

## LumaCAN Power & Data Considerations

**A** LumaCAN™ network carries both power and data to all of its devices as a means to supply power and communicate with each other. The rules for the data part of the wiring are very basic; however, the application of power supplies, power segmenting, and capacity analysis warrant a more in-depth discussion. This white paper reviews some of the key parameters that should be considered when designing LumaCAN systems.

NOTE: Leviton Applications Engineering services are here to help you with your LumaCAN systems. Our Quotations department will help you pick the right product for your needs and our Applications department will design a system taking all of this into account. This white paper covers the technical aspects for those that want the technical details.

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## LumaCAN Data Design Considerations

The data part of the LumaCAN network is what allows building controls to operate. LumaCAN is a Leviton proprietary application protocol running on a robust Control Area Network. The data moving between devices can be as simple as ON/OFF messages or as complex as configuration data. A LumaCAN network is broken down into Data Segments; multiple Data Segments can be joined together with LumaCAN Repeaters.

Because every network is different, data propagation concerns and the distribution of power must be treated differently.

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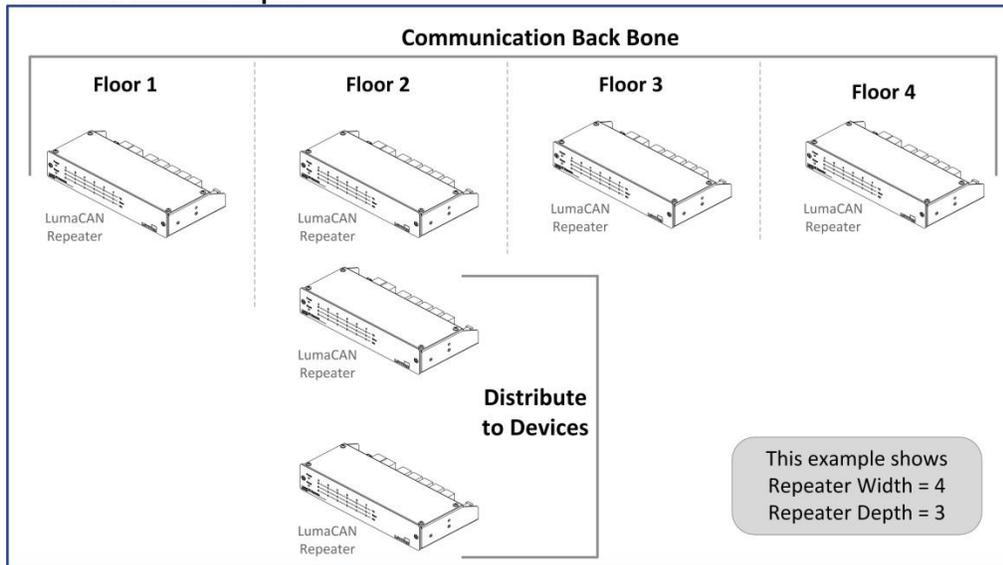
The basic rules for a Data Segment are:

- Topology: Daisy Chain
- Maximum length: 1600' (per Data Segment between EOL terminations)
- Wire type: Cat 6 recommended, Cat 5 not allowed
- Maximum number of devices: 110 devices per Data Segment
- Termination: Both ends of the Data Segment (no mid-point device should be terminated)

The basic rules for joining Data Segments with Repeaters are:

