TABOR ELECTRONICS

LUCID SERIES

Lucid Control Panel (LCP)

User Manual

Rev. 1.0

Distribution in the UK & Ireland

Lambda

Lambda Photometrics Limited
Lambda House Batford Mill
Harpenden Herts AL5 5BZ
United Kingdom
E: info@lambdaphoto.co.uk
W: www.lambdaphoto.co.uk
T: +44 (0)1582 764334
F: +44 (0)1582 712084

WARRANTY STATEMENT

Products sold by Tabor Electronics Ltd. are warranted to be free from defects in workmanship or materials. Tabor Electronics Ltd. will, at its option, either repair or replace any hardware products which prove to be defective during the warranty period. You are a valued customer. Our mission is to make any necessary repairs in a reliable and timely manner.

Duration of Warranty

The warranty period for this Tabor Electronics Ltd. hardware is one year, except software and firmware products designed for use with Tabor Electronics Ltd. Hardware is warranted not to fail to execute its programming instructions due to defect in materials or workmanship for a period of ninety (90) days from the date of delivery to the initial end user.

Return of Product

Authorization is required from Tabor Electronics before you send us your product for service or calibration. Call your nearest Tabor Electronics support facility. A list is located on the last page of this manual. If you are unsure where to call, contact Tabor Electronics Ltd. Tel Hanan, Israel at 972-4-821-3393 or via fax at 972-4-821-3388. We can be reached at: support@tabor.co.il

Limitation of Warranty

Tabor Electronics Ltd. shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than authorized Tabor Electronics service personnel or without the written consent of Tabor Electronics.

Tabor Electronics Ltd. expressly disclaims any liability to its customers, dealers and representatives and to users of its product, and to any other person or persons, for special or consequential damages of any kind and from any cause whatsoever arising out of or in any way connected with the manufacture, sale, handling, repair, maintenance, replacement or use of said products.

Representations and warranties made by any person including dealers and representatives of Tabor Electronics Ltd., which are inconsistent or in conflict with the terms of this warranty (including but not limited to the limitations of the liability of Tabor Electronics Ltd. as set forth above), shall not be binding upon Tabor Electronics Ltd. unless reduced to writing and approved by an officer of Tabor Electronics Ltd.

This document may contain flaws, omissions or typesetting errors. No warranty is granted nor liability assumed in relation thereto. The information contained herein is periodically updated and changes will be incorporated into subsequent editions. If you have encountered an error, please notify us at support@taborelec.com. All specifications are subject to change without prior notice.

Except as stated above, Tabor Electronics Ltd. makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and except to the extent stated above, Tabor Electronics Ltd. shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise.

PROPRIETARY NOTICE

This document and the technical data herein disclosed, are proprietary to Tabor Electronics, and shall not, without express written permission of Tabor Electronics, be used, in whole or in part to solicit quotations from a competitive source or used for manufacture by anyone other than Tabor Electronics. The information herein has been developed at private expense, and may only be used for operation and maintenance reference purposes or for purposes of engineering evaluation and incorporation into technical specifications and other documents, which specify procurement of products from Tabor Electronics.

Table of Contents

Table of Contents **3**

List of Figures **3**

Document Revision History **5**

Acronyms & Abbreviations **6**

1 General **9**

1.1 Scope 9
1.2 Lucid Control Panel Software Requirements 9
1.3 Document Conventions 9
1.3.1 General 9
1.3.2 Programming 10

2 Installation **11**

3 Operation **17**

3.1 Program Start 17
3.2 Communication Tab 17
3.3 CW & Modulation Tab 20
3.3.1 AM – Amplitude Modulation 21
3.3.2 FM – Frequency Modulation 22
3.3.3 PM – Phase Modulation 23
3.3.4 Pulse Modulation 24
3.3.5 Pattern Sequence 25
3.4 Sweep Tab 27
3.4.1 Frequency Sweep 27
3.4.2 Power Sweep 29
3.5 List Tab 31
3.6 Run Mode Tab 34
3.7 System Tab 36
3.8 About Tab 38

4 Troubleshooting **39**

4.1 Manually Installing Instrument Drivers 39
4.1.1 USB Device Driver Manual Installation (Windows 10) 39
4.1.2 USB Device Driver Manual Installation (Windows 7) 46

5 Appendix FPGA Firmware Update **51**

5.1 TE Update Tool Installation 51
5.2 TE Update Tool 54
5.3 Operating Instructions 58

List of Figures

Figure 1.1 Lucid Control Panel Splash Screen 9

Figure 2.1 LCP Setup Installation File 11

Figure 2.2 User Account Control 12
Figure 2.3 Welcome to the Lucid Setup Wizard 12
Figure 2.4 Optional features to install 13
Figure 2.5 Select Installation Folder 13
Figure 2.6 Ready to Install 14
Figure 2.7 Installing Lucid 14
Figure 2.8 Completing the Lucid Setup Wizard 15
Figure 2.9 Welcome to the Device Driver Installation Wizard! 15
Figure 2.10 Completing the Device Driver Installation Wizard! 16
Figure 3.1 Lucid Initializing Application 17
Figure 3.2 Communication Tab 18
Figure 3.3 Communication Tab Manual 19
Figure 3.4 CW & Modulation Tab 20
Figure 3.5 AM – Amplitude Modulation 22
Figure 3.6 FM – Frequency Modulation 23
Figure 3.7 PM – Phase Modulation 24
Figure 3.8 Pulse Definition 25
Figure 3.9 Pattern Sequence 26
Figure 3.10 Frequency Sweep 27
Figure 3.11 Export to List 28
Figure 3.12 Power Sweep 29
Figure 3.13 List 31
Figure 3.14 Start New List 32
Figure 3.15 Load List 32
Figure 3.16 Save List 32
Figure 3.17 Run Mode External 34
Figure 3.18 Run Mode Internal 35
Figure 3.19 System Tab 36
Figure 3.20 About Tab 38
Figure 5.1 TE Update Tool Installation File 51
Figure 5.2 User Account Control 52
Figure 5.3 Welcome to the Update Tool Setup Wizard 52
Figure 5.4 Select Installation Folder 53

Figure 5.5 Ready to Install 53
Figure 5.6 Installing Update Tool 54
Figure 5.7 Completing the Update Tool Setup Wizard 54
Figure 5.8 TE Update Tool 55
Figure 5.9 Select the IP-Address 55
Figure 5.10 About TE Update Tool 56
Figure 5.11 Select Binary Firmware File 57
Figure 5.12 Network Properties 58
Figure 5.13 TE Update Tool 59
Figure 5.14 Select the FPGA Firmware File 60
Figure 5.15 Warning 61
Figure 5.16 Progress Bar 62
Figure 5.17 Update Complete 62

Document Revision History

Table Document Revision History

Revision	Date	Description	Author
1.0	27-Jan-2021	• Original release supporting Lucid Control Panel Ver. 1.3.200 and TE Update Tool Ver. 1.1.000.	Jakob Apelblat

Acronyms & Abbreviations

Table Acronyms & Abbreviations

Acronym	Description
µs or us	Microseconds
ADC	Analog to Digital Converter
AM	Amplitude Modulation
ASIC	Application-Specific Integrated Circuit
ATE	Automatic Test Equipment
AWG	Arbitrary Waveform Generators
AWT	Arbitrary Waveform Transceiver
BNC	Bayonet Neill–Concelm (coax connector)
BW	Bandwidth
CW	Carrier Wave
DAC	Digital to Analog Converter
dBc	dB/carrier. The power ratio of a signal to a carrier signal, expressed in decibels
dBm	Decibel-Milliwatts. E.g., 0 dBm equals 1.0 mW.
DDC	Digital Down-Converter
DHCP	Dynamic Host Configuration Protocol
DSO	Digital Storage Oscilloscope
DUC	Digital Up-Converter
DUT	Device Under Test
ENoB	Effective Number of Bits
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
FPGA	Field-Programmable Gate Arrays
FW	Firmware
GHz	Gigahertz
GPIB	General Purpose Interface Bus
GS/s	Giga Samples per Second
GUI	Graphical User Interface
HID	Human Interface Device

Acronym	Description
HP	Horizontal Pitch (PXIe module horizontal width, 1 HP = 5.08mm)
Hz	Hertz
IF	Intermediate Frequency
I/O	Input / Output
IP	Internet Protocol
IQ	In-phase Quadrature
IVI	Interchangeable Virtual Instrument
JSON	JavaScript Object Notation
kHz	Kilohertz
LCD	Liquid Crystal Display
LO	Local Oscillator
MAC	Media Access Control (address)
MDR	Mini D Ribbon (connector)
MHz	Megahertz
ms	Milliseconds
NCO	Numerically Controlled Oscillator
ns	Nanoseconds
PC	Personal Computer
PCAP	Projected Capacitive Touch Panel
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PXI	PCI eXtension for Instrumentation
PXIe	PCI Express eXtension for Instrumentation
QC	Quantum Computing
Qubits	Quantum bits
R&D	Research & Development
RF	Radio Frequency
RT-DSO	Real-Time Digital Oscilloscope
s	Seconds
SA	Spectrum Analyzer
SCPI	Standard Commands for Programmable Instruments

Acronym	Description
SFDR	Spurious Free Dynamic Range
SFP	Software Front Panel
SINAD	Signal-to-Noise-And-Distortion Ratio
SMA	Subminiature version A connector
SMP	Subminiature Push-on connector
SPI	Serial Peripheral Interface
SRAM	Static Random-Access Memory
TFT	Thin Film Transistor
T&M	Test and Measurement
TPS	Test Program Sets
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
VCP	Virtual COM Port
Vdc	Volts, Direct Current
V p-p	Volts, Peak-to-Peak
VSA	Vector Signal Analyzer
VSG	Vector Signal Generator
WDS	Wave Design Studio

1 General

1.1 Scope

The scope of this manual is to describe the setup and operating procedures of the Lucid Control Panel (LCP). It is a software package that comes on a CD supplied with the device and can be downloaded from the Tabor web site. It enables full control and programming of your Tabor Electronics Lucid Series of devices via a user-friendly graphical user interface.

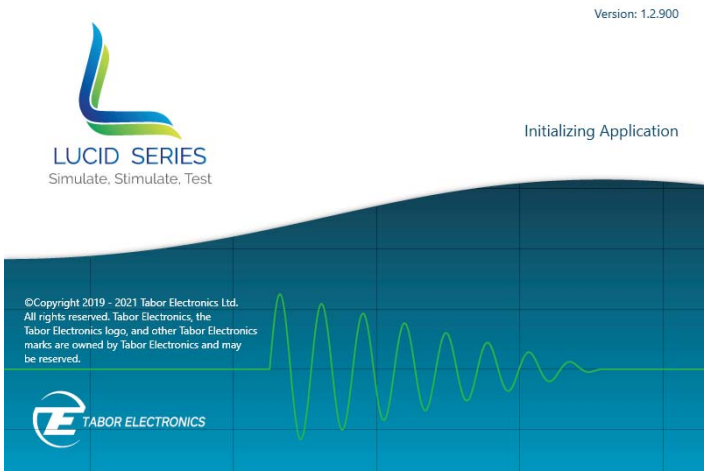


Figure 1.1 Lucid Control Panel Splash Screen

1.2 Lucid Control Panel Software Requirements

The Lucid Control Panel software installation requires the following:

- A PC running Windows 10 or Windows 7.
- An USB port for direct connection of the PC to the Lucid Benchtop, or
- An RJ45 Ethernet port.
- An optional CD device if no Internet connection is available for downloading the SW installation from the Tabor download site.

1.3 Document Conventions

1.3.1 General

Convention	Description	Example
Bold Writing	Indicates an item/message in the User Interface.	Click the **On** button.
<Angled and Bolded	Indicates a physical key on the	Press <Ctrl>+<B>.

Brackets>	keyboard.	

Caution!

- A Caution indicates instructions, which, if not followed, may result in damage to the equipment or to the loss of data.

Note

- A Note provides additional information to help obtain optimal equipment performance.

Idea

- An Idea provides an alternate procedure to obtain the same results.

1.3.2 Programming

Convention	Description	Example
{}	Braces indicate that parameters may be used in the command once, or several times, or not at all.	:LIST:POWer <val>{,<val>} a single power listing: LIST:POWer 5 a series of power listings: LIST:POWer 5,10,15,20
<>	Angle brackets indicate that their contents are not to be used literally in the command. They represent the required parameters.	:FREQuency:STARt <val><unit> In this command, the words <val> and <unit> should be replaced by the actual frequency and unit. :FREQuency:STARt 2.5GHZ
[]	Square brackets indicate that the enclosed keywords or parameters are optional when composing the command. The commands will be executed even if they are omitted.	:FREQuency[:CW]? SOURce and CW are optional items.
|	A vertical stroke between keywords or parameters indicates alterative choices. For parameters, the effect of the command varies depending on the choice.	:AM:MOD DEEP|NORMal DEEP or NORMal are the choices.

2 Installation

The Lucid series benchtop model is supplied with a CD that contains the Lucid Control Panel (LCP) software, a user-friendly program that controls instrument functions and features from a remote computer. The following installation procedure will install both the LCP software and driver that will enable controlling the instrument from remote. You can download the latest LCP from the Tabor Electronics website at http://www.taborelec.com/downloads.

Note

- The driver for the instrument is only installed if no driver is detected on the PC. When updating the LCP software to the newest version steps 12 to 19 will not be performed.

1. Locate the te_lucid_control_panel_x.y.zzz installation file on the supplied CD or in the destination folder to which it was downloaded.

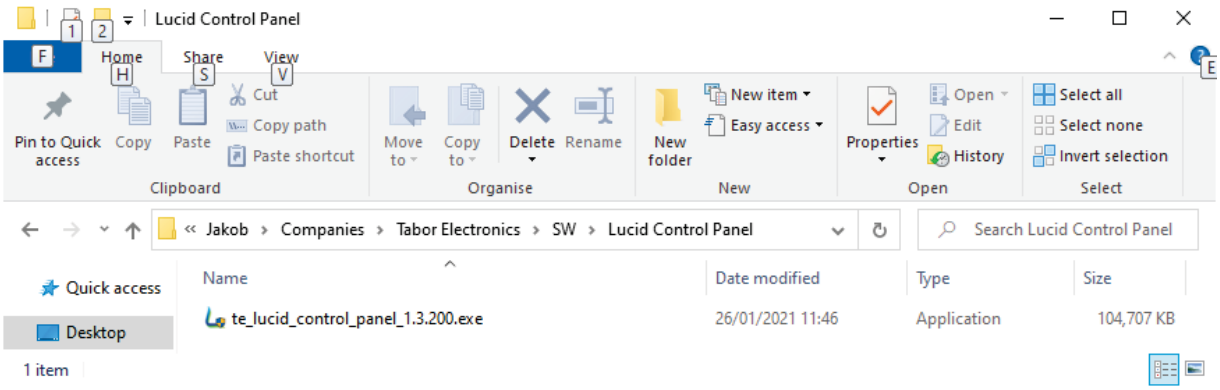


Figure 2.1 LCP Setup Installation File

2. Double-click the **te_lucid_control_panel_x.y.zzz** installation file.
3. A windows User Account Control confirmation window is displayed.

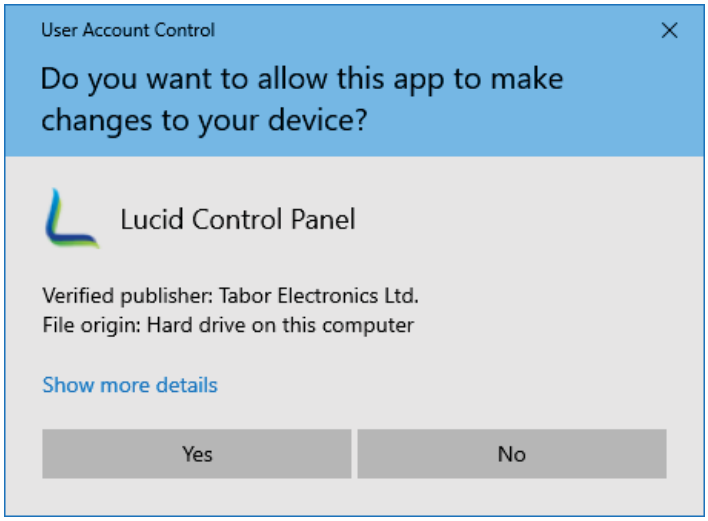


Figure 2.2 User Account Control

4. Click the **YES** button.
5. The welcome screen is displayed.

Figure 2.3 Welcome to the Lucid Setup Wizard

6. Click **Next.**

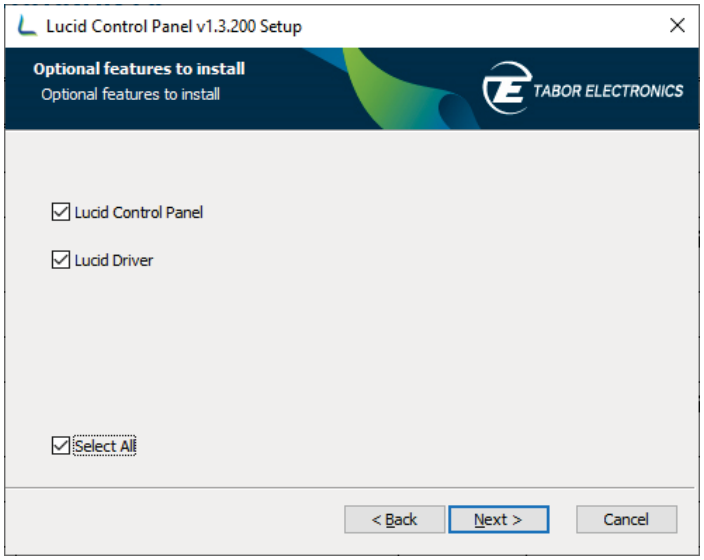


Figure 2.4 Optional features to install

7. Check **Select ALL**.
8. Click **Next**.

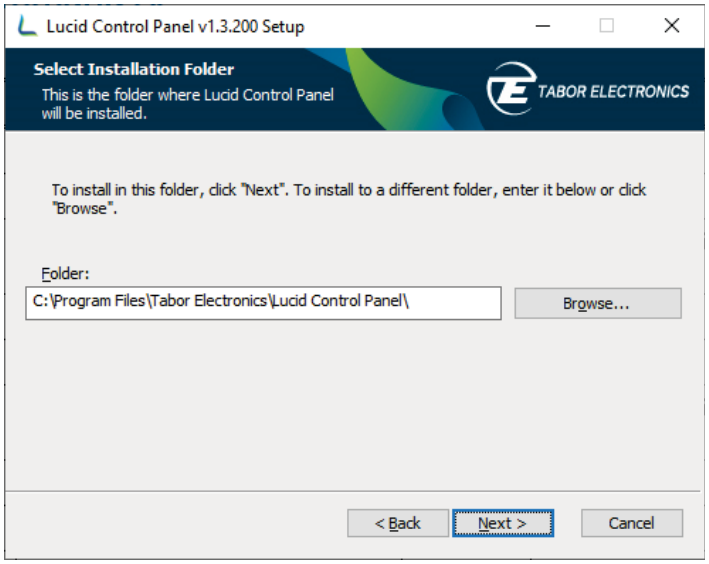


Figure 2.5 Select Installation Folder

9. Enter the destination directory for the **Lucid** software or browse to a destination directory by clicking the **Browse** button.
10. Click the **Next** button.
    The **Ready to Install** screen is displayed.

