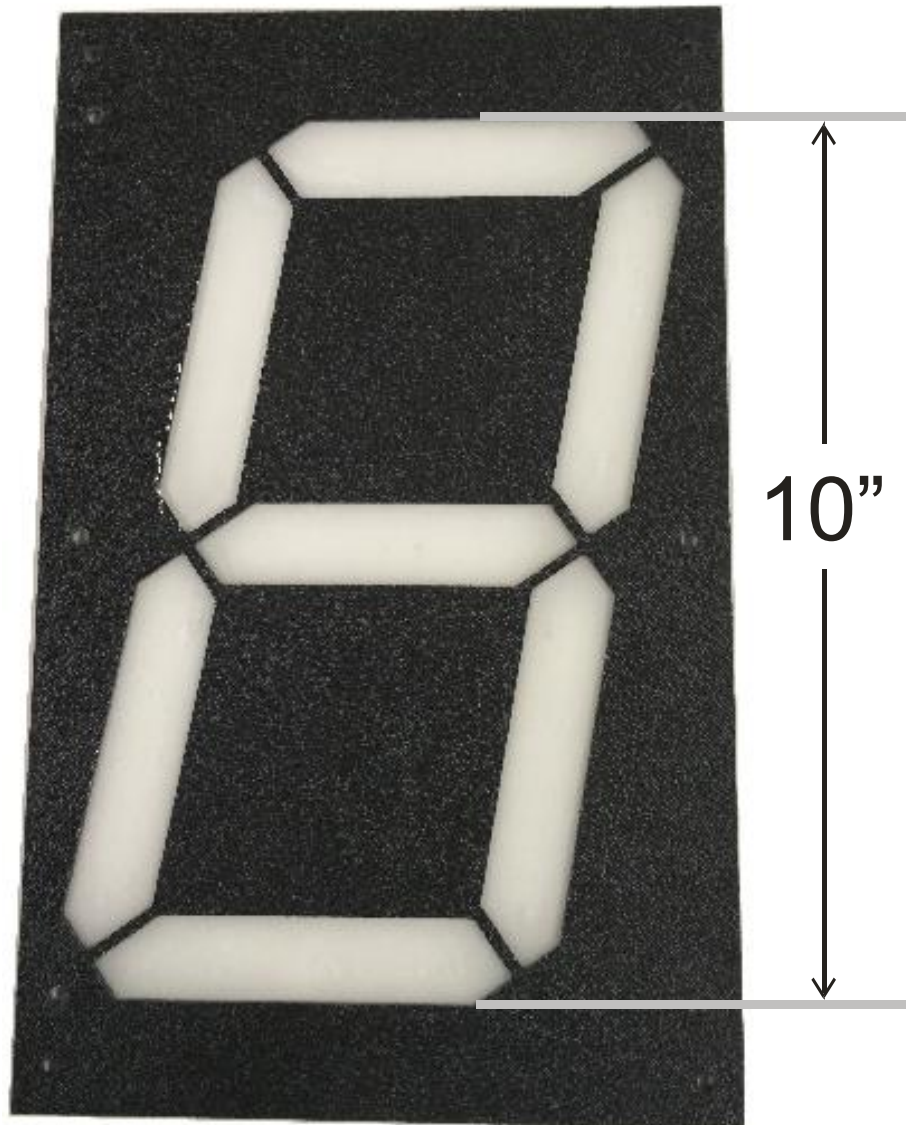


FS-10

10 Inch serial controlled RGB Digit



Introduction

Thank you for purchasing the FS-10. This unit is a 10 inch tall, 7-Segment, RGB Digit that is controlled by a 2-wire SPI type serial port. It requires only two microcontroller PIA output ports, a Clock and a DATA output for operation. Up to 30 FS-10 digits can be daisy chained together.



Features

- 1- Large 10 inch tall, 7-segment, RGB Digit.
- 2- Two-wire serial control allows easy processor interface.
- 3- Up to 30 Digits can be daisy chained together with no additional control ports.
- 4- Each SEGMENT is color controllable (RGB). 16.7 million color combinations.
- 5- Each SEGMENT has a 32 step(5-bit) GLOBAL color-independent brightness control
- 6- Powered by a single regulated 5VDC power supply (1.6A Max each digit)
- 7- Data Input and Output connectors for easy installation and expansion.