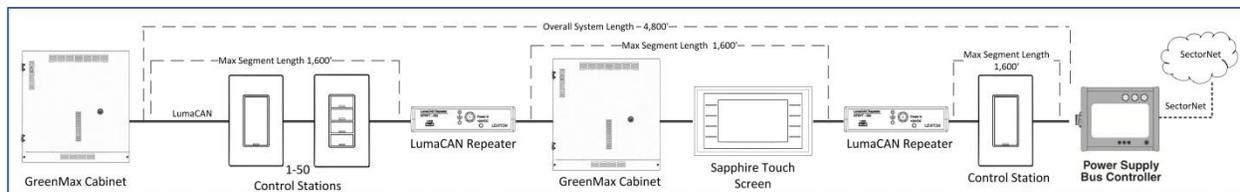
- Topology: Home-run, Daisy Chain
- Maximum Length: 10,000'
- Maximum number of devices: 250
- Maximum number of repeaters (depth): 3 (see illustration below)
- Maximum number of repeaters (width): 7 (see illustration below)
- Termination: Repeaters provide EOL terminations at each port

### Network Width & Depth



## Applying the Data Segment Rules

LumaCAN Repeaters can be added to extend the LumaCAN network length up to 10,000'. A Repeater is needed once a run exceeds 1600'. In the example below, three segments of 1600' each are connected together by two, 2-port repeaters creating an overall system length of 4,800'.



## LumaCAN Power Design Considerations

There are three general types of power devices on a LumaCAN network:

- Devices supplying power, like dedicated power supplies, GreenMAX® Command Modules and Remote Low Voltage Cabinets
- Devices consuming power, like GreenMAX digital switches, and Low Voltage Analog Input Cards
- Self-powered devices like Sector® Bus Controllers

It is critical each LumaCAN Power Segment has:

- Enough power to supply all devices consuming power
- Only one single power source per Power Segment
- Sufficient available voltage to function for all devices

Consider the chart below listing device power, minimum, and maximum operating voltages:

Devices Consuming Power		
Control Device	Voltage Requirements	Power Consumption
LumaCAN 2-Port Repeater	+12-24 VDC /LumaCAN bus	80-40 mA
LumaCAN 6-Port Repeater		170-85 mA
GreenMAX Switches	+21-24 VDC	25 mA
Sapphire Touch Screen	+12-24 VDC	1750-875 mA

**\*Note** that current ranges are given to express current over the voltage range, ex: 2-port repeater requires +12-24 VDC. At 12 VDC it requires 80 mA, at 24 VDC it requires 40 mA.

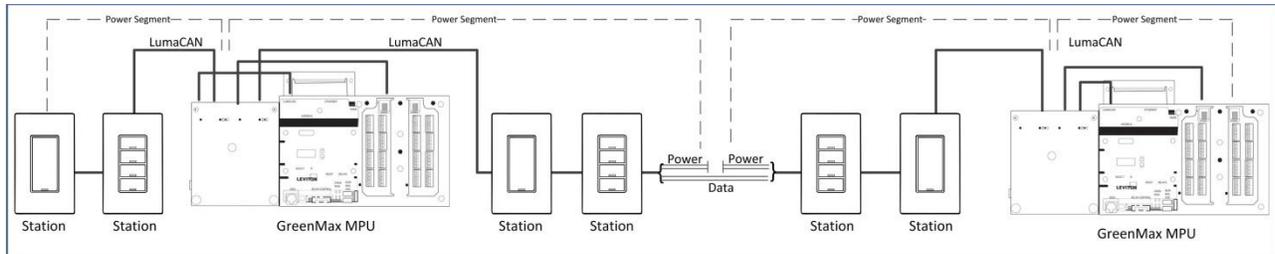
Devices Providing Power			
Power Control Device	Input Power	Output Power	
GreenMAX Command Module Power Supply	Any single phase voltage from 100 to 277 VAC	Side 'A' 35W	Maximum 1500 mA available - This to be reduced to 750 mA if connected to Main Processor board
		Side 'B' 35W	Maximum 1500 mA available - This to be reduced to 750 mA if connected to a fully populated Low Voltage Input board
GreenMAX Remote Low Voltage Input Cabinet	Any single phase voltage from 100 to 277 VAC	Side 'A' 35W	Maximum 1500 mA available
		Side 'B' 35W	Maximum 1500 mA available - This to be reduced to 750 mA if connected to a fully populated Low Voltage Input board