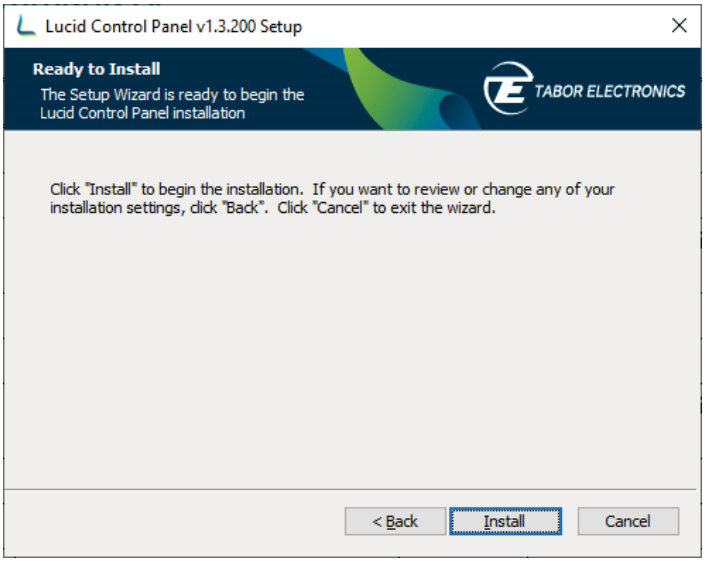


Figure 2.6 Ready to Install

11. Click the **Install** button.
12. The **Lucid** software installation starts.

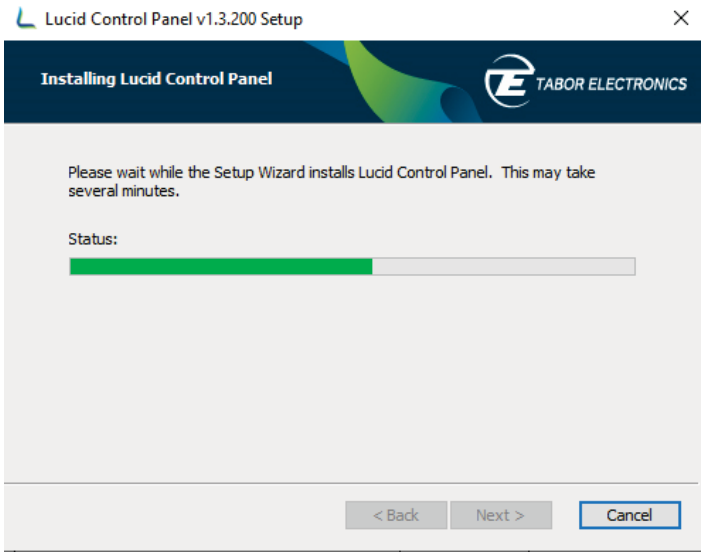


Figure 2.7 Installing Lucid

13. Wait for the installation process to complete.
    The **Installation Complete** window is displayed.

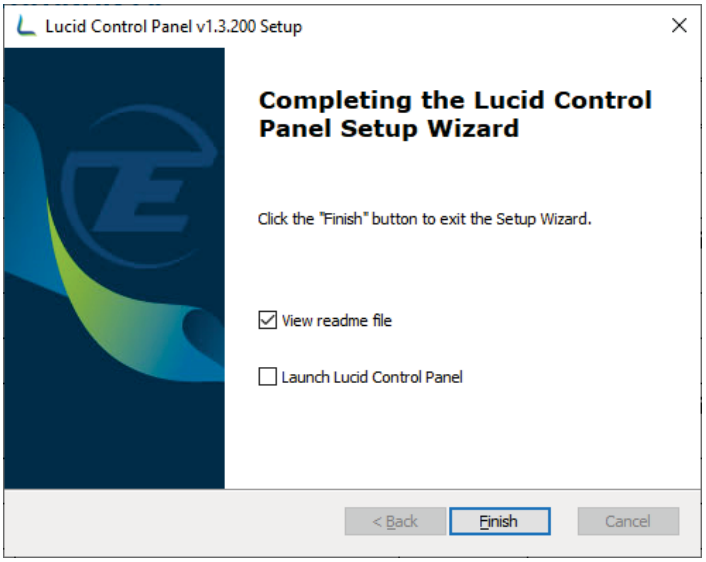


Figure 2.8 Completing the Lucid Setup Wizard

14. Click the **Finish** button to finish the software installation process.

15. The “Welcome to the Device Driver Installation Wizard!” dialog box is displayed.

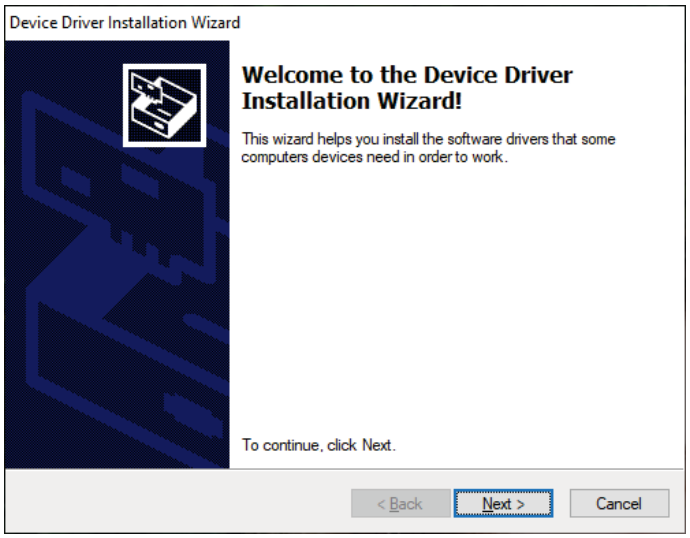


Figure 2.9 Welcome to the Device Driver Installation Wizard!

16. Click the **Next** button to continue the driver installation process.

17. The “Completing the Device Driver Installation Wizard!” dialog box is displayed

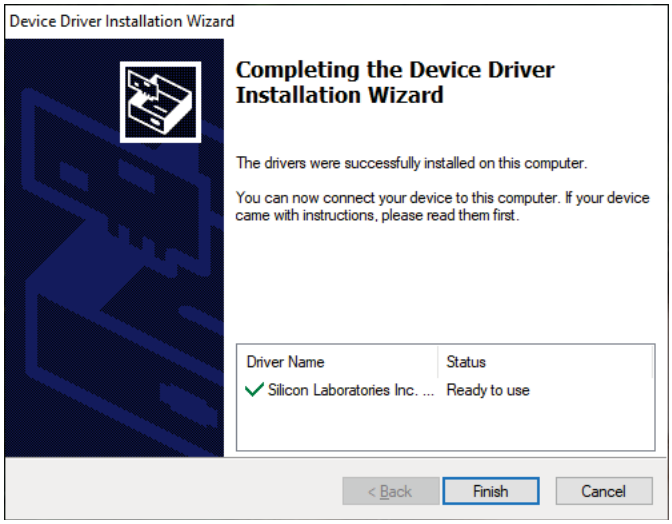


Figure 2.10 Completing the Device Driver Installation Wizard!

18. Click the **Finish** button.
19. The driver and software have been installed.
20. A Lucid shortcut is installed on the desktop .
21. Use the supplied USB cable to connect the Lucid benchtop model to the PC. You can also connect Lucid to a LAN using an RJ45 cable (not supplied) and control it via a PC connected to the same LAN. Refer to 3.2 Communication Tab, page 17.
22. The instrument can now be remotely controlled. For instructions on how to control the instrument with the Lucid software refer to section 3.2 Communication Tab, page 17.

3 Operation

3.1 Program Start

1. Double-click the Lucid shortcut on the desktop . The Lucid program is initialized.

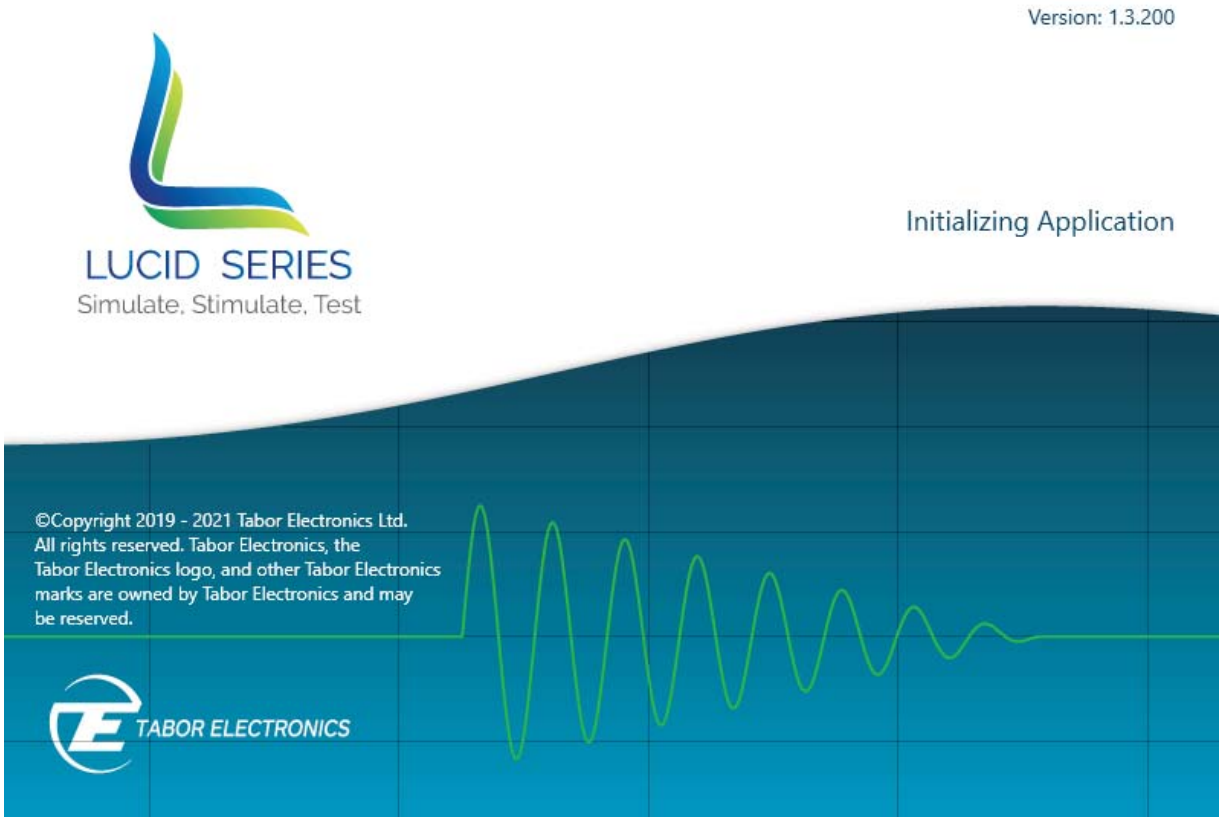


Figure 3.1 Lucid Initializing Application

2. Wait for the Communications tab to display.

3.2 Communication Tab

This is the first screen to be displayed after the software is activated. From here the user establishes communication with all the connected instruments.

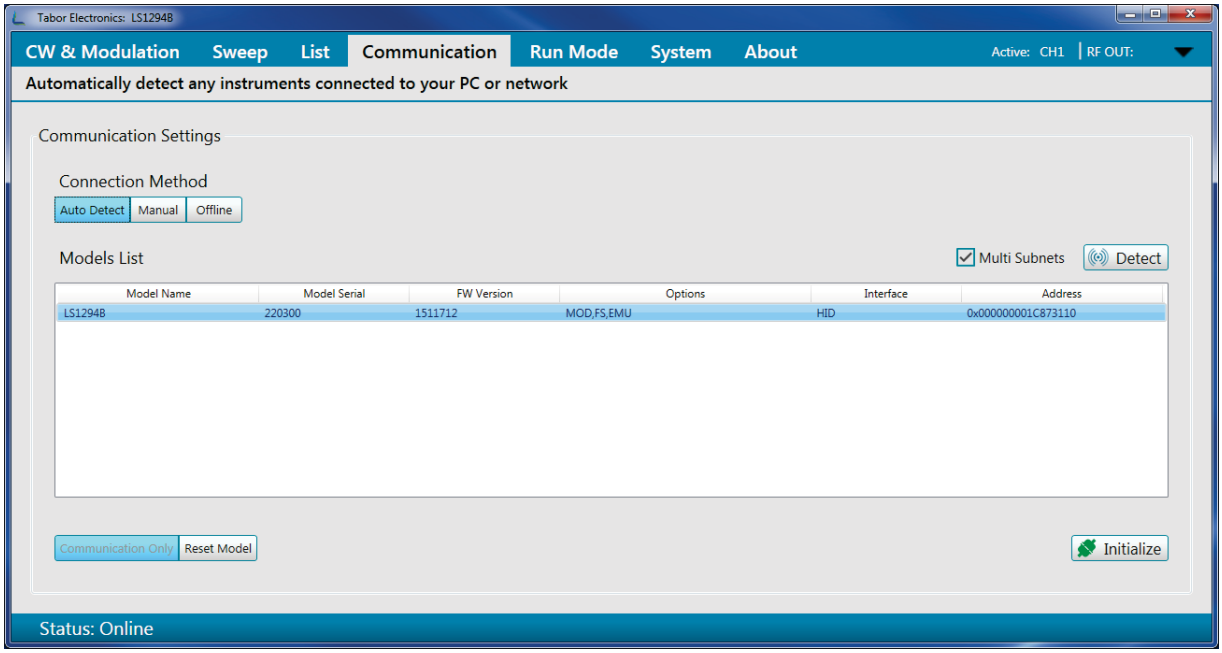


Figure 3.2 Communication Tab

Following is the menu description:

- **Auto Detect** –click the button to enable the **Lucid** software to automatically detect all connected instruments.
  - **Multi Subnets** – detect devices on LAN subnets.
  - **Detect** – click the button to initialize the detection process. At the end of the process, the following information is displayed:
    - **Model Name** – ordering information model, e.g. LS1291D.
    - **Model Serial** – the serial number of the device.
    - **FW Version** – the firmware version of the device.
    - **Options** – the options included in the device.
    - **Interface** – active communication interface.
      - USB
      - HID (Lucid Benchtop only)
      - LAN (Lucid Benchtop only)
    - **Address** – IP or USB physical address. For USB, the following parameters are displayed:
      - **vid** – vendor ID.
      - **pid** – product ID.
      - **serial** – a unique serial string programmed at the factory and used to distinguish between devices.

- **Manual** – click this button to enable manually connecting to the generator. After entering the generator's address (IP address or USB address), press to select the generator's model from the drop-down list.
- **Offline** – click this button to select a model and simulate as if the software is connected is connected to the generator.

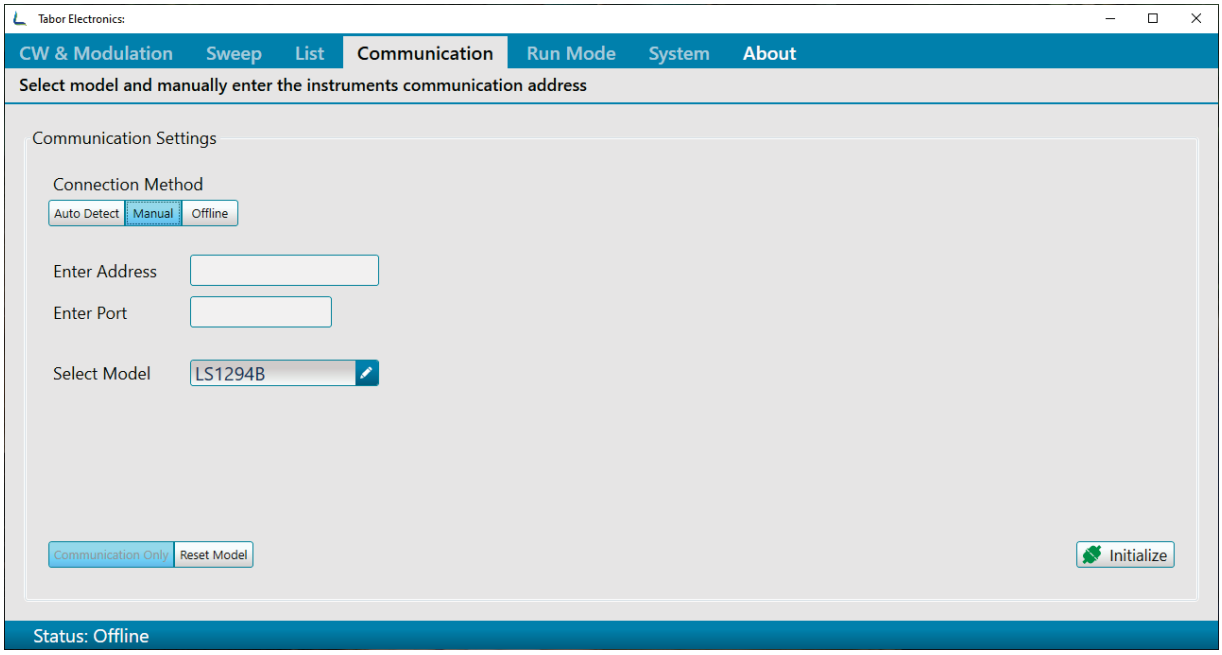


Figure 3.3 Communication Tab Manual

By selecting one of the following functions, the user sets the Initialization mode:

- **Communication Only** – when the Initialize button is clicked, communication is established, using the currently loaded setup (the last setup used).
- **Reset Model** – when the Initialize button is clicked, communication is established, the generator setup is reset.
- **Offline** – click this button to select a model and simulate as if the software is connected is connected to the generator.

- **Initialize** – click to initialize communication with the selected instrument. Once clicked, other tabs of the screen become available and can be accessed.

Note

- For information about options available for the Lucid Series RF Generator, refer to your Lucid device user manual.

3.3 CW & Modulation Tab

The CW (Carrier Wave) & Modulation tab becomes available after connectivity with the generator is established. From here the user can set the basic output parameters of the generator. The modulation types that are available depends on the installed options.