Specifications

Display Type: RGB LED, 10 Inch tall digit, 7-Segment, Single Digit with 2-wire serial control.

Digit Dimensions: 10.0" x 6.87"

Overall Dimensions: 12.5"H x 7.8" W x 1.4" D

Weight: 1.95 lbs

Mounting Screw Size: #6

Indoor Use Only: This unit was designed for indoors use. The display is NOT bright enough to be viewed in direct sunlight. The front of the FS-10 is water resistant, but the back side is not.

LED Type: Uses APA102 also known as "Superled". Leds are in a 5050 package.

Color Control: 24 bit color control for each individual SEGMENT. 8-bit PWM per color. 16.7 Million color combinations.

Global Brightness Control: 5-bit PMW control for each SEGMENT. Color-independent. 32 Steps

LEDs per Segment = 5

Total LEDS in Digit = 35

Operating Voltage: 4.75 to 5.5VDC (Regulated) Absolute Max = 5.5V

Maximum Current per Digit: 1.6A

Maximum Daisy Chained Digits: 30

Serial Control Input:

Type: Serial (2-wire SPI type) Clock and DATA. Both outputs

Logic "0" Voltage=-0.3 to 0.7v

Logic "1" Voltage= 0.7 to Power Supply+0.3v

Maximum speed= 4 mbps (4 MHz) Insensitive to speed variations.

Operating Temperature: -40°F to 158°F or (40°C to 70°C)

Storage Temperature: -58°F to 257°F or (-50°C to 125°C)

Face Plate Material: Extruded ABS

Power Supply



The FS-10 requires a regulated 5VDC power supply for operation. Each FS-10 requires a maximum of 1.6 amps each. To find the amperage requirement of your power supply, simply multiply the (number of FS-10 units) times 1.6A, plus the current requirement of your microprocessor board. You can always use a power supply with a higher current capability, but not one with less. Before connecting the power supply, power it up and verify that the output voltage is between 4.75 and 5.25V. Also make **DOUBLE, DOUBLE** sure that you have the polarity correct. EBAY is a great source for finding inexpensive Power Supplies.

Wiring

INPUT Connector

RED = +5VDC

GREEN= DATA Output from Processor

WHITE = Clock Output from Processor

BLACK = Ground (Power Supply and Processor)

Connector to mate to INPUT connector= Molex #03-09-1041 (Nylon) --#02-09-1615 (Pins)

