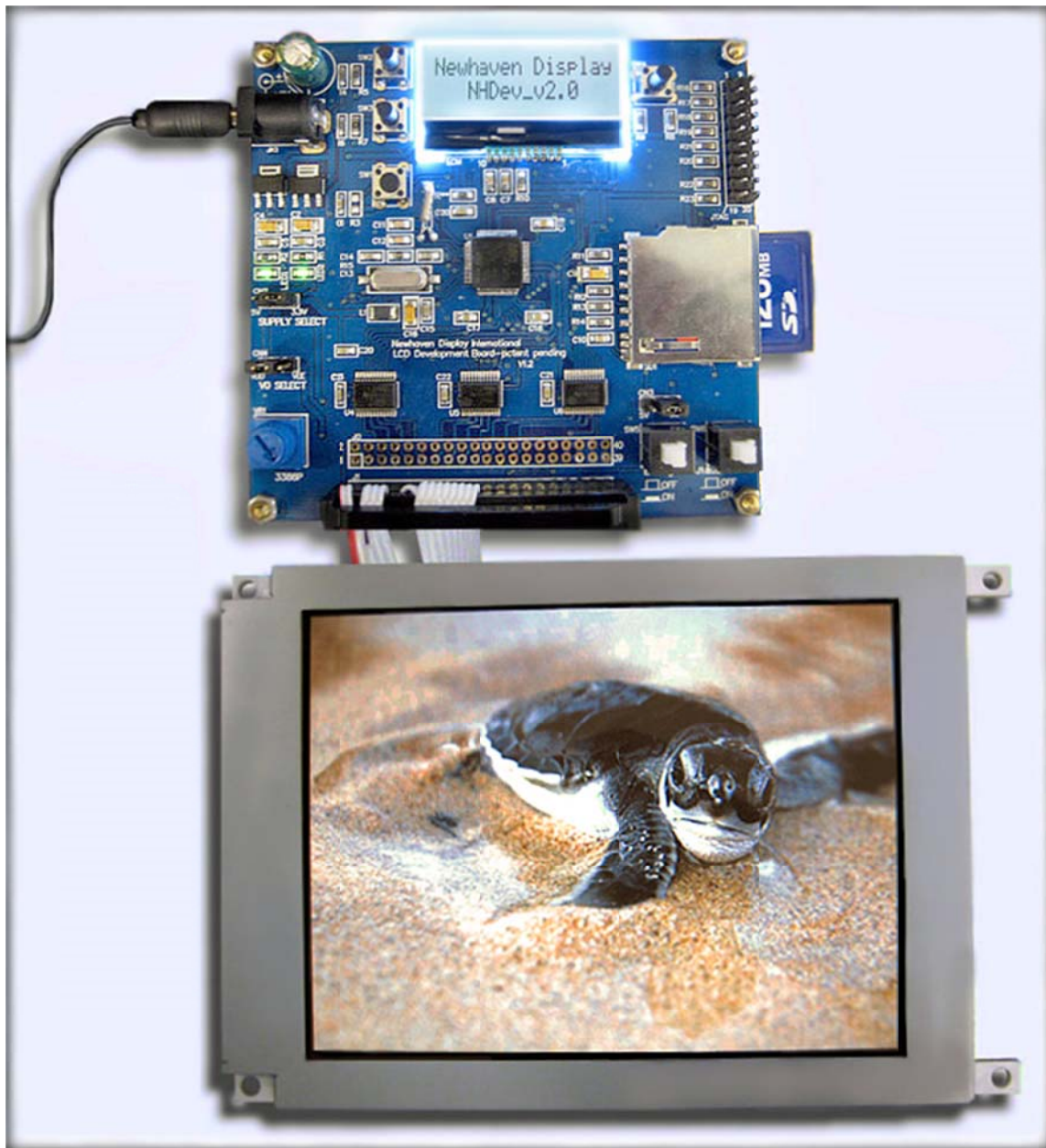


NHDev *LCD-OLED Development Board – User Manual*



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List of Supported Displays

TFTs

NHD-1.8-128160TF-CTXL#
NHD-2.4-240320SF-CTXI#
NHD-2.4-240320SF-CTXI#-1
NHD-3.5-320240MF-ATXL#-1 *
NHD-4.3-480272EF-ATXL# *
NHD-4.3-480800EF-CTXP#
NHD-5.0-800480TF-ATXI# *
NHD-5.7-320240WFB-CTXI#-1
NHD-5.7-640480WF-CTXL#
NHD-5.7-320240WFB-ETXI#-1
NHD-7.0-800480WF-CTXI#

*: requires Controller Board

Graphic Modules

NHD-12232AZ series
NHD-12232LZ series
NHD-12864WX series
NHD-12864MZ series
NHD-12864WG-B series
NHD-12864AZ series
NHD-14432WG series
NHD-16032AZ series
NHD-16032BZ series
NHD-160128WG series
NHD-19232WG series
NHD-24064CZ series
NHD-24064WG series
NHD-240128WG-B series
NHD-240128WG-A series
NHD-320240WG-B series
NHD-320240WG-C series

OLED Displays

NHD-0216KZW series
NHD-0216SZW series
NHD-0220DZW series
NHD-0420DZW series
NHD-2.23-12832UC series
NHD-2.7-12864UCY3
NHD-2.8-25664UC series
NHD-3.12-25664UC series
NHD-1.27-12896UGC3 **color OLED**
NHD-1.5-128128UGC3 **color OLED**
NHD-1.69-160128UGC3 **color OLED**