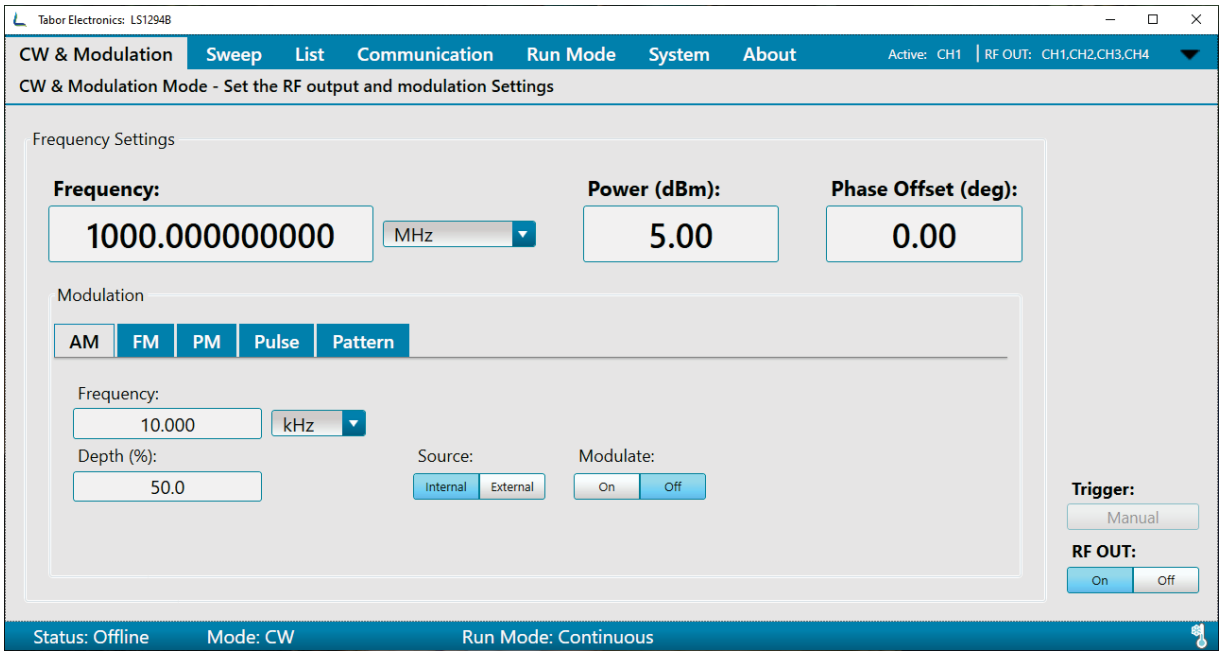


Figure 3.4 CW & Modulation Tab

- Status Bar – the bar at the bottom of the screen displays a summary of the system status.
  - **Status**
    - **Offline** – Not connected to a device.
    - **Online** – Connected to a device.
  - **Mode** – Shows which modulation is on (press Mode ON/Off in the respective modulation window).
    - **CW** – Carrier wave (default)
    - **AM** – Amplitude modulation
    - **FM** – Frequency modulation
    - **PM** – Phase modulation
    - **PULSE** – Pulse modulation
    - **PATT** – Pattern modulation
    - **FRSW** – Frequency sweep mode is selected
    - **PRSW** – Power sweep mode is selected
    - **LIST** – List mode is selected
  - **Run Mode:**

  - **Continuous** – The device will generate a signal when the user clicks the RF OUT On button.
  - **Trigger** – The device waits for an external/internal trigger event.
- **Reference**
  - **Internal** – The modulation source is the generator.
  - **External** – The modulation source is an external connected source.
- **Thermometer**
  - **Blue** – Normal temperature up to 65℃.
  - **Red** – Overheated. The device temperature is above 65℃ for more than 30s. Turn off the device immediately!

- **Frequency** – sets the generator's carrier wave frequency.
  The range of the entered value can be changed by using the drop-down list (Hz, kHz, MHz, GHz).

The default frequency is 1000 MHz. Refer to the Lucid Device User Manual section Specifications for valid frequency range.

Idea

- The shortcut for selecting the frequency range is ***<First Letter>***. For example, typing the value **5** and pressing **<G>** results in 5 GHz.

- **Power** – sets the power (amplitude) of the generator's output signal (in dBm). The default value is 5.00 dBm.
- **Phase Offset** – sets the phase offset of the signal. Phase offset range is between **0 degrees** to **360 degrees**. The default value is 0 degrees.
- **Modulations** – sets the signal modulation. Available modulation types depends on the installed options. For information about options available for the Lucid Series RF Generator, refer to your Lucid device user manual.

3.3.1 AM – Amplitude Modulation

Select the CW & Modulation tab, and then click the AM button to show the amplitude modulation parameters. You can set the amplitude modulation frequency and the amplitude depth.

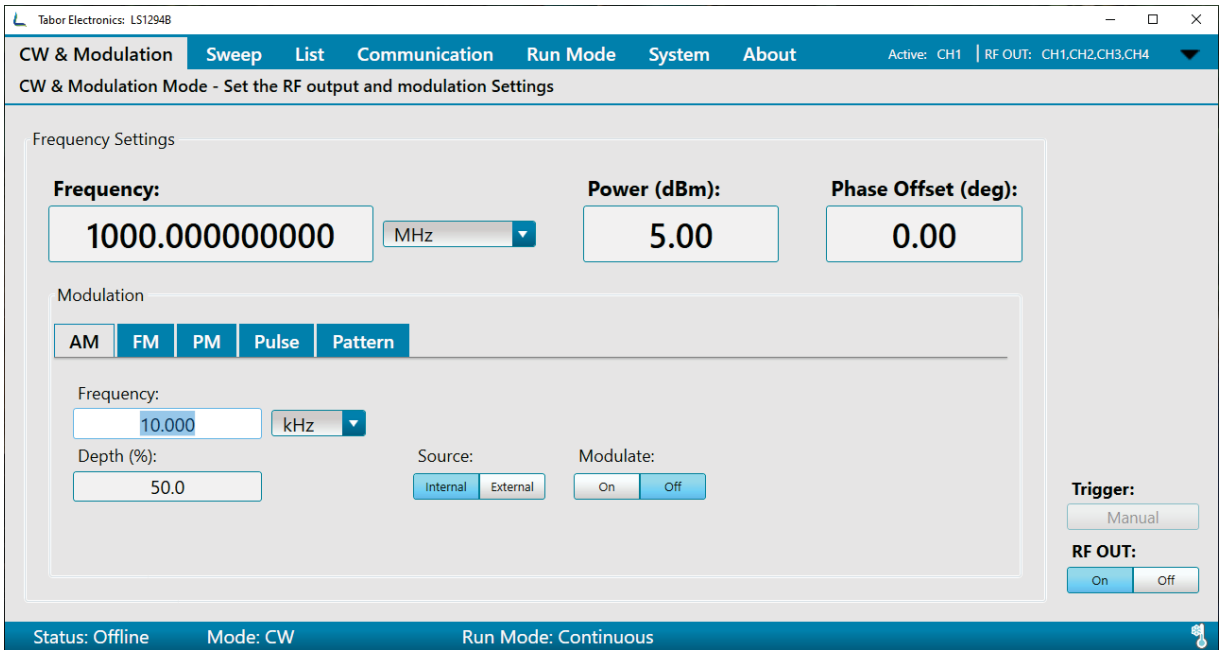


Figure 3.5 AM – Amplitude Modulation

- **Frequency:** – Set the modulation frequency (Hz/kHz).
- **Depth (%):** – Set the AM modulation in percent of the carrier wave amplitude.
- **Source:**
  - **Internal** – Use the screen modulation parameters.
  - **External** – Use an AM source connected to the generator's MODULATION IN connector located on the rear panel. The Generator will accept modulating signals between DC and 100 kHz within ±1 V (2 V p-p) amplitude.
- **Modulate: –** Push the **On/Off** button on the device front panel to start the modulation.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.3.2 FM – Frequency Modulation

Select the CW & Modulation tab, and then click the FM button to show the frequency modulation parameters. You can set the modulation frequency and the frequency deviation.

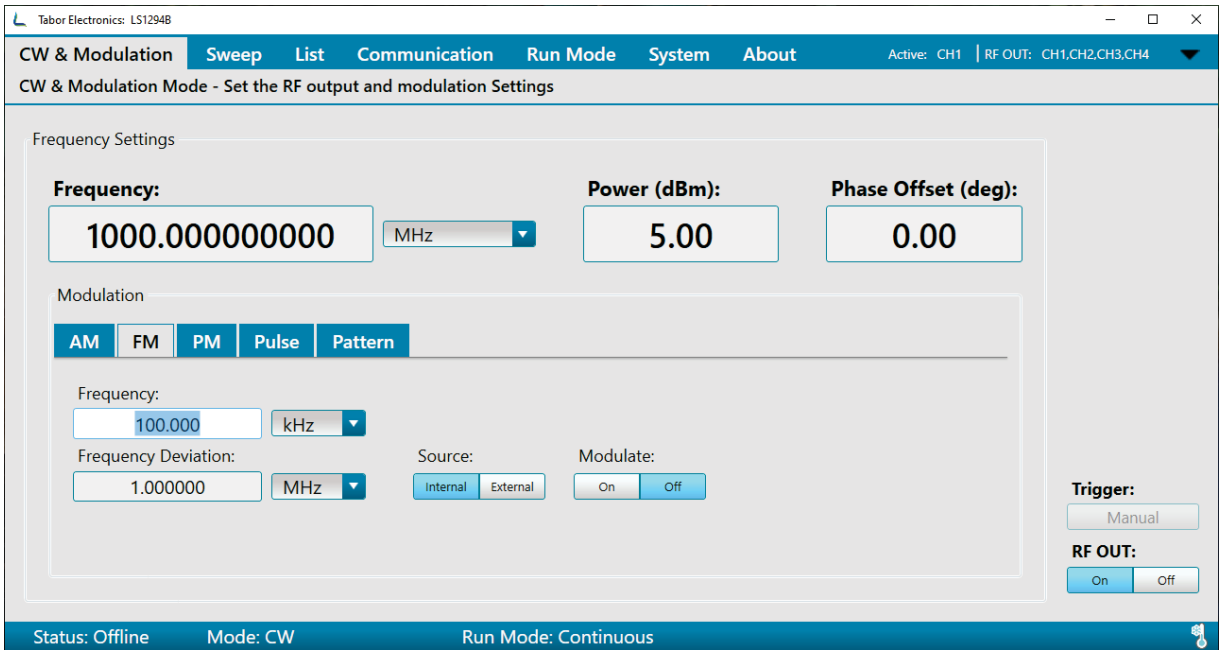


Figure 3.6 FM – Frequency Modulation

- **Frequency:** – Set the modulation Frequency (Hz/kHz/MHz).
- **Frequency Deviation:** – Set the frequency deviation of the carrier wave in (Hz/kHz/MHz/GHz).
- **Source**:
  - **Internal** – Use the screen modulation parameters.
  - **External** – Use an FM source connected to the generator's MODULATION IN connector located on the rear panel. The Generator will accept modulating signals between ±1 V (2 V p-p) amplitude.
- **Modulate: –** Push the **On/Off** button on the device front panel to start the modulation.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.3.3 PM – Phase Modulation

Select the CW & Modulation tab, and then click the PM button to show the phase modulation parameters. You can set the phase modulation frequency and the phase deviation.

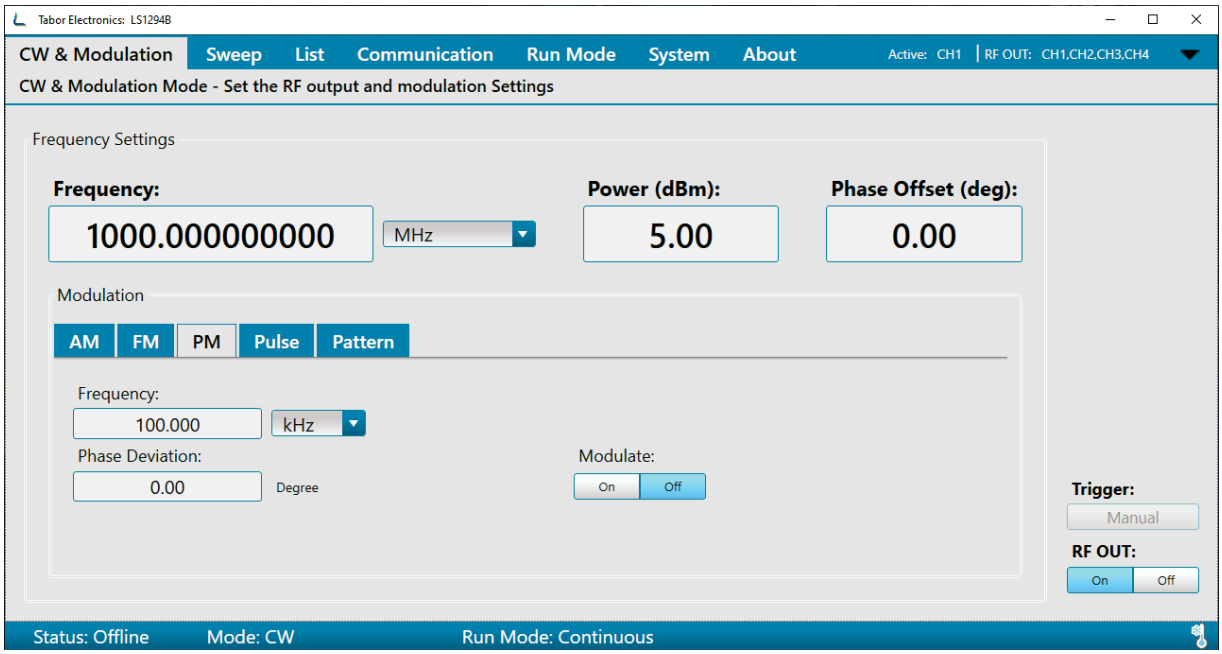


Figure 3.7 PM – Phase Modulation

- **Frequency:** – Set the modulation Frequency (Hz).
- **Phase Deviation:** – Set the phase deviation degree of the modulation frequency (0 to 360 degrees).
- **Modulate: –** Push the **On/Off** button on the device front panel to start the modulation.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.3.4 Pulse Modulation

Select the CW & Modulation tab, and then click the Pulse button to show the pulse parameters. You can set the pulse width and repetition rate.

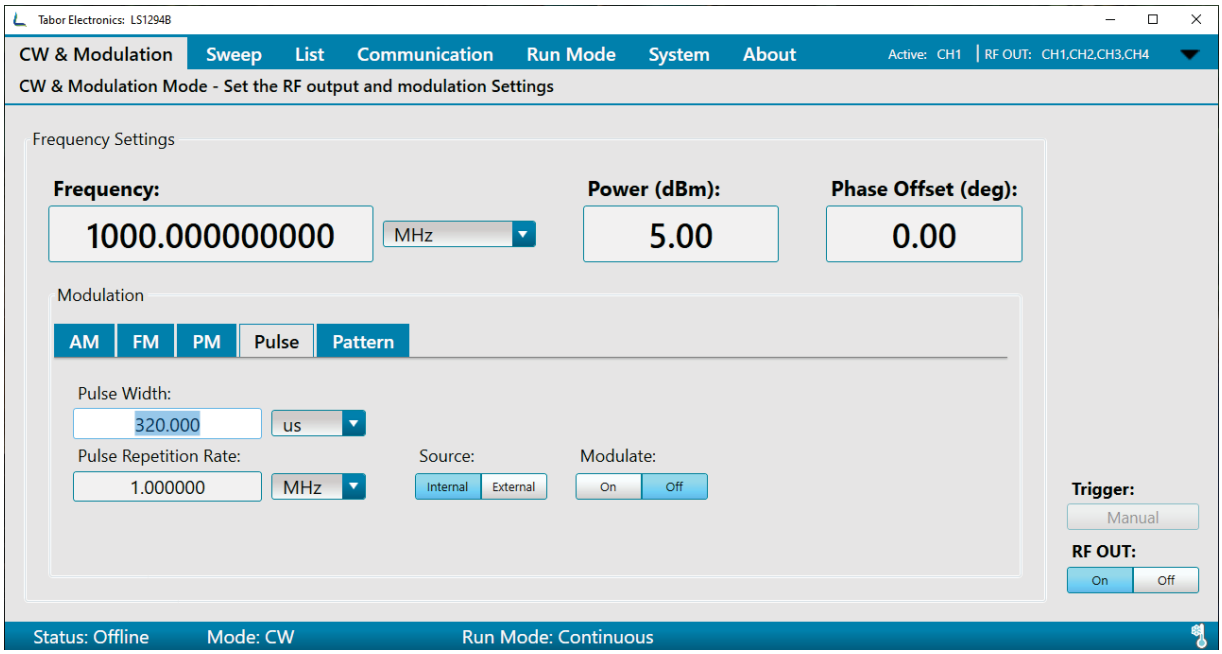


Figure 3.8 Pulse Definition

- **Pulse Width:** – Set the pulse modulation width (ns/µs/ms/s).
- **Pulse repetition rate:** – Set the pulse frequency (Hz/kHz/MHz).
- **Source**:
  - **Internal** – Use the screen modulation parameters.
  - **External** – Use a pulse source connected to the generator's MODULATION IN connector located on the rear panel. The Generator will accept modulating signals between ±1 V (2 V p-p) amplitude.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.3.5 Pattern Sequence

Select the CW & Modulation tab, and then click the PATTERN button to show the pattern sequence parameters. You can set a sequence of pulses according to the list of pulses where each step in the list defines a pulse Time On and Time Off time and the number of step repetitions.

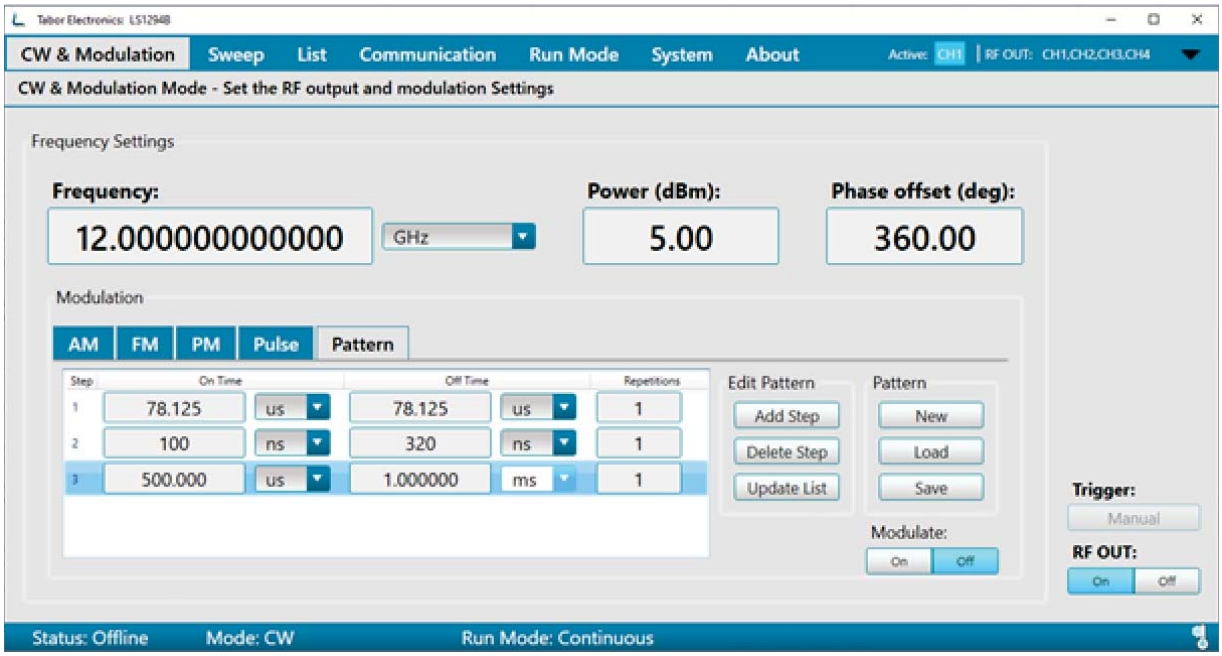


Figure 3.9 Pattern Sequence

Define a patter according to the steps below.