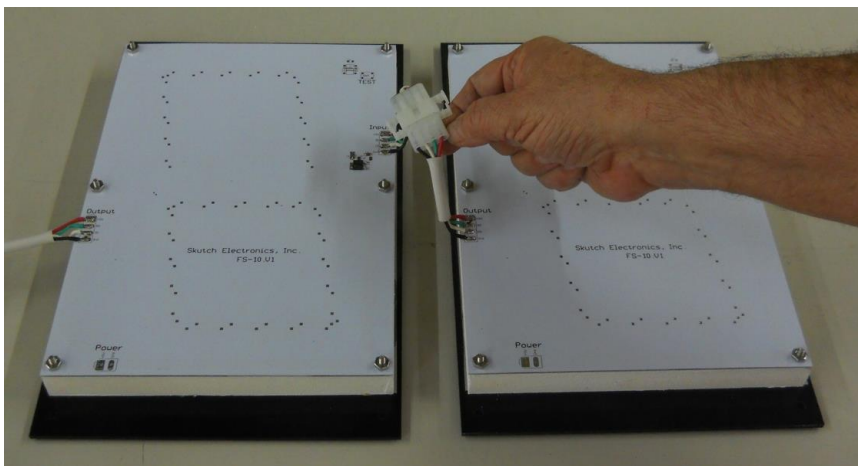
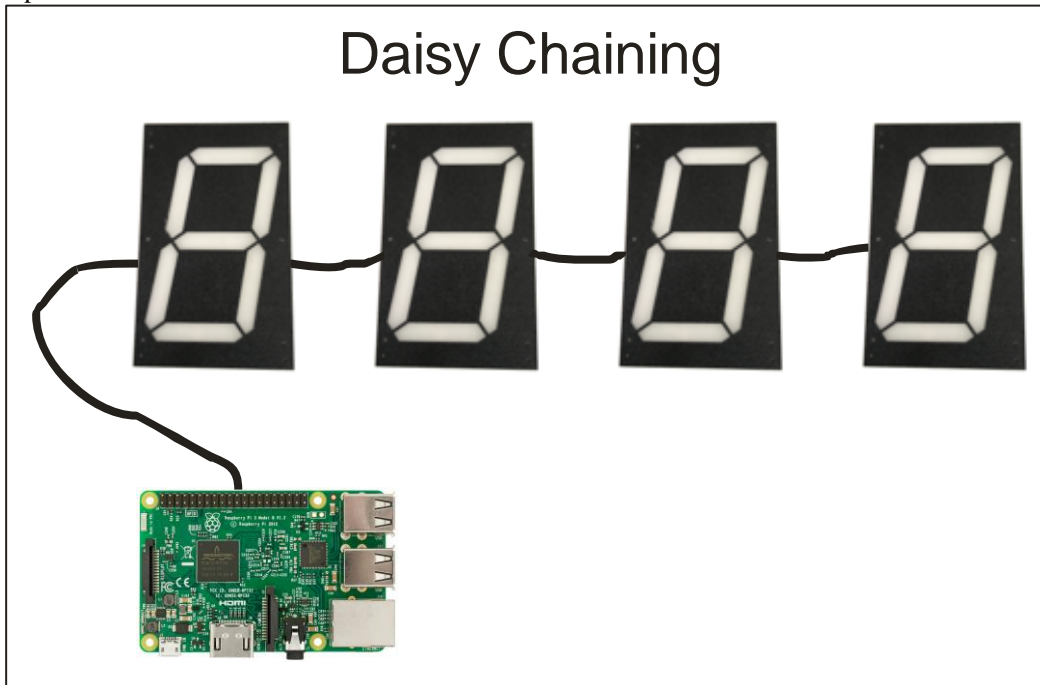
Connector to mate with OUTPUT connector= Molex #03-09-2041(Nylon)--#02-09-2611(Pins)

(These are available at Mouser or Digi-Key)

The length of the cable from the processor board to the FS-10 should be kept under 20 feet if possible. Lengths over 20' could require you to decrease your clock speed for proper operation.

You can connect your processor output pins directly to the CLOCK and DATA lines on the FS-10. The inputs on the FS-10 are standard CMOS inputs so they require very little power to drive. Make sure that the output voltage on your processors PIA ports meet the voltage specifications of the FS-10 first (see specifications).

To daisy chain multiple FS-10 units together simply connect the output connector of the first FS-10 to the input connector of the second FS-10 and so on.

