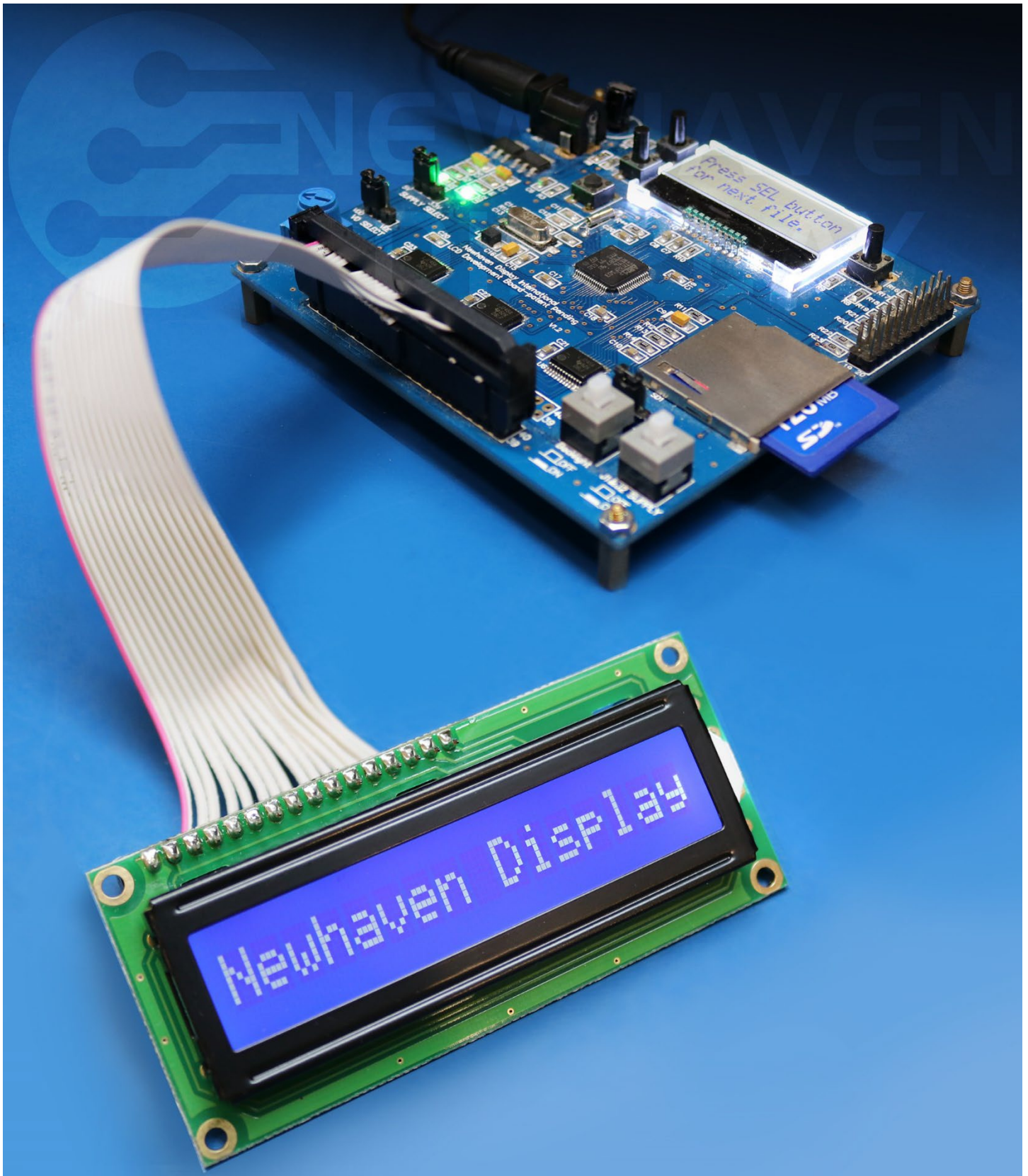


NHDev Development Board | User Guide



Introduction

The NHDev is a development board for evaluating or prototyping Newhaven's products including OLEDs, TFTs, graphic LCDs, character LCDs, COG, and VFDs. This development board is based on the STM32F103 Cortex-M3 microcontroller. The device has been preprogrammed to support display modules from Newhaven Display. The development board includes an SD Card with preloaded images and text files for the supported displays (page 3) and can be reloaded or edited using a PC to evaluate the supported displays using custom designed images or text.