1. **NEW** – Click the button to create a new Pattern.
1. **LOAD** – Click the button to select a file to load.
2. **SAVE** – Click the button to save the Pattern in a JSON (JavaScript Object Notation) format. You can save to a new name (valid name is only numbers) or overwrite an old file. You can select to store the data on the SD card.
3. **Add STEP** – Click the button to add a new step.
4. Enter the duration of the pulse (On Time), the delay for next pulse (Off Time), and the number of loops (Repetitions) of this step.
5. **Delete STEP** – Click the button to delete the last step.
6. **Update List** – Click the button to upload the Pattern to the instrument.

- **Modulate: –** Push the **On/Off** button on the device front panel to start the modulation.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.4 Sweep Tab

The Sweep Tab menu allows the user to set frequency range and step size, sweep direction, power range and step size, frequency and power dwell time, and triggering.

Following is the menu description:

Two **Sweep Types** are available:

- **Frequency** based – where the signal sweeps from one frequency to the next, maintaining the same amplitude.
- **Power** based – where the signal sweeps from one amplitude to the next, maintaining the same frequency.

3.4.1 Frequency Sweep

Select the Sweep tab, and then click the Frequency button in the Select Sweep Type field.

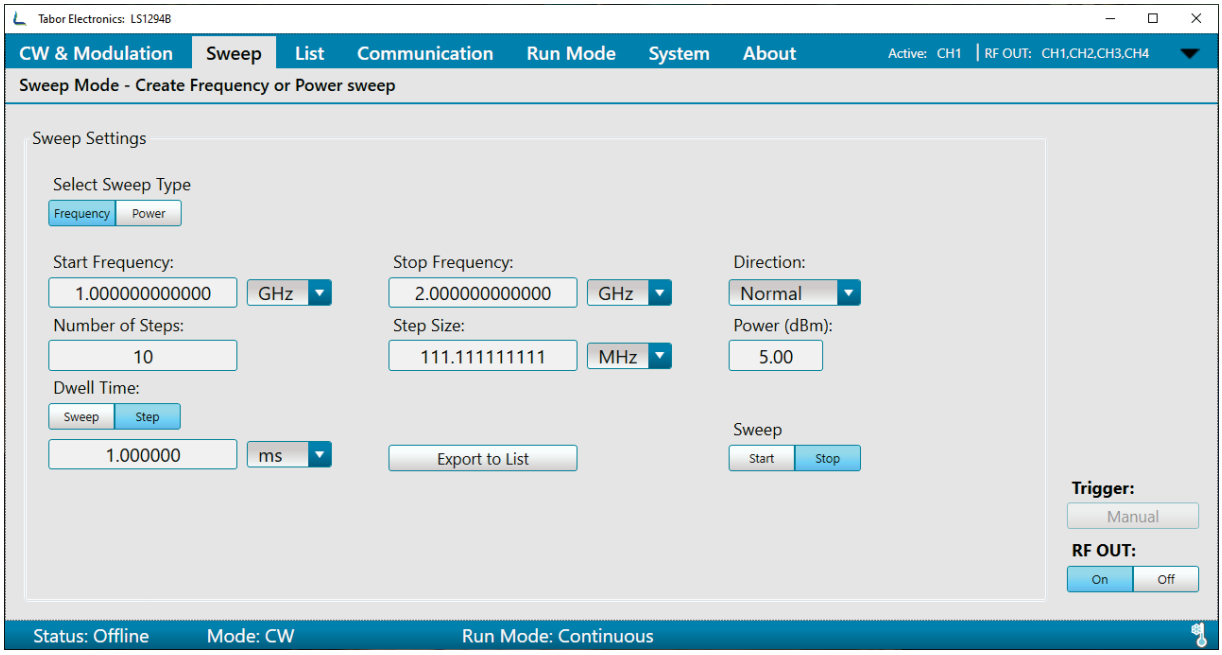


Figure 3.10 Frequency Sweep

- **Start Frequency** and **Stop Frequency** – sets the frequencies (in Hz, kHz, MHz, or GHz) on which the sweep will start and end. Type the **Start** and **Stop** values in the fields – the sweep direction is determined by the Direction field (see below).
- **Direction** – sets the sweep direction. The following options are available:
  - **UpDown** – to sweep from Start Frequency to Stop Frequency; then, from Stop Frequency to Start Frequency .
  - **Normal** – to sweep from Start Frequency to Stop Frequency.

- **Number of Steps** – Sets the number of steps in one sweep (including **Start** and **Stop**). The value displayed in **Step Size** changes accordingly.
- **Step Size** – Sets the size of each step (in Hz, kHz, MHz, or GHz) in one sweep. The value displayed in **Number of Step** changes accordingly.
- **Power** – Sets the amplitude (in dBm) of the signal. The value set here is the same as in the CW & Modulation Tab.

Note
- Multiple power levels are not allowed in frequency sweeps. Use the Power-based sweeps for power sweeps. Use the List Tab for combined Power and Frequency sweeps.

Note
- Changing the value of the amplitude (Power) in the Sweep Tab will change the Power value in the CW & Modulation Tab.

- **Dwell Time** – sets the duration of each step in the sweep or the entire sweep, before it continues to the next step or sweep. The following options are available:
  - **Sweep** – sets the duration of one entire sweep (in µs, ms, or s).
  - **Step** – sets the duration of each step in the sweep (in µs, ms, or s).
- **Export to List** – this button copies the displayed sweep to the List Tab.

  If there is already a list, the Export to List dialog box appears notifying that the current list will be deleted.
  - Click Yes to copy thee sweep data to the list table.
  - Click No to cancel the action.

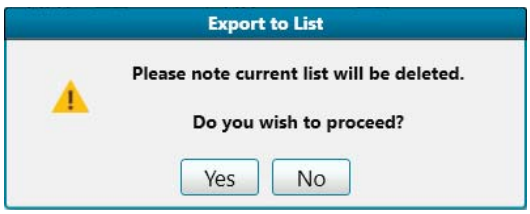


Figure 3.11 Export to List

- **Sweep** – starts or stops the sweep.
  - **Start** – starts the sweep.
  - **Stop** – stops the sweep.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.4.2 Power Sweep

Select the Sweep tab, and then click the Power button in the Select Sweep Type field.

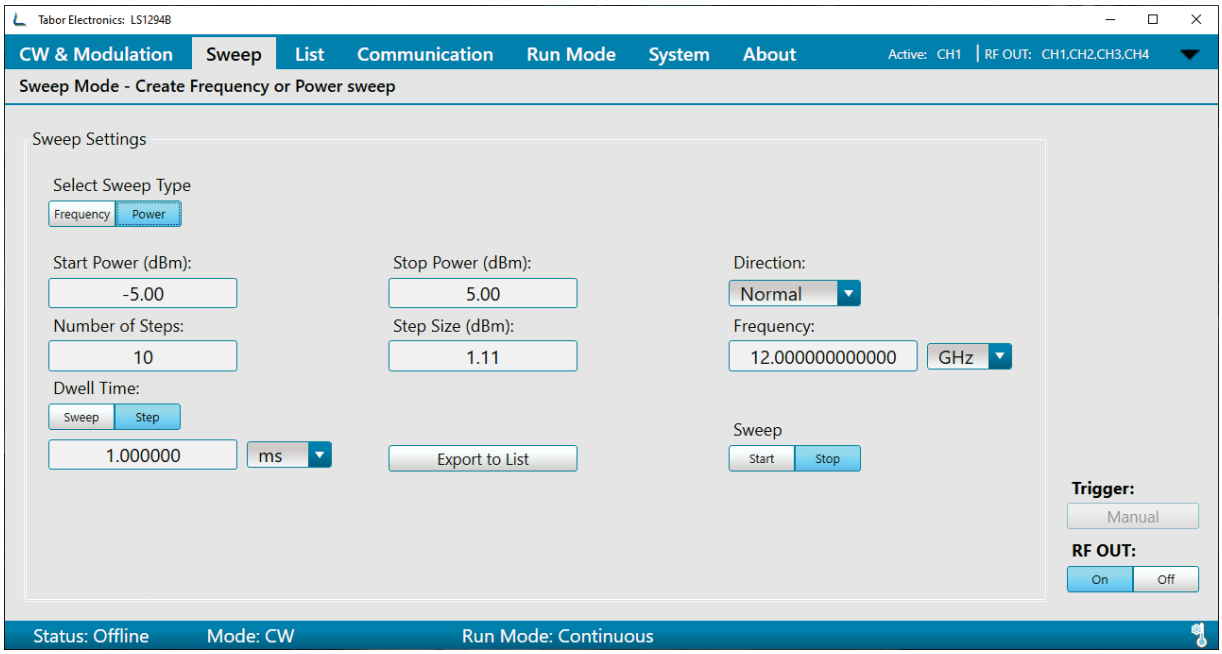


Figure 3.12 Power Sweep

- **Start Power** and **Stop Power** – sets the amplitudes (in dBm) on which the sweep will start and end. Type the **Start** and **Stop** values in the fields – the sweep direction is determined by the Direction field (see below).
- **Direction** – sets the sweeping direction. The following options are available:
  - **UpDown** – to sweep from Start Power to Stop Power; then, from Stop Power to Start Power.
  - **Normal** – to sweep from Start Power to Stop Power.
- **Number of Steps** – Sets the number of steps in one sweep (including **Start** and **Stop**). The value displayed in **Step Size** changes accordingly.
- **Step Size** – Sets the size of each step (in dBm) in one sweep. The value displayed in **Number of Step** changes accordingly.
- **Frequency** – Sets the frequency (in Hz, kHz, MHz, or GHz) of the signal. The value set here is the same as in the CW & Modulation Tab.

Note

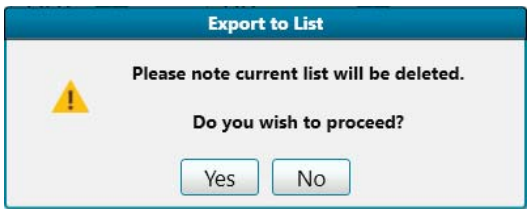
- Multiple frequencies are not allowed in power sweeps. Use the Frequency-based sweeps for frequency sweeps. Use the List Tab for combined Power and Frequency sweeps.

Note

- Changing the value of the frequency in the Sweep Tab will change the Frequency value in the CW & Modulation Tab.

- **Dwell Time** – sets the duration of each step in the sweep or the entire sweep, before it continues to the next step or sweep. The following options are available:
  - **Sweep** – sets the duration of one entire sweep (in µs, ms, or s).
  - **Step** – sets the duration of each step in the sweep (in µs, ms, or s).
- **Export to List** – this button copies the displayed sweep to the List Tab.

  If there is already a list, the Export to List dialog box appears notifying that the current list will be deleted.
  - Click Yes to copy the sweep data to the list table.
  - Click No to cancel the action.



- **Sweep** – starts or stops the sweep.
  - **Start** – starts the sweep.
  - **Stop** – stops the sweep.
- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.
- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.5 List Tab

The List Tab enables the user to create and generate a sequence of signals that can vary in frequency, power and dwell time.

When selecting the List tab for the first time the list table is empty unless the **Export to List** button was pressed in the Sweep Tab in which case it should contain the sweep list that was generated from the Sweep Tab. Newly added steps are added to the end of the list. In addition, you can load previously saved lists.

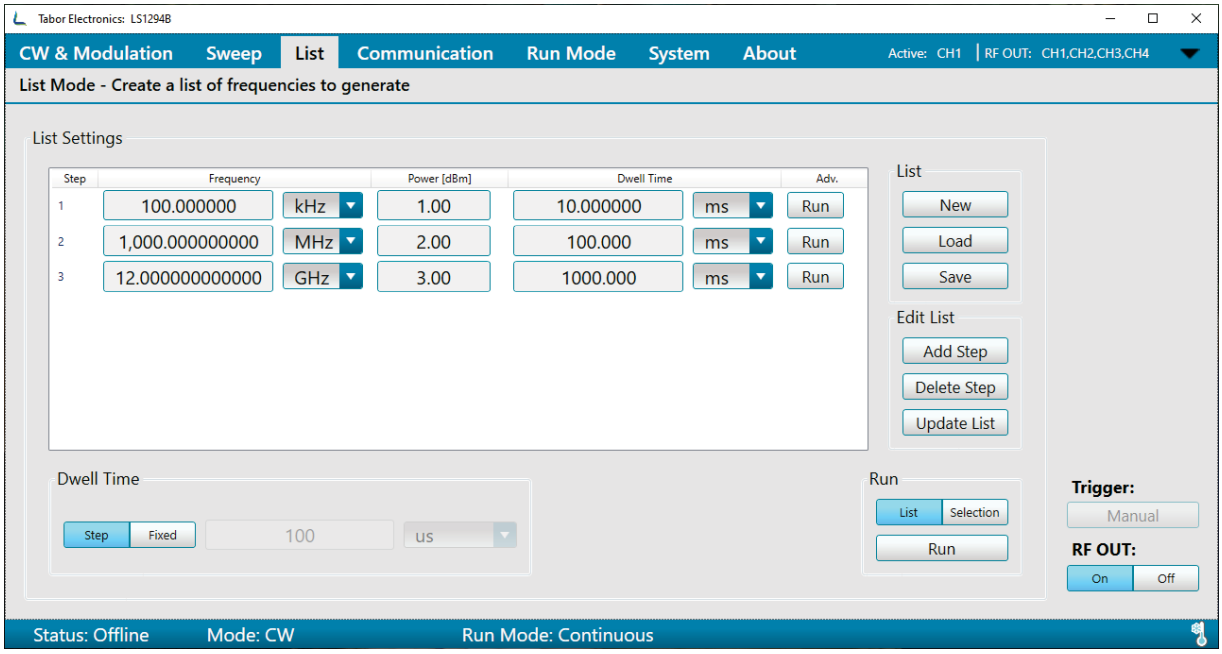


Figure 3.13 List

Following are the details of the List menu:

- **List Settings** – is where all the list steps are displayed. Each step in the list can be edited as follows:
  - Frequency (in Hz, kHz, MHz, or GHz) - sets the step frequency.
  - Power (in dBm) – sets the step power.
  - Dwell Time – sets the duration of the step (in µs, ms, or s).
  - Adv. – sets whether the Dwell Time is followed by a Run to the next step, or by a stop and Wait for a Trigger that advances it to the next step.
- **List** – affects the entire list.
  - **New** – clears the entire list, enabling the user to start a new one. The following dialog box appears.
    - Click **Yes** to start a new list.
    - Click **No** to cancel the action.

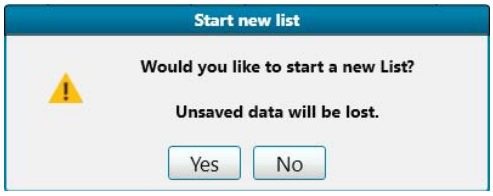


Figure 3.14 Start New List

- **Load** – enables the user to replace the current list by another one. The user browses to the location of the previously created file, and loads it, by clicking Open.

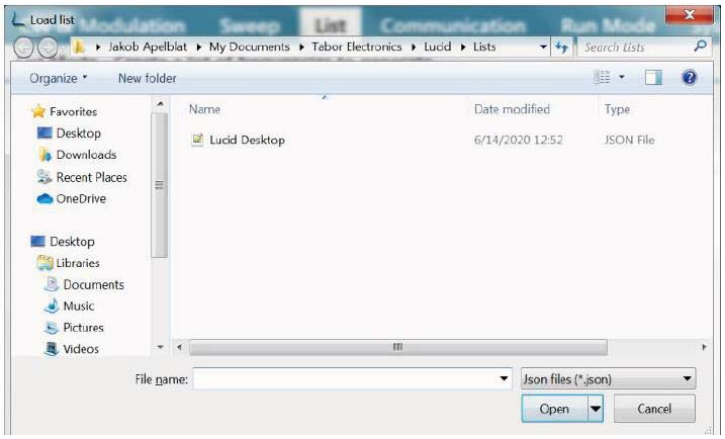


Figure 3.15 Load List

- **Save** – enables the user to save the current list as a text file. The user browses to the desired folder; then, names the file, and clicks Save.

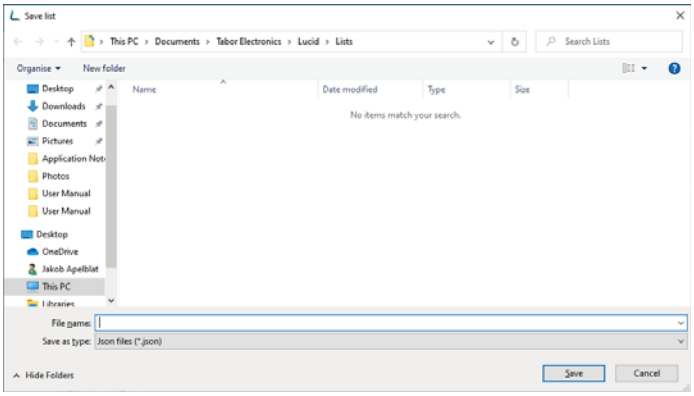


Figure 3.16 Save List

- **Edit List** – affects the list items (steps)
  - **Add Step** – adds a step to the end of the list. The default values are those set in the RF & Modulations Tab.
  - **Delete Step** – select the step and click Delete Step to delete the selected step from the list.

- **Update List** – after finishing editing the list, the user must click this button to activate the new parameters.

- **Dwell Time** – sets the duration of each step in the list.
  - **Step** – Dwell time is as set in each step in the list.
  - **Fixed** –Dwell time defined in the list is disabled; will be identical in all steps, as defined here (in µs, ms, or s).

- **Run** – sets what step will Run.
  - **List** – the entire list will run, one step after the next, in the displayed order. When reaching the end of the list, the run will restart. If the Wait switch is On, the run stops, and waits for a trigger event (as defined in the Run Mode Tab).
  - **Selection** – only the selected step in the list will run.

Note
- It is possible to select more than one step, using the same key used for multiple selection in Windows **(<Ctrl>** and **<Shift>**).

- **Run** – runs the list, according to the settings.

- **Trigger** – The Manual button is enabled when the instrument Run Mode is set to Trigger in the Run Mode tab, refer to 3.6 Run Mode Tab, page 34.
  - **Manual –** Push the button to send a trigger command to the instrument. The Trigger Source in the Run Mode tab shall be set to Bus, refer to 3.6 Run Mode Tab, page 34.