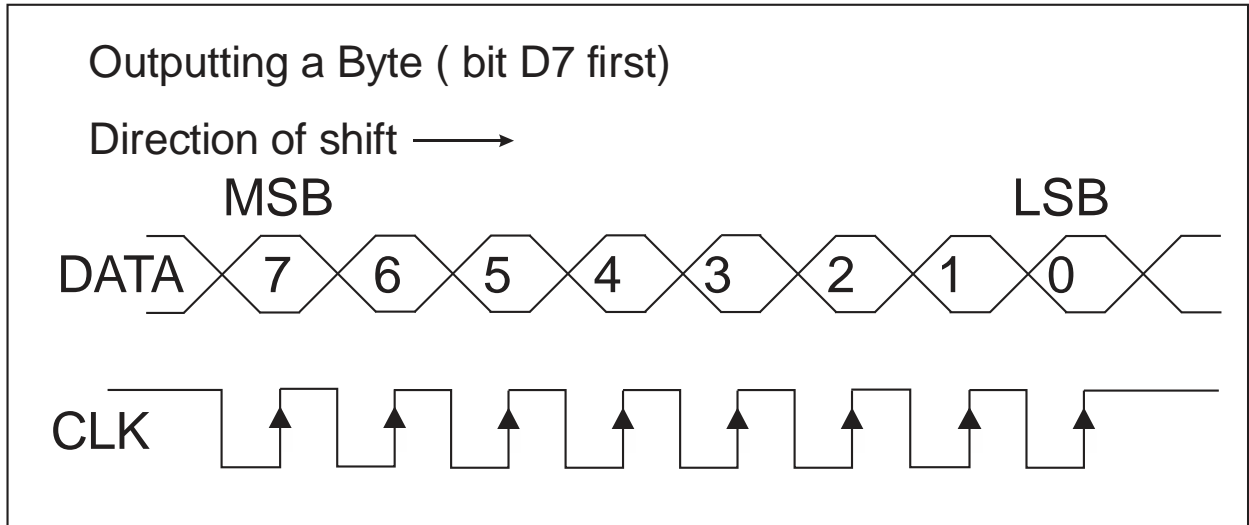


Communication Protocol

The FS-10 communicates with your processor via a simple 2-wire serial port. This consist of a CLOCK and a DATA output line from your processor. Because the timing of the clock does not have to be consistent, you can easily drive your processors PIA pins directly, or a much simpler method is to use a SPI port on your processor if it has one.

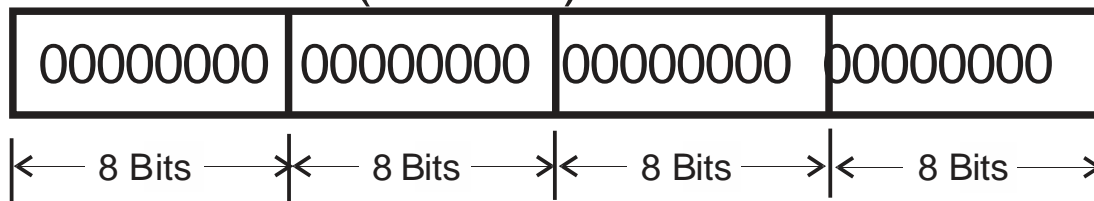
While the FS-10 will operate faster, we suggest that you limit the clock speed to 4 MHz or 4 mbps. The clock speed is not required to stay constant frequency during communications.

The following shows how a single Byte is outputted:



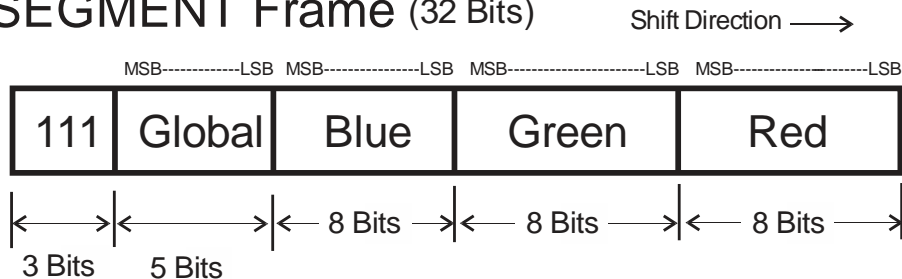
Data is outputted in FRAMES. A FRAME consist of 4 Bytes(32 bits) transferred in sequence with the Most Significant Bit (MSB) outputted first. There are three types of FRAMES. They are: the START FRAME, the SEGMENT FRAME, and the END FRAME.

Start Frame (32 Bits)



The START FRAME is the first DATA to be outputted at the beginning of each CONTROL STRING. It consist of 32 bits of logic "0" bits. This RESETS the communications to the first SEGMENT in the first DIGIT.

SEGMENT Frame (32 Bits)



The SEGMENT FRAME contains the DATA for an individual SEGMENT. There are 7 SEGMENTS in the FS-10, A through G, and they cannot be addressed individually. If you wish to make a change to any one or more SEGMENTS, all SEGMENT FRAMES, for all digits, must be transmitted during each CONTROL STRING. The first SEGMENT FRAME is segment A, the next is segment B, and so on.