Character Modules

NHD-0108 models
NHD-0112 models
NHD-0116 models
NHD-0208 models
NHD-0212 models
NHD-0216 models
NHD-0220 models
NHD-0224 models
NHD-0240 models
NHD-0416 models
NHD-0420 models
NHD-0440 models

Chip-On-Glass

NHD-C0220A series
NHD-C12832A1Z series
NHD-C12864HZ series
NHD-C12864B2Z series
NHD-C12864GG series
NHD-C12864WM series
NHD-C12864M series
NHD-C12864CZ series
NHD-C12864AZ series
NHD-C12864EZ series
NHD-C128128BZ series
NHD-C160100AZ series
NHD-C160100CZ series
NHD-C160100DiZ series

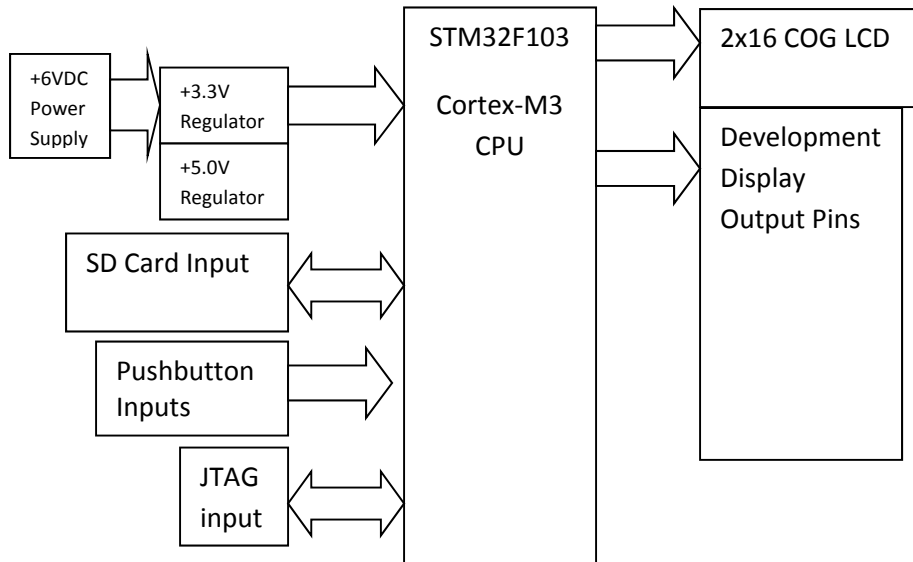
Introduction

The NHDev is a development board for evaluating or prototyping Newhaven Display's TFT, COG, Graphic, and Character LCD displays. This development board is based on the STM32F103 Cortex-M3 microcontroller. The device has been preprogrammed to support most of Newhaven's LCD displays. The board includes a SD Card with preloaded images and text files for the supported displays, 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
- 7VDC 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

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.

