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### APPLICATION NOTE

#### SOFTWARE INSTALLATION

1. Open the “NB7NQ621M\_GUI\_Rev2 installer” folder and run the “setup” application file.
2. Choose a directory to install the GUI and follow subsequent prompts from the installation window.
3. Accept the National Instruments license agreement.
4. Confirm installation file “NB7NQ621M\_GUI\_Rev2” and click next to start install.
5. Do not interrupt installation, and click finish once the installation is complete.

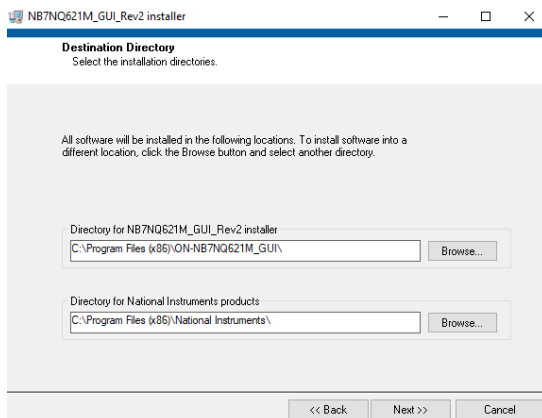


Figure 1. Destination Directory

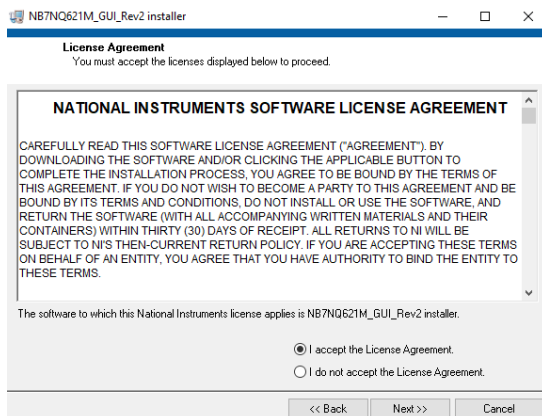


Figure 2. National Instruments License Agreement

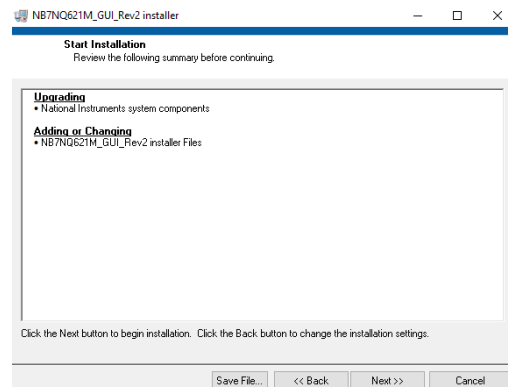


Figure 3. Start Installation

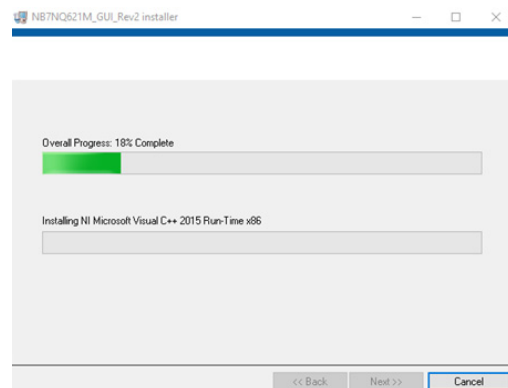


Figure 4. Installation in Progress

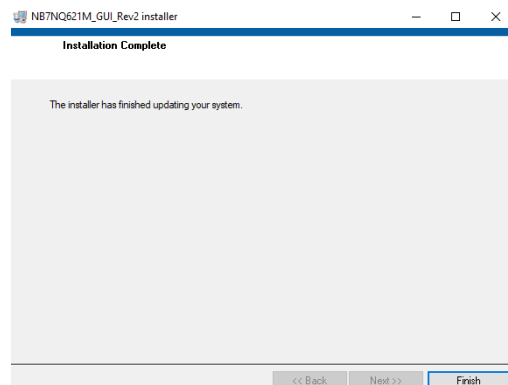


Figure 5. Installation Complete

## HARDWARE INITIALIZATION

1. Connect the Teensy Evaluation Board to a USB port on PC with the supplied USB cable.
2. Connect the SDA, SCL, and GND pins from the Teensy module to the same pins on the NB7NQ621M demonstration board.