## LumaCAN Power Segments

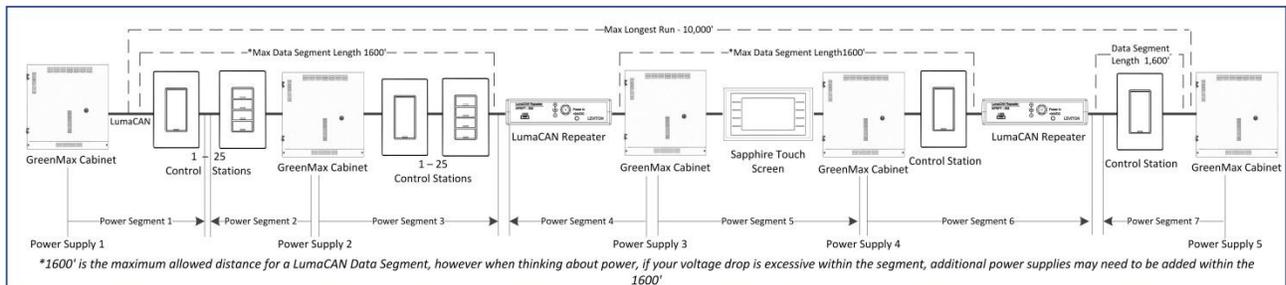
A Power Segment is a portion of the entire LumaCAN run powered by a single power supply. For reasons discussed in this document, an entire network may have more than one power supply. Considering that there must only be one power source per Power Segment, the network must be split into multiple Power Segments when there are multiple power supplies present. The cable in the LumaCAN network carries both power and data on its conductors. Power isolation jumpers are provided on certain devices to apportion power as needed to limit one power supply per Power Segment.

In the following example, both GreenMAX Command Modules are capable of supplying power to the network. But only one power supply is allowed per Power Segment. Therefore, power is

separated at a point along the network. Power is isolated by interrupting the continuity of the conductors between the stations. At the isolation point, LumaCAN data transmission is maintained but power is not interrupted.

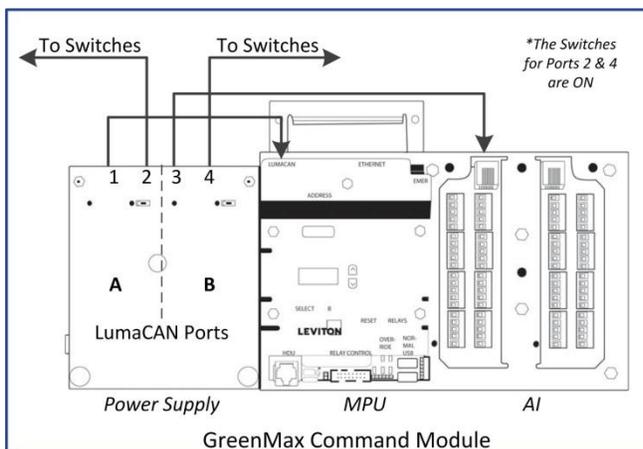


The illustration below compares the Data Segments joined by the two 2-port repeaters with the Power Segments associated with the available power supplies in the entire system. Notice that there are multiple power sources within each 1600' run requiring separation.



## GreenMAX Power Supply – 2 in 1

1. Creates two Power Segments, isolated at power supply
2. 1500 mA available from supply A
3. 1500 mA available from supply B



The GreenMAX Power Supply has 4 LumaCAN Data/Power ports. Ports 1 and 2 are connected to Supply A that has a total of 1500 mA (35 W) available. Ports 3 and 4 are connected to Supply B that has a total of 1500 mA (35 W) available.

This chart shows the possible combinations and ways in which power is distributed by port.