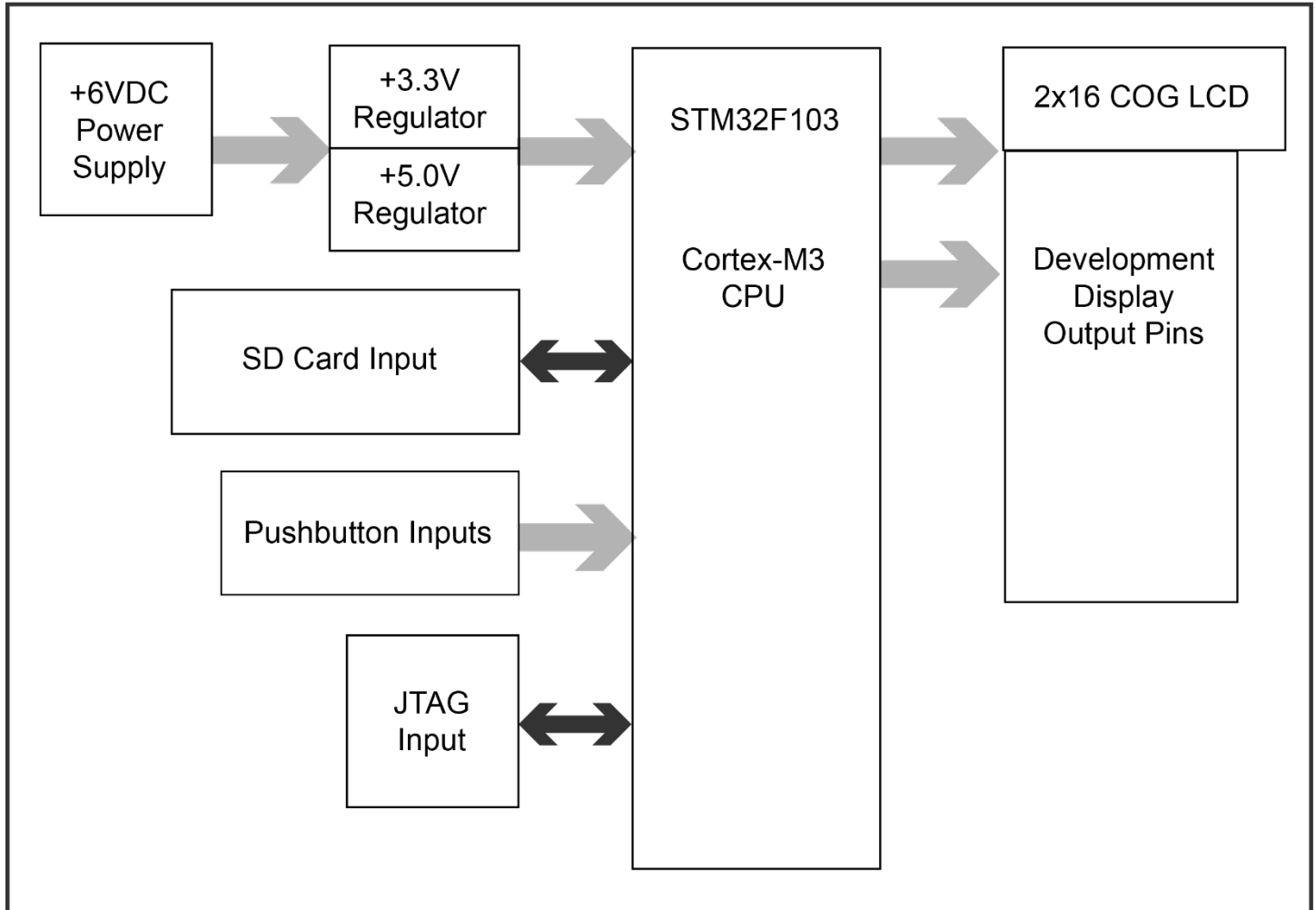
Features

- CPU: STM32F103RET6 ARM 32-bit Cortex-M3
- 2.54mm (0.1") pitch LCD development output pins and thru-holes
- PCB dimensions: 100 x 95mm
- SD card storage with preloaded images and text files
- NHD-C0216CZ-FSW-FBW display
- 3 pushbutton user interface
- 6VDC power supply, jumper to select +5V, 3.3V LCD power supply
- Jumper to select input to V0 potentiometer, either VSS or VEE (external voltage)
- Variable resistor to adjust contrast
- Backlight enable switch
- MPU reset switch
- JTAG connection with ARM2x10 pin layout for programming