## GUI INTERFACE

The NB7NQ621M GUI may be run. The NB7NQ621M graphical user interface is used in conjunction with ON Semiconductor NB7NQ621M demo boards in order to graphically program the devices I<sup>2</sup>C registers. The GUI has complete control over the NB7NQ621M's modes of operation.

1. *GUI Overview:* Figure 6 is the view of the GUI on start up. The GUI will open with all of the settings the same as the NB7NQ621M's default register settings.
2. In the I<sup>2</sup>C Slave Address menu, the address should be set to "BC" as default. Please refer to datasheet for more information.

**NOTE:** E0/ADDR0 and EQ1/ADDR1 are active I<sup>2</sup>C slave address pins when I2C\_EN is high.

3. In the Serial Port menu, select the appropriate COM port that the Teensy module is assigned to; i.e. COM4. Then press the RUN arrow in the upper left screen.

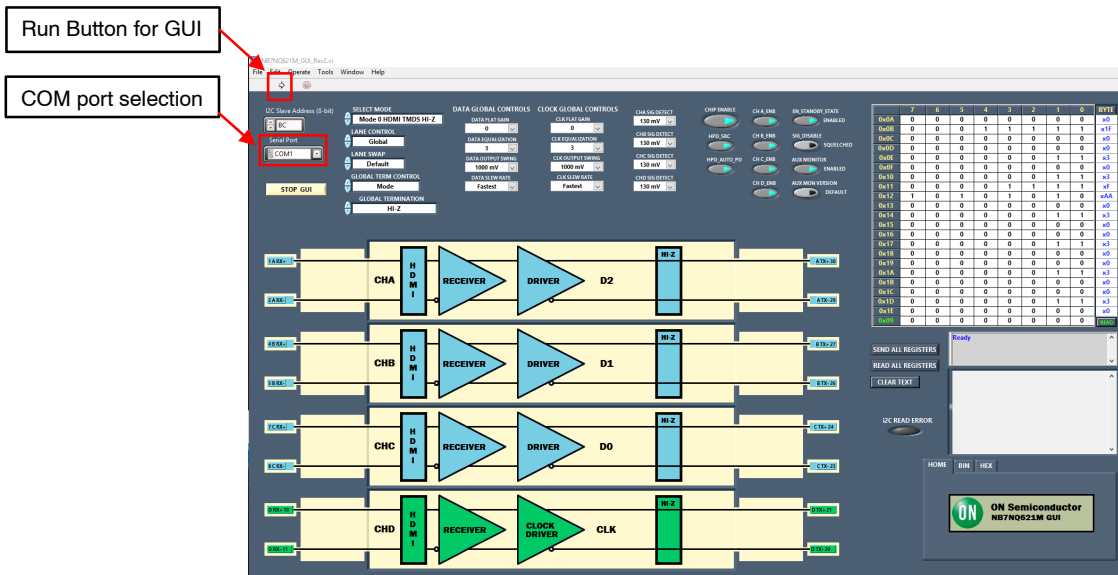


Figure 6. GUI Overview

## Connecting to Teensy Module

After the RUN button has been pressed, the teensy module will proceed to connect. The connection status of the teensy module is shown in the display window on the right side of

the GUI. Once the connection initialization is complete, "Ready" should be displayed in the display window indicating that the teensy module has been successfully connected and is ready for use.

