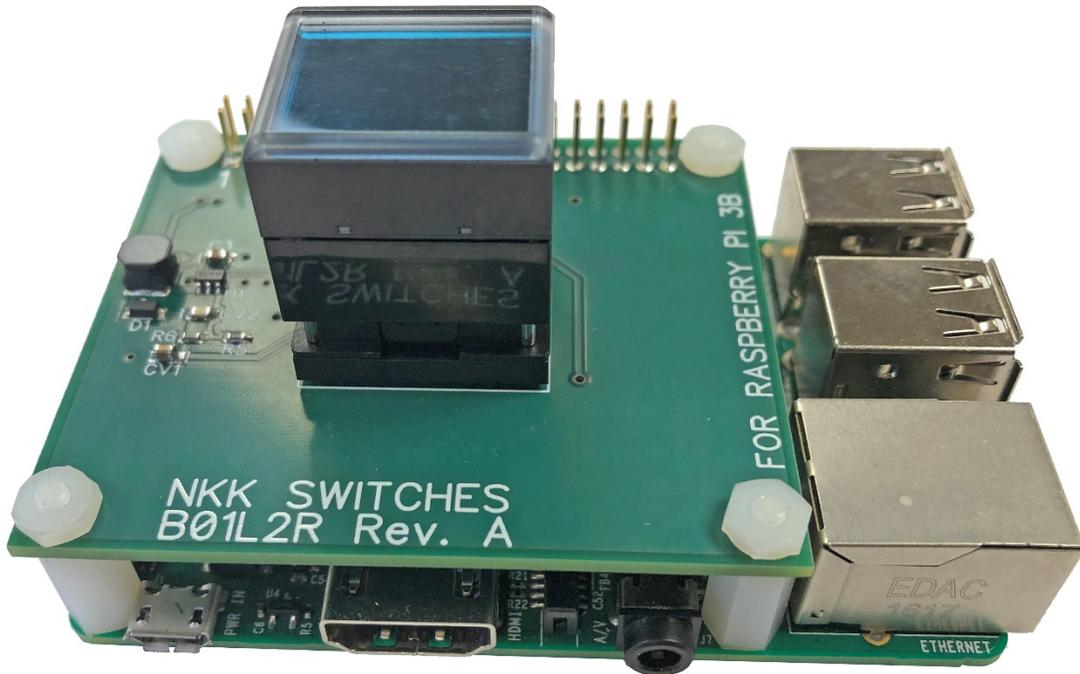

IS-71503
Video SmartDisplay Reference Design
User Manual
Revision A



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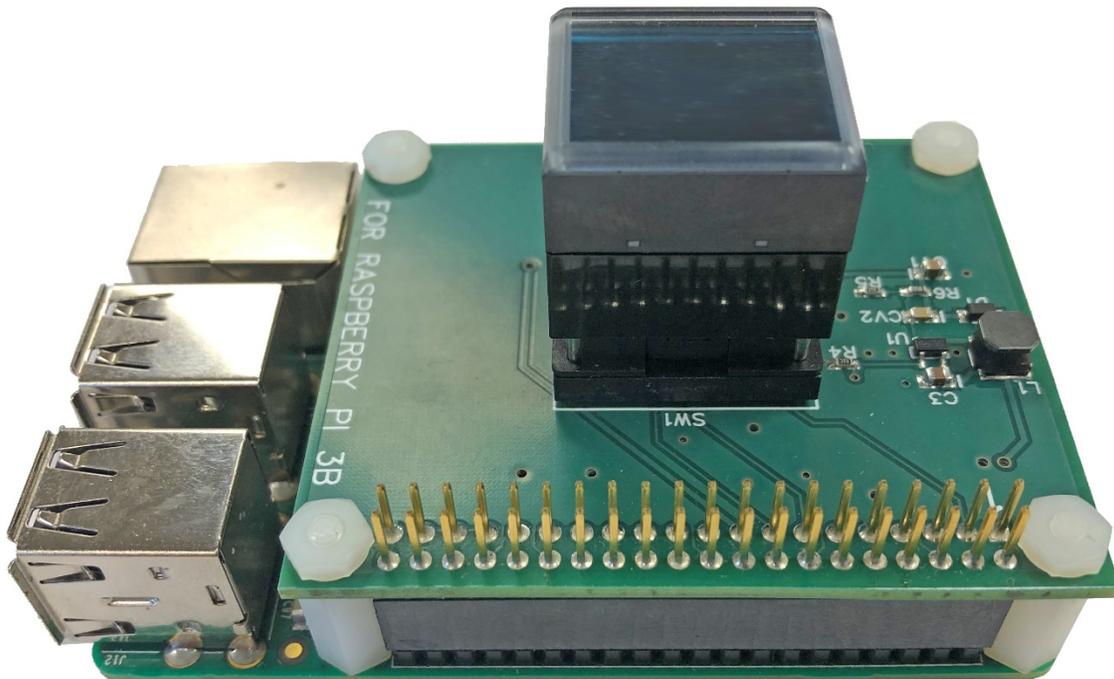
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1. NKK Switches IS-71503 Overview