List of Supported Displays

LCD TFTs	LCD Chip-On-Glass (COG)	LCD Character Modules
<p>NHD-1.8-128160EF-C series NHD-2.4-240320CF-C series *</p> <p>NHD-2.4-240320SF-C series **</p> <p>NHD-3.5-320240MB-A series ***</p> <p>NHD-3.5-320240MF-A series ****</p> <p>NHD-4.3-480272EF-A series ****</p> <p>NHD-4.3-480272EF-C series</p> <p>NHD-4.3-480272MB-A series ****</p> <p>NHD-4.3-480800CF-A series ****</p> <p>NHD-4.3-480800EZ-A series ****</p> <p>NHD-5.0-800480AF-A series ****</p> <p>NHD-5.0-800480MB-A series ****</p> <p>NHD-5.0-800480TF-A series ****</p> <p>NHD-5.7-320240WFB-A series ****</p> <p>NHD-5.7-320240WFB-C series</p> <p>NHD-5.7-320240WFB-E series</p> <p>NHD-5.7-640480WF-C series</p> <p>NHD-7.0-800480EF-A series ****</p> <p>NHD-7.0-800480EF-C series</p> <p>NHD-7.0-800480MB-A series ****</p> <p>NHD-7.0-800480WF-C series</p> <p>* 8-bit Parallel Mode ** 16-bit Parallel Mode *** Controller Board Required (TN Models) **** Controller Board Required (TN & IPS)</p>	<p>NHD-C0216AZ series NHD-C0216CZ series NHD-C0220AA series NHD-C0220AZ series NHD-C12832A1Z series NHD-C12864A1Z series NHD-C12864B2Z series NHD-C12864CR series NHD-C12864GG series NHD-C12864KGZ series NHD-C12864LZ series * NHD-C12864M1R series NHD-C12864WC series * NHD-C12864WO series * NHD-C12865AR series NHD-C12865BR series NHD-C128128BZ series NHD-C160100AZ series NHD-C160100CZ series NHD-C160100DiZ series</p> <p>* Parallel Mode</p>	<p>NHD-0108 series NHD-0112 series NHD-0116 series NHD-0208 series NHD-0212 series NHD-0216 series NHD-0220 series NHD-0224 series NHD-0240 series NHD-0416 series NHD-0420 series NHD-0440 series</p> <p>NOTE: Serial LCDs not supported</p>
<p>LCD Graphic Modules</p> <p>NHD-12232AZ series NHD-12232DZ series NHD-12864WX series NHD-12864MZ series NHD-12864WG-B series NHD-12864WG-C series NHD-12864AZ series NHD-14432WG-A series NHD-14432WG-B series NHD-16032AZ series NHD-16032BZ series NHD-160128WG series NHD-19232WG series NHD-24064CZ series NHD-24064WG series NHD-240128WG-A series NHD-240128WG-B series NHD-320240WG-B series NHD-320240WG-C series NHD-320240WX series</p>	<p>OLED Displays</p> <p>NHD-0216MW-AB3 * NHD-0216CW series ** NHD-0216KZW series ** NHD-0216SZW series ** NHD-0220CW series ** NHD-0220DZW series ** NHD-0420CW series ** NHD-0420DZW series ** NHD-2.23-12832UC series ** NHD-2.7-12864UC series ** NHD-2.8-25664UC series ** NHD-3.12-25664UC series ** NHD-1.27-12896UGC3 ** NHD-1.5-128128UGC3 ** NHD-1.69-160128UGC3 **</p> <p>* Interface Board Required (Parallel Mode) ** 8-bit Parallel Mode</p>	<p>VFD Modules</p> <p>M0116SD-161SDBR1-1 M0216SD-162SDAR2-1 M0216SD-162SDAR1 M0216SD-162SDAR8 M0216MD-162MDBR2-J M0220SD-202SDAR1 M0220SD-202SDAR1-1G M0220MD-202MDAR1-3 M0420SD-204SDAR1-3 M0420SD-204MDAR1-C</p>

Block Diagram



Warning of Use

The NHDev board is shipped in protective anti-static packaging. General practice for working with static sensitive devices should be applied when working with this board.