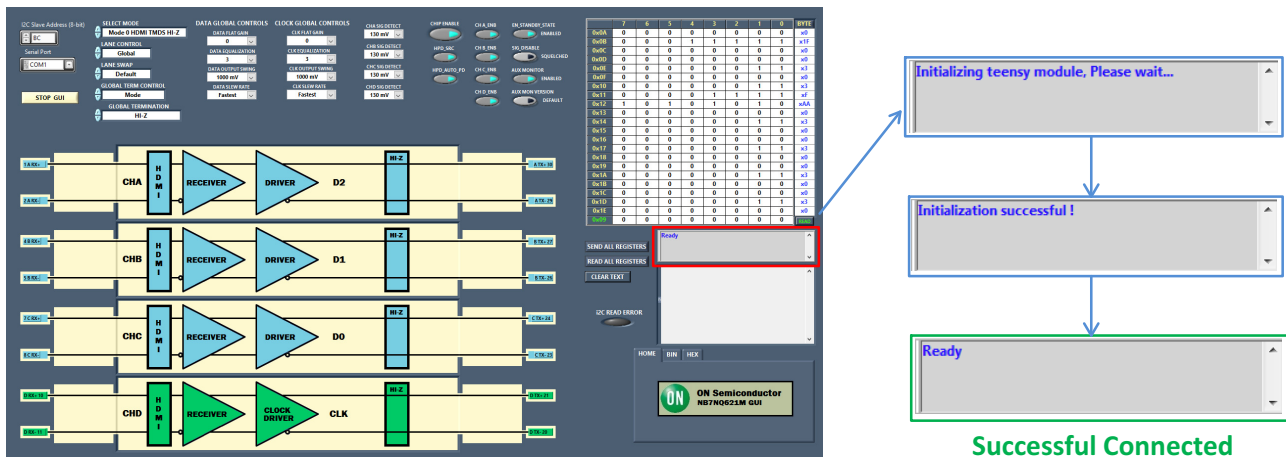


Figure 7. Successfully Connecting to the Teensy Module

Selectable & Default Settings

1. *Operation Modes:* The NB7NQ621M has seven operation modes to choose from. The default operation mode is “Mode 0, HDMI with HI-Z termination”.
2. *Lane Control:* The default setting is “Global” which allows for multiple device channel settings to be changed at the same time. These include channel slew rates, channel termination, output compression and AUX monitoring. If only individual channel settings need to be accessed the “Individual” option can be used instead.
3. *Global Term Control:* “Mode” is the default setting and the termination will match the datasheets

specified termination based on mode of operation. It can be changed to be “Global Register”. If this is selected then the termination will not change with the mode and may not match the mode. All Termination types will be available regardless of the device mode.

4. *Global Termination:* There are a total of 7 selectable global termination settings. The default global termination setting is “HI-Z (no term)”.

Details of each setting can be found in the [NB7NQ621M](#) datasheet.

	7	6	5	4	3	2	1	0	WRITE
0x0A	0	0	0	0	0	0	0	0	x0
0x0B	0	0	0	1	1	1	1	1	x1F
0x0C	0	0	0	0	0	0	0	0	x0
0x0D	0	0	0	0	0	0	0	0	x0
0x0E	0	0	0	0	0	0	0	1	x3
0x0F	0	0	0	0	0	0	0	0	x0
0x10	0	0	0	0	0	0	1	1	x3
0x11	0	0	0	0	1	1	1	1	xF
0x12	1	0	1	0	1	0	1	0	xAA
0x13	0	0	0	0	0	0	0	0	x0
0x14	0	0	0	0	0	0	1	1	x3
0x15	0	0	0	0	0	0	0	0	x0
0x16	0	0	0	0	0	0	0	0	x0
0x17	0	0	0	0	0	0	1	1	x3
0x18	0	0	0	0	0	0	0	0	x0
0x19	0	0	0	0	0	0	0	0	x0
0x1A	0	0	0	0	0	0	1	1	x3
0x1B	0	0	0	0	0	0	0	0	x0
0x1C	0	0	0	0	0	0	0	0	x0
0x1D	0	0	0	0	0	0	1	1	x3
0x1E	0	0	0	0	0	0	0	0	x0
0x1F	0	0	0	0	0	0	0	0	x0

Figure 8. Selectable & Default Settings

Signal Detection & AUX Monitoring

SIG\_Detect Button and Selection

The “SIG\_Detect,” button will turn the receiver signal detection on or off. It is on by default and the amplitude of detection is set to 130 mV for each channel. The device will only recognize signals that have an amplitude above this voltage selection. If the “SIG\_Detect”, button is clicked it will turn the signal detection off and the channels will stay active passing through all signal amplitudes.

