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BioLED Light Source Control Module Software User Manual

Version: 1.1.2

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Relevant Products

Part Numbers
BLS-XX02/04-U/S
BLS-PL02-U/S, BLS-PL04-U/S
BLS-IO04-U/S

Rev History

Revision	Date	Author	Description
1.0.0	Dec. 08, 2011	William Dai	Initial Revision
1.0.1	Feb. 03, 2012	William Dai	Clarify IntelliPulsing rules.
1.0.2	Apr. 23, 2014	William Dai	Enable Current control by sliding bar at follower mode.
1.0.3	Nov.3rd,2014	William Dai	Add Support for new BLS-PL, BLS-IO device working in Polygon Mode.
1.0.4	Jan.20th,2016	William	Add Support for device system functions.
1.1.0	Dec.5th,2017	WD	BioLED application and Polylite application changes reflected.
1.1.1	Feb,18th,2019	WD	Add Labview sample code.
1.1.2	Feb,20th,2021	WD	Modify the set trigger polarity command.

1 Control Module

The BLS Control module provides an USB port and a RS232 port for connecting with the Host (usually a PC). There's a slide switch on the control module's front panel to select between USB or RS232 port.

According to the device module NO (BLS-xx02/04), a module includes 2 or 4 outputs, each output installed with a light head connector and a BNC external trigger-in connector (for BLS-IO device, each output also installed with a digital output BNC connector).

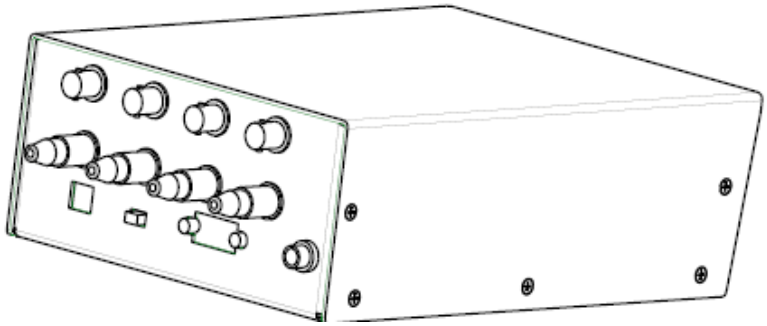


Figure 1.1 BLS Control Module

The rear face plate and front face plate of the control module are as follows:

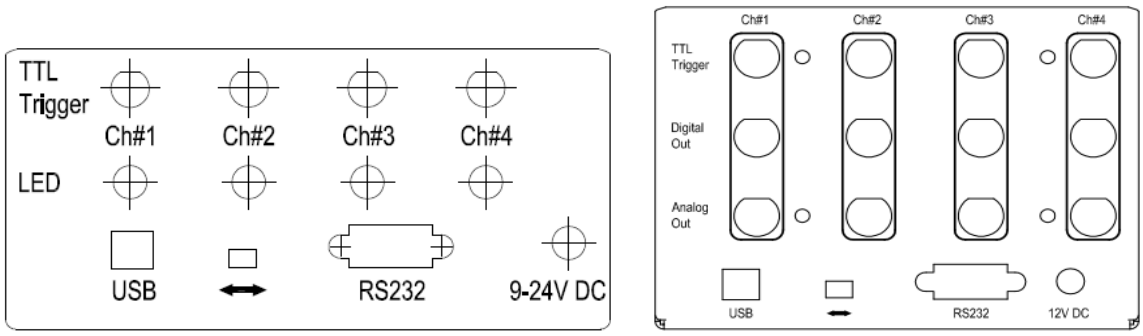


Figure 1.2 Rear face of BLS non-IO module and BLS-IO module

There are four output channels on the back, each with two connectors (three connectors for BLS-IO device). The top row is TTL Trigger connector (BNC), which takes an external input signal and synchronizes it with the light head output. The bottom row is LED connector (Aero connector), which connects to a Mightex light head. For BLS-IO device, there is a middle row, which is digital out.

2 Software Installation

2.1 Minimum Operation System/Hardware requirements

Processor: Pentium III, 900M or above

Operating System: Windows XP/Vista/7

USB 2.0 Host Controller

2.2 CD ROM File Organization

The CD ROM includes the following sub-directories:

\Application

\Documents

\SDK

2.3 Application Installation

Copy all the files under the \Application sub-directory of the CD into a target directory on your local disk, and run the “BioLEDController.exe” file.

3 Getting Started

Before starting the software, make sure the LED light heads are connected to the control module correctly, and the control module is connected to the PC via USB or COM port as selected by the slide switch, and make sure the control module is powered on.

3.1 Start the application

Start the application by running “BioLEDController.exe”. A port selection form will show up. Select the ‘USB’ OR a COMn port and click OK when the module is connected to PC via USB port or a certain RS232 port.

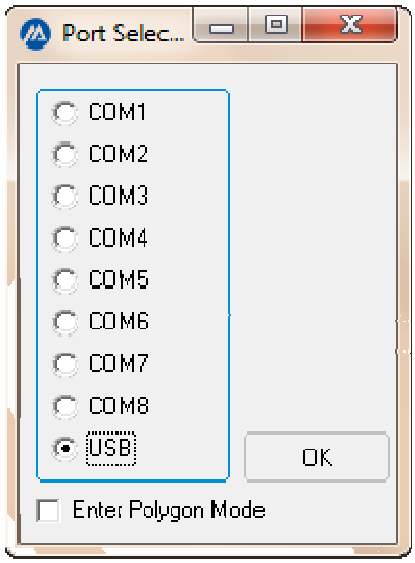


Figure 3.1 port selection window

Click [OK] and the main window will show up,

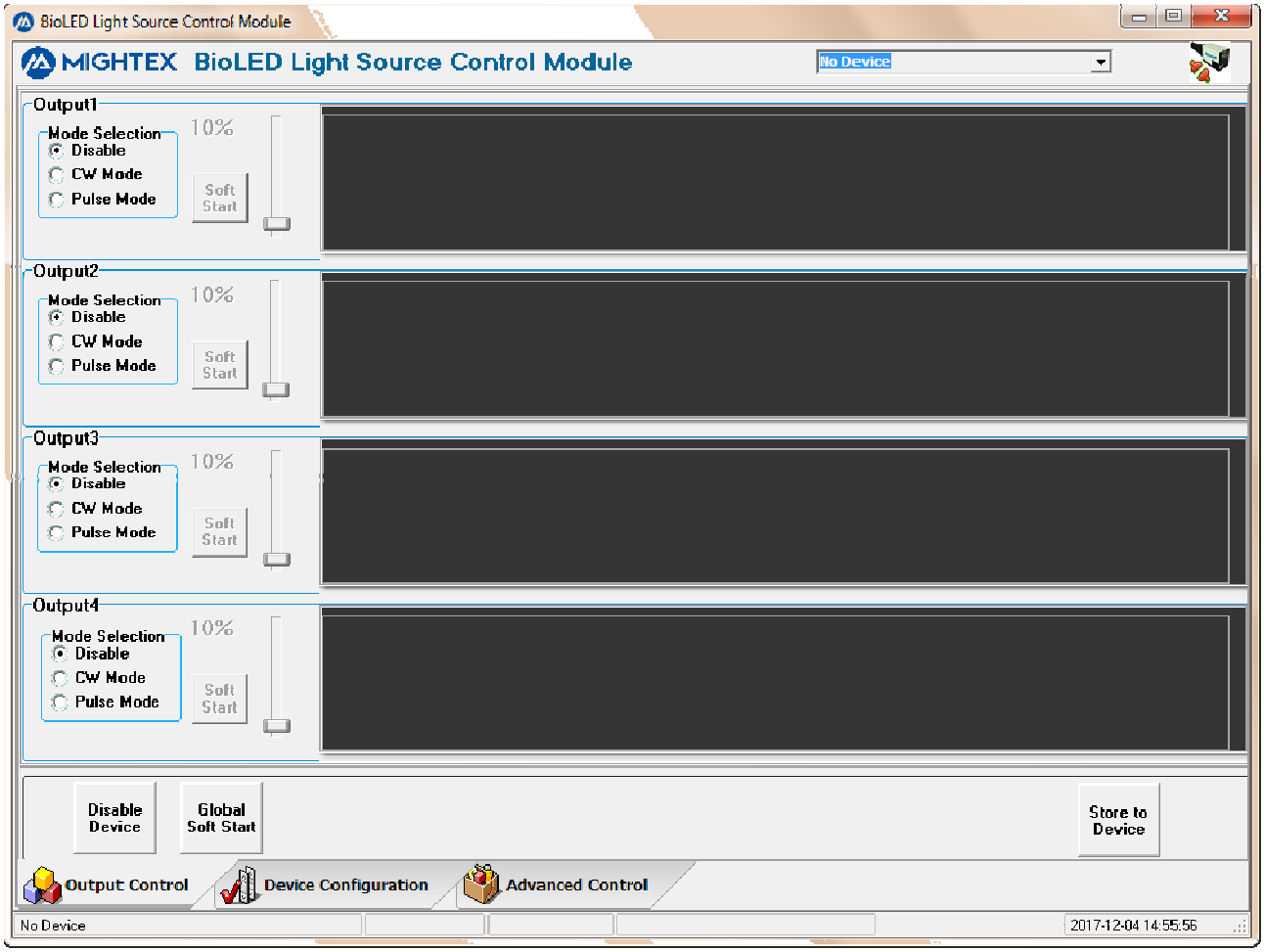


Figure 3.2 Main Operation Window

Select ‘CW Mode’ in the “Mode Selection” box of an output and drag the slide bar to control its output intensity, the connected LED light head will emit light accordingly.

