerBox

6.3.1   PowerBox Specifications

Specification	Details
Control	Ethernet, WiFi
Input Voltage	100 – 240 VAC
Output Voltage	24V DC
Maximum Size	PowerBox max capability 40 SmartTiles
Cooling	Active (temp. controlled fan)
Power Supply	500W
Dimensions	15.31x7.47x2.91 in / 389x190x74 mm
Weight	8.6lbs / 3.8kg
Housing	Steel, Rubber and Acrylonitrile butadiene styrene (ABS)
Operating Temperature	32° F to +104° F / 0° C to +40° C
Storage Temperature	-4° F to +158° F / -20° C to +70° C
Humidity	0-95% non-condensing
Environment	Indoor, dry location, IP20
Certification	UL, FCC

6.3.2   PowerBox Dimensions