NOTE: In HDMI mode Ch. D (CLK) must be active, or “SIG\_DETECT” must be disabled in order to use the data channels by themselves. The individual channels can have their signal detection threshold adjusted. For tests requiring very low input amplitudes like testing gain with a VNA, “SIG\_DETECT” should be disabled.

The screenshot displays the ON Semiconductor GUI for the NB7N0621M HDMI receiver. Key features include:

- Signal Detection Controls:** Four channels (CHA, CHB, CHC, CHD) with adjustable detection thresholds. The CHD dropdown menu is expanded, showing options: 50 mV, 90 mV, 130 mV (selected), and 170 mV.
- Auxiliary Monitoring:** A panel with buttons for EN\_STANDBY\_STATE (ENABLED), SIG\_DISABLE (SQUELCHED), AUX MONITOR (ENABLED), and AUX MON VERSION (DEFAULT).
- Block Diagram:** Shows the internal architecture with HDMI inputs (CHA, CHB, CHC, CHD) connected to receivers, then drivers (D2, D1, D0, CLK), and finally to outputs (ATX-30, ATX-29, BTX-27, BTX-26, CTX-24, CTX-23, BTX-21, DTX-20).
- Hex Dump Table:** A table on the right showing data bytes from 0x0A to 0x1E. The 'READY' bit is set to 1 in the 0x1E row.

	7	6	5	4	3	2	1	0	BYTE
0x0A	0	0	0	0	0	0	0	0	x0
0x0B	0	0	0	1	1	1	1	1	x1F
0x0C	0	0	0	0	0	0	0	0	x0
0x0D	0	0	0	0	0	0	0	0	x0
0x0E	0	0	0	0	0	0	0	1	x3
0x0F	0	0	0	0	0	0	0	0	x0
0x10	0	0	0	0	0	0	0	1	x1
0x11	0	0	0	0	1	1	1	1	xF
0x12	1	0	1	0	1	0	1	0	xAA
0x13	0	0	0	0	0	0	0	0	x0
0x14	0	0	0	0	0	0	0	1	x3
0x15	0	0	0	0	0	0	0	0	x0
0x16	0	0	0	0	0	0	0	0	x0
0x17	0	0	0	0	0	0	0	1	x3
0x18	0	0	0	0	0	0	0	0	x0
0x19	0	0	0	0	0	0	0	0	x0
0x1A	0	0	0	0	0	0	0	1	x3
0x1B	0	0	0	0	0	0	0	0	x0
0x1C	0	0	0	0	0	0	0	0	x0
0x1D	0	0	0	0	0	0	0	1	x3
0x1E	0	0	0	0	0	0	0	0	x0
READY	0	0	0	0	0	0	0	0	READY

Figure 9. Signal Detection

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## AUX Monitoring and AUX Monitoring Version

While operating in DisplayPort modes the NB7N0621M has the ability to monitor the AUX channels in order to turn main link lanes on or off and to change the devices power state. If operating the device in HDMI modes, these buttons

may be ignored and do not functionally change the device. While in DisplayPort mode, these buttons toggle the AUX monitoring feature on and off, and can change the version of monitoring in accordance with the datasheet.

The screenshot displays the NB7N0621M GUI with various control panels. A red box highlights the 'AUX MONITOR' and 'AUX MON VERSION' controls, which are currently set to 'ENABLED' and 'DEFAULT' respectively. An arrow points from this box to a larger inset showing a detailed view of these two controls.

The inset shows the following controls:

- EN\_STANDBY\_STATE: ENABLED
- SIG\_DISABLE: SQUELCHED
- AUX MONITOR: ENABLED
- AUX MON VERSION: DEFAULT

The main GUI also features a block diagram of the AUX channels (CHA, CHB, CHC, CHD) and a register map table.