The Video SmartDisplay Reference Design is a powerful human-to-machine-interface tool that uses a Frameless OLED SmartDisplay to dynamically change switch legends and images based on desired application functions. The kit is controlled by a Raspberry Pi and can be used in any end application. The SmartDisplay is a momentary pushbutton with a 96x64 OLED display screen manufactured by NKK Switches. The switch is capable of streaming video or animations for a dynamic user experience.



The Video SmartDisplay Reference Design is ideal for use in applications where switch functionality is changed due to external measurements or commands. The dynamic nature makes it perfect for use in Internet of Things (IoT) applications, stand-alone measurement devices, or any project where a sleek user interface is required! SmartDisplay is a switch, display, and interface all in one small package.

To assist with development, NKK Switches provides free demonstration software for the Raspberry Pi. This software shows basic SmartDisplay functionality; it is intended as a jumping off point for the user to develop code for their specific application. Please visit our website to download:

<https://www.nkkswitches.com/download-software/>

The IS-71503 comes pre-loaded with the open-source webcam program. Simply plug in a webcam, power on the device, and the webcam stream will appear on the SmartDisplay.

2. General Features

Two part numbers are referenced: IS-71503 Video SmartDisplay Reference Design which is the full kit and the IS-B01L2R-CS which is just the SmartDisplay adapter board.

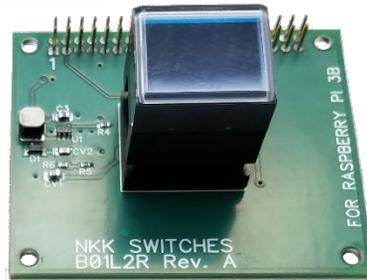
IS-71503 includes:

- 96x64 Frameless OLED SmartDisplay
- SmartDisplay Adapter Board (B01L2R)
- Raspberry Pi 3B+ (w/ software preloaded)
- Power Cable for Raspberry Pi
- MicroSD



IS-B01L2R-CS includes:

- 96x64 Frameless OLED SmartDisplay
- SmartDisplay Adapter Board (B01L2R)



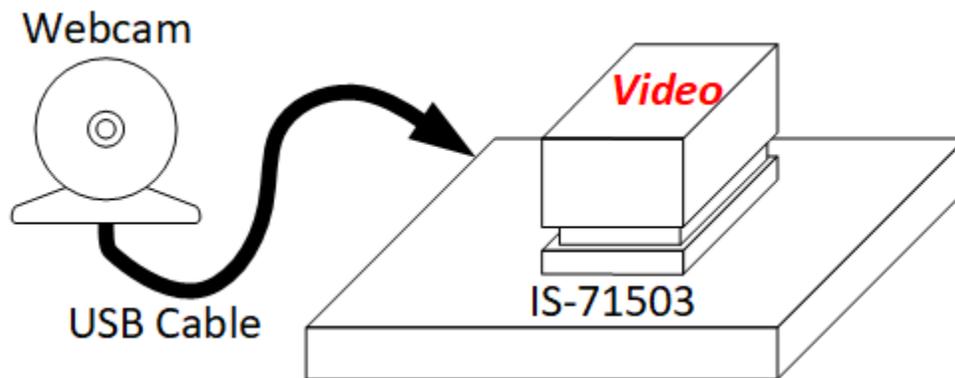
Features:

- Controls a Frameless 96x64 OLED SmartDisplay, ISF15ACP4, with momentary pushbutton functionality.
- Powered by Raspberry Pi, no external connections necessary.
- 16 levels of brightness.
- Real-time control by Raspberry Pi.
 - Show any image on switch (After proper formatting).
 - Reports switch presses to Raspberry Pi.
 - Can run videos and animations at up to 60 frames per second.
- Open-Source demonstration code provided for easy modification and customization.
- SmartDisplay board is centered over Raspberry Pi and has same mounting hole locations.
- 6 pins are used for SmartDisplay control. The rest are pass-through and available for use.

3. Operation

This reference design is intended to give users a platform to easily integrate SmartDisplay into their Raspberry Pi project. Example open-source software is provided at <https://www.nkkswitches.com/download-software/> to jump-start the integration into an existing project.