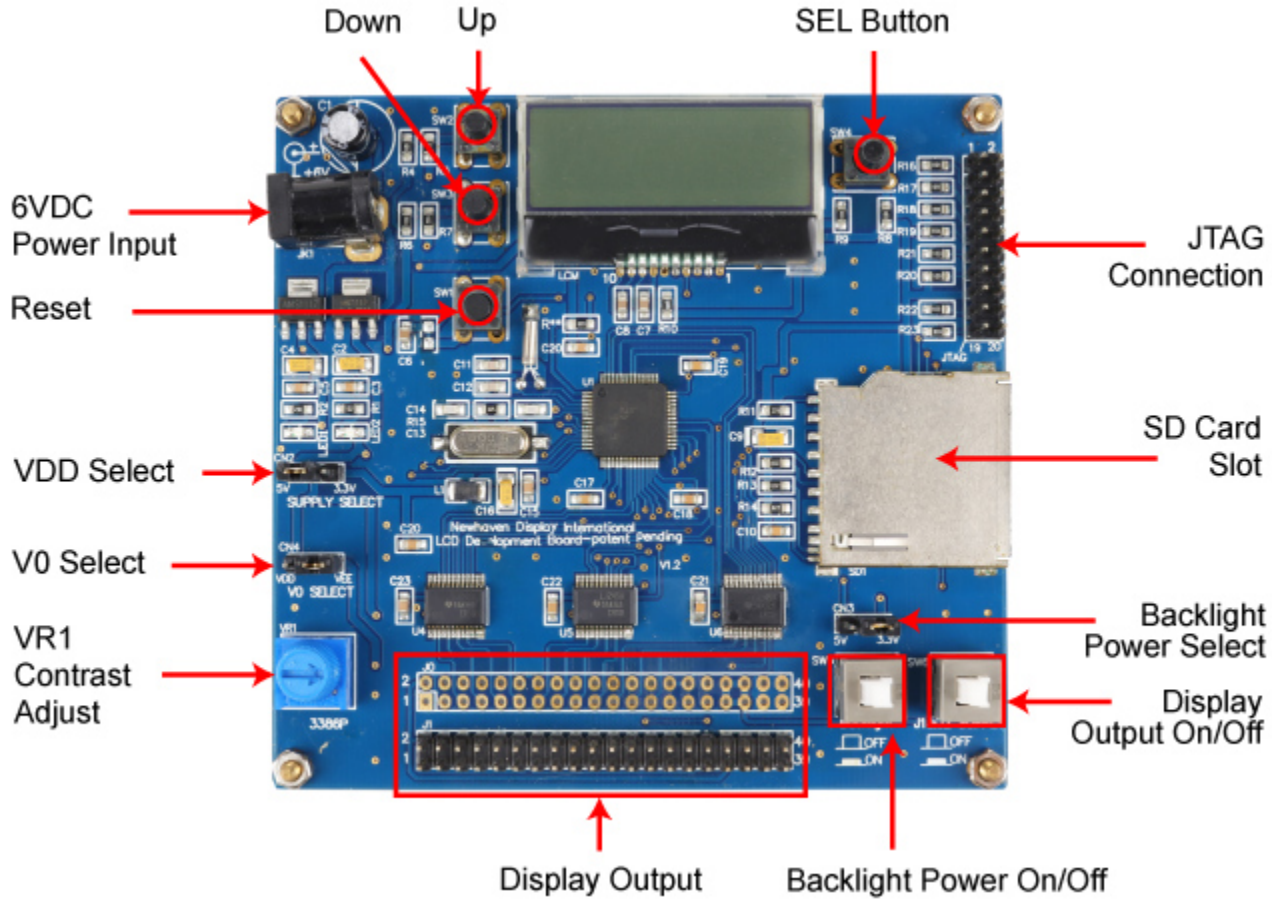
The NHDev board is designed to be used as a learning tool and method to achieve quick-to-market product decisions. The programming and timing used may not completely match the requirements as stated in the product specifications but can be used as general guidelines.

Though it may work, the NHDev board is not designed to be used with other manufacturer's displays. Consult the product's specification to ensure no damage will be caused to the display or the NHDev development board. Damage to the NHDev board or evaluated display caused by improper wiring or testing sequence is not covered under warranty.

Board Use Requirements

1. **Power supply:** 6VDC, 600mA wall transformer included.
2. **SD card:** 128MB card with default files included.
3. **Jumper shunts:** 3 included for VDD, V0, and Backlight power select.
4. **LCD interface cable:** sold separately or build your own.