	7	6	5	4	3	2	1	0	BYTE
0x0A	0	0	0	0	0	0	0	0	x0
0x0B	0	0	0	1	1	1	1	1	x1F
0x0C	0	0	0	0	0	0	0	0	x0
0x0D	0	0	0	0	0	0	0	0	x0
0x0E	0	0	0	0	0	0	1	1	x3
0x0F	0	0	0	0	0	0	0	0	x0
0x10	0	0	0	0	0	0	1	1	x3
0x11	0	0	0	0	1	1	1	1	xF
0x12	1	0	1	0	1	0	1	0	xAA
0x13	0	0	0	0	0	0	0	0	x0
0x14	0	0	0	0	0	0	1	1	x3
0x15	0	0	0	0	0	0	0	0	x0
0x16	0	0	0	0	0	0	0	0	x0
0x17	0	0	0	0	0	0	1	1	x3
0x18	0	0	0	0	0	0	0	0	x0
0x19	0	0	0	0	0	0	0	0	x0
0x1A	0	0	0	0	0	0	1	1	x3
0x1B	0	0	0	0	0	0	0	0	x0
0x1C	0	0	0	0	0	0	0	0	x0
0x1D	0	0	0	0	0	0	1	1	x3
0x1E	0	0	0	0	0	0	0	0	x0
0x1F	0	0	0	0	0	0	0	0	FF

Figure 10. AUX Monitoring and AUX Monitoring Version

**Flat Gain (FG) & Equalization (EQ)**

When the FRL or DisplayPort modes are selected the CLK flat gain and equalization controls will disappear as they are not used.

1. *Flat Gain*: Depending on the mode selected CLK and/or Data channels can have flat gain (Low frequency gain) settings changed.

2. *Equalization*: Depending on the mode selected CLK and/or Data channels can have equalization (high frequency gain) settings changed.

The screenshot displays the ON Semiconductor GUI for the NB7N0621M GUI. It features several control panels and a block diagram. At the top, there are two panels: 'DATA GLOBAL CONTROLS' and 'CLOCK GLOBAL CONTROLS'. Both panels have a red box highlighting the 'DATA FLAT GAIN' and 'CLK FLAT GAIN' settings, which are both set to '0'. Below these, 'DATA EQUALIZATION' and 'CLK EQUALIZATION' are set to '3'. Other settings include 'DATA OUTPUT SWING' and 'CLK OUTPUT SWING' at '1000 mV', and 'DATA SLEW RATE' and 'CLK SLEW RATE' at 'Fastest'. The block diagram below shows four channels: CHA, CHB, CHC, and CHD. Each channel consists of an HDMI input, a receiver, a driver, and an output. CHA, CHB, and CHC are data channels (D2, D1, D0) with HI-Z outputs. CHD is the clock channel (CLK) with a HI-Z output. On the right, there is a hex dump table with columns for bits 7, 6, 5, 4, 3, 2, 1, 0 and a 'BYTE' column. The hex dump shows values for addresses 0x0A through 0x1E. Below the hex dump are buttons for 'SEND ALL REGISTERS', 'READ ALL REGISTERS', and 'CLEAR TEXT'. At the bottom right, there is a logo for ON Semiconductor NB7N0621M GUI.

	7	6	5	4	3	2	1	0	BYTE
0x0A	0	0	0	0	0	0	0	0	x0
0x0B	0	0	0	1	1	1	1	1	x1F
0x0C	0	0	0	0	0	0	0	0	x0
0x0D	0	0	0	0	0	0	0	0	x0
0x0E	0	0	0	0	0	0	1	1	x3
0x0F	0	0	0	0	0	0	0	0	x0
0x10	0	0	0	0	0	0	1	1	x3
0x11	0	0	0	0	1	1	1	1	xF
0x12	1	0	1	0	1	0	1	0	xAA
0x13	0	0	0	0	0	0	0	0	x0
0x14	0	0	0	0	0	0	1	1	x3
0x15	0	0	0	0	0	0	0	0	x0
0x16	0	0	0	0	0	0	0	0	x0
0x17	0	0	0	0	0	0	1	1	x3
0x18	0	0	0	0	0	0	0	0	x0
0x19	0	0	0	0	0	0	0	0	x0
0x1A	0	0	0	0	0	0	1	1	x3
0x1B	0	0	0	0	0	0	0	0	x0
0x1C	0	0	0	0	0	0	0	0	x0
0x1D	0	0	0	0	0	0	1	1	x3
0x1E	0	0	0	0	0	0	0	0	x0
0x1F	0	0	0	0	0	0	0	0	0x00

Figure 11. Flat Gain and Equalization

**Send All Registers & Read All Registers**

The registers can be read back from the device with the “READ ALL REGISTERS” button. The “SEND ALL REGISTERS” can be useful when the part is power cycled

and previous GUI settings want to be written to the redriver. All GUI settings can be sent to the device as long as the GUI has not been stopped and power is again applied to the part.