4 Software User's Guide

4.1 Connection Port Selection

After starting the application, a "Port Selection" Window will appear (Figure 3.1), which requires selection of the port through which the control module is connected. The control module can be connected to a PC via a USB port or one of the COMn ports (RS232). When connecting via USB, multiple Control Modules can be connected to a PC; however, when connecting a module with a RS232 port, only one module can be connected.

The check box 

is for BLS-PL/IO device working with Mightex Polygon400 DSI-G/E device. If a BLS-PL/IO device is connected, check this check box will set BLS-PL/IO device in Polygon Mode and open Polygon Mode GUI. For details about operating BLS-PL/IO device in Polygon Mode, please see Appendix A.

4.2 Main Operation Window

The Main Operation Window can be divided into four sections, Figure 4.1.

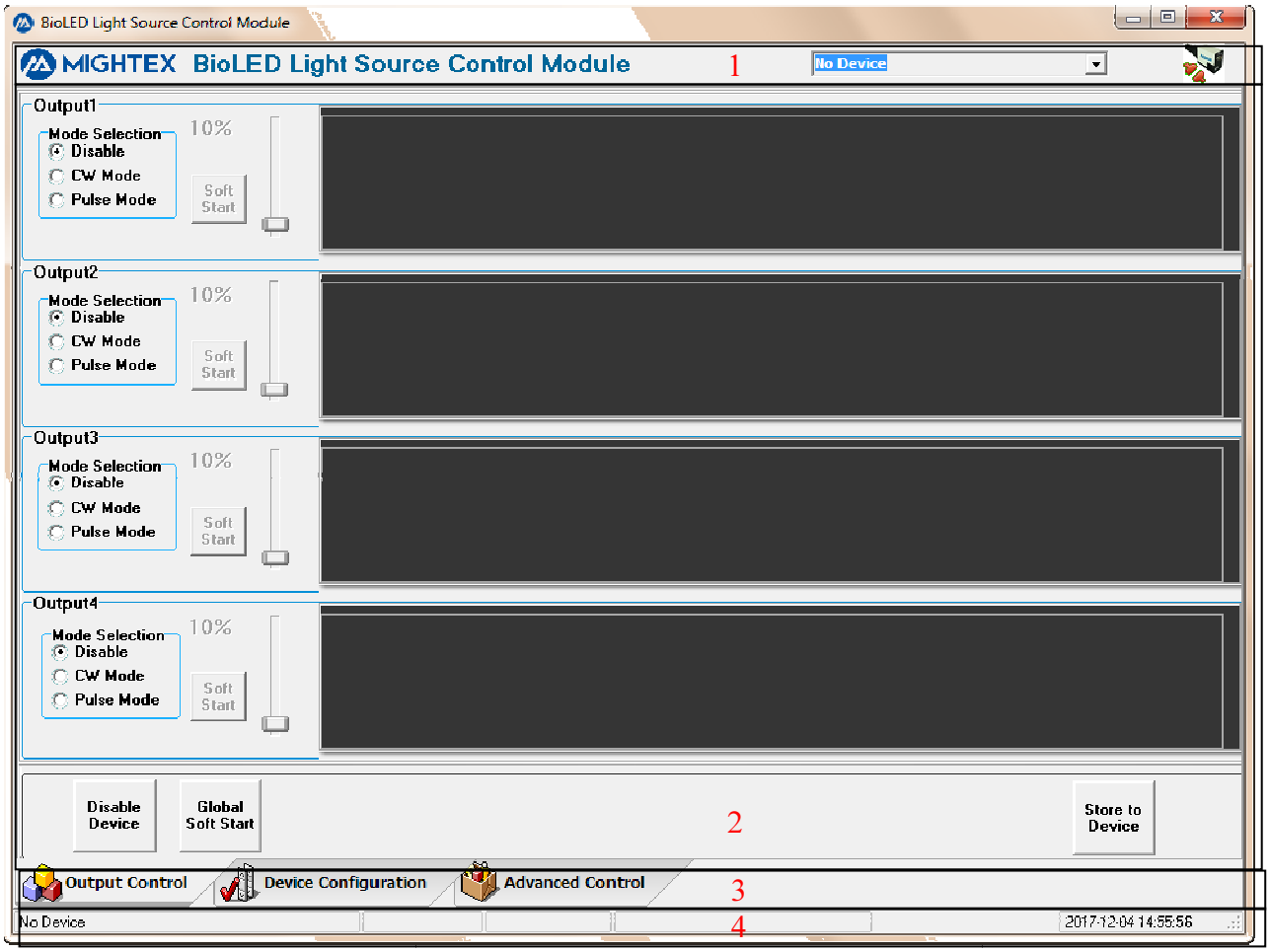


Figure 4.1

1 – Application Title and Device Selection Box: Device Selection Box lists the Module No and Serial No of the currently connected BioLED Control Modules. If more than one BioLED Control Module is connected (via USB), this box can select to which module the settings will be applied.

If a BLS-PL/IO device is selected, the Polygon Mode button  is visible, which when clicked set the device to Polygon Mode and show Polygon Mode operation GUI. For details about operating BLS-PL/IO device in Polygon Mode, please see Appendix A.

2 – Working Area.

3 – Tab Selection: There are 3 tabs on the main operation window:

[Output Controls] is the main tab for controlling the various outputs of the light heads connected to the module. These controls include the working mode, intensity, and pulse profile. The **[Device Configuration]** tab displays the current device configuration information, and also allows the saving and loading of other configuration files. **[Advanced Controls]** is used for firmware upgrading, as well as manually communicating with the module itself (mainly for service purposes.)

4 – Status bar: Shows the selected device's Module No. and Serial No.

4.3 Device Configuration

To view device configuration window, select **[Device Configuration]** tab, and the device configuration window shows up, (Figure 4.2).

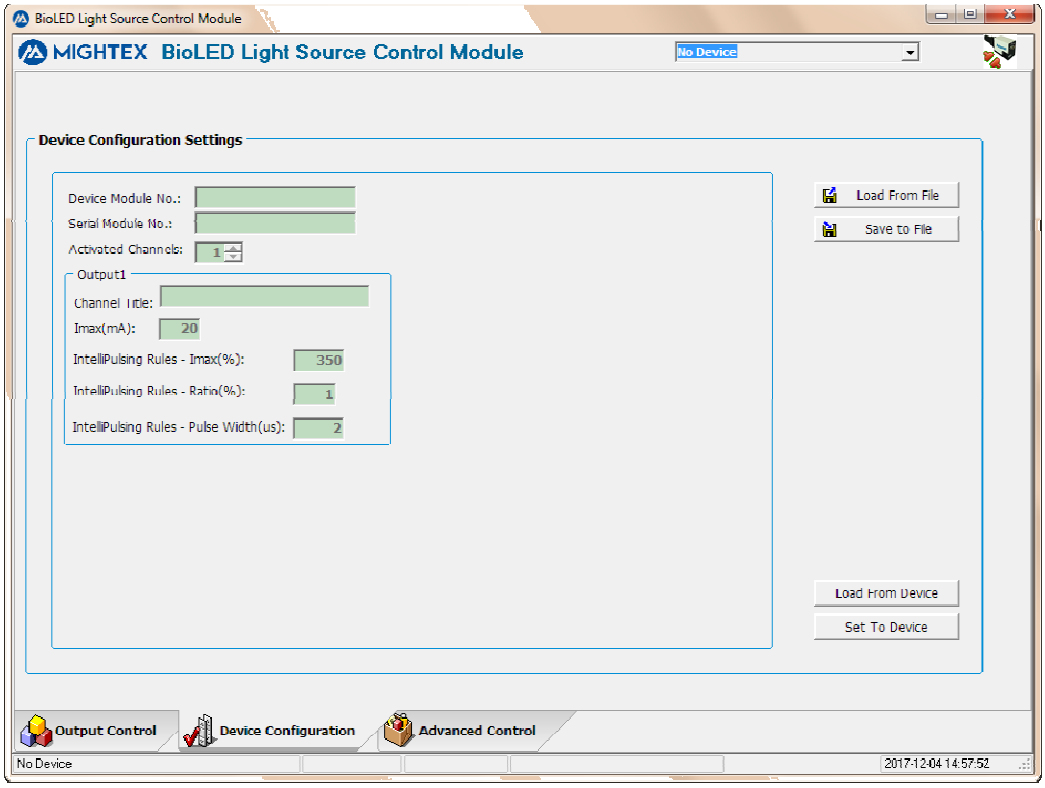


Figure 4.2

Each Control Module is programmed with configurations for the activated outputs at Mightex. These configurations are called "Device Configuration" which will show up in the "Device Configuration" tab. While this information is "read only", it can be modified by loading another configuration file, which can then be applied to the device. The current configuration settings may also be saved to a file. These features can be used when new physical light head connection layout is used and has to have a new device configuration.