- **RF OUT:** – Push the **On** button to generate the RF output signal.

3.6 Run Mode Tab

The Run Mode Tab sets the mode by which the unit will run; for example, if the sweeps start generating the signals when the user clicks the **Start** button, or does it also wait for a trigger event.

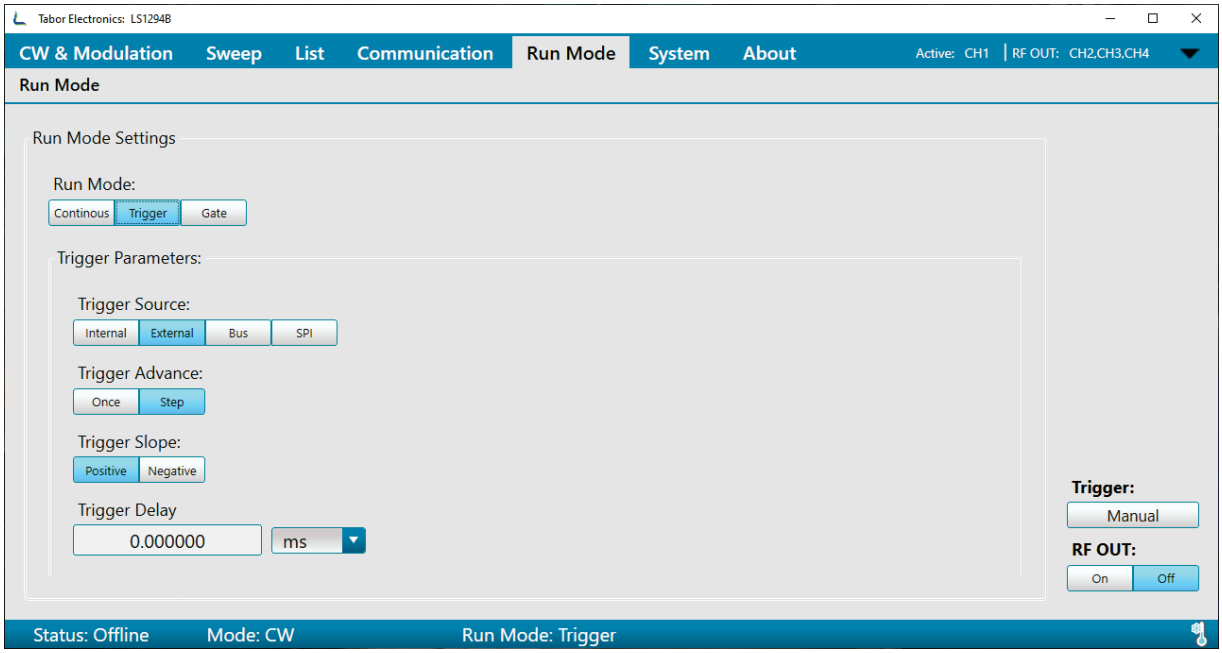


Figure 3.17 Run Mode External

Following are the details of the Run Mode menu:

- **Run Mode** – sets the way in which the signals are generated.
  - **Continuous** – enables running the signal continuously, as defined in the other tabs, and regardless of the trigger events. All trigger-oriented parameters are not accessible.
  - **Trigger** – enables running the signal, when a trigger event is detected.
- **Trigger Source** – sets the source of the trigger.
  - **Internal** – the software issues triggers according to the following parameters.
    - **Timer** – sets the rate for clocked triggers (in ns, µs, ms, or s).

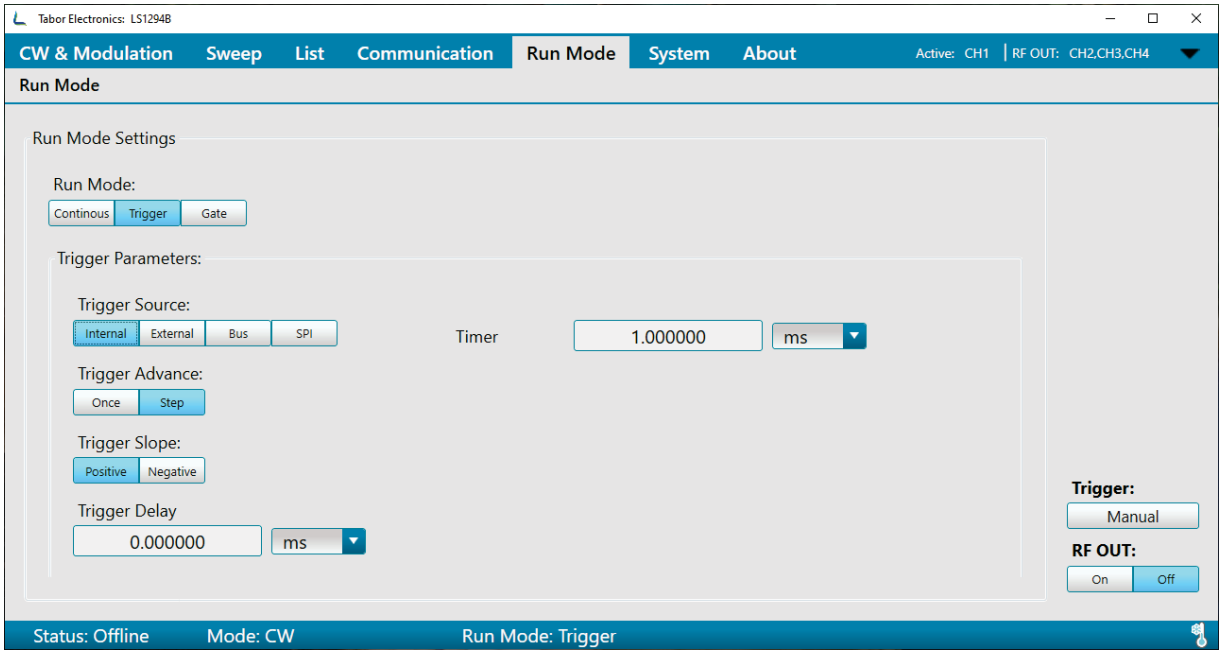


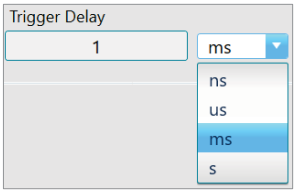
Figure 3.18 Run Mode Internal

- **External** – an external source, connected to the TRIGGER IN port, issues the triggers.
- **Bus** – a trigger is issued when the user clicks the Manual button.

- **Trigger Advance** – sets the trigger advance either in steps or as a one-time event.
  - **Once** – sets the number of triggers that will be issued.
    - **Once Count** – sets the number of times a sweep or list will be generated. When the count is set to 0, the device outputs a signal continuously once a trigger is accepted.
  - **Step** – for every trigger that is accepted the sweep or list is advanced by 1 step. While the step is being generated, any incoming trigger is ignored.

- **Trigger Slope** – sets whether a trigger is valid on the trigger positive (rising) edge or negative (falling) edge.

- **Trigger Delay** – defines a delay in units of time between the receiving of the trigger signal and the generation of the output signal.



- **Trigger** – when the trigger source is set to **Bus**, clicking **Manual** issues a trigger.

- **RF OUT** – turns On or Off the RF output switch.

3.7 System Tab

The System Tab manages the setup parameters of the entire system. Loading a system file results in the ability to re-use the Modulations, Sweeps and Lists, etc., that were used, when the system file was created.

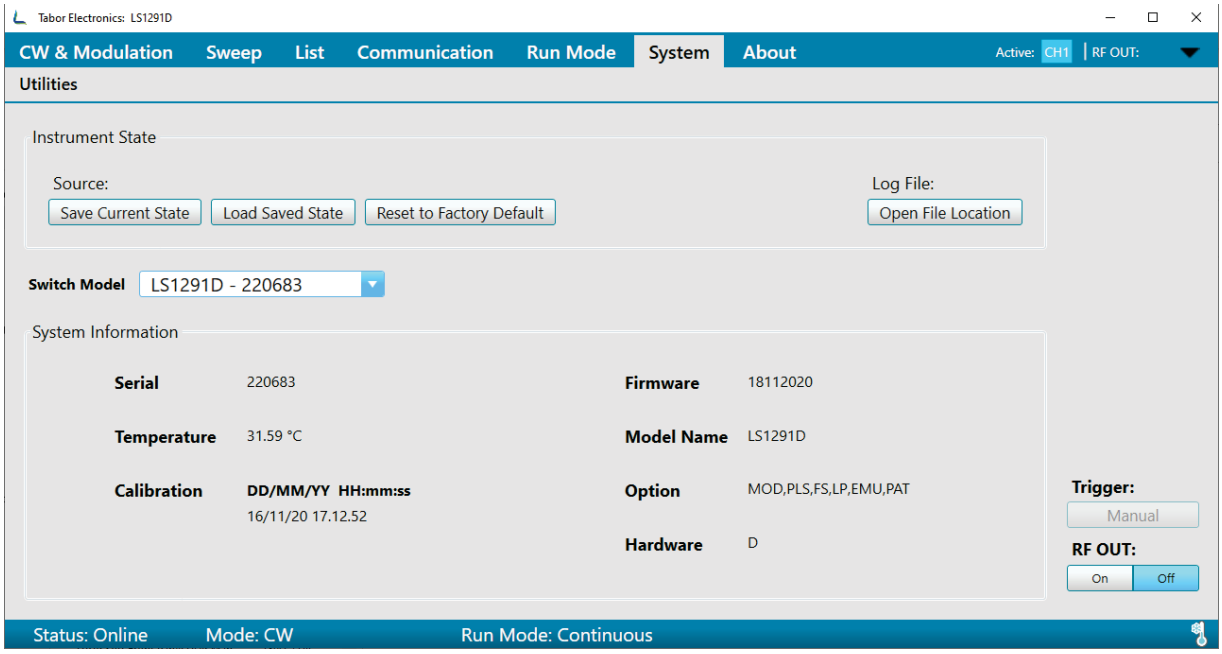


Figure 3.19 System Tab

Following are the details of the System menu:

- **Instrument State** – enables the user access to the System State file.
  - **Source:**
    - **Save current state** – saves the current state of the entire system in a file.
    - **Load saved state** – loads a previously saved System State file. The settings in all the tabs will change accordingly.
    - **Reset to factory default** – resets instrument and tabs to factory default settings.
  - **Log File**:
    - **Open file location** – The log file contains all the SCPI communication between the PC and the device.
- **Switch Model** – Switch between connected models that appear in Figure 3.2 Communication Tab, page 18.
- **System Information** – displays the system information
  - **Serial** – the serial number of the generator.
  - **Temperature** – the temperature at critical locations inside the generator chassis.
  - **Calibration** – the time stamp of the last calibration.
  - **Firmware** – the FPGA firmware version.

- **Model Name** – the model number of the generator.
- **Option** – the options installed in the generator.
  - **MOD** – Modulation package (AM, FM, PM).
  - **Pulse** – Pulse generator.
  - **FS** – Fast switching.
  - **LP** – Low Power (-90 dBc).
  - **Emulation** – Includes emulators for Keysight, R&S, Anapico, and Holzworth
  - **Pattern** – Pattern generator.
- **Hardware** – the hardware version.

- **Trigger** – when the Trigger Source in the **Run Mode** Tab is set to **Bus**, clicking **Manual** issues a trigger.
- **RF OUT** – turns On or Off the RF output switch.

3.8 About Tab

The About Tab displays the application version.

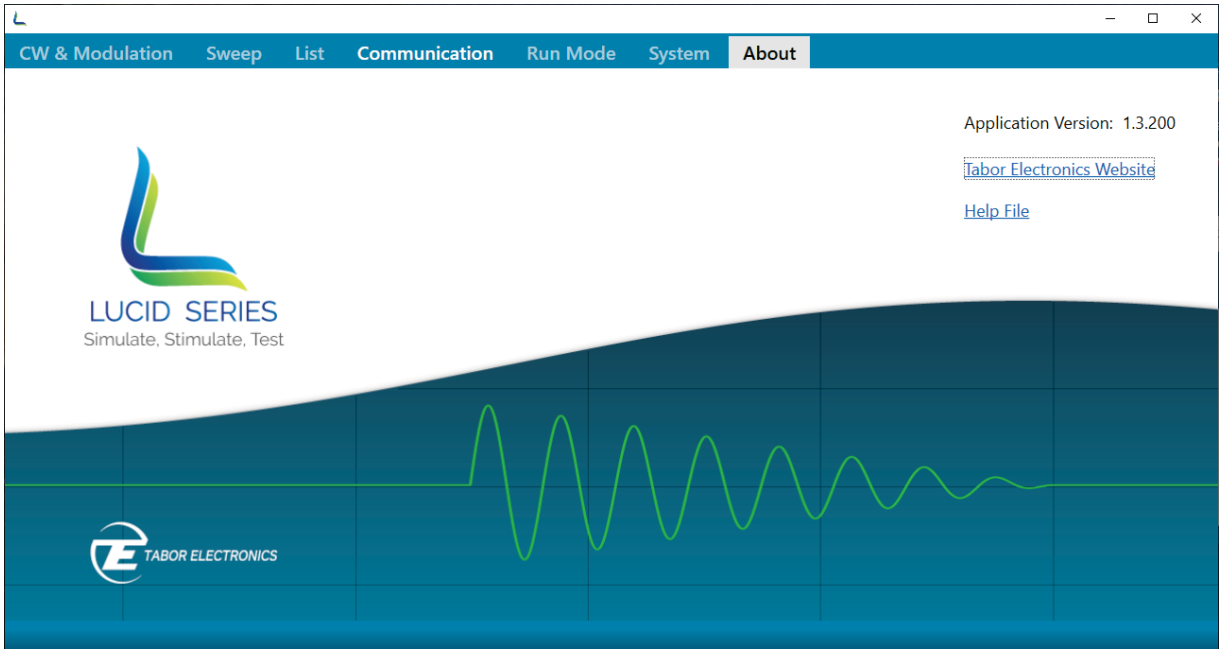


Figure 3.20 About Tab

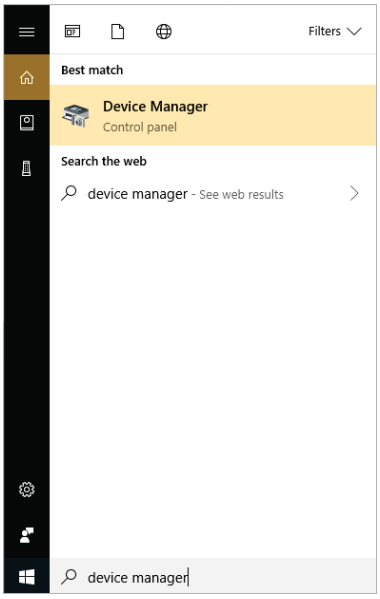
- **Tabor Electronics Website** – Click the link to access the website. Click the DOWNLOADS tab to download the latest version of manual, software, and FPGA firmware.
- **Help File** – Displays the Lucid Control Panel user manual (this manual).

4 Troubleshooting

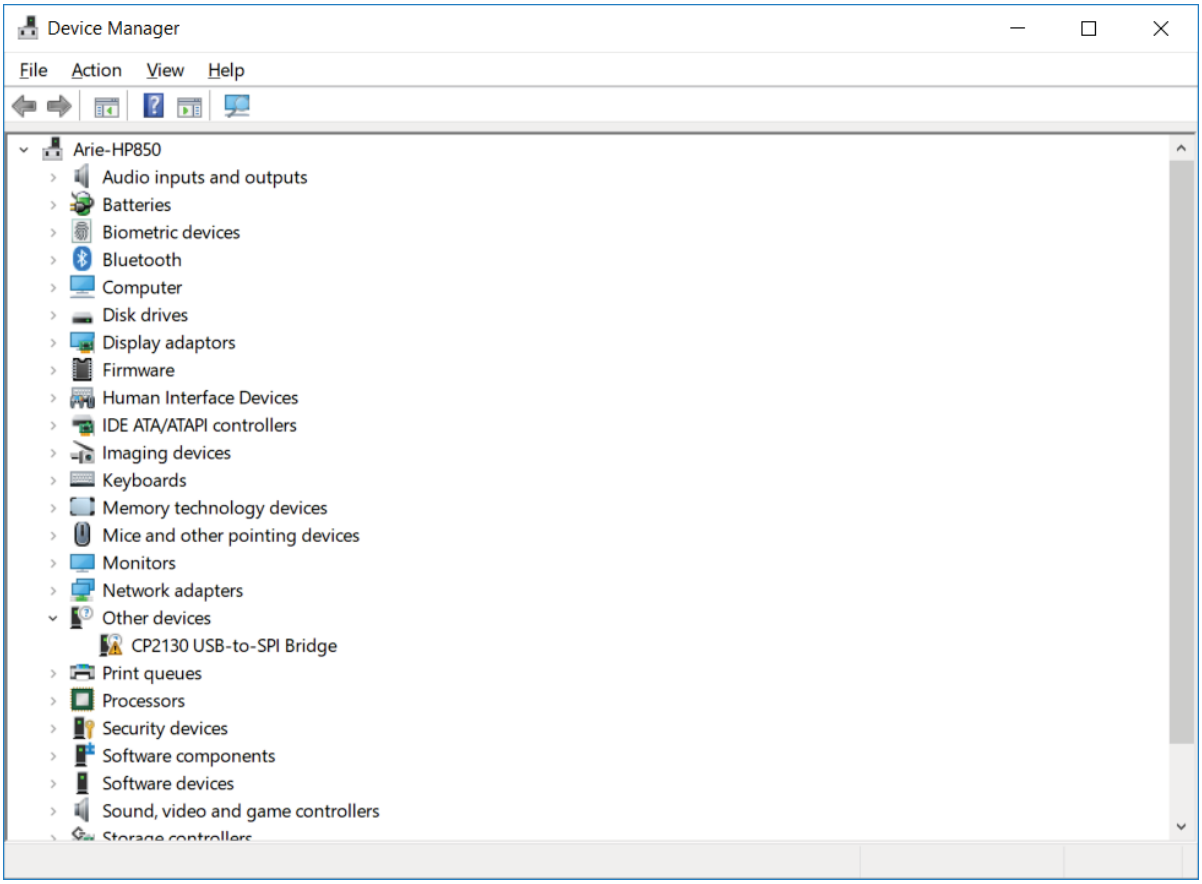
4.1 Manually Installing Instrument Drivers