Interface Introduction



Output Pin Description

Pin	Symbol	Level	Description
1	VSS	GND	Ground
2	VDD	5V / 3.3V	Selectable 5V, 3.3V Logic Power Supply
3	V0	Variable	LCD Contrast adjustment voltage selectable between VSS to VDD or VSS to VEE
4	VEE	Input	LCD voltage input (selected with J2)
5	RS or A0	H/L	Register Select. H=Data, L= Instruction
6	R/W or /WR	H/L	R/W in M6800 interface. H=Read, L=Write /WR in I8080 interface. H=Write Inactive, L=Write Active
7	E or /RD	H/L	E in M6800 interface. H->L = Enable Strobe /RD in I8080 interface. H=Read Inactive, L=Read Active
8	E2	H/L	H-> L = Enable Strobe for second controller
9	/CS1	H/L	Chip Select. L=Chip Active
10	/CS2 or DISP or IMO	H/L	Chip Select-Second Controller. L=Chip Active DISP=Display ON signal IMO= Interface Mode select
11	/RES	H/L	Reset. L=Reset controller.
12	BLE	5V / 3.3V	Backlight power switch (SW5)
13-16	DB0 – DB3	H/L	Bi-directional 3-state data bus lines. Not used in 4-bit mode.
17-20	DB4 – DB7	H/L	Bi-directional 3-state data bus lines.
21-28	DB8 – DB15	H/L	Bi-directional 3-state data bus lines.
29	SDI or SDA	H/L	Serial Data In
30	SCK or SCL	H/L	Serial Clock
31	SPISS	H/L	Serial Slave Select
32	BLE	5V / 3.3V	Backlight power switch (SW5)
33-36	VDD	5V / 3.3V	Selectable 5V, 3.3V Logic Power Supply
37-40	VSS	GND	Ground

Jumper Pin Description

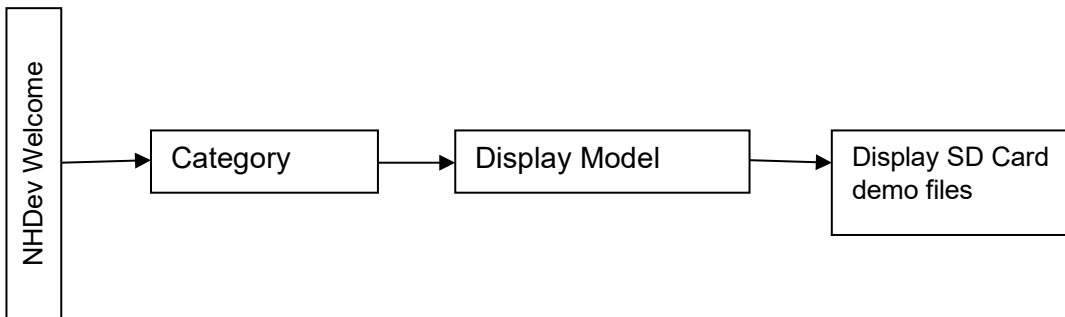
Pins	Name	Level	Output	Description
CN2	SUPPLY SELECT	5V	VDD and logic pins	Select 5V as VDD for the display and logic
		3.3V		Select 3.3V as VDD for the display and logic
CN4	V0 SELECT	VDD	V0 (pin 3)	Select contrast voltage between VDD and VSS. (For a Positive LCD voltage). Adjustable via VR1 potentiometer.
		VEE		Select contrast voltage between VSS and VEE. (For a Negative LCD voltage). VEE must be supplied externally onto PIN4. Adjustable via VR1 potentiometer.
CN3	BACKLIGHT SUPPLY SELECT	5V	SW5 (pins 12,32)	Select 5V as voltage supply for LED backlight. External current limiting resistor may be required.
		3.3V		Select 3.3V as voltage supply for LED backlight. External current limiting resistor may be required.

Development Board Firmware Description

The NHDev Development Board comes programmed with demonstration firmware for all of the Newhaven Display modules listed above. By selecting the desired part number from the NHDev user interface, you can quickly demonstrate and evaluate any of these display modules. Prior to selecting the appropriate firmware, the display module must be wired to the NHDev board by matching the display's pin description to the NHDev output pin description. Then when the firmware is selected by the display's part number, the display is initialized, and demonstration text or images is read from the SD Card and sent onto the display. The demonstration text and images can be edited or replaced to see the many capabilities of each display module.

