



## Sapling Two-Wire Clock System – Converter Box Calculator

One of the world's most efficient wired synchronized clock systems on the market today, Sapling's 2-Wire Digital Communication is the perfect fit for any facility looking to implement a synchronized time system. Receiving both the power necessary to run the clock, as well as the clock's time correction on only two wires, the 2-Wire system eliminates hefty wiring expenses that have been associated with past wired solutions. When planning for the installation of a 2-Wire system, the building should be analyzed prior to installation. Below is some helpful information when planning the implementation of the 2-Wire system in your building or facility.

### Current Ratings

To help with your calculation, we've listed below the maximum current draw (load) for the Sapling 2-Wire Communication clocks and the maximum output for the Converter Box. Also listed is a web site for your voltage drop calculations due to load, distance and wire gauge selection. This calculation should help you choose the appropriate wire gauge, the number of Converter Boxes and number of clocks on any given run for the project. Additionally, please visit this [website](#) for further assistance in making these calculations.

### Current Draw for 2-Wire System Secondary Clocks

Current Draw from Analog Clocks	
Analog, 9" 12" or 16"	30 mA including correction

Current Draw from Digital Clocks				
	Red Display (Standard)	Amber Display	Green Display	White Display
Digital, 2.5" 4 digits	89 mA	105.8 mA	127.6 mA	127.5 mA
Digital, 2.5" 6 digits	121 mA	113.71 mA	155.42 mA	155.12 mA
Digital, 4.0" 4 digits	138 mA	139.87 mA	186.2 mA	189.9 mA
Digital, 4.0" 6 digits	183 mA	158.53 mA	229.74 mA	230.51 mA

### Converter Box Part Number

SCB-100-100-1 Input: 110VAC - 230VAC Output: 24V @ 5.5 AMPS. (Direct replacement for Converter Box SCB-000-000-1 and SCB-000-000-2).

### Our Recommendation

There are many wire manufactures and although we do not specify anyone, as a guideline we recommend using 12AWG, 14AWG or 16 AWG wire thickness according to the type and number of clocks used. The input voltage to the secondary clocks (analog or digital), should not be less than 18V at any point on the run. If so you will need to add a Converter Box, use fewer clocks in the run or change the wire gauge size.

**Please Note:** Although Sapling's 2-Wire System is capable of working on different cables, currents and voltages, any federal, state and local codes that are different, relevant and applicable supersede Sapling's recommendations and must be followed.

### Number of Clocks is Dependant on Building Conditions

Due to the fact that Sapling does not know the topography, local codes, and/or safety rules for every particular country and project, Sapling cannot certify the number of clocks per Converter Box or the particular wire size or manufacturer of the cabling for the 2-Wire Digital Communication system. We understand that each project has a different layout, length and number of runs, style of the clocks, distance between the clocks, and the environmental circumstances in which the wire is channeled. These are "on-site conditions" that should be considered prior to installation.

**Please note:** The charts below only provide basic information in regards to the amount of Converter Boxes needed per project. In order to provide a more detailed calculation, Sapling has created a Converter Box Excel Calculator which is available to download online. This calculator will allow you to mix and match analog and digital clocks within the system as well as determine how many converter boxes are required for a project. To download the calculator, please visit our [website](#).

If you need any additional information, please contact your dedicated Sapling representative.



## Sapling Two-Wire Clock System – Converter Box Calculator

### Sapling AWG Suggestions for Two-Wire Digital 24V Communication Systems Analog Clocks Calculations

Feet / Meters		Number of Analog Clocks (0.030A each)							
		20	30	40	50	60	70	100	
Distance (feet / meters)	0-99   0-30	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	100-199   30-60	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	200-299   61-91	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	300-399   91-122	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	400-499   122-152	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	500-599   152-183	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>
	600-699   183-213	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>
	700-799   213-244	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>
	800-899   244-274	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>
	900-999   274-305	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>

### 2.5", 4 Digit Digital Clock Calculations

**Please note:** All calculations shown below are based on using one Converter Box & Red LED displays. More convertor boxes can be added as needed.

Feet / Meters		Number of 2.5", 4 Digit Clocks (0.089A each)							
		10	20	30	40	45	50	55	
Distance (feet / meters)	0-99   0-30	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	
	100-199   30-60	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>		
	200-299   60-91	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>			
	300-399   91-122	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>				
	400-499   122-152	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>					
	500-599   152-183	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>					
	600-699   183-213	16AWG   1.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						
	700-799   213-244	16AWG   1.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						
	800-899   244-274	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						
	900-999   274-305	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						

### 2.5", 6 Digit Digital Clock Calculations

**Please note:** All calculations shown below are based on using one Converter Box & Red LED displays. More convertor boxes can be added as needed.

Feet / Meters		Number of 2.5", 6 Digit Clocks (0.121A each)							
		10	15	20	25	30	35	40	
Distance (feet / meters)	0-99   0-30	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	
	100-199   30-60	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>		
	200-299   60-91	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>		
	300-399   91-122	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>			
	400-499   122-152	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>				
	500-599   152-183	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>				
	600-699   183-213	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>					
	700-799   213-244	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						
	800-899   244-274	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						
	900-999   274-305	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>						



## Sapling Two-Wire Clock System – Converter Box Calculator

### 4.0", 4 Digit Digital Clock Calculations

**Please note:** All calculations shown below are based on using one Converter Box & Red LED displays. More converter boxes can be added as needed