Example 1: Available Power Combinations by Port			
Power Supply Half A		Power Supply Half B	
Port 1*	Port 2	Port 3**	Port 4
1500 mA		1500 mA	
Power to MPU 750 mA	750 mA Available	Power to AI Board 750 mA	750 mA Available

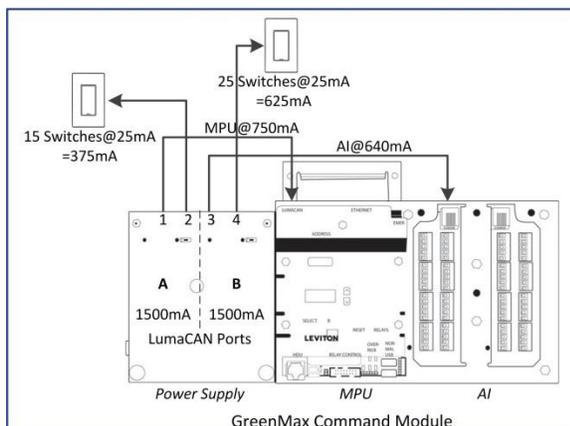
\* Port 1 typically powers MPU when the power supply is in a cabinet. The MPU requires 750 mA of power. If the power supply is used in a cabinet that does not have an MPU, like a remote input cabinet, then the total 1500 mA is available from the combination of ports 1 and 2.

\*\* Port 3 typically powers the AI card. AI current draw is dependent upon the devices connected to the AI card but at no time exceeds 750 mA.

Example 2: Available Power Combinations by Port			
Power Supply Half A		Power Supply Half B	
Port 1	Port 2	Port 3	Port 4
1500 mA		1500 mA	
Total 1500 mA Available		Power to MPU 750 mA	Power to AI Board 750 mA

## GreenMAX Power Jumper Settings

When creating complex networks with multiple power segments, you may need to isolate power on one of the GreenMAX connectors. Port 2 & 4 have the ability to disconnect power from the power supply and can be used when you have segments outside of the GreenMAX Cabinet needing a power supply. This example illustrates the detailed power supply call outs and loads added:



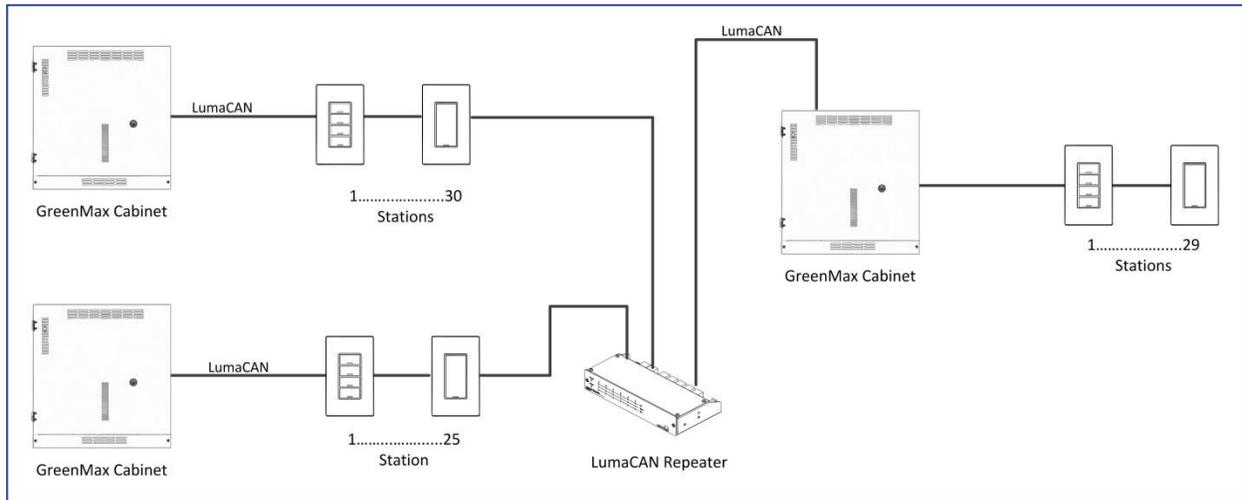
Once the system layout is planned, it should be confirmed that the power supply will support the capacity of the network. The philosophy to calculate power needed within a system is simple: determine the maximum available current of your supply and add up the required loads of each device. Verify the total device load is less than the maximum available power from your source.