Current Version: V2.10

Structure of the Demonstration Menu



Running the Development Board

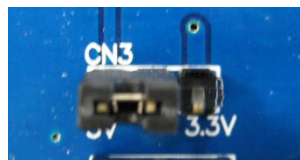
1. Wire the display by matching the pin descriptions of the display module to the NHDev output pin description. Visit <https://newhavendisplay.com/nhdev/> for wiring diagrams or see the display datasheet for reference.
2. Select either 5V or 3.3V power supply for the display being evaluated. This is determined based on the specification of the desired display.



3. Select either VDD or VEE for the V0 power supply for the display being evaluated. This is determined based on the specification of the desired display.
 - If the display has a VEE voltage output connected to Pin 4, you should select VEE.
 - If the display's V0 (contrast voltage) is negative, you should select VEE.
 - If the display's V0 (contrast voltage) is greater than VDD, you should select VEE.
 - If the display's V0 (contrast voltage) is between VDD and 0V, you should select VDD.



4. Select either 5V or 3.3V for the backlight supply voltage. This is determined based on the specification of the desired display. If the backlight of the display requires any voltage other than 5V or 3.3V, select the greater voltage and include a current limiting resistor in line with the backlight when wiring.



5. Push ON J1 and J2 (push buttons are clicked down).

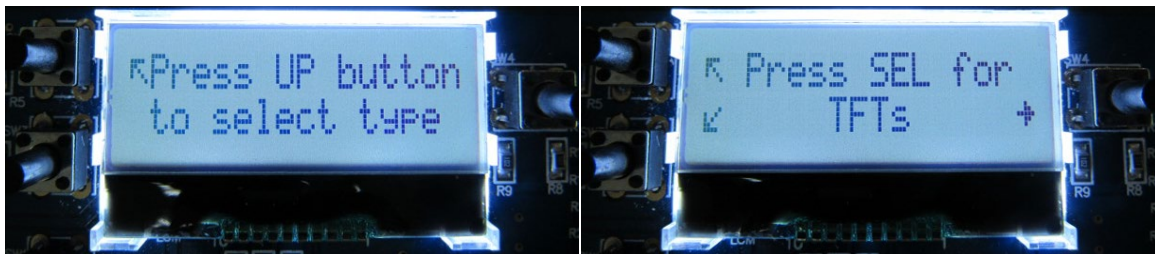


6. Make sure the SD card is inserted into the NHDev board.

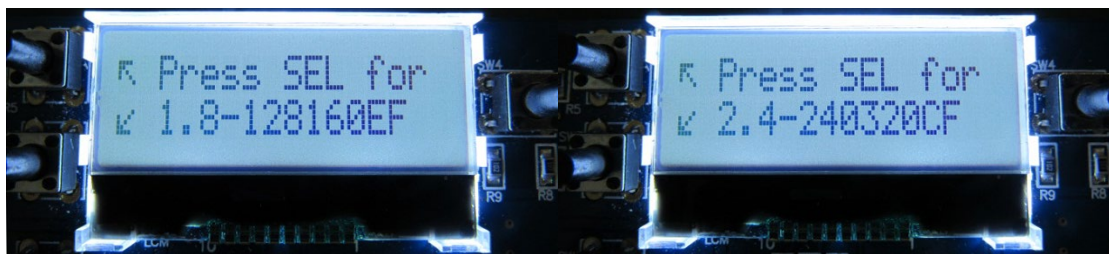
- Apply power to the NHDev board. A 6.0V DC wall transformer is included. On power up, the NHDev built-in COG display will show the current program revision.



- The NHDev COG display will then show "Press UP to select type". Pressing the UP and DOWN buttons will cycle through the available display categories that NHDev is programmed to demonstrate. Pressing the SEL button will enter that category and begin listing specific part number models.



- The NHDev COG display will show the first part number model in the selected category. Pressing UP and DOWN buttons will cycle through the available part number models that NHDev is programmed to demonstrate. When the desired part number model is reached, stop pressing buttons.



- Press the SEL button to initialize the selected display and begin the demonstration program.



11. When prompted, press the SEL button to continue the demonstration program and scroll through the corresponding files on the SD Card. See Appendix B for SD Card file formatting and editing. You may see a blink on the display as the SD Card is being read and the display is being re-initialized and written.



12. To evaluate another display, reset power and repeat all steps.

SD Card File Format

For each display model, the demonstration program will attempt to read a default file. The default file must be saved on the SD Card and be readable or the NHDev program will error and halt.

The default file is always signified by a 0 (zero) immediately before the .BMP or .TXT file format.