Feet / Meters		Number of 4.0", 4 Digit Clocks (0.138A each)					
		10	15	20	25	30	35
Distance (feet / meters)	0-99   0-30	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>
	100-199   30-60	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	
	200-299   60-91	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	
	300-399   91-122	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>		
	400-499   122-152	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>			
	500-599   152-183	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>				
	600-699   183-213	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>				
	700-799   213-244	12AWG   3.31 mm <sup>2</sup>					
	800-899   244-274	12AWG   3.31 mm <sup>2</sup>					
	900-999   274-305	12AWG   3.31 mm <sup>2</sup>					

### 4.0", 6 Digit Digital Clock Calculations

**Please note:** All calculations shown below are based on using one Converter Box & Red LED displays. More converter boxes can be added as needed

Feet / Meters		Number of 4.0", 6 Digit Clocks (0.183A each)			
		10	15	20	25
Distance (ft/m)	0-99   0-30	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>
	100-199   30-60	16AWG   1.31 mm <sup>2</sup>	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>
	200-299   60-91	16AWG   1.31 mm <sup>2</sup>	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	
	300-399   91-122	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>	
	400-499   122-152	14AWG   2.08 mm <sup>2</sup>	12AWG   3.31 mm <sup>2</sup>		
	500-599   152-183	12AWG   3.31 mm <sup>2</sup>			
	600-699   183-213	12AWG   3.31 mm <sup>2</sup>			
	700-799   213-244	12AWG   3.31 mm <sup>2</sup>			

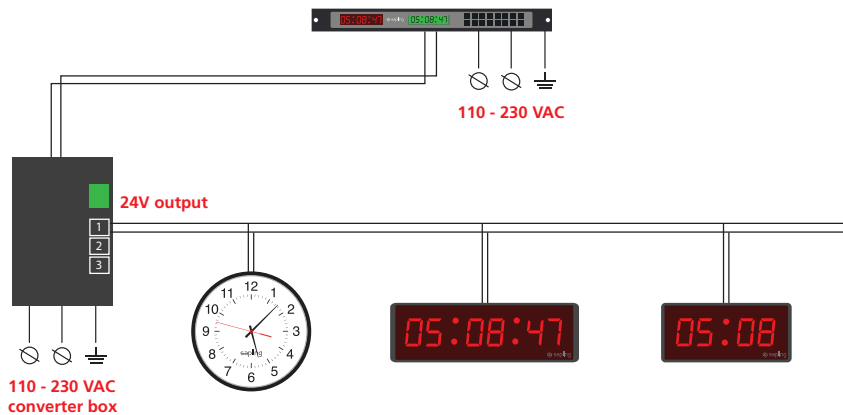


## Sapling Two-Wire Clock System – Converter Box Calculator

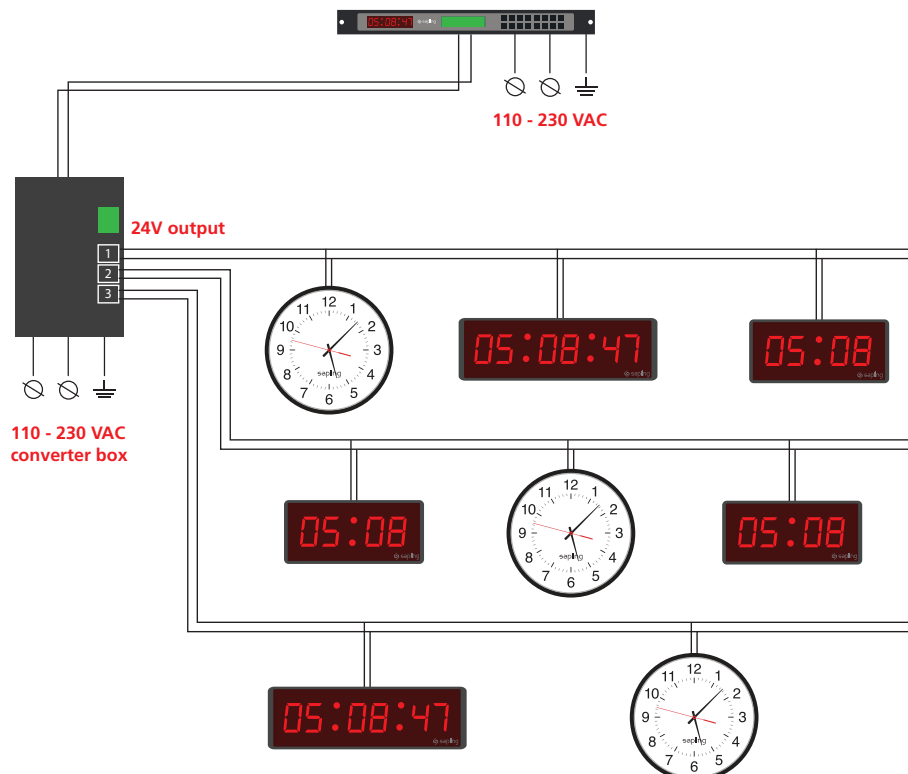
Sapling has engineered each Converter Box to contain three runs. With these three runs, a system integrator has the option to install the clocks all on one run or on multiple runs. For example, if you have a multi floor building, the clocks on the first floor can be installed on run one, the clocks on the second floor can be installed on run two and the clocks can on the third floor can be installed on run three. Whether a system uses one, two or three runs is up to the system integrator.

**Please Note:** There is a limit to the number of clocks that can be powered by each Converter Box. Please refer to Sapling's [Converter Box Excel Calculator](#) to determine the number of clocks each Converter Box can support.

### Example of Clocks on One Run



### Example of Clocks on Three Runs





## Sapling Two-Wire Clock System – Converter Box Calculator

### Example of Multiple Converter Boxes in a System