4.1.1 USB Device Driver Manual Installation (Windows 10)

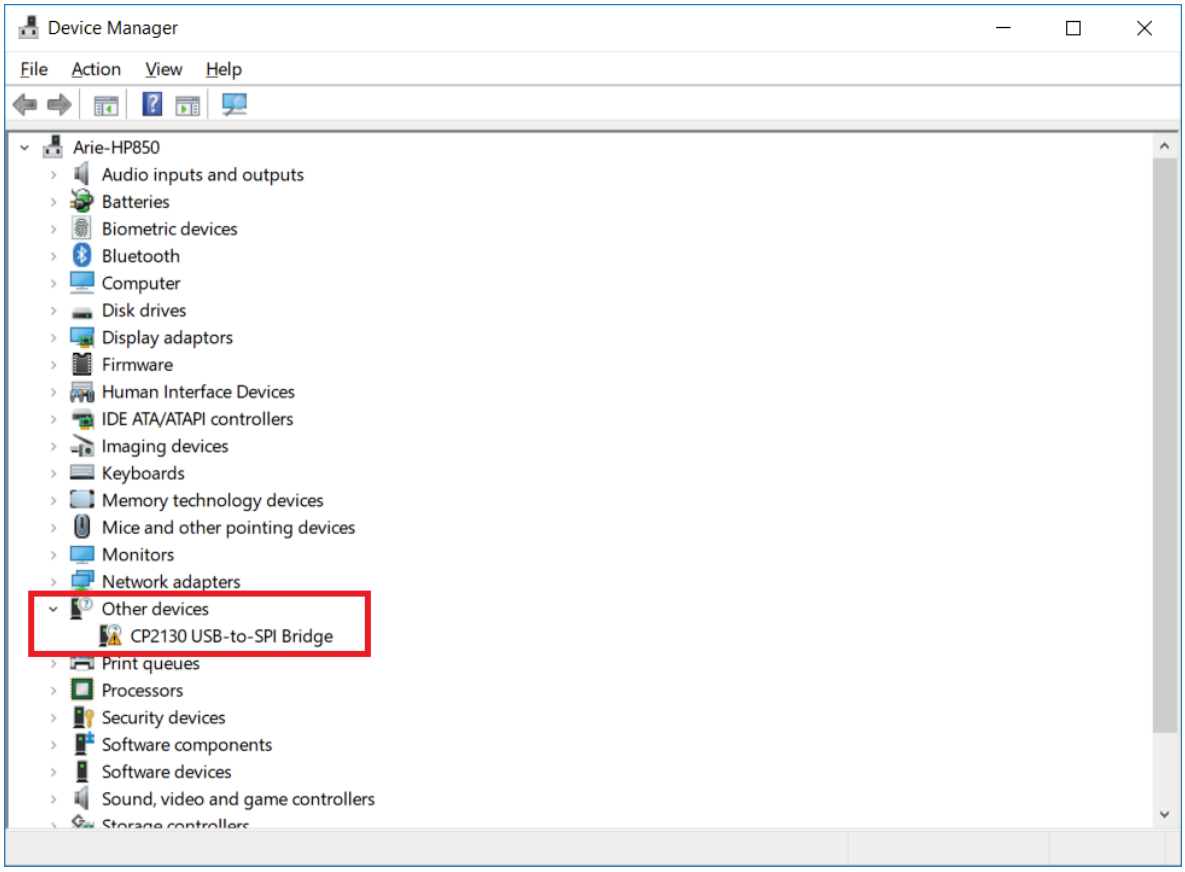
1. Download the latest Lucid series USB device driver from www.taborelec.com/downloads.
2. Using the supplied USB cable, connect the Lucid benchtop model to the PC.
3. Open the **Start** menu, and in the search field, type **Device Manager**.



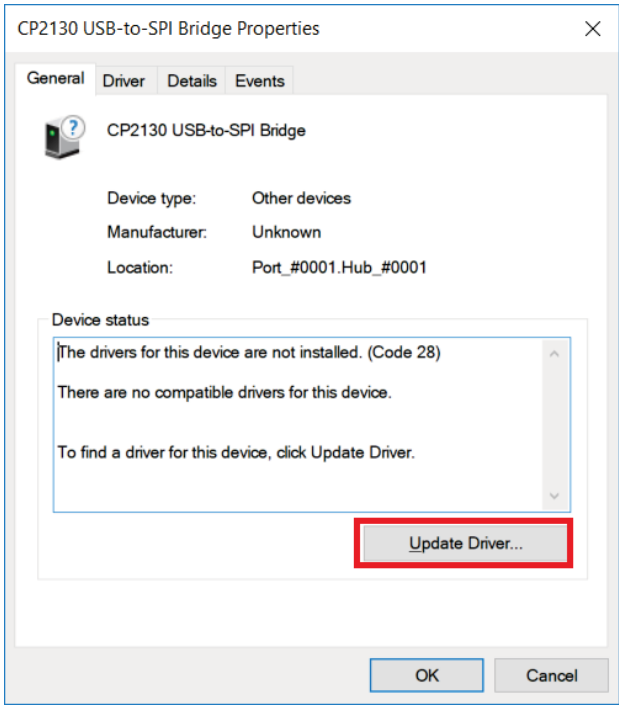
4. In the search results list, select **Device Manager**.
   The **Device Manager** window opens.



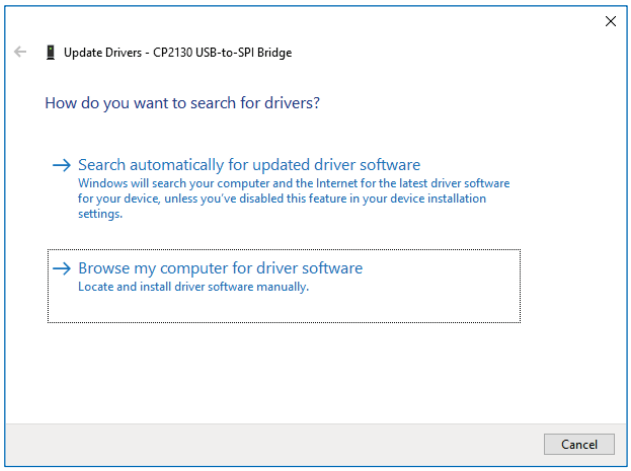
5. In the navigation tree, expand **Other devices** and double click on **CP2130 USB-to-SPI Bridge**.



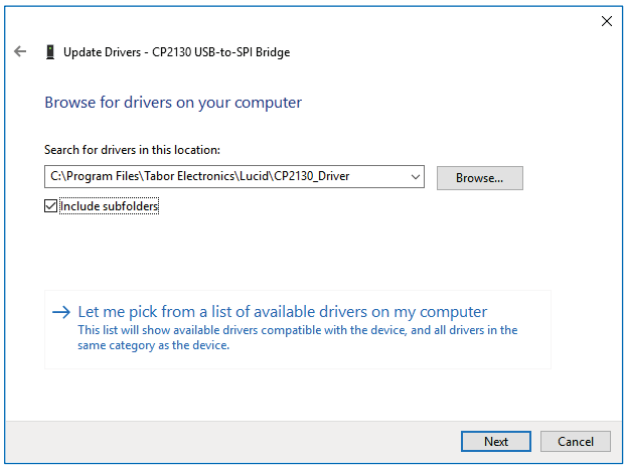
6. The **CP2130 USB-to-SPI Bridge Properties** window opens.
   Click **Update Driver**.



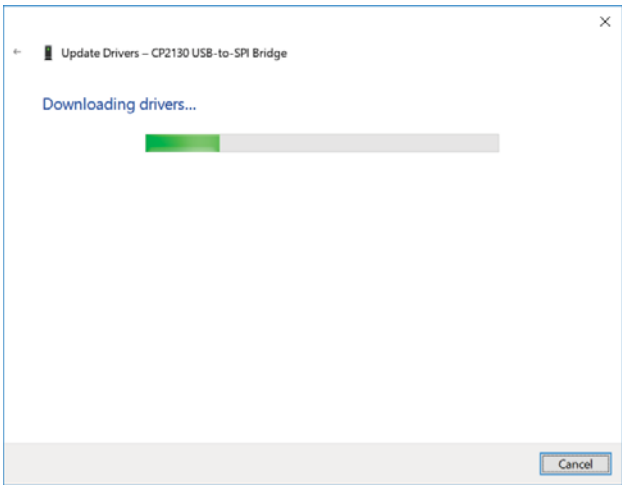
7. In the **Update Drivers** - **CP2130 USB-to-SPI Bridge** window, select **Browse my computer for driver software**.



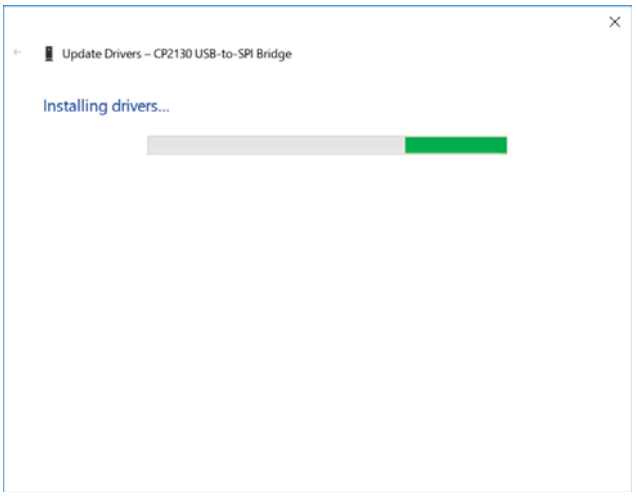
8. Browse to the driver software location on PC, select its folder and click **OK**.



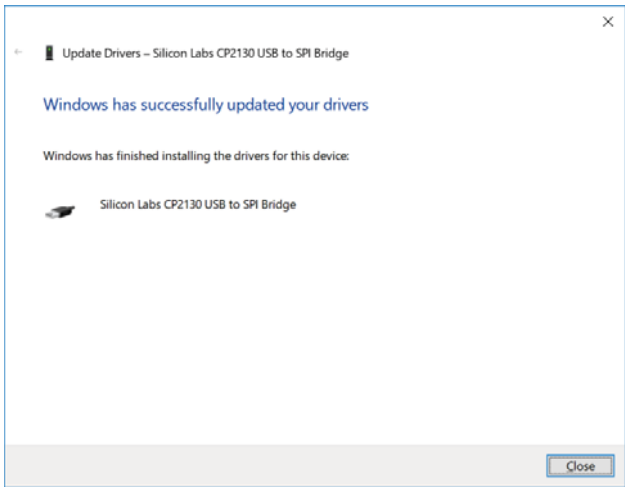
9. Driver download begins.



10. After the download is complete, the driver installation begins.

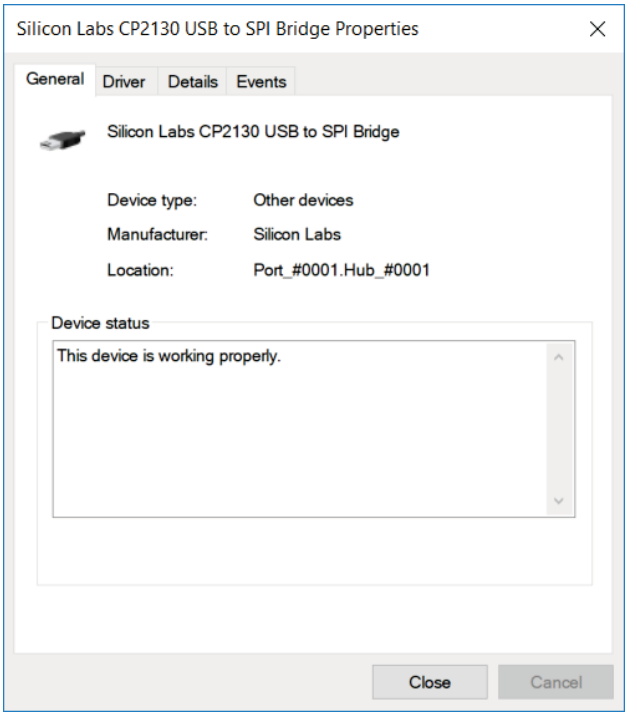


11. After the installation is complete, the following success message is displayed:



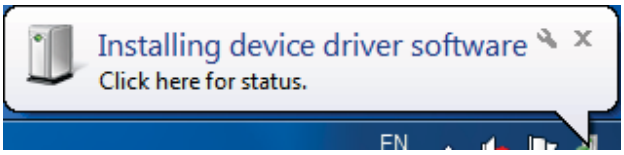
12. Click Close to close the Update Drivers window and to proceed.

13. In the **CP2130 USB-to-SPI Bridge Properties** window the displayed device status should be: **The device is working properly**.



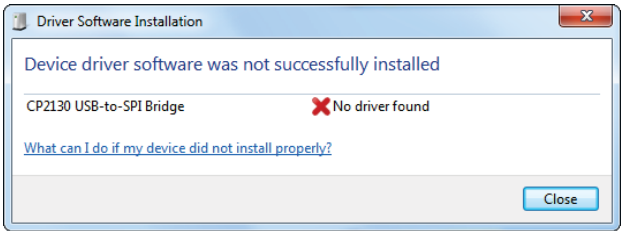
4.1.2 USB Device Driver Manual Installation (Windows 7)

1. Download the latest Lucid series USB device driver from the Tabor Electronics Ltd., website. Device drivers are available at www.taborelec.com/downloads
2. Connect the Lucid Generator to the PC using the supplied USB Cable.

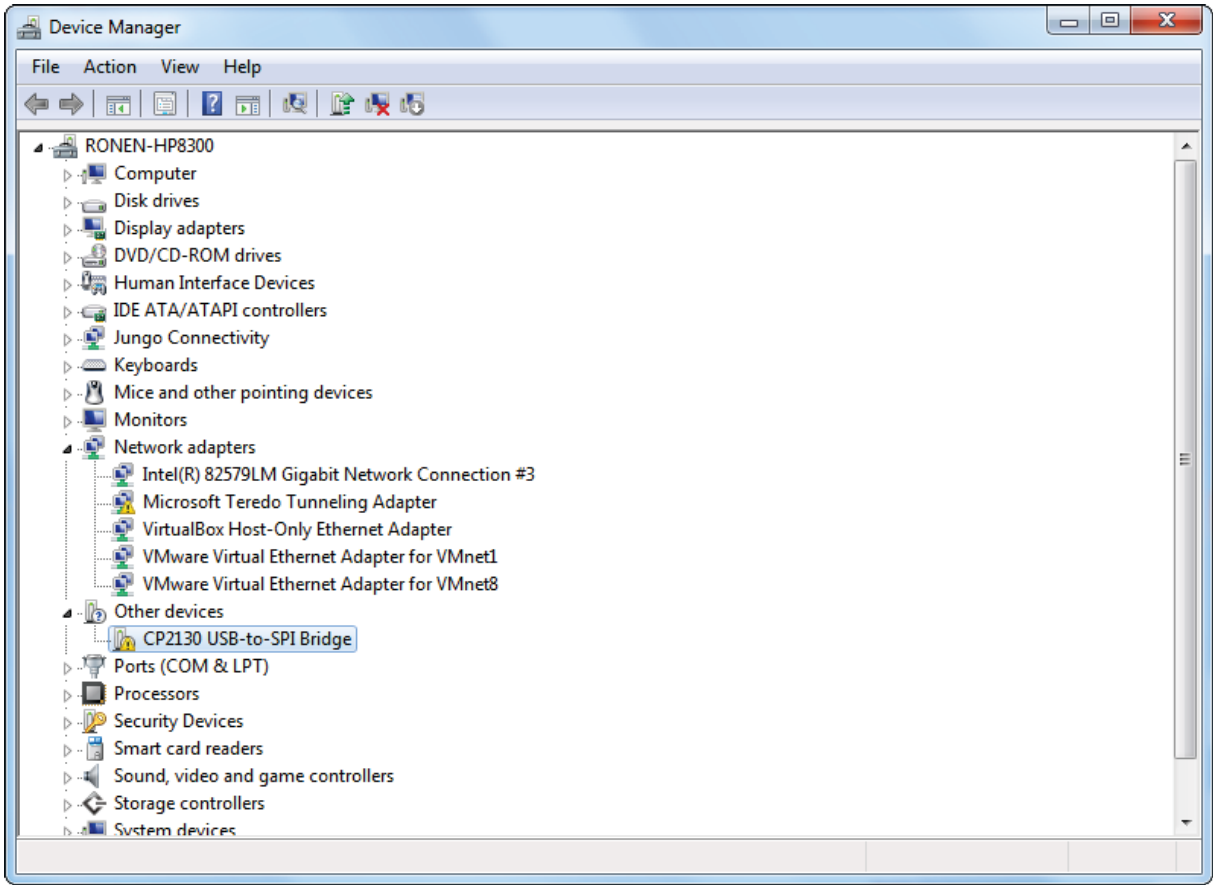


The **Installing Device Driver Software** message is displayed at the lower-right part of the screen.

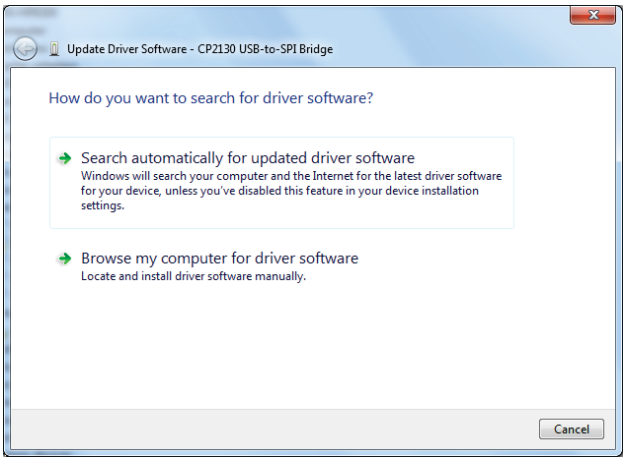
3. Wait for the following messages to appear:



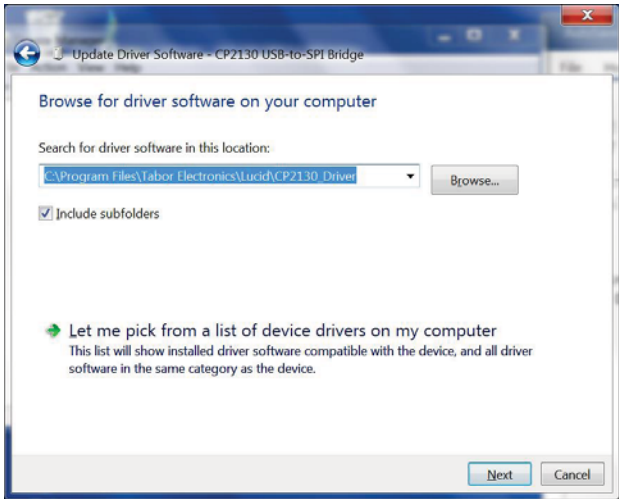
4. Click **Close**.
5. Open the **Start** menu, and in the search field, type **Device Manager**.
6. In the search results list, select **Device Manager**. The **Device Manager** window opens.
7. In the navigation tree, expand **Other devices** and select **CP2130 USB-to-SPI Bridge**.