The demonstration software requires a webcam to function. Prior to power-up, connect a USB webcam (not provided) to the Raspberry Pi. After power up, the Raspberry Pi will configure the SmartDisplay, get the webcam stream, format the frames, and send the stream to the SmartDisplay. If no webcam is connected, the SmartDisplay will only display a white screen.



The switch is controlled using the SPI bus and discrete GPIO on the Raspberry Pi connector.

IS-B01L2R-CS Considerations

For IS-B01L2R-CS, a driver package is needed to access the pins. NKK recommends:

BCM2835 for direct GPIO: <http://www.airspayce.com/mikem/bcm2835/>

GPIOZERO for Python: <https://gpiozero.readthedocs.io/en/stable/>

The Raspberry Pi also needs to be configured to access the SPI bus. Click the Raspberry->Preferences->Raspberry Pi Configuration. Click the interfaces tab, then enable SPI. Click OK and reboot.

It is critical to reference the data sheet https://www.nkkswitches.com/pdf/ISF15ACP4_FramelessOLED.pdf and application notes <https://www.nkkswitches.com/smartdisplay-resources/> when developing software for SmartDisplay.

Frameless OLED SmartDisplay

The Frameless OLED SmartDisplay is an OLED display on top of a switch. This allows for dynamically changing images, switch legends, or even showing video streams up to 60 frames per second! The Frameless OLED can display 65,000 colors at a resolution of 96x64 pixels. This reference design is also capable of

running the Standard OLED SmartDisplay (64x48 resolution). The only change required would be to the configuration commands sent on startup (see open-source software <https://www.nkkswitches.com/download-software/> and application notes for examples).

4. Images

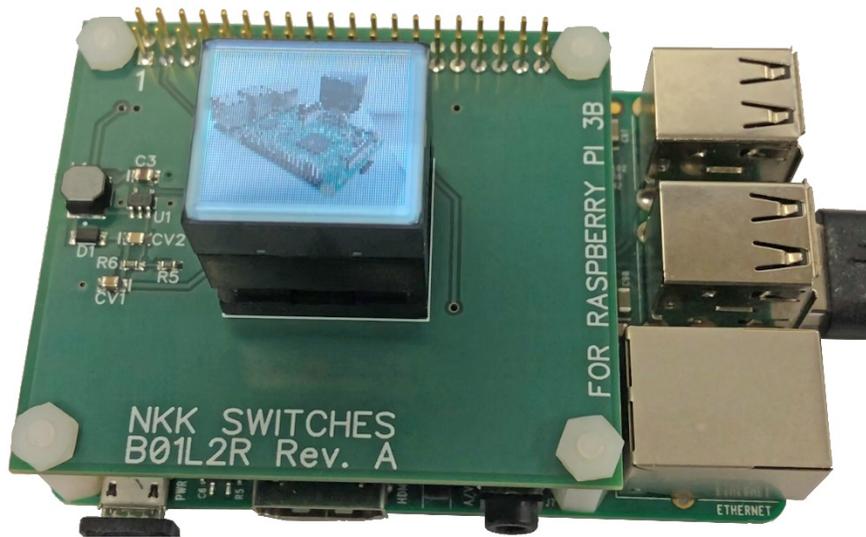
Images can be created in any graphics software such as Paint, Photoshop, etc, or even user-created software.

The 96x64 Frameless OLED SmartDisplay expects image pixels to be 16-bit using 565 BGR format. That's 2 bytes for every pixel to support 65k colors.

B4	B3	B2	B1	B0	G5	G4	G3	G2	G1	G0	R4	R3	R2	R1	R0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

Please reference the SmartDisplay datasheet at https://www.nkkswitches.com/pdf/ISF15ACP4_FramelessOLED.pdf and application notes for more information on formatting and sending image data.

Close-up of Video on SmartDisplay



5. Hardware

The Video SmartDisplay Reference Design contains the minimal hardware needed to get a SmartDisplay up and running. This includes:

- SPI Clock and Data for setup commands and image data
- Data/Command signal for SmartDisplay
- SPI Switch select (If SPI bus is used for multiple devices)
- +3.3V from Raspberry Pi
- +15V charge pump for OLED voltage

The pinout is as follows:

J8			
+3.3V	1	2	+5V to charge pump
Switch Press	3	4	+5V
	5	6	GND
	7	8	
	9	10	
LCD power enable	11	12	
Data/Command	13	14	GND
SPI Switch Select	15	16	Switch Reset
+3.3V	17	18	
SPI MOSI	19	20	GND
SPI MISO	21	22	
SPI Clock	23	24	
GND	25	26	
	27	28	
	29	30	GND
	31	32	
	33	34	GND
	35	36	
	37	38	
GND	39	40	

Typical dimensions in millimeters.