For instance, if the control module initially has 2 light heads connected, there are only two outputs (Output1 and Output2) activated in the device configuration, and the data in configuration for each output are set according to the specification of the two particular light heads connected to them. Later on, if another 1 or 2 light heads are added to the control module (as the control module can support 4 outputs at maximum), a new device configuration is required to be loaded to the control module. A new configuration file can be obtained by doing the following (for this instance):

*. Run the application software with the control module connected, and go to the [Device Configuration] tab in main window.

*. Click the **[Load From Device]** button. The detailed device configuration of the current selected device will be shown. (Note that if there are only 2 activated outputs, there will only be two outputs (Output1 and Output2) shown in the window.

*. Click the **[Save to File]** button to save the current device configuration to a file.

*. E-mail the saved device configuration file back to Mightex Systems.

*. Mightex Systems will build a new device configuration (according to the new light heads configuration), generate a new device configuration file, and send it back.

*. Run the application software with device connected, and go [Device Configuration] tab.

*. Click the **[Load From File]** button to load the device configuration from file (the new file sent from Mightex).

*. Click the **[Set to Device]** button to load the new device configuration to device. This will cause the software to check if the connected control module matches with the device configuration file, as the file contains the module no. and serial no. of the device to which it will apply.

4.3.1 Output Configuration Data

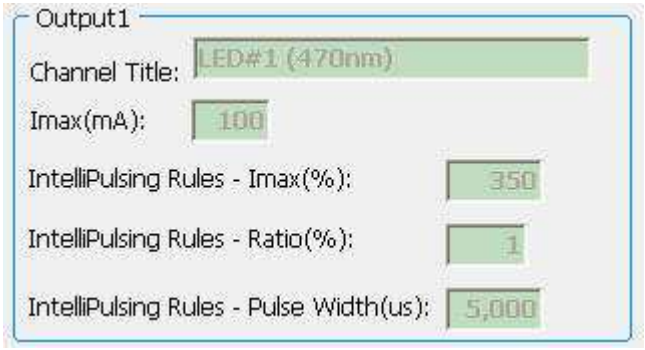


Figure 4.4

For each output, the device configuration includes the following items: (**"Read Only"** to users)

Channel Title: This is the title of the output.

Imax(mA): The maximum current of the light head that is connected to this output.

IntelliPulsing Rules - Imax(%): When in pulse mode, if **IntelliPulsing** is enabled, this parameter sets the maximum current, I21 that can be applied to the light head. For example, when it is 200, it means 200% of the specified maximum current of the light head can be applied in pulse mode.

IntelliPulsing Rules - Ratio(%): When in pulse mode, if **IntelliPulsing** is enabled, this parameter defines the maximum duty cycle. In **IntelliPulsing** mode, the output intensity may exceed the specified maximum limit. However, the ratio of "On to Off" time must be limited to prevent damage to the light head.

IntelliPulsing Rules - Pulse Width (µs): In pulse mode, if **IntelliPulsing** is enabled, this parameter defines the maximum absolute pulse width, t2.

Important Notes:

1) ***IntelliPulsing*** *is a LED driving technology introduced by Mightex, which is used to effectively protect the LED light head when applying larger than maximum current over the LED light head specification.* ***When IntelliPulsing is enabled, and if I2 is larger than 100%, the applied current and timing should adhere to the following constraints:***

a) T1, T2, T3 must be larger than 0.

b) I2 must be larger than I1, I3.

c) I2 must not be larger than ***IntelliPulsing Rules - Imax(%).***

d) I1 and I3 must not be larger than 10%. Of Imax

e) T2 must not longer than ***Pulse Width(us).***

f) The duty ratio defined by T2/(T1+T2+T3) must not be larger than ***Ratio(%).***

Rules (a) and (b) are generic rules for all pulse definitions, including non IntelliPulsing pulses. (c) to (f) are for IntelliPulsing pulse only.

2) For definition of I1, I2, I3 and t1, t2 and t3, see Figure 4.13.

*3) When **IntelliPulsing** (**Intelligent Pulsing**) is enabled, the channel can be programmed to output a larger than* **Imax(mA)** *to the light head. Then maximum output current with IntelliPulsing is defined by **IntelliPulsing Rules – Imax**.*

The limitation is the time elapse of output current is short which defined by **IntelliPulsing Rules - Pulse Width (µs).** And the pulse duty ratio should not be larger than **IntelliPulsing Rules - Ratio(%).**

4) For BLS-IO device, the items **Imax(mA), IntelliPulsing Rules - Imax(%), IntelliPulsing Rules - Ratio(%) and IntelliPulsing Rules - Pulse Width** *are not adaptable and thus are not visible.*

4.4 Advanced Control

The **[Advanced Controls]** tab includes firmware upgrade tools and a command/response interface, the latter is mainly for technical service purposes.

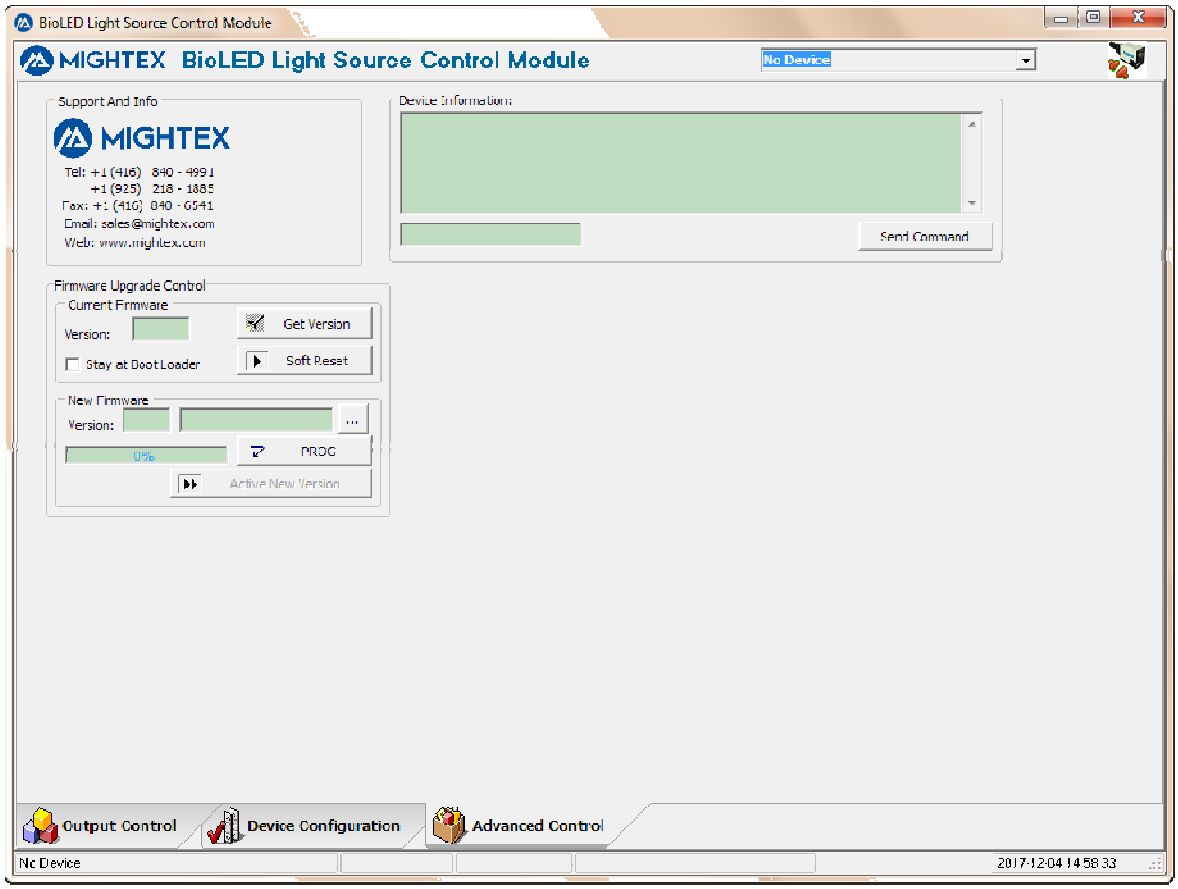


Figure 4.5 Advanced Control

By clicking the **[Get Version]** button, the firmware version of the current control module is displayed.

