Smart Nixie Tube User Guide

Thank you for purchasing the Smart Nixie Tube! This guide will help you get your Smart Nixie Tube powered up, explain how to connect the Smart Nixie Tube to your PC, describe the command protocol used to communicate to the Smart Nixie Tube, along with show you how to connect multiple Smart Nixie Tubes together using the headers.

Powering your Smart Nixie Tube:

The Smart Nixie Tube requires a DC input of 9 – 12V. The barrel connector is the same diameter as an Arduino Uno (2.1mm inner diameter and 5.5mm outer diameter), meaning you can use your existing 9V or 12V Arduino power supplies. Each Smart Nixie Tube consumes a maximum of 300mA at 9VDC, or XXXmA at 12VDC. If you are planning on chaining multiple Smart Nixie Tubes together, make sure you have a power supply large enough to power all of the Smart Nixie Tubes. You can verify this by making sure your power supply's current rating is greater than the total maximum current draw from your chain of Smart Nixie Tubes.

If you're using a 9VDC power supply:

$$I_{Power\ Supply} > N_{number\ of\ Smart\ Nixie\ Tubes} * 300mA$$

If you're using a 12VDC power supply:

$$I_{Power\ Supply} > N_{number\ of\ Smart\ Nixie\ Tubes} * XXXmA$$

The following table shows the power supply current requirements for a given number of Smart Nixie Tubes:

Number of Smart Nixie Tubes	Current Requirement of Power Supply @ 9VDC	Current Requirement of Power Supply @ 12VDC
1	>= 300 mA	
2	>= 600 mA	
3	>= 900 mA	
4	>= 1200 mA	
5	>= 1500 mA	
6	>= 1800 mA	
7	>= 2100 mA	
8	>= 2400 mA	
9	>= 2700 mA	
10	>= 3000 mA	

Connecting the Smart Nixie Tube to your PC:

If you purchased a kit or fully assembled Smart Nixie Tube, you received a free FTDI programming adapter with your order. You can use this programming adapter to both download new code to the Smart Nixie Tube as well as send commands to it while it's running. Simply connect the FTDI programming adapter to the 6 pin header on the back of the Smart Nixie Tube, and then plug a USB mini-B cable from your PC to the programming adapter. The programming adapter will show up as a COM port under Windows, OSX and Linux.

Alternatively, you can purchase a Bluetooth module in order to make controlling your Smart Nixie Tube wireless! Any Bluetooth module that outputs serial data will work, however, I recommend the Bluetooth Mate Silver from Sparkfun as it has the same exact 6 pin header as the FTDI programming adapter. This means the Bluetooth Mate Silver is a direct replacement for the FTDI programming adapter with no custom wiring required. Once you plug it in to the 6 pin header on the back of the Smart Nixie Tube, you can pair the Bluetooth module with your PC and it will show up as a COM port under Windows, OSX and Linux.

You can use the example software provided to test the functionality of your Smart Nixie Tube; all you have to do is connect to the COM port of your FTDI programming adapter or Bluetooth module.

Below are the default serial port settings for the Smart Nixie Tube:

Baud Rate: 115200 baud

Data Bits: 8

Parity Bits: None

Stop Bits: 1

Sending commands to your Smart Nixie Tube:

Communicating with your Smart Nixie Tube is incredibly easy. Once you have opened the COM port of your FTDI programming adapter or Bluetooth module, all you have to do is send a string of ASCII characters to the Smart Nixie Tube in order to control all aspects of the display. Below is the command protocol format:

$[DIGIT],[LEFT D.P.],[RIGHT D.P.],[BRIGHTNESS],[RED],[GREEN],[BLUE]!

Example: $8,N,N,128,000,000,255!

Let's break down the individual parts of the command protocol to see what they mean.

$ All commands must start with the $ sign. It's a way for the Smart Nixie Tube to know where the command starts.

[DIGIT] This is the digit you would like to display on the Nixie Tube. It can be 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, or – to turn the Nixie Tube off.

[LEFT D.P.] This is the control character for the left decimal point of the Nixie Tube. It can be a Y or N. Y will turn the left decimal point on, while N will turn the left decimal point off.

[RIGHT D.P.] This is the control character for the right decimal point of the Nixie Tube. It can be a Y or N. Y will turn the right decimal point on, while N will turn the right decimal point off.

[BRIGHTNESS] Brightness controls the PWM value for the Nixie Tube. This affects how bright the Nixie Tube appears. It MUST be three digits long, anywhere between 000 – 255.

[RED] Brightness controls the red PWM value for the RGB LED. This affects how bright the red LED appears. It MUST be three digits long, anywhere between 000 – 255.

[GREEN] Brightness controls the green PWM value for the RGB LED. This affects how bright the green LED appears. It MUST be three digits long, anywhere between 000 – 255.

[BLUE] Brightness controls the blue PWM value for the RGB LED. This affects how bright the blue LED appears. It MUST be three digits long, anywhere between 000 – 255.

! The exclamation point is the LATCH command which signals the Smart Nixie Tube to update its display. This is very useful if you are chaining multiple Smart Nixie Tubes together, as you only need to send the *!* after all of the commands have been sent to the tubes.

Connecting multiple Smart Nixie Tubes together:

The architecture of the Smart Nixie Tube allows for an unlimited number of digits by simply connecting the headers together on the top PCB. The serial data is passed from left to right, meaning that you need to connect your FTDI or Bluetooth adapter to the leftmost digit. Below is an example of sending data to a chain of four Smart Nixie Tubes:

Example:

$1,N,N,128,255,000,000$2,N,N,128,000,255,000$3,N,N,128,000,000,255$4,N,N,128,255,000,255!

The first set of data (**$1,N,N,128,000,000,255**) is going to be passed all the way to the rightmost Smart Nixie Tube. The last set of data (**$4,N,N,128,000,000,255**) is going to be in the leftmost Smart Nixie Tube. Lastly, we send the **!** in order to tell all of the Smart Nixie Tubes that the data is ready to be latched into their display buffer.