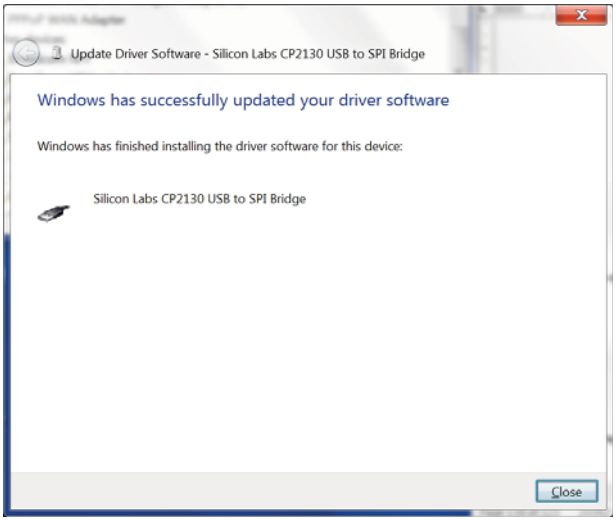
8. In the U**pdate Drivers** - **CP2130 USB-to-SPI Bridge** window, select **Browse my computer for driver software**.



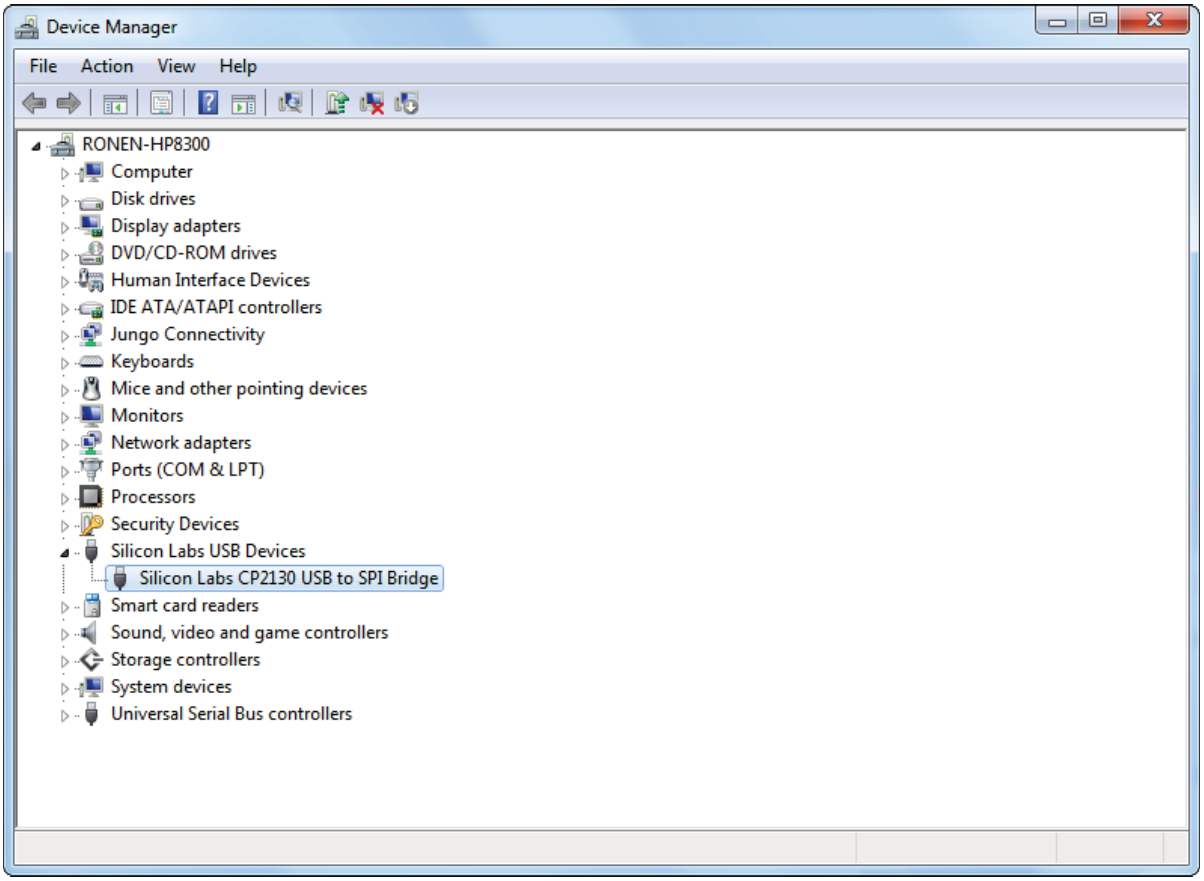
9. Browse to the driver software location on PC, select the folder and click **Next**.
Driver installation begins.



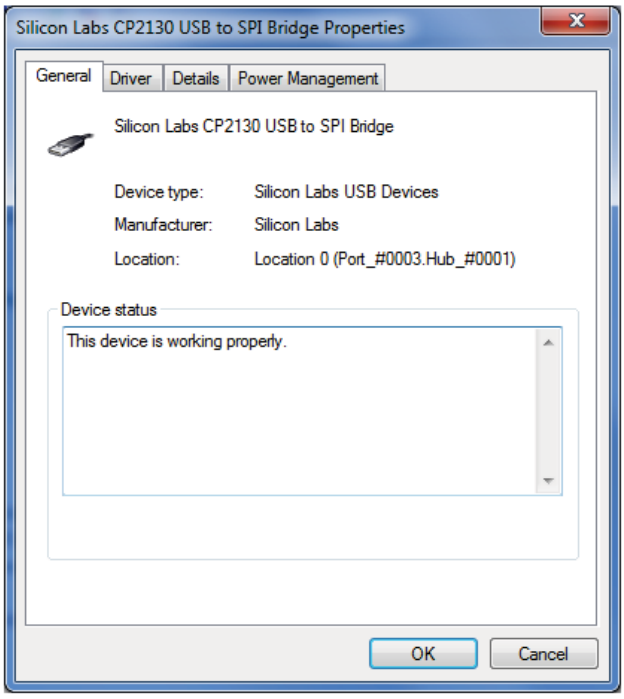
10. After the driver software installation is complete, click **Close**.



11. In the Device Manager, under Silicon Labs USB Devices, click **Silicon Labs CP2130 USB to SPI Bridge**.



12. In the **CP2130 USB-to-SPI Bridge Properties** window the device status should indicate the device is working properly.


Silicon Labs CP2130 USB to SPI Bridge Properties
General
Driver
Details
Power Management
Silicon Labs CP2130 USB to SPI Bridge
Device type:
Silicon Labs USB Devices
Manufacturer:
Silicon Labs
Location:
Location 0 (Port_#0003.Hub_#0001)
Device status
This device is working properly.
OK
Cancel

5 Appendix FPGA Firmware Update

The Lucid series models comes with a powerful FPGA (Field-Programmable Gate Arrays). In order to update the FPGA, you should download the Lucid FW (Firmware) zip file, e.g. “LUCID_FPGA_HWVer_F_FWVer_221220.zip”, and the FPGA update tool “Tabor Electronics Update Tool Setup – x.y.z” from the Tabor Electronics website at http://www.taborelec.com/downloads.

Notes

- The Lucid Control Panel shall be installed before installing the TE Update Tool.
- Verify the HW board version of Lucid, e.g. D, E or F, and download the correct FW version.
- Verify the version of the FPGA firmware installed on the device is older than the version on the Tabor website. Refer to Figure 3.19 System Tab, page 36. The TE Update Tool does also display the FPGA FW version.

5.1 TE Update Tool Installation

1. Locate the “Tabor Electronics Update Tool Setup – x.y.z.exe” installation file on the supplied CD or in the destination folder to which it was downloaded.

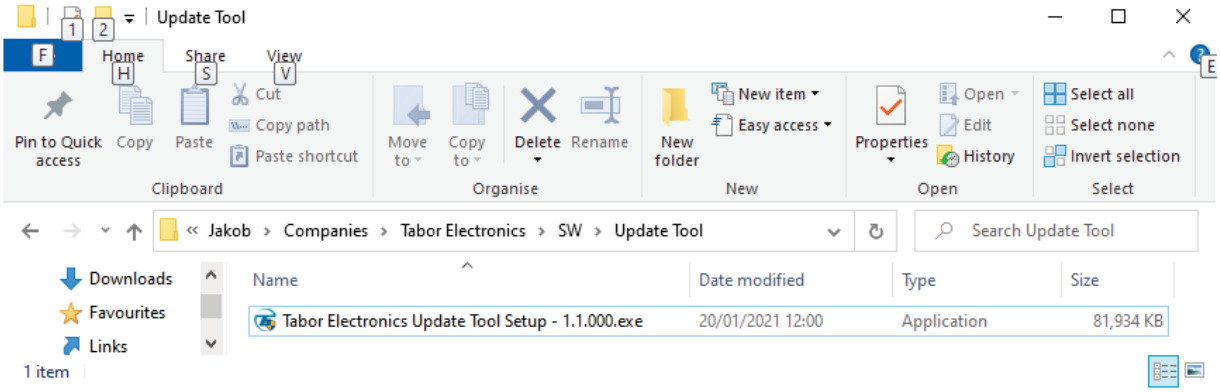


Figure 5.1 TE Update Tool Installation File

2. Double-click the **Tabor Electronics Update Tool Setup – x.y.z.exe** installation file.
3. A windows User Account Control confirmation window is displayed.

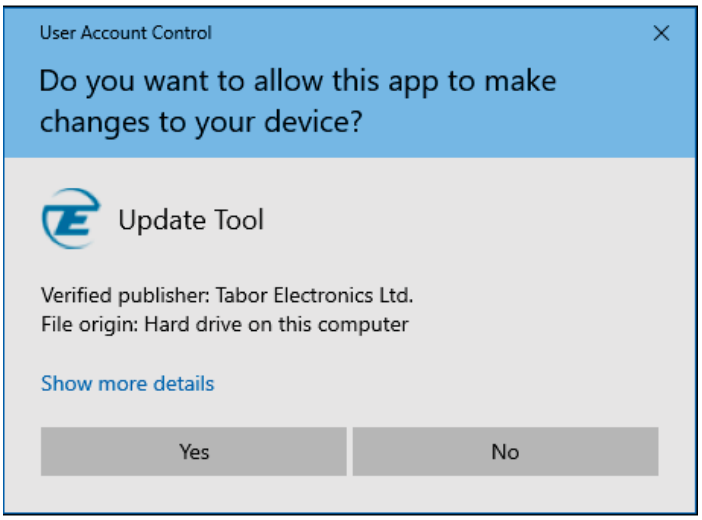


Figure 5.2 User Account Control

4. Click the **YES** button.
5. The welcome screen is displayed.

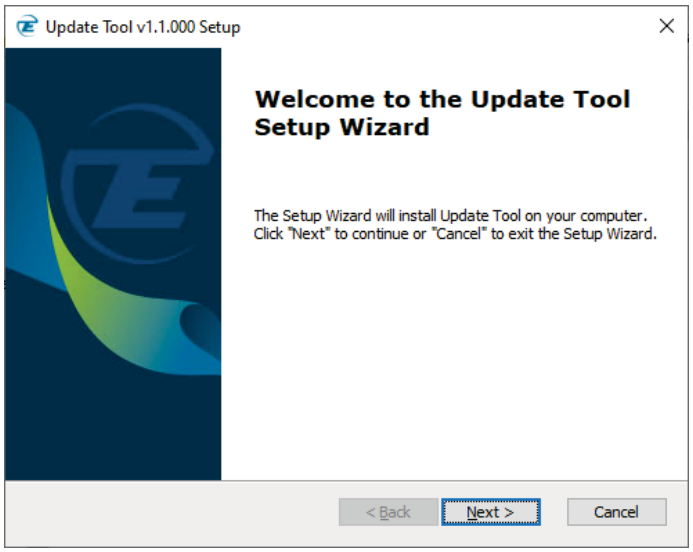


Figure 5.3 Welcome to the Update Tool Setup Wizard

6. Click **Next.**

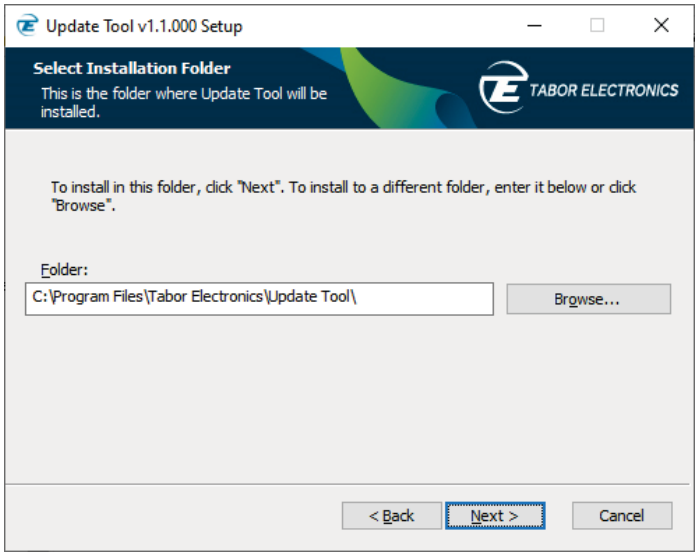


Figure 5.4 Select Installation Folder

7. Enter the destination directory for the **Update Tool** software or browse to a destination directory by clicking the **Browse** button.

8. Click the **Next** button.
   The **Ready to Install** screen is displayed.

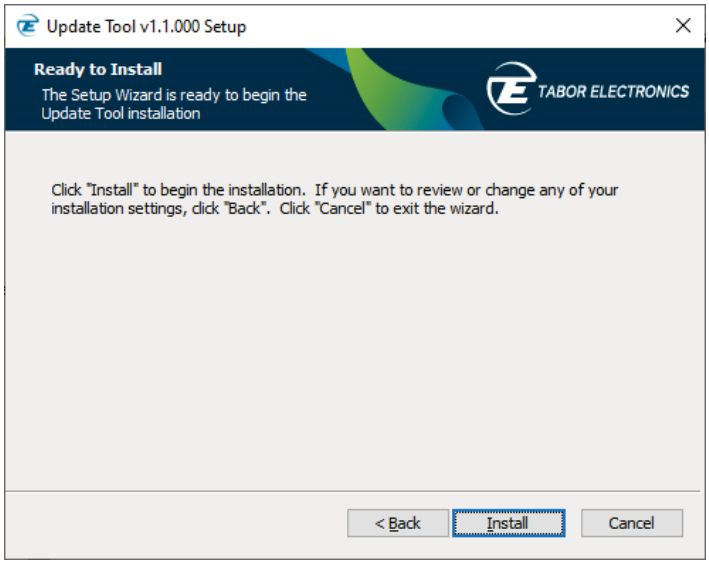


Figure 5.5 Ready to Install

9. Click the **Install** button.

10. The **Update Tool** software installation starts.

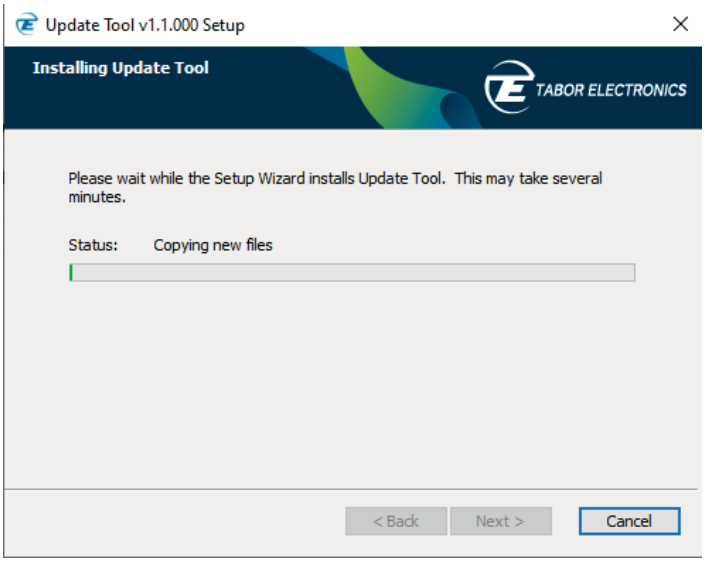


Figure 5.6 Installing Update Tool

11. Wait for the installation process to complete.
    The **Installation Complete** window is displayed.

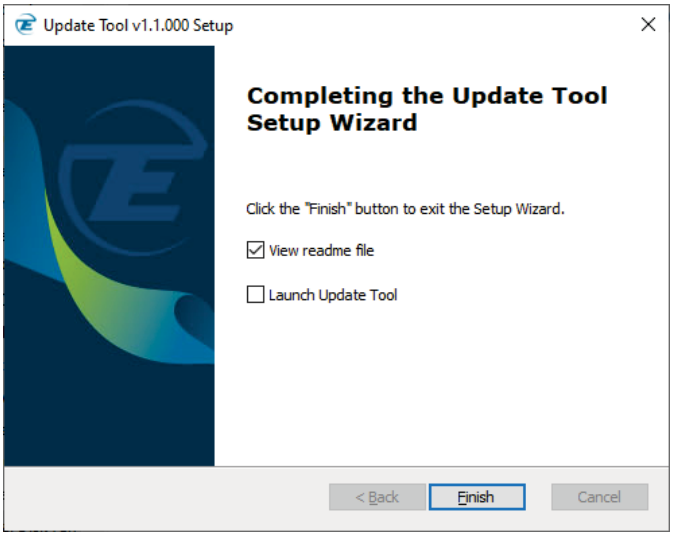


Figure 5.7 Completing the Update Tool Setup Wizard

12. Click the **Finish** button to finish the software installation process.

5.2 TE Update Tool

Double-click the TE Update Tool shortcut on the desktop .

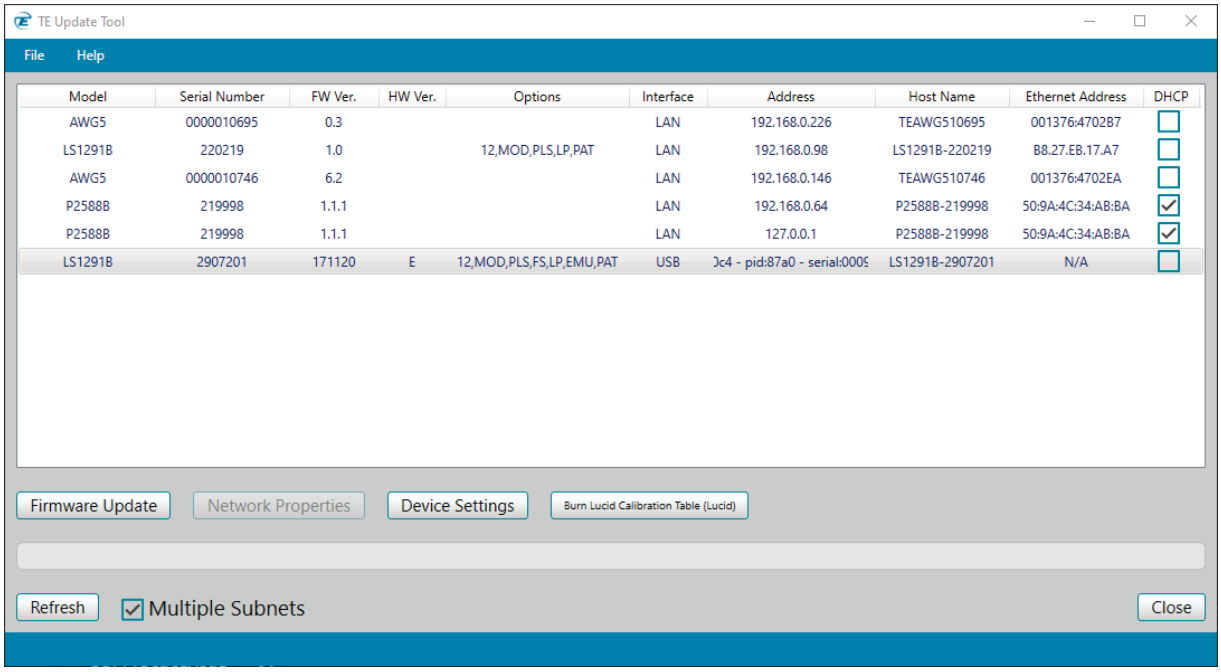


Figure 5.8 TE Update Tool

- **File** –Click the button to display a drop list.
  - **Open Connection** – Enter the IP address of the device you want to update.