After reading and displaying the default file, if the SEL button is pressed, the next file, if available and readable, will be read and displayed. If no additional files are available, the default file will be displayed again.

The next file is determined by incrementing the number or letter immediately before the .BMP or .TXT.

- ✓ Char2x16_0.txt
- Char2x16_1.txt
- Char2x16_2.txt
- ...
- Char2x16_9.txt
- Char2x16_A.txt
- Char2x16_B.txt
- ...
- Char2x16_Y.txt
- Char2x16_Z.txt
- ✓ Char2x16_0.txt
- Char2x16_1.txt

You may edit the contents of any of the provided files or create your own according to the following table:

Model No.	Resolution	File Type	Default File Name (***Required File***)
TFTs			
NHD-1.8-128160EF-C	128x160 pixels	24-bit bitmap .BMP	1_8_128160EF_0.bmp
NHD-2.4-240320CF-C	240x320 pixels	24-bit bitmap .BMP	2_4_240320CF_0.bmp
NHD-2.4-240320SF-C	240x320 pixels	24-bit bitmap .BMP	2_4_240320SF_0.bmp
NHD-3.5-320240MB-A	320x240 pixels	24-bit bitmap .BMP	3_5_320240MF_0.bmp
NHD-3.5-320240MF-A	320x240 pixels	24-bit bitmap .BMP	3_5_320240MF_0.bmp
NHD-4.3-480272EF-A	480x272 pixels	24-bit bitmap .BMP	4_3_480272EF_0.bmp
NHD-4.3-480272MB-A	480x272 pixels	24-bit bitmap .BMP	4_3_480272EF_0.bmp
NHD-4.3-480800EF-C	480x800 pixels	24-bit bitmap .BMP	4_3_480800EF_0.bmp
NHD-5.0-800480MB-A	800x480 pixels	24-bit bitmap .BMP	5_0_800480TF_0.bmp
NHD-5.0-800480TF-A	800x480 pixels	24-bit bitmap .BMP	5_0_800480TF_0.bmp
NHD-5.7-320240WFB-A	320x240 pixels	24-bit bitmap .BMP	5_7_320240WFB_0.bmp
NHD-5.7-320240WFB-C	320x240 pixels	24-bit bitmap .BMP	5_7_320240WFB_0.bmp
NHD-5.7-320240WFB-E	320x240 pixels	24-bit bitmap .BMP	5_7_320240WFB_0.bmp
NHD-5.7-640480WF-C	640x480 pixels	24-bit bitmap .BMP	5_7_640480WF_0.bmp
NHD-7.0-800480EF-A	800x480 pixels	24-bit bitmap .BMP	7_0_800480EF_0.bmp
NHD-7.0-800480MB-A	800x480 pixels	24-bit bitmap .BMP	7_0_800480EF_0.bmp
NHD-7.0-800480WF-C	800x480 pixels	24-bit bitmap .BMP	7_0_800480WF_0.bmp
Character Modules			
NHD-0108	8 characters	.TXT	Char1x8_0.txt
NHD-0112	12 characters	.TXT	Char1x12_0.txt
NHD-0116	16 characters	.TXT	Char1x16_0.txt
NHD-0208	16 characters	.TXT	Char2x8_0.txt
NHD-0212	24 characters	.TXT	Char2x12_0.txt
NHD-0216	32 characters	.TXT	Char2x16_0.txt
NHD-0220	40 characters	.TXT	Char2x20_0.txt
NHD-0224	48 characters	.TXT	Char2x24_0.txt
NHD-0240	80 characters	.TXT	Char2x40_0.txt
NHD-0416	64 characters	.TXT	Char4x16_0.txt
NHD-0420	80 characters	.TXT	Char4x20_0.txt
NHD-0440	160 characters	.TXT	Char4x40_0.txt
Graphic Modules			
NHD-12232AZ	122x32 pixels	Monochrome bitmap .BMP	12232_0.bmp
NHD-12232DZ	122x32 pixels	Monochrome bitmap .BMP	12232_0.bmp
NHD-12864WX	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864MZ	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864WG-B	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864WG-C	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-12864AZ	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-14432WG-A	144x32 pixels	Monochrome bitmap .BMP	14432_0.bmp
NHD-14432WG-B	144x32 pixels	Monochrome bitmap .BMP	14432_0.bmp
NHD-16032AZ	160x32 pixels	Monochrome bitmap .BMP	16032_0.bmp
NHD-16032BZ	160x32 pixels	Monochrome bitmap .BMP	16032_0.bmp
NHD-160128WG	160x128 pixels	Monochrome bitmap .BMP	160128_0.bmp
NHD-19232WG	192x32 pixels	Monochrome bitmap .BMP	19232_0.bmp
NHD-24064CZ	240x64 pixels	Monochrome bitmap .BMP	24064_0.bmp
NHD-24064WG	240x64 pixels	Monochrome bitmap .BMP	24064_0.bmp
NHD-240128WG-A	240x128 pixels	Monochrome bitmap .BMP	240128_0.bmp
NHD-240128WG-B	240x128 pixels	Monochrome bitmap .BMP	240128_0.bmp
NHD-320240WG-B	320x240 pixels	Monochrome bitmap .BMP	320240_0.bmp
NHD-320240WG-C	320x240 pixels	Monochrome bitmap .BMP	320240_0.bmp
NHD-320240WX	320x240 pixels	Monochrome bitmap .BMP	320240_0.bmp