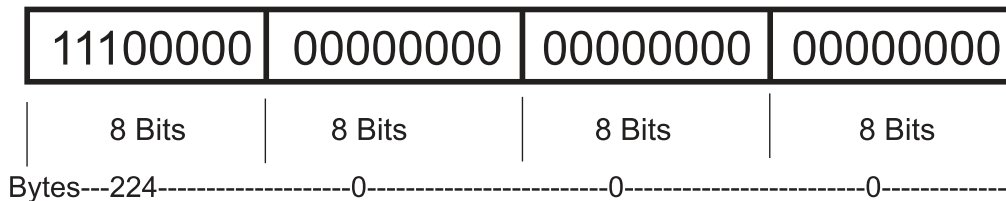
The first 3 bits of the FRAME must be logic “1”. The next 5 bits are the GLOBAL bits. This controls the overall brightness of the segment, where 0=OFF and 32=Brightest. The valid range of the “GLOBAL BYTE” is (224 to 255 decimal) or (0E0h to 0FFh in HEX), where 224=OFF and 255=Full ON.

The GLOBAL value does NOT affect the color of the segment. Think of the GLOBAL as the master brightness control for the segment.

The next 8 bits control the BLUE intensity, where 0=OFF and 255= maximum intensity. The following 8 bits control the GREEN intensity, where 0=OFF and 255=maximum intensity. The last 8 bits control the RED intensity, where 0=OFF and 255=maximum intensity. By controlling the intensity of each of the three colors, it allows you to create different colors. There are 16.7 million different color combinations. If all three color intensities are set to the same value, then you will get a white segment.

End Frame (32 Bits)

Shift Direction ---->



The END FRAME is outputted after the last SEGMENT FRAME of the last digit . It’s job is basically to activate the last segment in the last digit. It is the same code that you use to turn a SEGMENT OFF.

CONTROL STRING

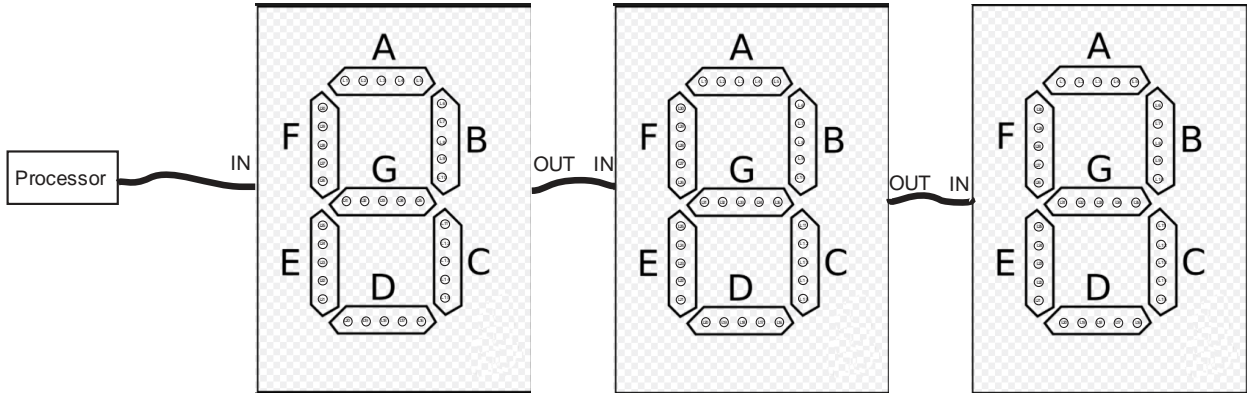
Shift Direction —> Total of 9 Frames or 36 Bytes (288 bits)



Any time that you want to change any one or more SEGMENT states, you must output a complete CONTROL STRING with all 7 SEGMENT FRAMES. You can not address SEGMENTS individually. CONTROL STRINGS only have to be outputted when you desire to make a change in the displayed digit. The display will maintain the last digit outputted until a change is made. When driving a single FS-10 digit, a CONTROL STRING consist of one START FRAME, followed by seven SEGMENT FRAMES, starting with [SEGMENT A] through [SEGMENT G], followed by an END FRAME.

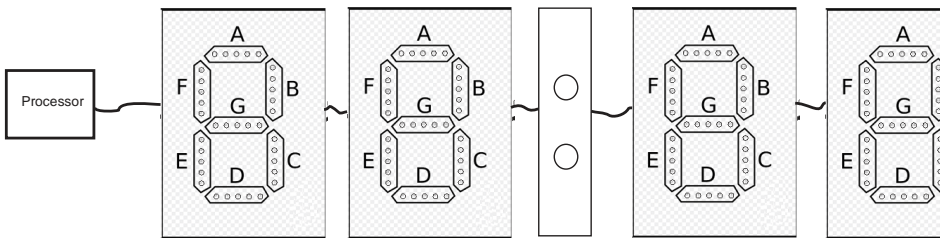
Driving multiple FS-10 Digits

Multiple FS-10 digits can be daisy chained together. In this case, the CONTROL STRING starts with a START FRAME, followed by (Number of FS-10 Digits x 7) SEGMENT FRAMES, followed by a single END FRAME. The DIGIT that the processor is directly connected to will be the first digit data to be transmitted, followed by the next daisy chained FS-10, and so on.