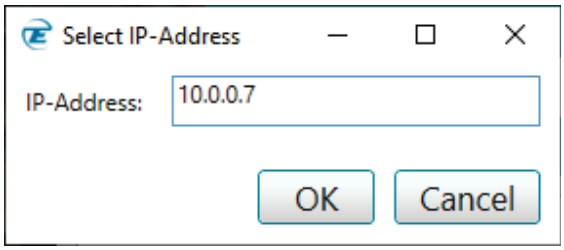


Figure 5.9 Select the IP-Address

  - **Exit** – Exit the TE Update Tool.
- **Help** – Click the button to display a drop list.
  - **About** – Display the application version.

Figure 5.10 About TE Update Tool

- **Model** – The ordering model name.
- **Serial Number** – The serial number of the generator.
- **FW Ver.** – The FPGA firmware version.
- **HW Ver**. – The device hardware board version.
- **Options** – The options available in the generator.
- **Interface** – active communication interface.
  - USB
  - HID TBD (Lucid Benchtop only, no support for updating the FPGA via HID/USB)
  - LAN
- **Address** – IP or USB physical address. For USB, the following parameters are displayed:
  - **vid** – vendor ID.
  - **pid** – product ID.
  - **serial** – a unique serial string programmed at the factory and used to distinguish between devices.
- **Host Name** – The model name and serial number. For older Tabor devices such as WW, WX, SE it is the "model name – 47" + last 4 digits of the serial number in HEX.
- **Ethernet Address** – The device MAC address.
- **DHCP** – Dynamic Host Configuration Protocol.
  - **Fixed** – Define a static IP Address. Verify that the PC running Lucid software is on the same network (default).
  - **Dynamic** – Get an IP address from the DHCP server. The IP Address, Port and Subnet Mask fields are not accessible.
- **Firmware Update** – Click the button to update the selected device's FPGA firmware.

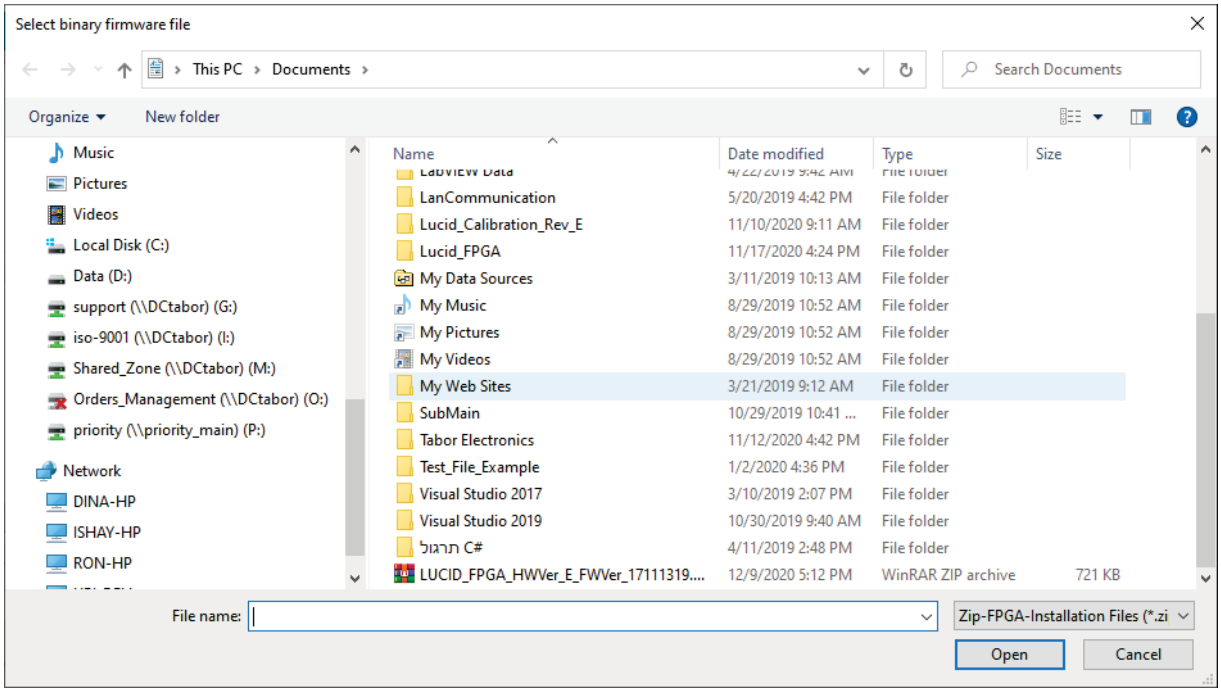


Figure 5.11 Select Binary Firmware File

- **Network Properties** – Click the button to change selected device's IP parameters.

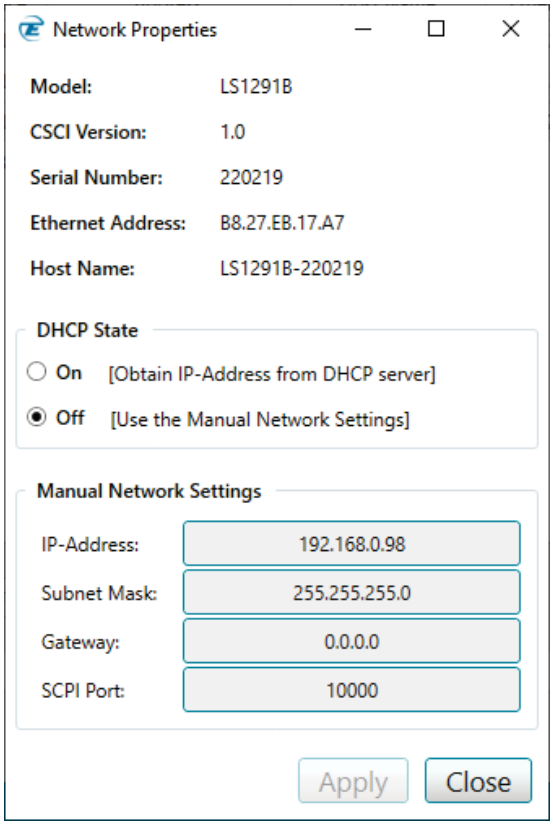


Figure 5.12 Network Properties

- **Refresh** – Click the button to update the display for all connected devices.
- **Multiple Subnets** – Check the box to search for devices in multiple subnets.
- **Close** – Click the button to exit the TE Update Tool.

5.3 Operating Instructions

1. Connect your control PC to the Tabor device using any available LAN, USB or PXI connections.
2. Double-click the TE Update Tool shortcut on the desktop .

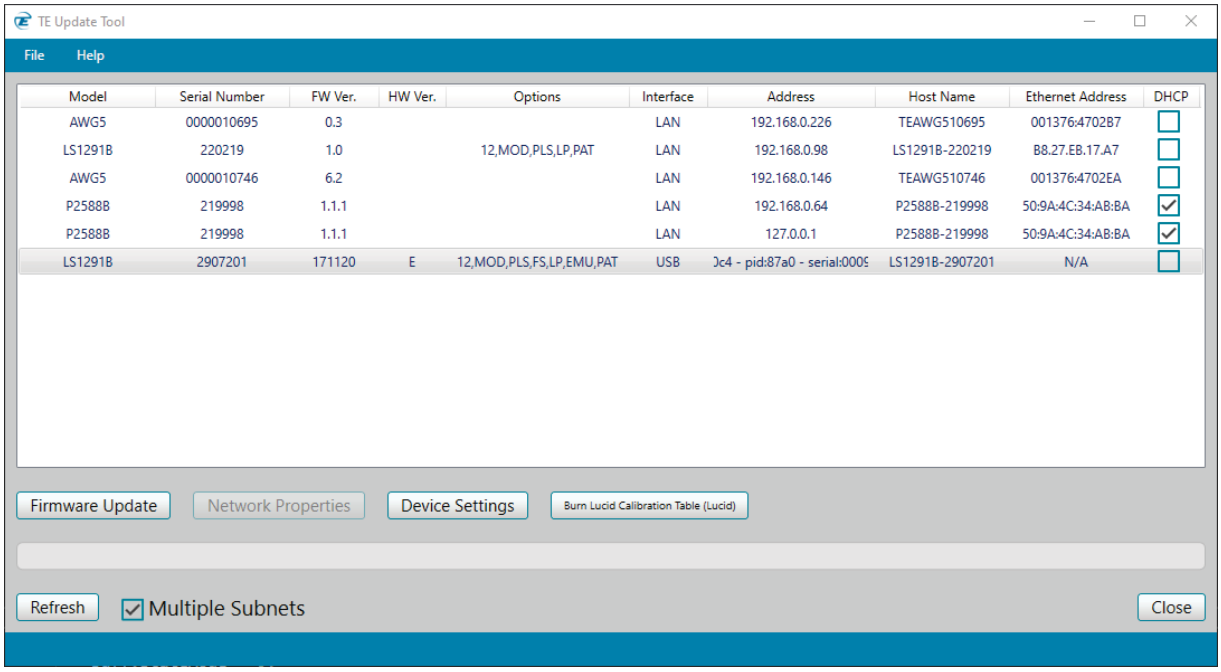


Figure 5.13 TE Update Tool

3. Select the unit and click the **Firmware Update** button.

Notes

- Verify the HW board version of device, e.g. “D”, and download the correct “D” FW version.

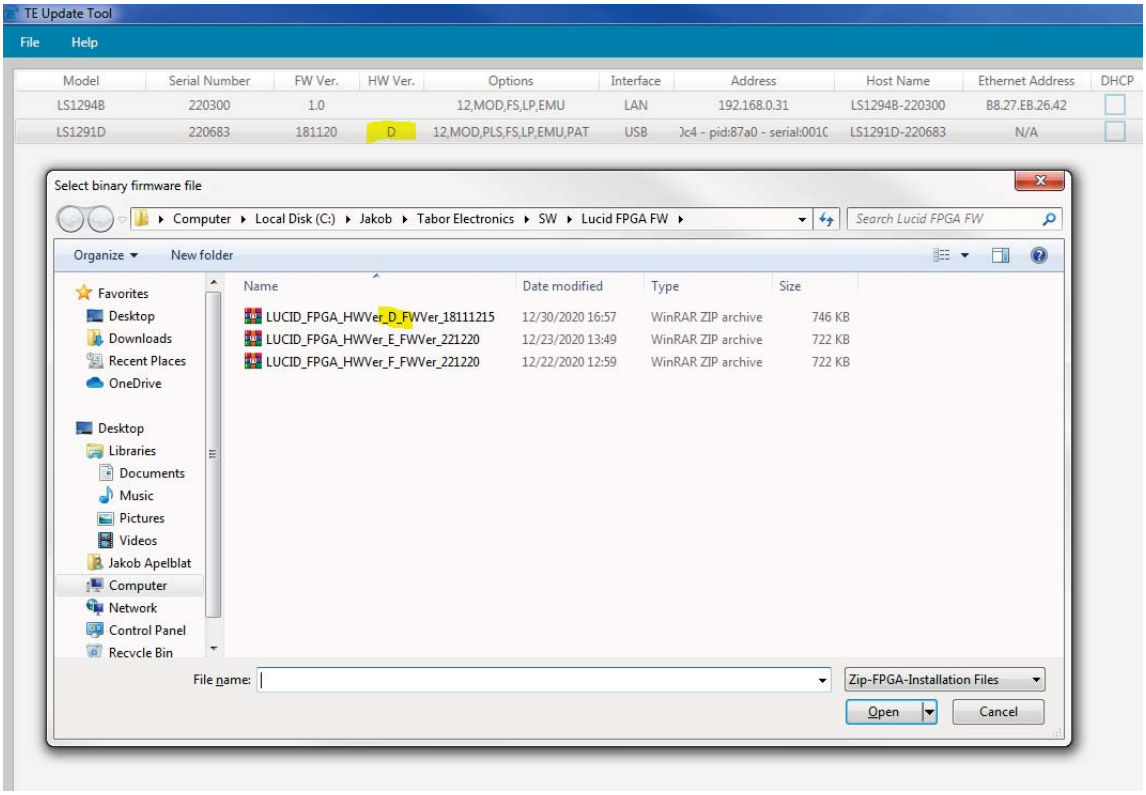


Figure 5.14 Select the FPGA Firmware File

4. Select the applicable zip file according to the HW Ver., and then click **Open.**
5. A warning dialog box will be displayed. Click OK. The update operation will start and it will take several minutes depending on the device interface.

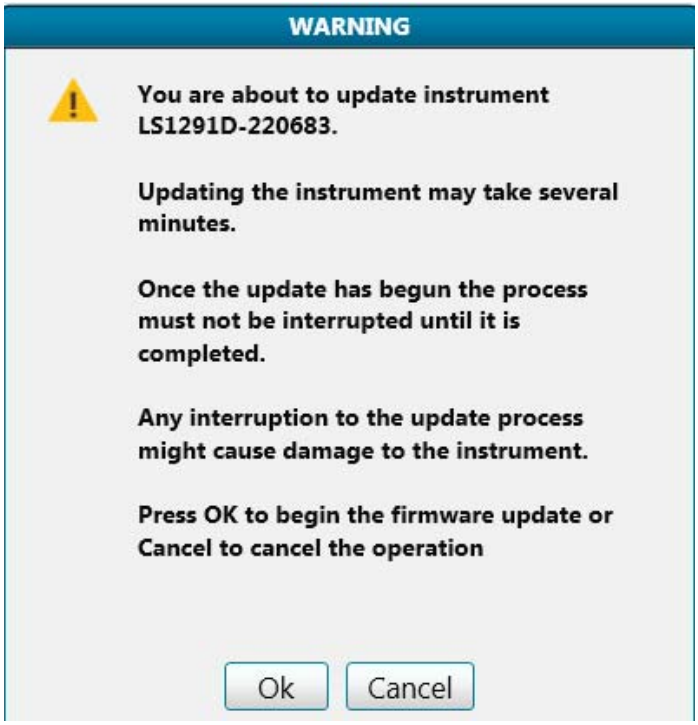


Figure 5.15 Warning

Caution!

- The update operation shall not be interrupted as this will damage the device.

6. The TE Update Tool progress bar will show the update status.

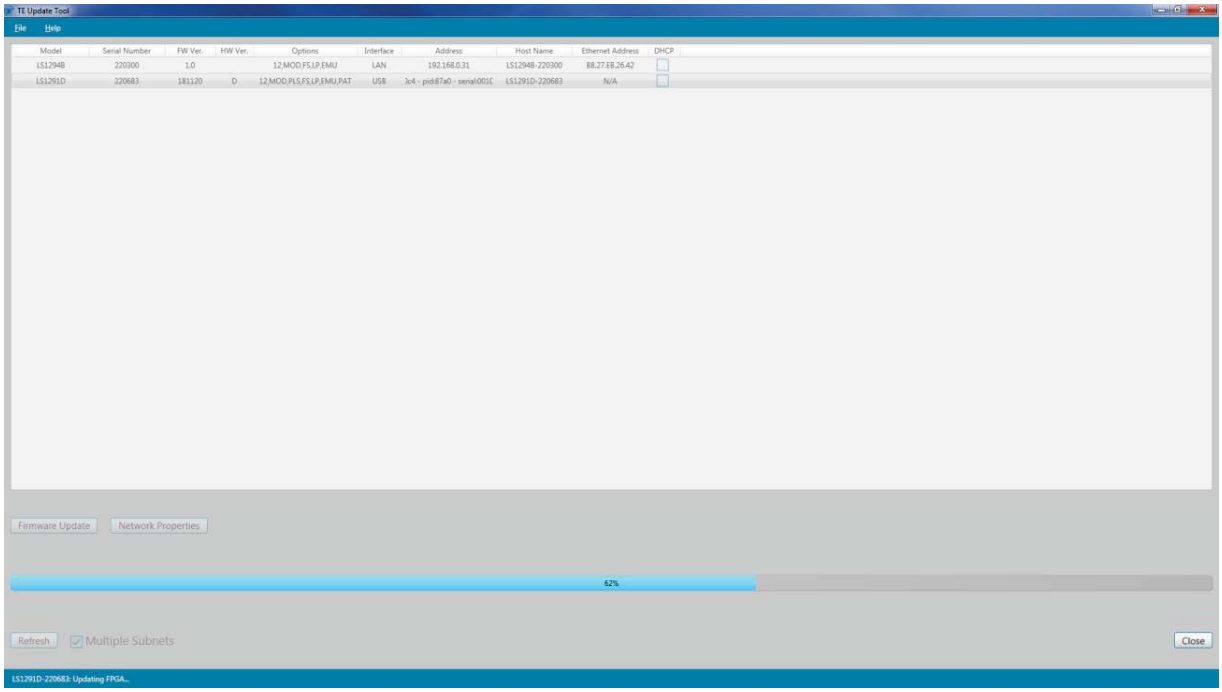


Figure 5.16 Progress Bar

7. When the firmware update has completed the Update Complete message box is displayed. Click **OK**.

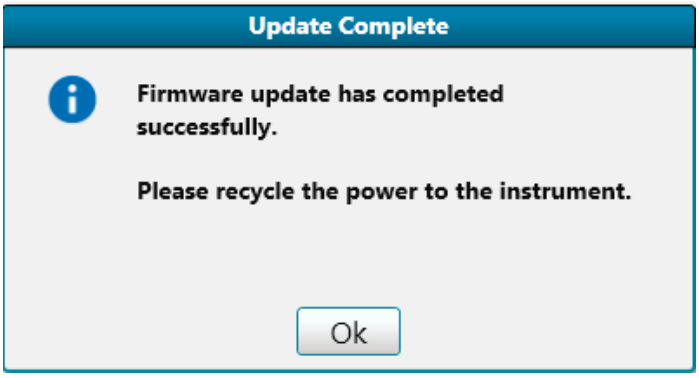


Figure 5.17 Update Complete

8. Power cycle the device.
9. Click the Refresh button on the TE Update Tool to verify that the FPGA firmware has been updated.