COG Displays

NHD-C0216AZ	32 characters	.TXT	Char2x16_0.txt
NHD-C0216CZ	32 characters	.TXT	Char2x16_0.txt
NHD-C0220AA	40 characters	.TXT	Char2x20_0.txt
NHD-C0220AZ	40 characters	.TXT	Char2x20_0.txt
NHD-C12832A1Z	128x32 pixels	Monochrome bitmap .BMP	C12832_0.bmp
NHD-C12864A1Z	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864B2Z	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864CR	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864GG	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864KGZ	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864LZ	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864M1R	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864WC	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12864WO	128x64 pixels	Monochrome bitmap .BMP	12864_0.bmp
NHD-C12865AR	128x65 pixels	Monochrome bitmap .BMP	12865_0.bmp
NHD-C12865BR	128x65 pixels	Monochrome bitmap .BMP	12865_0.bmp
NHD-C128128BZ	128x128 pixels	Monochrome bitmap .BMP	C128128_0.bmp
NHD-C160100AZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp
NHD-C160100CZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp
NHD-C160100DiZ	160x100 pixels	Monochrome bitmap .BMP	C160100_0.bmp

OLED Modules

NHD-0216CW	32 characters	.TXT	Char2x16_0.txt
NHD-0216KZW	32 characters	.TXT	Char2x16_0.txt
NHD-0216SZW	32 characters	.TXT	Char2x16_0.txt
NHD-0220CW	40 characters	.TXT	Char2x20_0.txt
NHD-0220DZW	40 characters	.TXT	Char2x20_0.txt
NHD-0420CW	80 characters	.TXT	Char4x20_0.txt
NHD-0420DZW	80 characters	.TXT	Char4x20_0.txt
NHD-2.23-12832UC	128x32 pixels	Monochrome bitmap .BMP	OLED_12832_0.bmp
NHD-2.7-12864WD	128x64 pixels	Monochrome bitmap .BMP	OLED_12864_0.bmp
NHD-2.8-25664UC	256x64 pixels	Monochrome bitmap .BMP	OLED_25664_0.bmp
NHD-3.12-25664UC	256x64 pixels	Monochrome bitmap .BMP	OLED_25664_0.bmp
NHD-1.27-12896UGC3	128x96 pixels	24-bit bitmap .BMP	OLED_12896_0.bmp
NHD-1.5-128128UGC3	128x128 pixels	24-bit bitmap .BMP	OLED_128128_0.bmp
NHD-1.69-160128UGC3	160x128 pixels	24-bit bitmap .BMP	OLED_160128_0.bmp

VFD Modules

M0116SD-161SDBR1-1	16 characters	.TXT	Char4x20_0.txt
M0216SD-162SDAR2-1	32 characters	.TXT	Char4x20_0.txt
M0216SD-162SDAR1	32 characters	.TXT	Char4x20_0.txt
M0216SD-162SDAR8	32 characters	.TXT	Char4x20_0.txt
M0216MD-162MDBR2-J	32 characters	.TXT	Char4x20_0.txt
M0220SD-202SDAR1	40 characters	.TXT	Char4x20_0.txt
M0220SD-202SDAR1-1G	40 characters	.TXT	Char4x20_0.txt
M0220MD-202MDAR1-3	40 characters	.TXT	Char4x20_0.txt
M0420SD-204SDAR1-3	80 characters	.TXT	Char4x20_0.txt
M0420SD-204MDAR1-C	80 characters	.TXT	Char4x20_0.txt