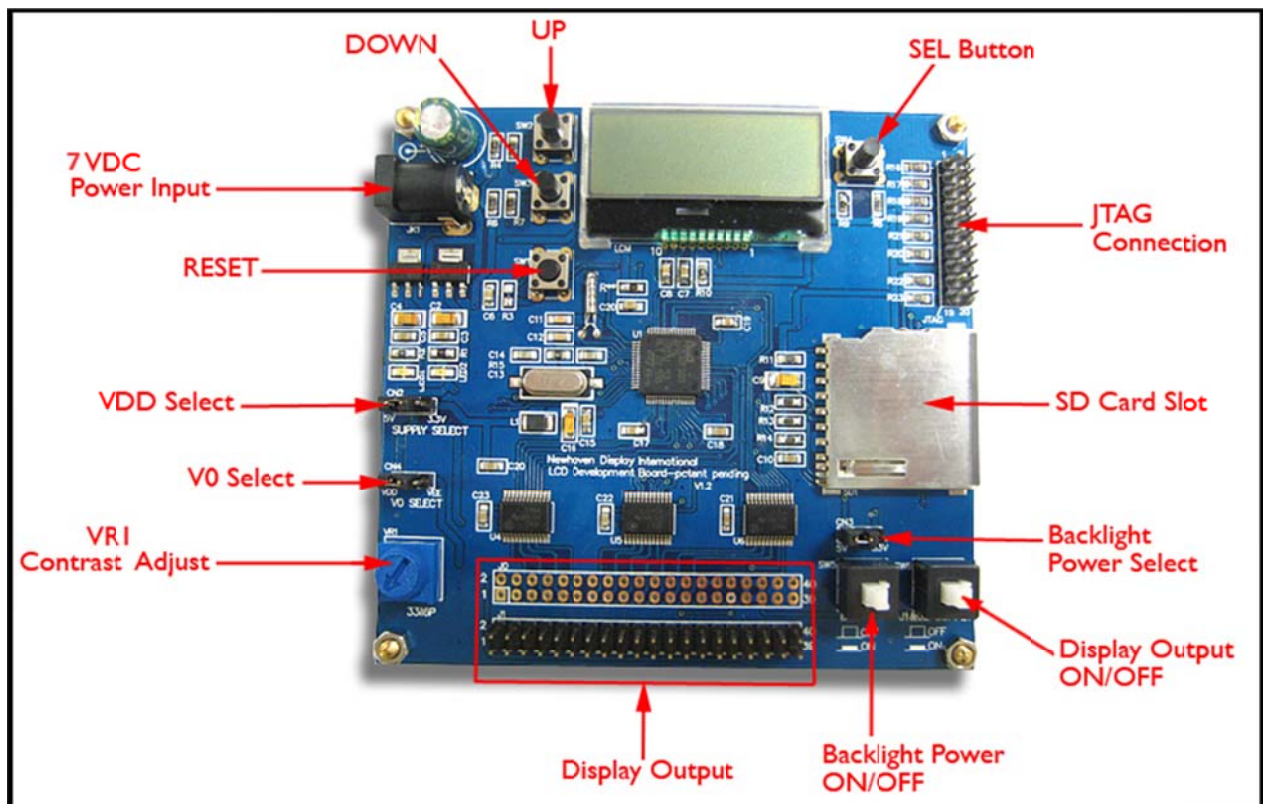
Though it may work, the NHDev board is not designed to be used with other manufacturer's LCDs. Consult the product specification to ensure no damage will be caused to the LCD or the NHDev board.