4.4.1 Firmware Upgrade

When there is a new firmware of the BLS control module available, it can be downloaded to the control module using the following steps:

Step 1: Check the "Stay at Boot Loader" checkbox and click the **[Soft Reset]** button to let the device be prepared for firmware upgrade.

Step 2: Click the **[...]** button. A dialog pops up requesting the downloaded firmware file (*.bin file). The downloaded firmware version will be shown in the version box.

Step 3: Click the **[PROG]** button. New firmware will be loaded into the device and the progress bar will show the current writing progress. This procedure will take some time. Continue once the progress bar has reached 100%.

Step 4: After the firmware is successfully written, a dialog stating “Firmware download complete! “ shows up and the **[Active New Version]** button will be enabled.

Step 5: Click the **[Active New Firmware]** button to activate the new firmware, **OR** power cycle the module to restart the device, which will start the device with the new firmware.

4.5 Output Controls

The main features of the BLS control module are provided within the **[Output Controls]** tab, in which the output controls are implemented. Figure 4.6 shows the control window of a certain output.

Figure 4.6 Output Control

In each Output Control section there are four items.

Mode Selection group box: Select Channel working mode.

Soft Start button: When channel is in Pulse Mode, click this button simulate an incoming trigger and output the predefined pulse form.

Current Control Sliding bar: This is to set the out current when device is in CW Mode, or set the I_ON current when device is in pulse follower mode.

Graphic Chart: Displays current channel pulse forms.

4.5.1 Working Mode

Each output can be set to one of three working modes.

[Disable]: The output is completely turned off.

[CW Mode]: The output delivers constant intensity which can be set from 0.0% to 100.0% with the vertical slider bar.

[Pulse Mode]: The output is turned off until the **[Soft Start]** button is clicked **OR** an external trigger signal occurs on the TTL Trigger pin of this channel. In the latter case, it will deliver a pre-defined Pulse Profile, which includes a repeatable pulse combination. Each pulse combination may have a maximum of 21 pulses.

4.5.1.1 Disable Mode

Selecting **Disable** mode will disable all controls related to this output channel, such as the **[Soft Start]** button, slider bar, and chart.

4.5.1.2 CW Mode

Selecting **CW Mode** will set the output to a constant intensity and the vertical slide bar will be activated, as seen in Figure 4.7.

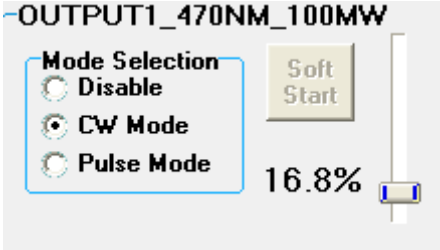


Figure 4.7 CW Mode

The slide bar can be used to change the output constant intensity level, from 0.0% to 100.0%.

4.5.1.3 Pulse Mode

Selecting **Pulse Mode** will set the output to pulse mode, activate the **[Soft Start]** button, and enable the pulse chart as seen in Figure 4.8. The pulse chart will show current defined pulse form of current channel.

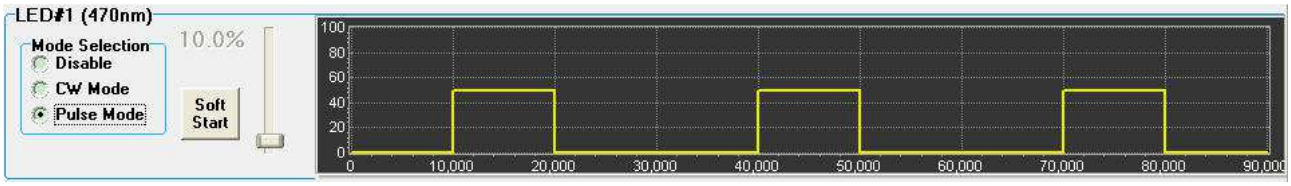


Figure 4.8 Pulse Mode, External trigger without **IntelliPulsing**.

Double-clicking any area on the graphic chart, a new window will pop up which allow configure the detail settings of pulse mode.

4.6 Pulse Mode Settings

When the output is set to pulse mode, **double clicking** the chart will pop up a "**Pulse Profile Settings**" window which can be used to set detailed parameters of the pulse mode. See Figure 4.11.

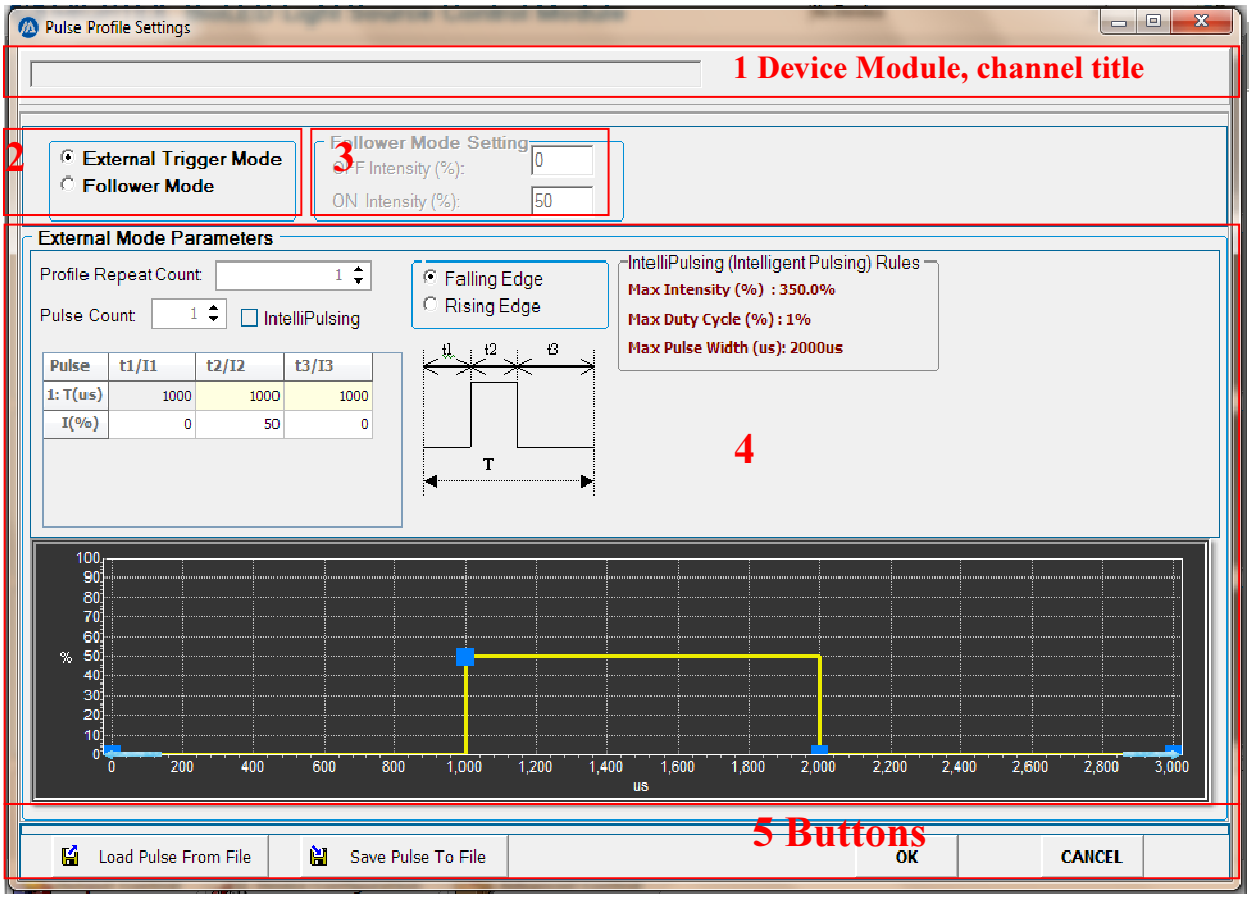


Figure 4.9 Pulse Profile setting window

The **Pulse Profile Setting** window is divided into five function sections.

1 - **Output Title:** Displays the control module's Module No, Serial No and the output title. This field cannot be edited.

2 - **Pulse Mode Selection**: Select External Trigger Mode or Follower Mode for the output.

3 - **Follower Mode Setting:** Set the parameters of the Follower Mode.

4 - **External Mode Setting:** Set the pulse profile of the External Trigger Mode.

5 - **Pulse Profile Setting Buttons:** Provides several buttons for loading and saving the pulse profile from and to the computer, respectively.

4.6.1 Pulse Mode Selection

There are two different working modes when a channel/output is set to “Pulse Mode”:

1) Follower Mode – In this mode, the output timing of current channel is completely following the input of the TTL Trigger Pin and the output intensities can be set for High (H) and Low (L) state. When incoming TTL trigger signal is “H”, the device will output intensity value set by “ON Intensity”. When incoming TTL trigger is “L”, the device will output intensity value set by “OFF Intensity”. Note that when an output is set to this mode, it is initially OFF until a rising edge (“L” to “H”) occurs on the “Trigger In” Pin. After that, the output timing will follow the Trigger In signal, which outputs “On Intensity” when the trigger signal is “H”, and outputs “Off Intensity” when the trigger signal is “L”.