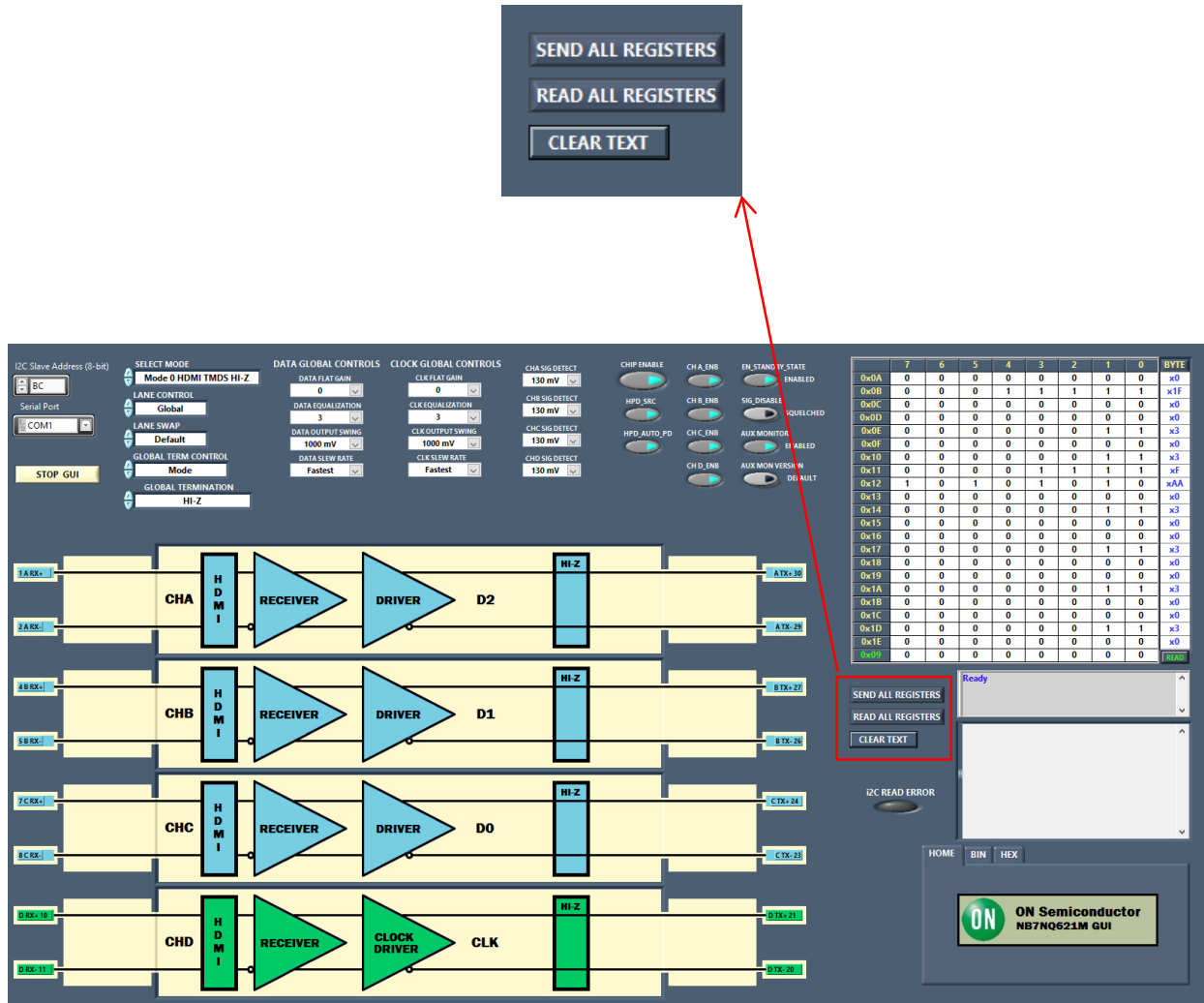


Figure 12. Send All Registers & Read All Registers

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