Damage to the NHDev board or evaluated LCD caused by improper wiring or testing sequence is not covered under warranty.

Board Use Requirements

- **Power Supply:** 7VDC, 600mA wall transformer included.
- **SD Card:** 128MB card with default files included.
- **Jumper shunts:** 3 included for VDD, V0, Backlight power select
- **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 |

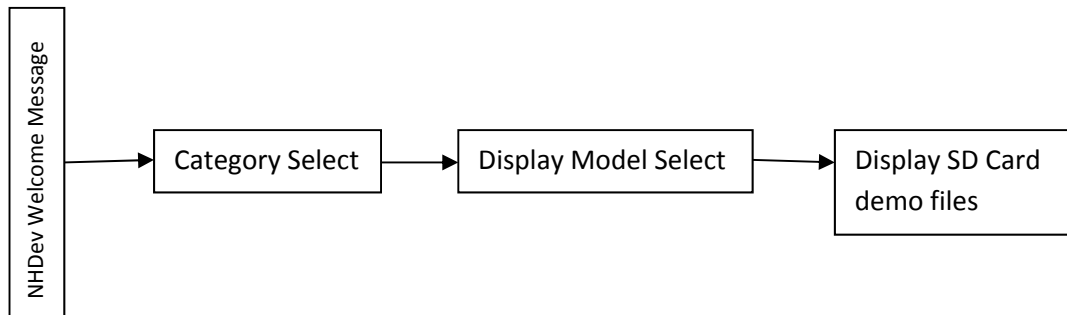
Jumper Pin Description

| 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, one is able to 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 in order to see the many capabilities of each display module.

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.

See http://www.newhavendisplay.com/nhdev/NHDev_Wiring_Diagram.php for examples.

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.

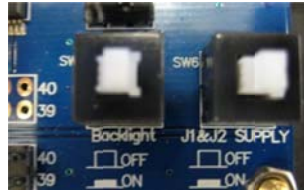
- If the display has a VEE Voltage Output connected to Pin 4, you should select VEE.
- If the display's V0 (Contrast Voltage) is negative, you should select VEE.
- If the display's V0 (Contrast Voltage) is greater than VDD, you should select VEE.
- If the display's V0 (Contrast Voltage) is between VDD 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.



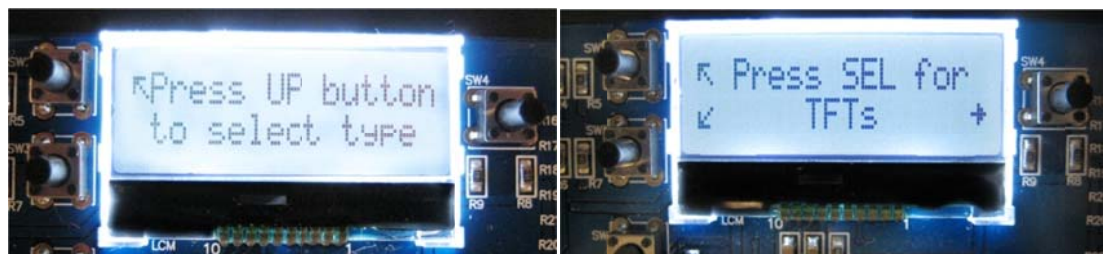
5. Push **ON** J1 and J2 (push buttons are clicked down)