The diagram above shows the A ports have 375 mA supply available allowing for additional devices to be connected and the B ports have 235 mA available. This confirms there is sufficient power to support the network and is an example of one of many possible GreenMAX command module configurations. To review other options, see the GreenMAX Manual.

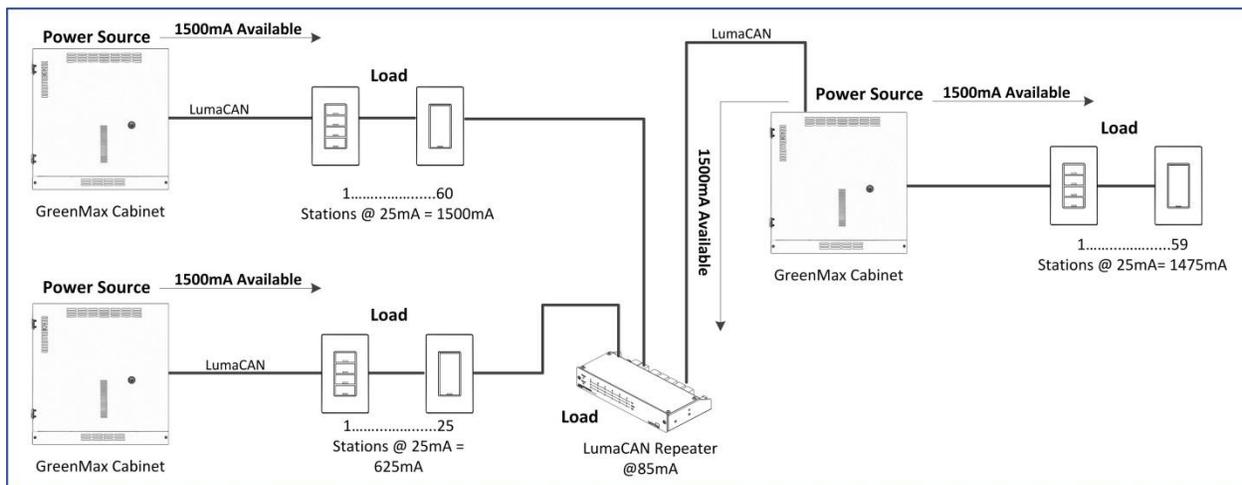
## Power Segmenting When Using 6 Port Repeaters

To allow for flexibility in system design, power can be routed by adjusting the LumaCAN Repeater Jumpers and isolating power on any part of the network. The 6-port repeater jumpers can be set to power the repeater from the available supply, isolate power at the port, bridge ports to pass power between the ports.