Selecting “**Follower Mode**” in the pulse mode selection box will activate the **“Follower Mode Setting”** box.

In the “**Follower Mode Setting**” box, the intensities can be set for OFF state (when the TTL signal is “L”) and ON state (when the TTL signal is “H”).

When a channel is set to “Follower Mode”, a green text reading **“Follower Mode”** shows up under the “Mode Selection” box, and the chart shows a green wave which marks the two output intensities, as seen in Figure 4.10.

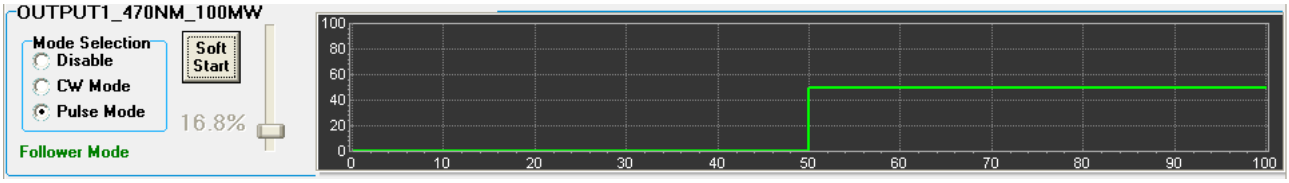


Figure 4.10 Pulse Mode, set in “**Follower Mode**”

The sliding bar can be used to control the ON state intensity when the **pulse follower mode** is select.

2) External Trigger Mode – In this mode, the current channel will output a “Pulse Profile” when an incoming trigger signal is detected or SoftStart is clicked. The “Pulse Profile” contains a repeated pulse combination comprising of pulses. Each pulse combination can have up to 21 pulses and the repeat number can range from 1 to 1000. Each pulse comprises 3 steps, and each step is defined by a time(t)-intensity(I) pair. Thus, a pulse is defined by three pairs (I1/T1, I2/T2, I3/T3). The polarity (falling edge or rising edge) of incoming signal can be selected via polarity group.

In summary, a pulse profile contains the following:

*. Repeat Count of pulse combination, default is “1” which means no repeat.

*. Pulse Count in the pulse combination, default is “1” which means there’s ONE pulse only

*. Step parameters of each pulse, there are 3 pairs of Intensity/Time in a step.

*. Trigger Assertion definition (falling edge or rising edge)

Selecting "External Trigger Mode" in pulse mode selection group will activate the **"External Mode Parameter"** box which can be used to edit the pulse profile, as displayed in Figure 4.11.

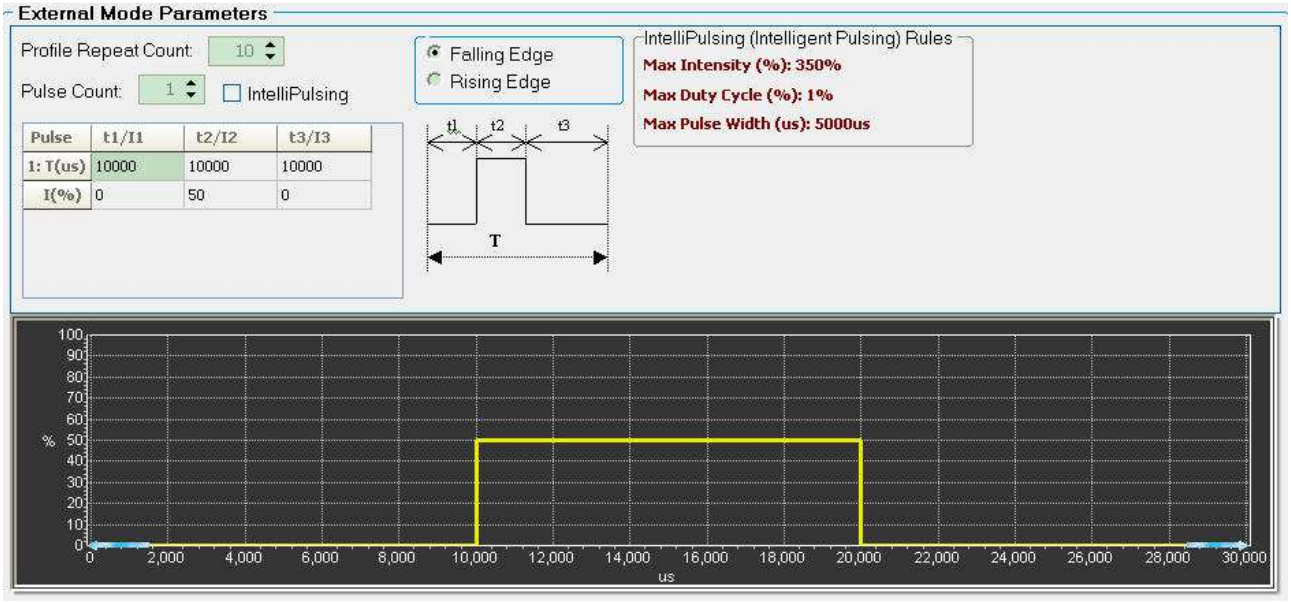


Figure 4.11 External Trigger Parameters Box

The pulse profile is listed both in table and on graphic chart. The basic unit of a pulse profile is a single pulse, comprised of three steps defined by (t1, I1), (t2, I2), and (t3, I3). t1, t2, t3 defines the timing of each step （**t1 > 0; t2 > 0; t3 > 0**）, and I1, I2, I3 (**I2 > I1; I2 > I3**) defines the intensity of each step as in the following figure:

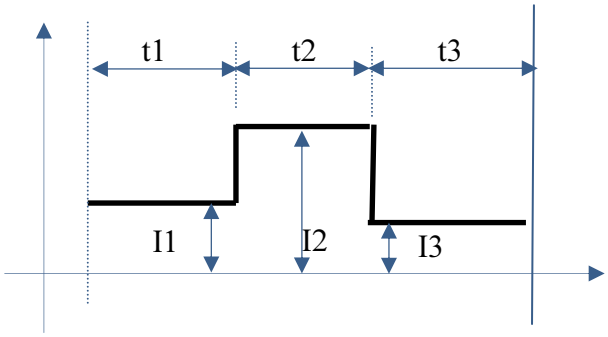


Figure 4.12 Pulse Definition

Pulse width: t2;

Pulse ratio: t2/(t1+t2+t3).

The first column of table lists the pulse profile index, second to four columns lists the three steps of a pulse. And each pulse takes two rows in the table, with first row lists the timing parameters and second row lists the intensity parameters.

The graphic chart shows the pulse combination in graphic mode. The X-axis is defined as time (in μs) and

the Y-axis is defined as intensity (as a percentage of maximum current).

4.6.2 Pulse Editing

Pulses can be edited directly on the table grid. Clicking any cell allows enables editing. Input the desired value and hit the **Enter** key. The newly input value will be accepted and also reflected in the graphic chart.

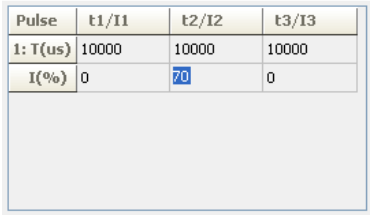


Figure 4.13

OR a pulse can also be edited on the chart graphically with mouse. When the mouse cursor is in the chart, blue squares appear as in Figure 4.15.

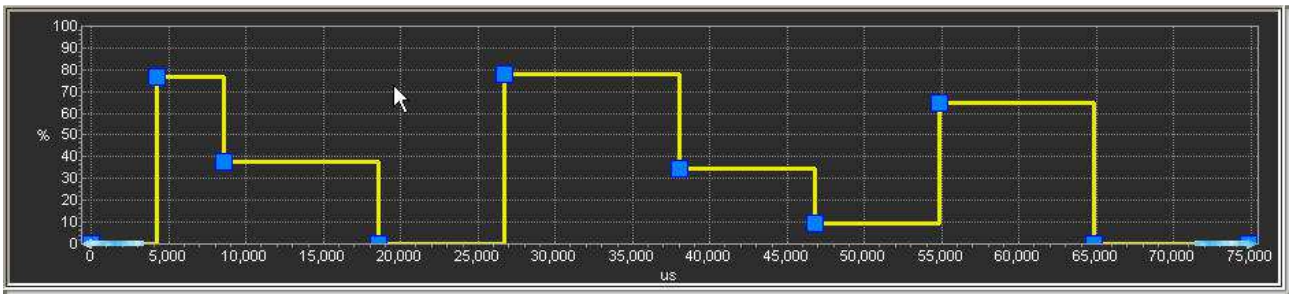


Figure 4.14

Put the mouse cursor on any one of these blue square points and the mouse cursor will change to a hand shape. Drag a blue square to change the pulse parameters. A label will display the current pulse section information, as shown as Figure 4.16.