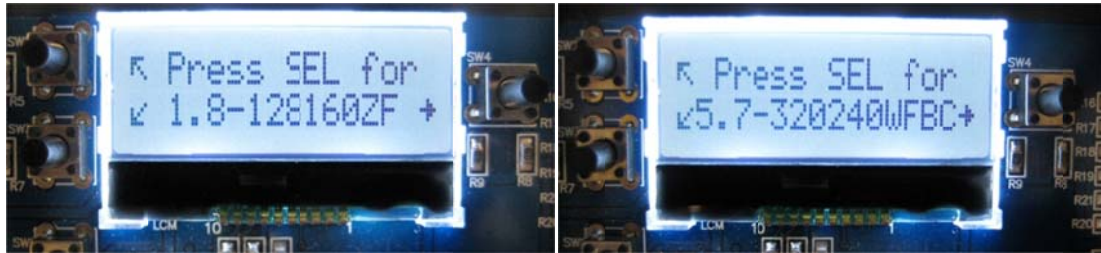
6. Make sure the SD Card is inserted into the NHDev board.
7. Apply power to NHDev board. A 7.0V DC wall transformer is included. On power up, the NHDev built-in display will show the current program revision.



8. The NHDev 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.



9. The NHDev 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.



10. 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, disconnect the 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-1.8-128160ZF-CTXL# | 128x160 pixels | 24-bit bitmap .BMP | 1_8_128160ZF_0.bmp |
| NHD-2.4-240320SF-CTXI# | 240x320 pixels | 24-bit bitmap .BMP | 2_4_240320SF_0.bmp |
| NHD-2.4-240320SF-CTXI# | 240x320 pixels | 24-bit bitmap .BMP | 2_4_240320SF_0.bmp |
| NHD-3.5-320240MF-ATXL#-1 | 320x240 pixels | 24-bit bitmap .BMP | 3_5_320240MF_0.bmp |
| NHD-4.3-480272EF-ATXL#-1 | 480x272 pixels | 24-bit bitmap .BMP | 4_3_480272EF_0.bmp |
| NHD-4.3-480800EF-CTXP# | 480x800 pixels | 24-bit bitmap .BMP | 4_3_480800EF_0.bmp |
| NHD-5.0-800480TF-ATXI# | 800x480 pixels | 24-bit bitmap .BMP | 5_0_800480TF_0.bmp |
| NHD-5.7-320240WFB-CTXI#-1 | 320x240 pixels | 24-bit bitmap .BMP | 5_7_320240WFB_0.bmp |
| NHD-5.7-640480WF-CTXL# | 640x480 pixels | 24-bit bitmap .BMP | 5_7_640480WF_0.bmp |
| NHD-7.0-800480WF-CTXI# | 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-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-12864AZ | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-14432WG | 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-B | 240x128 pixels | Monochrome bitmap .BMP | 240128_0.bmp |
| NHD-240128WG-A | 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 |

COG Modules

| | | | |
|----------------|----------------|------------------------|----------------|
| NHD-C0216CZ | 32 characters | .TXT | Char2x16_0.txt |
| NHD-C0216AZ | 32 characters | .TXT | Char2x16_0.txt |
| NHD-C0216CiZ | 32 characters | .TXT | Char2x16_0.txt |
| NHD-C0216CU | 32 characters | .TXT | Char2x16_0.txt |
| NHD-C0220BiZ | 40 characters | .TXT | Char2x20_0.txt |
| NHD-C0220A | 40 characters | .TXT | Char2x20_0.txt |
| NHD-C12832A1Z | 128x32 pixels | Monochrome bitmap .BMP | C12832_0.bmp |
| NHD-C12864HZ | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864B2Z | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864GG | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864WM | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864M | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864CZ | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864AZ | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12864EZ | 128x64 pixels | Monochrome bitmap .BMP | 12864_0.bmp |
| NHD-C12865AZ | 128x65 pixels | Monochrome bitmap .BMP | 12865_0.bmp |
| NHD-C12865BZ | 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-0216KZW | 32 characters | .TXT | Char2x16_0.txt |
| NHD-0216SZW | 32 characters | .TXT | Char2x16_0.txt |
| NHD-0220DZW | 40 characters | .TXT | Char2x20_0.txt |
| NHD-0420DZW | 80 characters | .TXT | Char4x20_0.txt |
| NHD-2.23-12832UC | 128x32 pixels | Monochrome bitmap .BMP | OLED_12832_0.bmp |
| NHD-2.7-12864UCY3 | 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 |