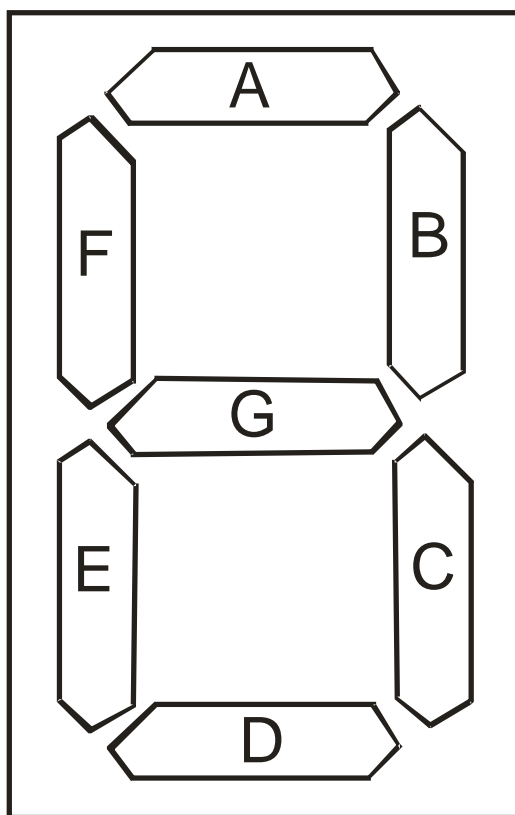
The FS-10C Colon

The FS-10C is a COLON that can be used to create a giant clock. The colon is daisy chained between FS-10 digits. It uses one SEGMENT Frame for control.



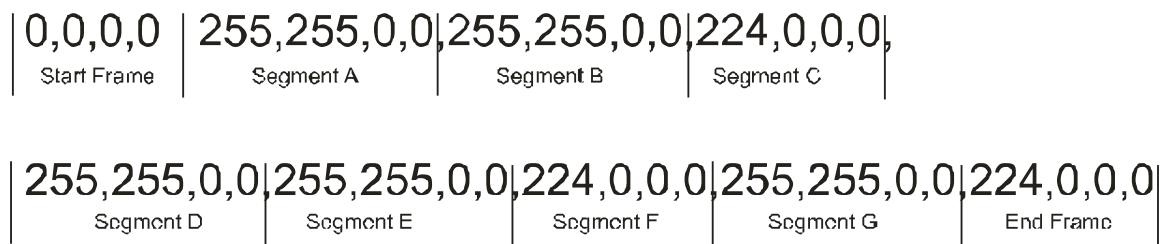
The following table shows the SEGMENTS which must be turned ON to display the various numbers.

Displayed Number	Segments	Total LEDs
0	A,B,C,D,E,F	30
1	B,C	10
2	A,B,D,E,G	25
3	A,B,C,D,G	25
4	B,C,F,G	20
5	A,C,D,F,G	25
6	A,C,D,E,F,G	30
7	A,B,C	15
8	A,B,C,D,E,F,G	35
9	A,B,C,F,G	25



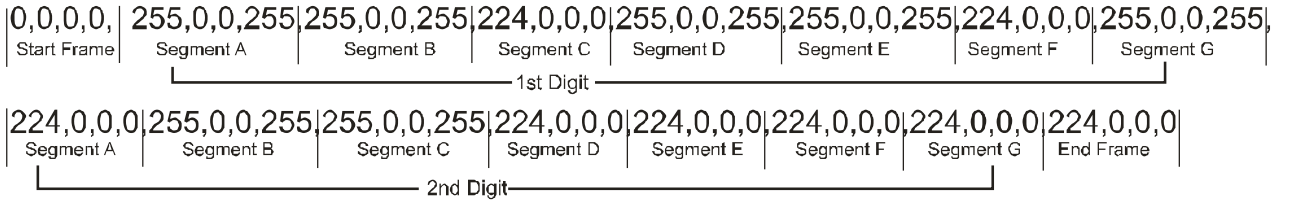
The following is an example of what the outputted CONTROL STRING would look like if you wanted to display a BLUE “2”, at maximum intensity, on a single FS-10 digit. Segments A,B,D,E, and G must be ON. Each number is a BYTE in decimal format.