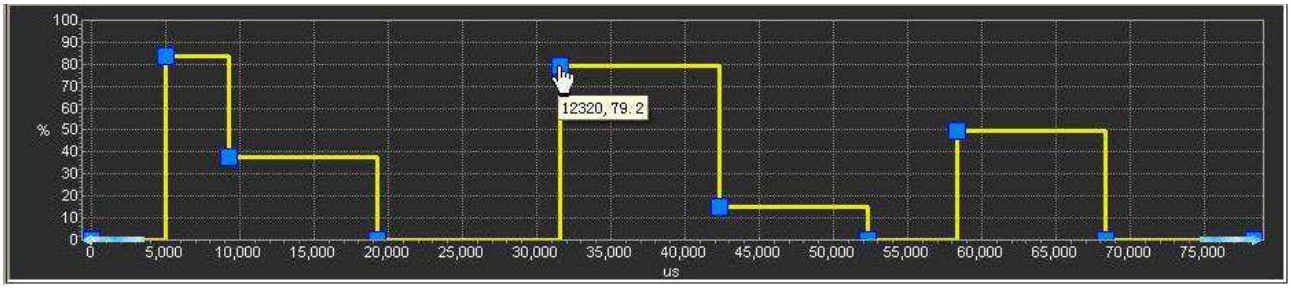


Figure 4.15 Editing the Point

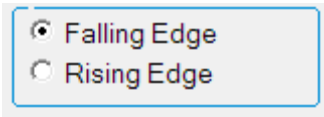
When the mouse cursor drags a blue square, the parameters of the pulse will be changed on both the chart and the table.

Note: There are some constraints when programming the pulse parameters:

1). I2 (Intensity of the second step) must be greater than both I1 and I3 (I2>=I1, I2>=I3).

2). the minimum value and interval of time (T1, T2 and T3) is 20us.

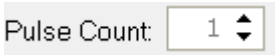
4.6.4 Other pulse mode parameters include:

1) **Input trigger edge selection** 

: "Falling Edge" or "Rising Edge" may be selected as the trigger assertion of the TTL trigger signal.

2) 

: This is the repeat count of the pulse combination.

3) 

: The pulse count defines the pulses in the pulse combination. When a new pulse count is set, the rows in the table grid and the graphic chart will be changed accordingly.

4) 

: Checking this box enables **IntelliPulsing** rules. If **IntelliPulsing** is enabled for the output, a red text reading "**IntelliPulsing Enabled**" will show under the mode selection box. See Figure 4.16 below.

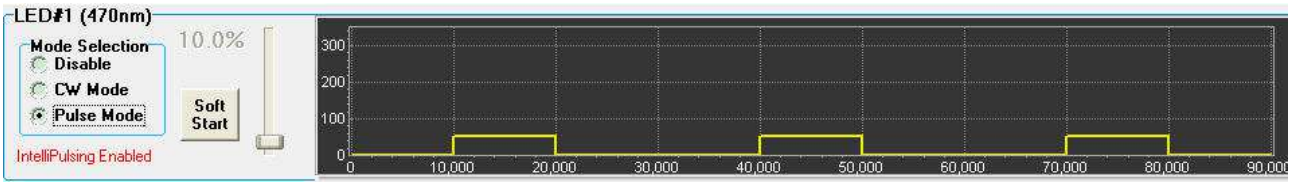


Figure 4.16 Pulse Mode, External trigger with **IntelliPulsing**.

4.6.5 Save/Load Pulse Profile

The current pulse profile can be saved to a file by clicking the **[Save Pulse To File]** button, which opens up a dialog requesting the directory and file name of the file that is being saved.

By clicking the **[Load Pulse Profile]** button, a previously saved pulse profile file can be loaded.

Apply Pulse Profile

An example of an established Pulse Profile is shown in Figure 4.17:

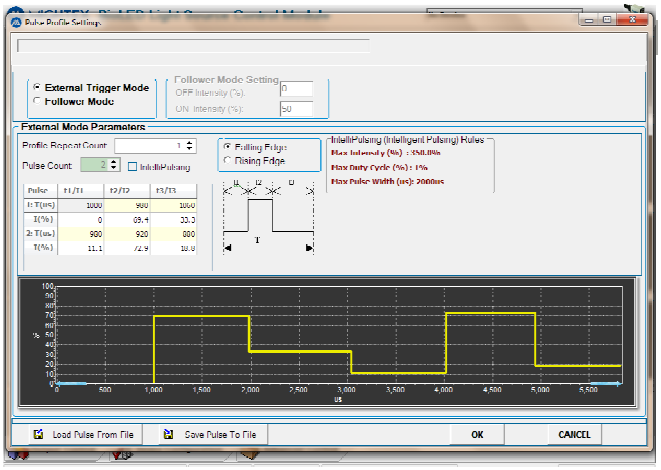


Figure 4.17 the Pulse Profile

*. Click the **[OK]** button to accept the new profile as the pulse profile of the output. It will close the "**Pulse Profile Settings**" window and returns to the main operation window. As shown in the Figure 4.18, the new pulse profile will be displayed on the output chart (in this example, it is Output1).

OR *. Click the **[Cancel]** button to return to main window. This will NOT set the new profile to the output.

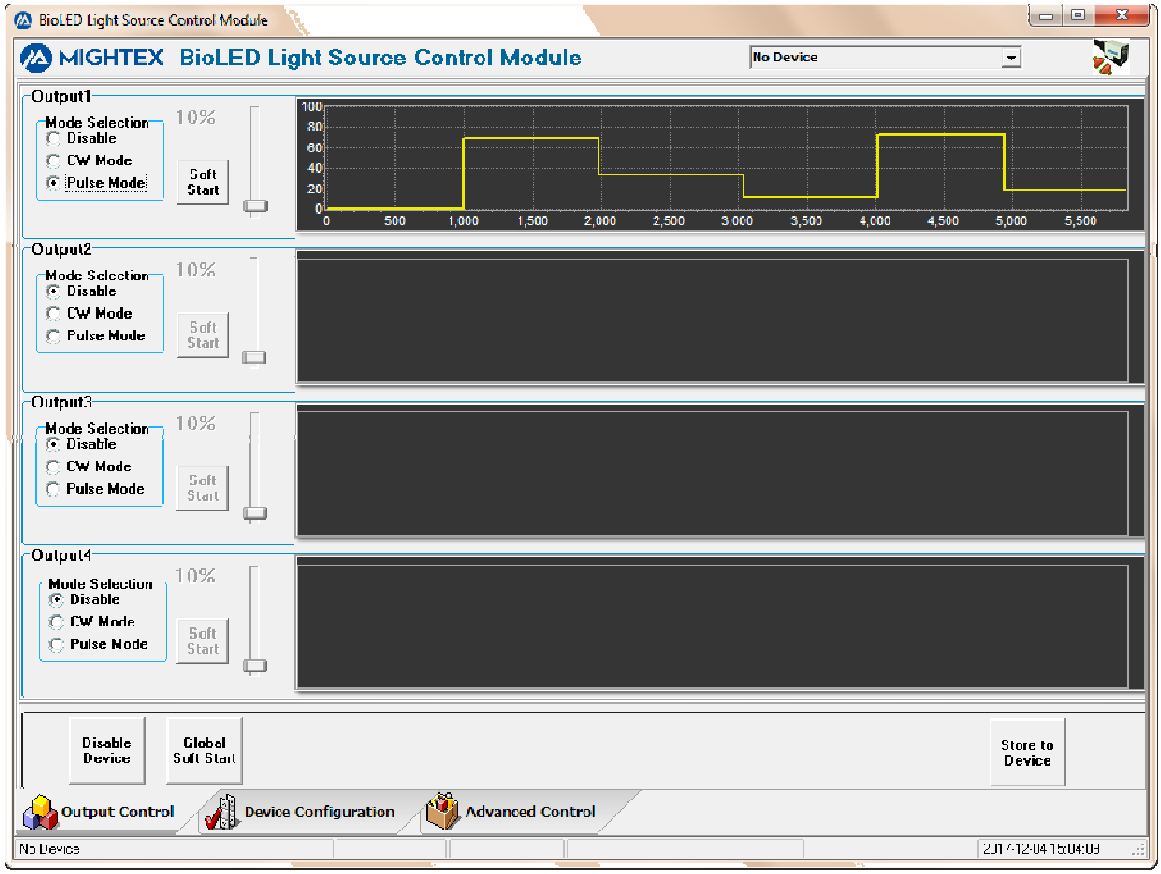


Figure 4.18 The Main Operation Window with new pulse profiled loaded (Output1)

Clicking [OK] will close the "Pulse Profile Settings" window and send the new pulse profile to the control module. However, this new pulse profile will not physically output to the light head until:

1). the output is in "External Trigger Mode", the **[Soft Start]** button of the output is clicked, **OR** there is an assertion (rising or falling edge, defined in the pulse profile) on the Trigger In pin.

Or 2) there is a rising edge (from L to H) on the Trigger-In signal while in "Follow Mode."