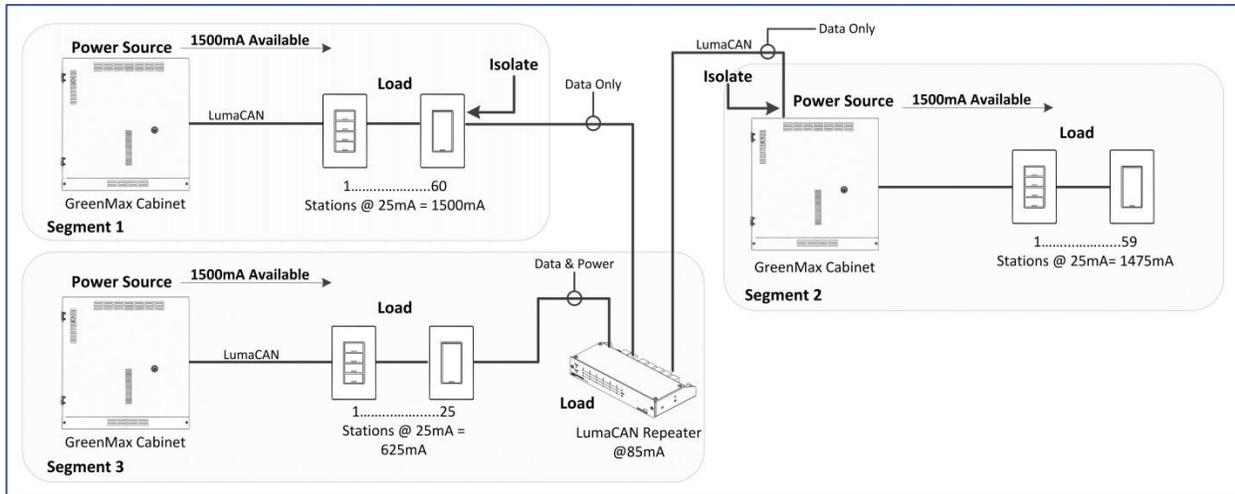
This example shows three GreenMAX cabinets providing power to the network:



Take a moment and review the diagram and ask yourself: From where should the LumaCAN Repeater receive its power? How should power be segmented? To answer those questions, let's review the available power and load requirements for the system:



The next step is to determine the available power supplies and subtract the load requirements to decide the best power segmenting method to meet both power and length requirements.



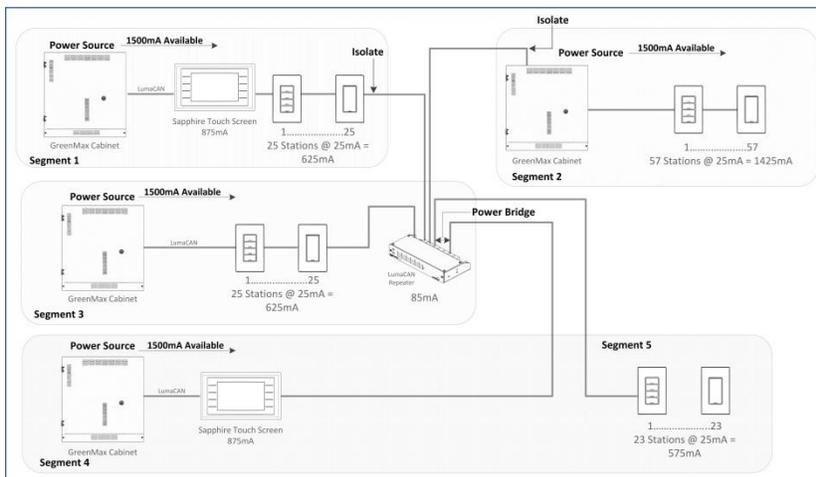
Now we can determine that splitting the network into 3 segments is the best approach:

**Segment 1** – Has 1500 mA available and a load requirement of 1500 mA that leaves no additional power. Power is isolated at the last switch and data only transmits to the repeater.

**Segment 2** – Has 1500 mA available and a load requirement of 1475 mA, which leaves 25 mA of available power. This is not enough to power the repeater so the power is isolated at the cabinet and only data transmits to the repeater.

**Segment 3** – Has 1500 mA available and a load requirement of 710 mA, which leaves 790 mA of available power for additional devices if the system design were to require them. Power must be isolated at the repeater to conform to the system requirement of only one power supply per segment.

This diagram shows a more complicated system with 5 segments and 4 power segments:



Segment 4 has ample power available after powering the Sapphire Touch Screen (625 mA), and Segment 5 does not have a power supply available to it. The solution is to bridge power between the LumaCAN Repeater ports that segment 4 and 5 are connected to so that power will pass through the repeater and power Segment 5 devices.