Example: Display a Blue “2” (Single Digit)

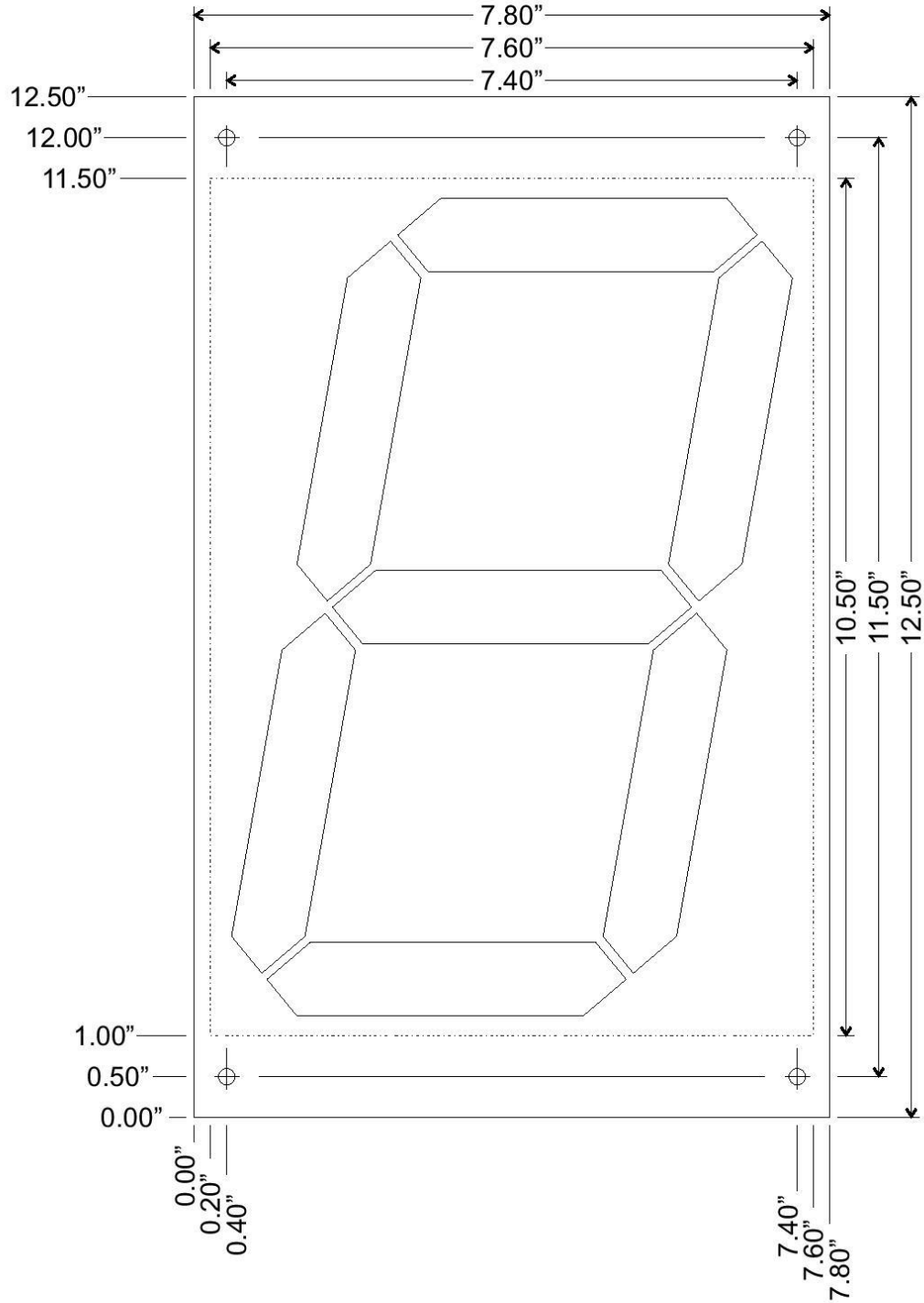


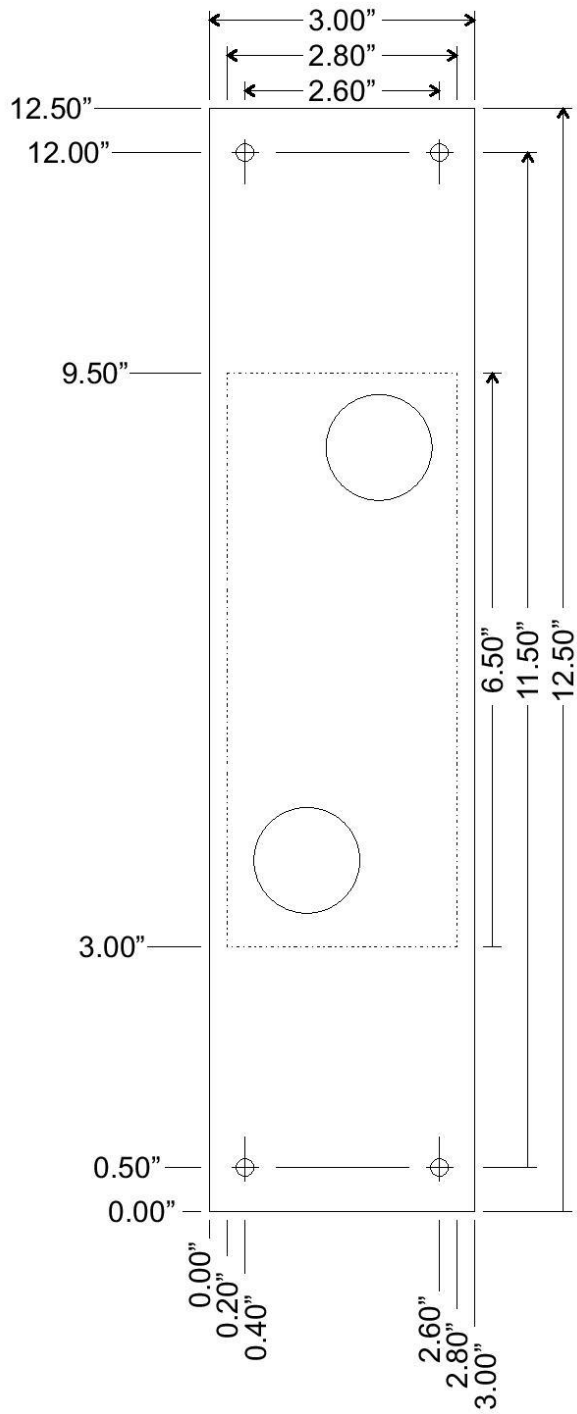
The next example shows of what the outputted CONTROL STRING would look like if you wanted to display a “RED” “21”, at maximum intensity, on two daisy chained FS-10 digits.

Example: Display a Red "21" (Two Digits)



Mounting Dimensions





Tech Support - 916-786-6186

If you have any problems getting the unit to work properly feel free to give us a call. Technical Support is available between the hours of 7:30 AM and 4:30 PM Pacific Time, Monday through Friday.

• ONE YEAR LIMITED WARRANTY

This SKUTCH PRODUCT is warranted against defects for a period of one (1) year from the date of the original invoice. Within this period, we will repair it without charge for parts and labor. To obtain warranty service the product must be returned, at the customer's expense, to SKUTCH Electronics along with a copy of the original invoice. After the unit has been repaired, SKUTCH will ship the PRODUCT back via UPS GROUND service at our expense. If any other form of return shipment is requested, the customer will pay for 100% of the shipping cost.

This Warranty does not apply if in the sole opinion of SKUTCH Electronics, the PRODUCT has been damaged by lightning or any other Acts of God, or by accident, misuse, neglect, or improper packing, shipping, modification or servicing by other than an authorized SKUTCH Service Center.

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