4.7 Control buttons

The “Output Controls” tab of the main window also provides several other buttons, as the following:

[Disable Device]: This disables all the outputs no matter what working mode the outputs are in.

[Global Soft Start]: This will start the output of all devices set to “External Trigger Mode”.

[Store to Device]: This will store all the current settings into the Non Volatile memory of the device. This enables the device to remember all the parameters currently set to the device. The next time the device is powered up, those parameters are set to the outputs automatically. This allows the device to be used when there’s NO host connected (e.g. a PC).

In the scenario of a control module being powered on without a host connected, the behaviors of the outputs are:

*. If the last mode of the output was “Disable”, the output is complete off.

*. If the last mode was “CW Mode”, the output is the last intensity that was set with the software.

*. If the last mode was “Pulse Mode”, the output is off until

a) The output is in the “External Trigger Mode” of “Pulse Mode” and it reads a rising or falling edge from the Trigger In pin, which is defined in the pulse profile settings.

b) The output is in “Follower Mode” of “Pulse Mode” and there is a rising edge (from “L” to “H”) on the Trigger In signal.

4.8 Exit application

When exiting the application, the application will prompt to disable all outputs of the current control module.

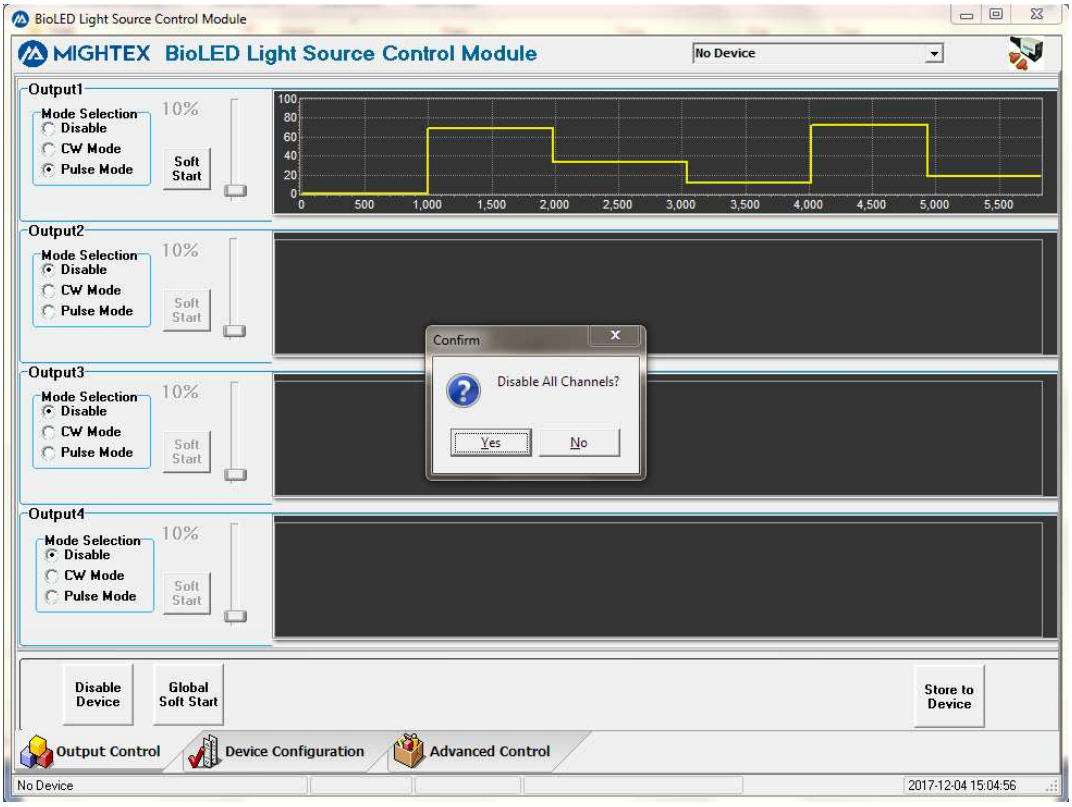


Figure 4.19 Exit application

Appendix A. Polygon Mode: BLS-PL/IO device working with Mightex Polygon400 DSI-E/G device

A.1 Setup

1) Connect a BNC cable from the "Out Trigger" port of the Polygon400 to the "TTL Trigger" pin of **Channel #1** on the BioLED module.

2) Connect your light sources to their designated spots on the BioLED module.

3) Connect the appropriate power supplies and USB cables to your Polygon400 and BioLED module.

4) Power on and connect your Polygon400 and BioLED module to your PC

A.2 Configure Polygon400 to communicate with BioLED module

1) Click Tools-> Device Output Trigger Settings button to bring up the output trigger setting window.

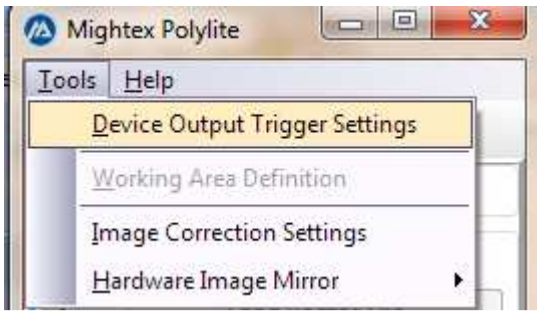
2) Enable **Output Trigger** in popup 'Output Trigger Settings' form.

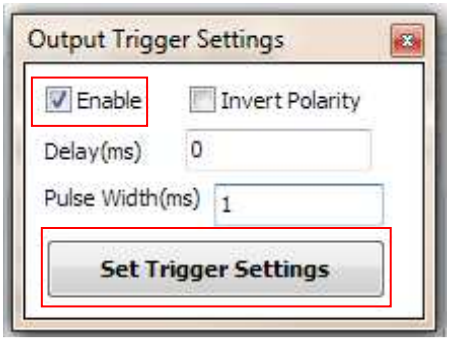
3) Define desired **Output Pulse Width** and **Trigger Delay**.

   Output Pulse Width: Determines width of pulse being sent from the Polygon400's OUT Trigger port. One pulse is sent at the beginning of every pattern.

   Trigger Delay: Delays the Output trigger by the entered amount of time.

4) Click **[Set Output Trigger Settings]** button to save your **Output Trigger** settings.

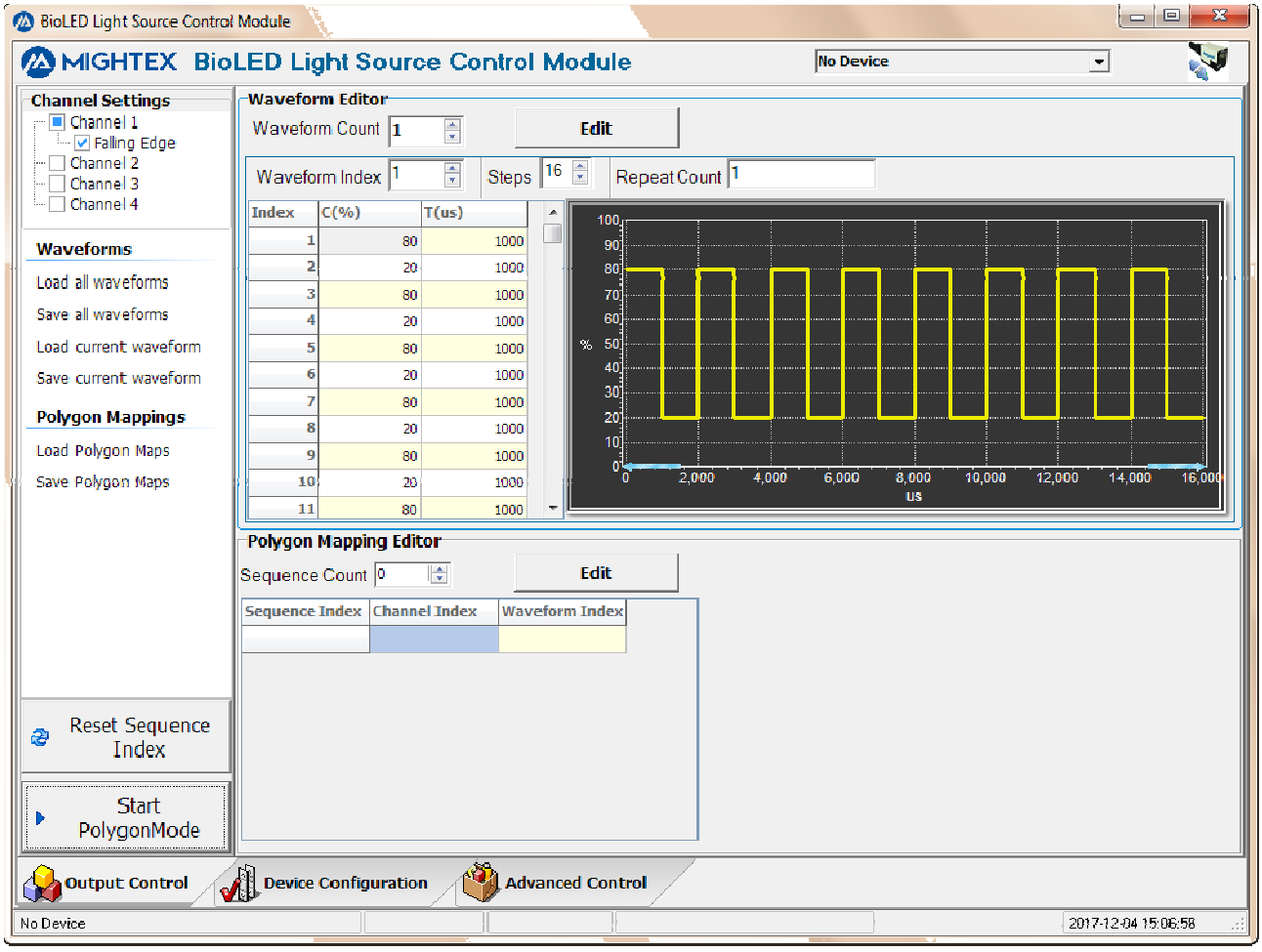




A.3 Configure BioLED module

3.1) Enter Polygon Mode.