## Voltage Drop Considerations

When planning your network and segmenting power, voltage drop must be considered to ensure that all devices along the length of the Power Segment, especially at the end, have sufficient power to operate. If devices do not have sufficient power, the network will be unreliable and you will have problems. The solution to voltage drop is to inject additional power into your network while taking voltage drop into account. The chart below provides maximum voltage drop for available load devices.

Device	Input Voltage Range	Max Voltage Drop
GreenMAX Switch	21-26 V	5 V
LumaCAN Repeater	12-24 V	12 V
Sapphire Touchscreen	12-24 V	12 V

To determine the voltage drop on your network, use the following formula:  
 $V_{\text{drop}} = \text{Current (amps)} \times \text{Run Length (feet)} \times \text{Wire Resistance (ohms per foot)}$

Terminology:

$V_{\text{drop}}$ : Difference in voltage along the distance of the conductors

Current (I): Total current draw in the circuit (amps)

Run Length: Total length of the conductors (feet)

Wire Resistance: Resistance of the conductors (ohms per foot)

For Category 6 cable, common resistance is:

20 ohms per 1000 feet

or

0.02 ohms per foot

In LumaCAN wiring, Leviton uses (2) parallel conductors for power, so resistance can be determined by:

$\frac{1}{2} \times 0.02 \text{ ohms/foot} = \underline{\underline{0.01 \text{ ohms/foot}}}$

\*\*Kirchhoff's Law for parallel resistances applied

### Example:

Given a network with 35 GreenMAX Digital Switches that is 1,100' long, and knowing from the table above that each switch requires 25 mA (0.025 A):

$$I = 35 \times 0.025 \text{ A} = 0.875 \text{ A}$$

$$\text{Run Length} = 1,100 \text{ feet}$$

$$\text{Wire Resistance} = 0.01 \text{ ohms/foot}$$

$$V_{\text{drop}} = 0.875 \text{ A} \times 1,100 \text{ feet} \times 0.01 \text{ ohms/foot} = 9.625 \text{ V}$$

As shown above, the maximum allowed voltage drop for GreenMAX Digital Switches is 5 volts and we're dropping 9.625 volts. Therefore, the network must be split into two power segments with an additional power supply required. A good rule of thumb for networks containing GreenMAX digital switches is to have a power supply every 900' feeding in two directions. Assuming the run is split into two equal length segments with switches evenly distributed through the runs and roughly half of them are powered from each supply; the calculation is as follows:

The new power segment 1 with 18 GreenMAX Digital Switches that is 550' long:

$$\begin{aligned} I &= 18 \times 0.025 \text{ A} = 0.45 \text{ A} \\ \text{Run Length} &= 550 \text{ feet} \\ \text{Wire Resistance} &= 0.01 \text{ ohms/foot} \\ V_{\text{drop}} &= 0.45 \text{ A} \times 550 \text{ feet} \times 0.01 \text{ ohms/foot} = 2.475 \text{ V} \end{aligned}$$

The new power segment 2 with 17 GreenMAX Digital Switches that is 550' long:

$$\begin{aligned} I &= 17 \times 0.025 \text{ A} = 0.425 \text{ A} \\ \text{Run Length} &= 550 \text{ feet} \\ \text{Wire Resistance} &= 0.01 \text{ ohms/foot} \\ V_{\text{drop}} &= 0.425 \text{ A} \times 550 \text{ feet} \times 0.01 \text{ ohms/foot} = 2.3375 \text{ V} \end{aligned}$$

Both of these segments are well within the voltage tolerance of the switches.

## Successful System

To ensure a successful system when designing a LumaCAN system, keep these details in mind:

- LumaCAN data and power are separate issues and should be considered separately
- Review power and create Power Segments where needed
- Isolated jumpers on some devices are provided to assist with easy creation of Power Segments
- Remember to not only review current but also voltage drop to be sure your network has sufficient power