User can set device to polygon mode and open application's polygon mode GUI by checking the Enter Polygon Mode checkbox in the **Port Selection** window, or by clicking the polygon mode button  on the top right corner of the application.

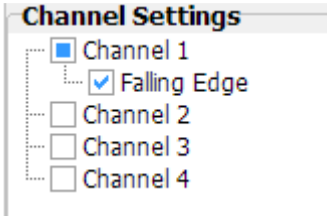


3.2 Polygon mode channel settings

Each channel of the module can be in any state of three working states (Disabled, CW Mode or pulse Mode). For a channel to work in polygon mode, this channel must be set to pulse mode(External trigger mode).

In Polygon Mode, channel #1 is always selected as the Trigger-in of channel #1 becomes a global trigger-in pin and when there is a valid assertion on this pin, the waveforms pre-programmed will be output on the selected channel. The effective polarity(the falling edge or rising edge that trigger the pulse profile output) of channel #1's Trigger-in signal can be selected between falling edge or rising edge, which is default to falling edge.

If two or more channels are needed, other channels should also be set to pulse external trigger mode before it can be used to output wave forms. Checking the check box before the channel No. will set the channel to pulse mode automatically (selected). Un-checking the check box will set the channel to Disabled Mode.



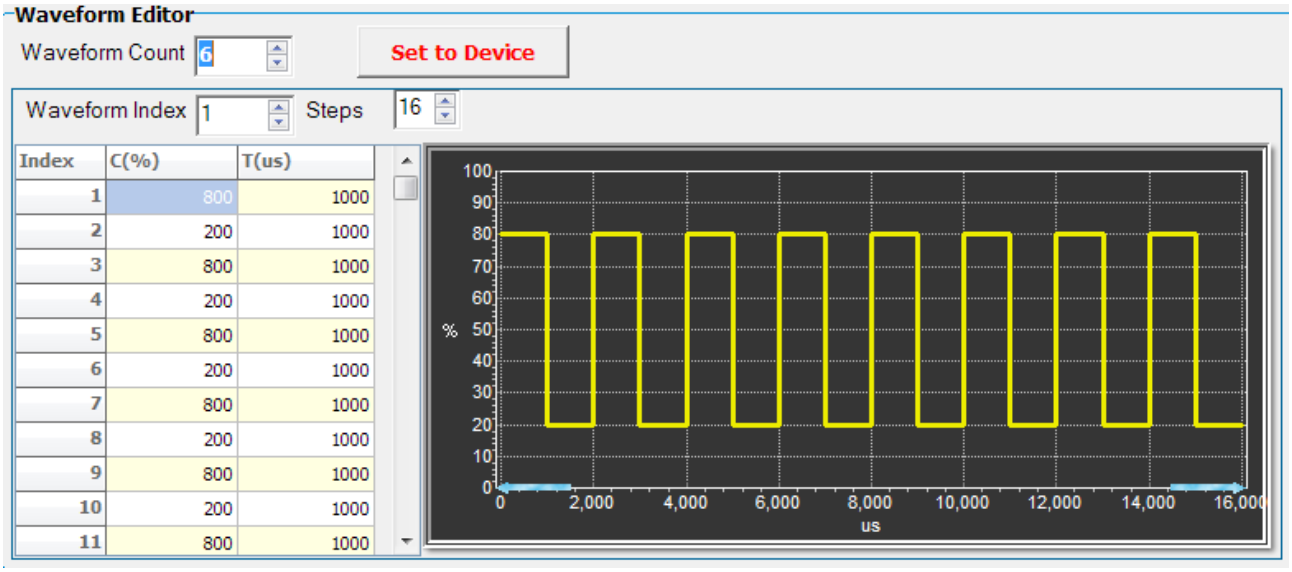
3.3 Waveforms and sequence mappings

User should pre-program a maximum 32 waveforms to device. Then user can use the channel No. and waveform index to form sequence mappings, which is later used by BLS module to output the waveform on mapped channel/output.

1) Waveforms

The waveform editor allows viewing the waveforms. If edit button 

is clicked or waveforms is loaded from a file, the editor allows editing the waveforms and saving the programmed waveforms to device.



Each waveform comprises of maximum 16 C/T pairs, the C is the percentage of programmed maximum normal current (and voltage for BLS-IO device) and the T is timing in us.

Note: 1) if C=800, means 80.0% of maximum current of voltage.

2) T should be multipliers of 20us.

3) Any loaded or programmed waveforms should be set to Device before it can be used by BLS module.

The waveforms can be saved to/loaded from a text file (*.txt). The current waveform can be saved to/loaded from a CSV file (*.csv, a comma separated text file).

2) Sequence mappings

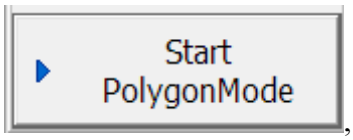
The Polygon Mapping editor also allows viewing the polygon mappings. If the Edit button in the polygon mapping's group is clicked, the polygon mapping editor will allow editing the polygon mapping data and setting the mapping data to device.

A polygon sequence map is comprised of channel No. and waveform index. A channel should be selected before it can be used in polygon sequence map, and waveform should be programmed before it can be used in polygon sequence map.

A sequence can have up to 1024 maps.

The polygon sequence mapping data can be saved to/loaded from a text file. The new loaded or programmed sequence mapping file should be set to device before starting the polygon mode.

3.4 Reset polygon sequence starting index and Start/Stop polygon sequence

After programming the waveforms and polygon mapping data, user can start the polygon mode by clicking the Start polyong mode button 

, which will put BLS device in wait status. If any assertion signal is detected in Channel #1's Trigger-In port, the device will output pre-programmed waveform on selected channel according to polygon mapping data. User can stop the polygon mode by clicking the button again.

If a sequence is interrupted, clicking Start Polygon Mode button will start the sequence at the interrupted point. If user wants to start the polygon sequence from scratch, user can reset the polygon sequence start index by clicking Reset Sequence Index button 

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An Example

1) Waveforms file example

```
Mightex_BLS-PLG_WaveformFile0.1
#Mightex BLS-Device waveforms file
#waveform index, C,T….. Maximum C,T pairs are 16.
1,100,1000,000,1000,100,1000
2,200,1000,000,1000,200,1000,000,1000,200,1000,000,1000
3,800,1000000,100,1000000,800,1000000,100,1000000
4,800,1000000,100,1000000,800,1000000,100,1000000,800,1000000
5,800,1000000,100,1000000,800,1000000,100,1000000,800,1000000
6,800,1000000,100,1000000,800,1000000,100,1000000,800,1000000,100,1000000
```

The first line is file header, should always be Mightex_BLS-PLG_WaveformFile0.1.

The second and third lines are comment lines, which starts with '#'.

The following lines are waveform definition. The first number is the waveform index, and following the waveform index are waveform pair number in the order of "C,T".

This waveforms file defines 6 waveforms. The first waveform has 3 steps and second waveform has 6 steps. A waveform can have maximum 16 steps.

2) Polygon mappings file example

```
Mightex_BLS-PLG_MapFile0.1
# Mightex BLS device Polygon mapping definition file
#channel index , waveform index
1, 6
3, 5
4, 4
2, 3
1, 2
```

The first line is the file header, should always be Mightex_BLS-PLG_MapFile0.1.

The second line and third line are comment lines, which starts with a '#'.

The following lines define the polygon mappings. With first mapping is channel 1 and waveform 6, second line define mapping of channel 3, waveform 5, etc..

If the previous waveforms file and mapping file are loaded to BLS module, and the Reset Sequence Index button is clicked, when a trigger signal is asserted in channel #1 TTL-Trigger In port, the BLS module will output waveform 6 on channel 1. When second trigger signal is asserted, the BLS module will outut waveform 5 on channel 3, etc.